R.F. power transistors and modules
<table>
<thead>
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<th>Topic</th>
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<td>Selection guide</td>
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<td>Index of type numbers with main characteristics</td>
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<td>Line-ups in main r.f. power applications</td>
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<td>Envelopes</td>
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<td>Index of all devices in semiconductor Data Handbooks</td>
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Our Data Handbook System comprises more than 60 books with specifications on electronic components, subassemblies and materials. It is made up of four series of handbooks:

**ELECTRON TUBES**  
**SEMICONDUCTORS**  
**INTEGRATED CIRCUITS**  
**COMPONENTS AND MATERIALS**

The contents of each series are listed on pages iv to vii.

The data handbooks contain all pertinent data available at the time of publication, and each is revised and reissued periodically.

When ratings or specifications differ from those published in the preceding edition they are indicated with arrows in the page margin. Where application information is given it is advisory and does not form part of the product specification.

Condensed data on the preferred products of Philips Electronic Components and Materials Division is given in our Preferred Type Range catalogue (issued annually).

Information on current Data Handbooks and on how to obtain a subscription for future issues is available from any of the Organizations listed on the back cover.

Product specialists are at your service and enquiries will be answered promptly.
ELECTRON TUBES (BLUE SERIES)

The blue series of data handbooks comprises:

T1  Tubes for r.f. heating
T2a Transmitting tubes for communications, glass types
T2b Transmitting tubes for communications, ceramic types
T3  Klystrons
T4  Magnetrons for microwave heating
T5  Cathode-ray tubes
     Instrument tubes, monitor and display tubes, C.R. tubes for special applications
T6  Geiger-Müller tubes
T8  Colour display systems
     Colour TV picture tubes, colour data graphic display tube assemblies, deflection units
T9  Photo and electron multipliers
T10 Plumbicon camera tubes and accessories
T11 Microwave semiconductors and components
T12 Vidicon and Newvicon camera tubes
T13 Image intensifiers and infrared detectors
T15 Dry reed switches
T16 Monochrome tubes and deflection units
     Black and white TV picture tubes, monochrome data graphic display tubes, deflection units
The red series of data handbooks comprises:

S1  Diodes
    Small-signal silicon diodes, voltage regulator diodes (< 1,5 W), voltage reference diodes, tuner diodes, rectifier diodes

S2a Power diodes

S2b Thyristors and triacs

S3 Small-signal transistors

S4a Low-frequency power transistors and hybrid modules

S4b High-voltage and switching power transistors

S5 Field-effect transistors

S6 R.F. power transistors and modules

S7 Surface mounted semiconductors

S8a Light-emitting diodes

S8b Devices for optoelectronics
    Optocouplers, photosensitive diodes and transistors, infrared light-emitting diodes and infrared sensitive devices, laser and fibre-optic components

S9 Power MOS transistors

S10 Wideband transistors and wideband hybrid IC modules

S11 Microwave transistors

S12 Surface acoustic wave devices

S13 Semiconductor sensors

*S14 Liquid Crystal Displays

*To be issued shortly.
The NEW SERIES of handbooks is now completed. With effect from the publication date of this handbook the "N" in the handbook code number will be deleted. Handbooks to be replaced during 1986 are shown below.

The purple series of handbooks comprises:

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* The Microprocessors were included in handbook IC14N 1985, so IC18 will replace that part of IC14N.
COMPONENTS AND MATERIALS (GREEN SERIES)

The green series of data handbooks comprises:

C2 Television tuners, coaxial aerial input assemblies, surface acoustic wave filters
C3 Loudspeakers
C4 Ferroxcube potcores, square cores and cross cores
C5 Ferroxcube for power, audio/video and accelerators
C6 Synchronous motors and gearboxes
C7 Variable capacitors
C8 Variable mains transformers
C9 Piezoelectric quartz devices
C11 Varistors, thermistors and sensors
C12 Potentiometers, encoders and switches
C13 Fixed resistors
C14 Electrolytic and solid capacitors
C15 Ceramic capacitors
C16 Permanent magnet materials
C17 Stepping motors and associated electronics
C18 Direct current motors
C19 Piezoelectric ceramics
C20 Wire-wound components for TVs and monitors
C22 Film capacitors
SELECTION GUIDE
TYPE NUMBER SURVEY
LINE-UPS
The following tables present our complete range of transmitting transistors and modules, grouped according to main r.f. power application area. The data in each table is further grouped according to voltage and (within each voltage group) arranged in order of increasing power.

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<th>$V_{CE}$ V</th>
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s.s.b. class-AB; $f = 28$ MHz; $d_5; d_5 < -30$ dB
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s.s.s. class-A; f = 28 MHz; $d_3; d_5 < -40$ dB
v.h.f. base stations;  
class-B operation

\[
\begin{array}{ccccccc}
 P_W & V_{C E} & f_{\text{MHz}} & G_{\text{dB}} & \text{envelope} & \text{type number} & \text{page} \\
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4 & 28 & 175 & 10 & \text{TO-39/1} & BFS23A & 67 \\
8 & 28 & 175 & 12 & \text{SOT-48/2} & BLY91A & 1025 \\
8 & 28 & 175 & 12 & \text{SOT-120} & BLY91C & 1033 \\
8 & 28 & 175 & 12 & \text{SOT-123} & BLV20 & 271 \\
15 & 28 & 175 & 10 & \text{SOT-48/2} & BLY92A & 1041 \\
15 & 28 & 175 & 10 & \text{SOT-120} & BLY92C & 1049 \\
15 & 28 & 175 & 10 & \text{SOT-123} & BLV21 & 279 \\
25 & 28 & 175 & 9 & \text{SOT-56} & BLY93A & 1057 \\
25 & 28 & 175 & 9 & \text{SOT-120} & BLY93C & 1065 \\
25 & 28 & 175 & 9 & \text{SOT-123} & BLW84 & 661 \\
45 & 28 & 175 & 7,5 & \text{SOT-120} & BLX39 & 825 \\
45 & 28 & 175 & 7,5 & \text{SOT-123} & BLW86 & 681 \\
50 & 28 & 175 & 7 & \text{SOT-55} & BLY94 & 1073 \\
80 & 28 & 175 & 6,5 & \text{SOT-121} & BLV80/28 & 407 \\
80 & 28 & 108 & 8 & \text{SOT-121} & BLW76 & 585 \\
100 & 28 & 150 & 6 & \text{SOT-121} & BLW78 & 613 \\
130 & 28 & 87,5 & 7,5 & \text{SOT-121} & BLW77 & 599 \\
150 & 50 & 108 & 7,5 & \text{SOT-55} & BLX15 & 809 \\
160 & 50 & 108 & 7 & \text{SOT-121} & BLW95 & 727 \\
200 & 50 & 108 & 6,5 & \text{SOT-121} & BLW96 & 737 \\
\end{array}
\]

v.h.f. mobile transmitters;  
class-B operation

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2 & 13,5 & 175 & 11 & \text{TO-39/1} & BFQ42 & 41 \\
4 & 13,5 & 175 & 8 & \text{TO-39/1} & BFS22A & 59 \\
4 & 13,5 & 175 & 12 & \text{TO-39/3} & BFO43 & 51 \\
4 & 13,5 & 175 & 12 & \text{TO-39/3} & BFO43S & 51 \\
8 & 13,5 & 175 & 9 & \text{SOT-48/2} & BLY87A & 967 \\
8 & 13,5 & 175 & 12 & \text{SOT-120} & BLY87C & 975 \\
8 & 13,5 & 175 & 9 & \text{SOT-123} & BLV10 & 255 \\
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15 & 13,5 & 175 & 7,5 & \text{SOT-48/2} & BLY88A & 983 \\
15 & 13,5 & 175 & 7,5 & \text{SOT-120} & BLY88C & 991 \\
15 & 13,5 & 175 & 7,5 & \text{SOT-123} & BLV11 & 263 \\
25 & 13,5 & 175 & 6 & \text{SOT-56} & BLY89A & 999 \\
25 & 13,5 & 175 & 6 & \text{SOT-120} & BLY89C & 1009 \\
25 & 13,5 & 175 & 6 & \text{SOT-123} & BLW87 & 695 \\
28 & 13,5 & 175 & 9 & \text{SOT-120} & BLW31 & 511 \\
45 & 12,5 & 175 & 6,5 & \text{SOT-119} & BLV45/12 & 365 \\
45 & 12,5 & 175 & 5 & \text{SOT-56} & BLW60 & 559 \\
45 & 12,5 & 175 & 5 & \text{SOT-120} & BLW60C & 573 \\
45 & 12,5 & 175 & 4,5 & \text{SOT-123} & BLW85 & 689 \\
50 & 12,5 & 175 & 5 & \text{SOT-55} & BLY90 & 1017 \\
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### SELECTION GUIDE

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| 0,45           | 24       | 225     | 17      | -55         | 200      | SOT-122  | BLV30       | 295  |
| 1,5            | 25       | 225     | 18      | -60         | 460      | SOT-122  | BLV31       | 307  |
| 5              | 25       | 225     | 15      | -58         | 800      | SOT-122  | BLV32F      | 317  |
| 10             | 25       | 225     | 16      | -55         | 1500     | SOT-160  | BLV33F      | 339  |
| 16             | 25       | 225     | 13,5    | -55         | 3200     | SOT-147  | BLV33      | 327  |

#### TV transmitter circuits

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| 0,3            | 15       | 860     | 11      | -60         | 120      | SOT-122  | BFO34       | **
| 0,5            | 25       | 860     | 11      | -60         | 150      | SOT-122  | BLW32       | 519  |
| 0,7            | 15       | 860     | 10      | -60         | 240      | SOT-122  | BFO86       | **
| 1,0            | 25       | 860     | 10      | -60         | 300      | SOT-122  | BLW33       | 529  |
| 1,8            | 25       | 860     | 9       | -60         | 600      | SOT-122  | BLW34       | 539  |
| 3,5            | 25       | 860     | 6,5     | -60         | 850      | SOT-122  | BLW98       | 757  |
| 6              | 25       | 860     | 8       | -60         | 2x850    | SOT-161  | BLV57       | 373  |

#### R.F. power MOSFET

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* At 1 dB power gain compression

** See Handbook "Wideband transistors and hybrids".
In this alphanumeric list we present all transmitting transistors and modules mentioned in this handbook together with the most important data.

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**Notes**

1. $P_o$ sync at $d_{im} < -60$ dB.
2. $P_o$ sync at $d_{im} < -55$ dB.
3. P.E.P. at $d_3 < -40$ dB.
4. P.E.P. at $d_3$ typ. $-30$ dB.
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**Notes**

1. $P_o \text{ sync at } d_{im} < -60 \text{ dB.}
2. $P_o \text{ sync at } d_{im} < -55 \text{ dB.}
3. P.E.P. at $d_3 < -40 \text{ dB.}
4. P.E.P. at $d_3 \text{ typ. } -30 \text{ dB.}
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**Notes**

1. P\textsubscript{0} sync at d\textsubscript{im} < -60 dB.
2. P\textsubscript{0} sync at d\textsubscript{im} < -55 dB.
3. P.E.P. at d\textsubscript{3} < -40 dB.
4. P.E.P. at d\textsubscript{3} typ. -30 dB.
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2. P<sub>o</sub><sub>sync</sub> at d<sub>i</sub><sub>im</sub> < -55 dB.
3. P.E.P. at d<sub>3</sub> < -40 dB.
4. P.E.P. at d<sub>3</sub> typ. -30 dB.
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In this section we present information on recommended circuit line-ups in the main r.f. power application areas. A comprehensive range of output power levels is indicated together with our recommended types in the particular line-up configuration. The necessary drive power level for each line-up is indicated in the first column.

More detailed application information as well as computer aided design parameters are available on request.

**S.S.B. TRANSMITTERS (1.5 MHz – 30 MHz)**

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<th>2nd stage</th>
<th>3rd stage</th>
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<th>( V_{CE} ) (V)</th>
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<th>flange F</th>
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<tr>
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<td>BLW87 *</td>
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<td>2 x BLW77</td>
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<td>F</td>
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</tr>
<tr>
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<td>S</td>
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<td>2 x BLW78 **</td>
<td>8 x BLX15</td>
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<td>50</td>
<td>S/F</td>
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<td>4 x BLW50F</td>
<td>8 x BLW96</td>
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**MILITARY COMMUNICATION TRANSMITTERS (25 MHz – 80 MHz)**

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<th>1st stage</th>
<th>2nd stage</th>
<th>3rd stage</th>
<th>( P_L ) (W)</th>
<th>( V_{CE} ) (V)</th>
<th>stud S</th>
<th>flange F</th>
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<tbody>
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<td>2</td>
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<tr>
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<td>2N4427 *</td>
<td>2 x BLW80</td>
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<td></td>
</tr>
<tr>
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<td>BLW79 *</td>
<td>2 x BLW29</td>
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<td>13</td>
<td>S</td>
<td></td>
</tr>
<tr>
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<td>BLW89 *</td>
<td>2 x BLY92C</td>
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<td>28</td>
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</tr>
<tr>
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<td>2N3866 *</td>
<td>2 x BLY91C</td>
<td>2 x BLX39</td>
<td>90</td>
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<td>S</td>
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- See Handbook wideband transistors and hybrids.
- Class-A operation.
- ** 28 V supply voltage; class-A operation.
### MOBILE TRANSMITTERS (68 MHz – 87.5 MHz)

<table>
<thead>
<tr>
<th>Input Power (mW)</th>
<th>1st Stage</th>
<th>2nd Stage</th>
<th>3rd Stage</th>
<th>$P_L$ (W)</th>
<th>$V_{CE}$ (V)</th>
<th>Stud S</th>
<th>Flange F</th>
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<tbody>
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<td>BLV10</td>
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<td>8</td>
<td>13</td>
<td>F</td>
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<td>S</td>
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<td>190</td>
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<td>BLV75/12</td>
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<td>75</td>
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### BASE STATIONS (68 MHz – 87.5 MHz)

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<th>1st Stage</th>
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<th>3rd Stage</th>
<th>$P_L$ (W)</th>
<th>$V_{CE}$ (V)</th>
<th>Stud S</th>
<th>Flange F</th>
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<tbody>
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<td>28</td>
<td>S</td>
<td>F</td>
</tr>
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<td>65</td>
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<td>25</td>
<td>28</td>
<td>F</td>
<td>S</td>
</tr>
<tr>
<td>125</td>
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<td>28</td>
<td>F</td>
<td>S</td>
</tr>
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<td>BLV21</td>
<td>BLW78</td>
<td>100</td>
<td>28</td>
<td>F</td>
<td>S</td>
</tr>
<tr>
<td>50</td>
<td>2N3866 **</td>
<td>BLY93C **</td>
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<td>50</td>
<td>S</td>
<td>F</td>
</tr>
<tr>
<td>50</td>
<td>2N3866 **</td>
<td>BLW84 **</td>
<td>BLW95</td>
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<td>F</td>
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### F.M. BROADCAST TRANSMITTERS (87.5 MHz – 108 MHz)

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<th>3rd Stage</th>
<th>$P_L$ (W)</th>
<th>$V_{CE}$ (V)</th>
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<th>Flange F</th>
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<td>S</td>
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<tr>
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<td>2N3866</td>
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<td>BLW78</td>
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<td>S</td>
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<td>100</td>
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<td>4 x BLV25</td>
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### A.M. AIRCRAFT TRANSMITTERS (118 MHz – 136 MHz)

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<th>3rd Stage</th>
<th>$P_L$ (W)</th>
<th>$V_{CE}$ (V)</th>
<th>Stud S</th>
<th>Flange F</th>
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<tbody>
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<td>F</td>
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<td>12</td>
<td>13/28</td>
<td>S</td>
<td>F</td>
</tr>
<tr>
<td>240</td>
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<td>BLW86</td>
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<td>12</td>
<td>13/28</td>
<td>F</td>
<td>S</td>
</tr>
<tr>
<td>100</td>
<td>BLX92A</td>
<td>BLY93C</td>
<td>BLW78</td>
<td>25</td>
<td>13/28</td>
<td>S/F</td>
<td>F</td>
</tr>
<tr>
<td>100</td>
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<td>BLW78</td>
<td>25</td>
<td>13/28</td>
<td>S/F</td>
<td>F</td>
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- See Handbook small signal transistors.
- ** 28 V supply voltage.
### PORTABLE AND MOBILE TRANSMITTERS (132 MHz – 174 MHz)

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<th>3rd stage</th>
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<th>$V_{CE}$ V</th>
<th>stud S flange F</th>
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<td>13</td>
<td>F</td>
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<tr>
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<td>S</td>
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<td>18</td>
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<td>F</td>
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<td>250</td>
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<td>13</td>
<td>S</td>
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<tr>
<td>100</td>
<td>2N4427</td>
<td>BLW29</td>
<td>BLV45/12</td>
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<td>13</td>
<td>S/F</td>
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<td>BLV45/12</td>
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<td>13</td>
<td>F</td>
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<td>BLV75/12</td>
<td>75</td>
<td>13</td>
<td>S/F</td>
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### BASE STATIONS (132 MHz – 174 MHz)

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<th>3rd stage</th>
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<th>$V_{CE}$ V</th>
<th>stud S flange F</th>
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<td>BLY93C</td>
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<td>28</td>
<td>S</td>
</tr>
<tr>
<td>200</td>
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<td>28</td>
<td>F</td>
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<td>S</td>
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<td>BLW86</td>
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<td>F</td>
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<td>BLW84</td>
<td>2 x BLW86</td>
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### TV TRANSPOSERs (Band III: 174 MHz – 230 MHz)

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<th>3rd stage</th>
<th>4th stage</th>
<th>$P_{o \text{sync}}$ W</th>
<th>$P_{o \text{sat}}$ W</th>
<th>$V_{CE}$ V</th>
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<td>2 x BLV33</td>
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<td>4 x BLV33</td>
<td>8 x BLV33</td>
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### TV TRANSMITTERS (Band III: 174 MHz – 230 MHz)

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<th>3rd stage</th>
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<th>$V_{CE}$ V</th>
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<td>2 x BLV33F</td>
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<td>2 x BLV32F</td>
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<td>8 x BLV36</td>
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<td>28</td>
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*With linearity correction.
● See handbook wideband transistors and hybrids.
## PORTABLE AND MOBILE TRANSMITTERS (400 MHz – 512 MHz)

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<th>1st stage</th>
<th>2nd stage</th>
<th>3rd stage</th>
<th>PL (W)</th>
<th>VCE (V)</th>
<th>stud S</th>
<th>flange F</th>
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<tr>
<td>45</td>
<td>BLV90</td>
<td>BLU99</td>
<td></td>
<td>3</td>
<td>7,5</td>
<td></td>
<td>S</td>
</tr>
<tr>
<td>100</td>
<td>BGY40A</td>
<td>BGY40B</td>
<td></td>
<td>7,5</td>
<td>12,5</td>
<td></td>
<td>F</td>
</tr>
<tr>
<td>15</td>
<td>BFR96S</td>
<td>BLU99</td>
<td>BLW81</td>
<td>10</td>
<td>13</td>
<td></td>
<td>S</td>
</tr>
<tr>
<td>150</td>
<td>BGY41A</td>
<td>BGY41B</td>
<td></td>
<td>13</td>
<td>12,5</td>
<td></td>
<td>F</td>
</tr>
<tr>
<td>400</td>
<td>BLU99</td>
<td>BLU20/12</td>
<td></td>
<td>20</td>
<td>13</td>
<td></td>
<td>S/F</td>
</tr>
<tr>
<td>100</td>
<td>BGY40A/B</td>
<td>BLU30/12</td>
<td></td>
<td>30</td>
<td>13</td>
<td></td>
<td>F</td>
</tr>
<tr>
<td>280</td>
<td>BLU99</td>
<td>BLU20/12</td>
<td>BLU45/12</td>
<td>45</td>
<td>13</td>
<td></td>
<td>S/F</td>
</tr>
<tr>
<td>400</td>
<td>BLU99</td>
<td>BLU20/12</td>
<td>BLU60/12</td>
<td>60</td>
<td>13</td>
<td></td>
<td>S/F</td>
</tr>
</tbody>
</table>

## BASE STATIONS (400 MHz – 470 MHz)

<table>
<thead>
<tr>
<th>input power (mW)</th>
<th>1st stage</th>
<th>2nd stage</th>
<th>3rd stage</th>
<th>4th stage</th>
<th>PL (W)</th>
<th>VCE (V)</th>
<th>stud S</th>
<th>flange F</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>BLX91A</td>
<td>BLW91</td>
<td>BLX94C</td>
<td>25</td>
<td>28</td>
<td></td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>250</td>
<td>BLW90</td>
<td>BLX94C</td>
<td>BLX95</td>
<td>40</td>
<td>28</td>
<td></td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>BLX91A</td>
<td>BLW91</td>
<td>BLX94C</td>
<td>2 x BLX95</td>
<td>70</td>
<td>28</td>
<td>S</td>
<td></td>
</tr>
</tbody>
</table>

## TV TRANSPOasers (Band IV/V: 470 MHz – 860 MHz)

<table>
<thead>
<tr>
<th>input power (mW)</th>
<th>1st stage</th>
<th>2nd stage</th>
<th>3rd stage</th>
<th>4th stage</th>
<th>Po sync (W)</th>
<th>Po sat (W)</th>
<th>VCE (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>BFQ34</td>
<td>BFQ68</td>
<td>2 x BFQ68</td>
<td></td>
<td>1,4</td>
<td>1,4</td>
<td>15</td>
</tr>
<tr>
<td>6</td>
<td>BLW32</td>
<td>BLW33</td>
<td>2 x BLW34</td>
<td></td>
<td>4,4</td>
<td>5,7</td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td>BLW32</td>
<td>BLW33</td>
<td>2 x BLW34</td>
<td>2 x BLW98</td>
<td>8</td>
<td>8</td>
<td>25</td>
</tr>
<tr>
<td>3</td>
<td>BLW32</td>
<td>BLW33</td>
<td>2 x BLW34</td>
<td>2 x BLV57</td>
<td>13</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>10</td>
<td>BFQ68</td>
<td>2 x BLW34</td>
<td>2 x BLW98</td>
<td>4 x BLV57</td>
<td>23</td>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>14</td>
<td>BFQ68</td>
<td>2 x BLW34</td>
<td>2 x BLV57</td>
<td>8 x BLV57</td>
<td>38</td>
<td>60</td>
<td>25</td>
</tr>
</tbody>
</table>

## TV TRANSMITTERS (Band IV/V: 470 MHz – 860 MHz)

<table>
<thead>
<tr>
<th>input power (mW)</th>
<th>1st stage</th>
<th>2nd stage</th>
<th>3rd stage</th>
<th>4th stage</th>
<th>Po sync (W)</th>
<th>VCE (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>BFR96S</td>
<td>BFQ68</td>
<td>2 x BLW34</td>
<td>2 x BLV59</td>
<td>60</td>
<td>28</td>
</tr>
<tr>
<td>30</td>
<td>BFQ34</td>
<td>2 x BLW33</td>
<td>2 x BLV57</td>
<td>4 x BLV59</td>
<td>120</td>
<td>28</td>
</tr>
<tr>
<td>80</td>
<td>BFQ68</td>
<td>2 x BLW34</td>
<td>4 x BLV57</td>
<td>8 x BLV59</td>
<td>240</td>
<td>28</td>
</tr>
</tbody>
</table>

*With linearity correction.
* See handbook “Wideband transistors and hybrids”.
### MOBILE TRANSMITTERS (800 MHz – 960 MHz)

<table>
<thead>
<tr>
<th>Input Power (mW)</th>
<th>1st Stage</th>
<th>2nd Stage</th>
<th>3rd Stage</th>
<th>4th Stage</th>
<th>$P_L$ (W)</th>
<th>$V_{CE}$ (V)</th>
<th>Stud S/F</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>BLU98</td>
<td>BLV91</td>
<td>BLV93</td>
<td></td>
<td>8</td>
<td>13</td>
<td>S/F</td>
</tr>
<tr>
<td>100</td>
<td>BLV90</td>
<td>BLV92</td>
<td>BLV94</td>
<td></td>
<td>15</td>
<td>13</td>
<td>S/F</td>
</tr>
<tr>
<td>50</td>
<td>BLU98</td>
<td>BLV91</td>
<td>BLV93</td>
<td>BLV95</td>
<td>22</td>
<td>13</td>
<td>S/F</td>
</tr>
<tr>
<td>120</td>
<td>BLV90</td>
<td>BLV92</td>
<td>BLV94</td>
<td>2 x BLV95</td>
<td>40</td>
<td>13</td>
<td>S/F</td>
</tr>
</tbody>
</table>

### BASE STATIONS (800 MHz – 960 MHz)

<table>
<thead>
<tr>
<th>Input Power (mW)</th>
<th>1st Stage</th>
<th>2nd Stage</th>
<th>3rd Stage</th>
<th>4th Stage</th>
<th>$P_L$ (W)</th>
<th>$V_{CE}$ (V)</th>
<th>Stud S/F</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>BLV99</td>
<td>BLV98</td>
<td>2 x BLV97</td>
<td></td>
<td>60</td>
<td>24</td>
<td>S/F</td>
</tr>
</tbody>
</table>

**Notes**

1. For TV transposers and transmitters, the input powers quoted relate to the peak sync levels.
2. $P_{O \text{ sync}}$ for transposers is the peak sync output power for a three-tone intermodulation distortion of $-54$ dB (vision carrier $-8$ dB, sound carrier $-7$ dB, sideband signal $-16$ dB) without pre-correction.
3. $P_{O \text{ sync}}$ is the peak sync output power of a transposer before the sound carrier has been added. After addition of the sound carrier the peak output power will be approximately twice $P_{O \text{ sync}}$. In transposers with pre-correction the intermodulation distortion is reduced and therefore $P_{O \text{ sync}}$ can be increased. However there is a limit formed by the saturated output power of the transistor. Taking this into account $P_{O \text{ sat}}$ is the maximum value of $P_{O \text{ sync}}$ in pre-corrected systems.
4. In the transmitter line-ups the output stage operates in class-AB, the driver stages in class-A.
5. $P_{O \text{ sync}}$ for transmitters is the peak sync output power at 1 dB power gain compression.
GENERAL

Type designation
Rating systems
Letter symbols
s-parameters
Mounting recommendations
PRO ELECTRON TYPE DESIGNATION CODE
FOR SEMICONDUCTOR DEVICES

This type designation code applies to discrete semiconductor devices — as opposed to integrated circuits —, multiples of such devices and semiconductor chips.

“Although not all type numbers accord with the Pro Electron system, the following explanation is given for the ones that do.”

A basic type number consists of:

TWO LETTERS FOLLOWED BY A SERIAL NUMBER

FIRST LETTER

The first letter gives information about the material used for the active part of the devices.

A. GERMANIUM or other material with band gap of 0,6 to 1,0 eV.
B. SILICON or other material with band gap of 1,0 to 1,3 eV.
C. GALLIUM-ARSENIDE or other material with band gap of 1,3 eV or more.
R. COMPOUND MATERIALS (e.g. Cadmium-Sulphide).

SECOND LETTER

The second letter indicates the function for which the device is primarily designed.

A. DIODE; signal, low power
B. DIODE; variable capacitance
C. TRANSISTOR; low power, audio frequency ($R_{th \ j-mb} > 15 \ K/W$)
D. TRANSISTOR; power, audio frequency ($R_{th \ j-mb} \leq 15 \ K/W$)
E. DIODE; tunnel
F. TRANSISTOR; low power, high frequency ($R_{th \ j-mb} > 15 \ K/W$)
G. MULTIPLE OF DISSIMILAR DEVICES — MISCELLANEOUS; e.g. oscillator
H. DIODE; magnetic sensitive
L. TRANSISTOR; power, high frequency ($R_{th \ j-mb} \leq 15 \ K/W$)
N. PHOTO-COUPLER
P. RADIATION DETECTOR; e.g. high sensitivity phototransistor
Q. RADIATION GENERATOR; e.g. light-emitting diode (LED)
R. CONTROL AND SWITCHING DEVICE; e.g. thyristor, low power ($R_{th \ j-mb} > 15 \ K/W$)
S. TRANSISTOR; low power, switching ($R_{th \ j-mb} > 15 \ K/W$)
T. CONTROL AND SWITCHING DEVICE; e.g. thyristor, power ($R_{th \ j-mb} \leq 15 \ K/W$)
U. TRANSISTOR; power, switching ($R_{th \ j-mb} \leq 15 \ K/W$)
X. DIODE: multiplier, e.g. varactor, step recovery
Y. DIODE; rectifying, booster
Z. DIODE; voltage reference or regulator (transient suppressor diode, with third letter W)
TYPE DESIGNATION

SERIAL NUMBER

Three figures, running from 100 to 999, for devices primarily intended for consumer equipment.*
One letter (Z, Y, X, etc.) and two figures, running from 10 to 99, for devices primarily intended for industrial/professional equipment.*
This letter has no fixed meaning except W, which is used for transient suppressor diodes.

VERSION LETTER

It indicates a minor variant of the basic type either electrically or mechanically. The letter never has a fixed meaning, except letter R, indicating reverse voltage, e.g. collector to case or anode to stud.

SUFFIX

Sub-classification can be used for devices supplied in a wide range of variants called associated types. Following sub-coding suffixes are in use:

1. VOLTAGE REFERENCE and VOLTAGE REGULATOR DIODES: ONE LETTER and ONE NUMBER
   The LETTER indicates the nominal tolerance of the Zener (regulation, working or reference) voltage
   A. 1% (according to IEC 63: series E96)
   B. 2% (according to IEC 63: series E48)
   C. 5% (according to IEC 63: series E24)
   D. 10% (according to IEC 63: series E12)
   E. 20% (according to IEC 63: series E6)
   The number denotes the typical operating (Zener) voltage related to the nominal current rating for the whole range.
   The letter 'V' is used instead of the decimal point.

2. TRANSIENT SUPPRESSOR DIODES: ONE NUMBER
   The NUMBER indicates the maximum recommended continuous reversed (stand-off) voltage $V_R$. The letter 'V' is used as above.

3. CONVENTIONAL and CONTROLLED AVALANCHE RECTIFIER DIODES and THYRISTORS: ONE NUMBER
   The NUMBER indicates the rated maximum repetitive peak reverse voltage ($V_{RRM}$) or the rated repetitive peak off-state voltage ($V_{DRM}$), whichever is the lower. Reversed polarity is indicated by letter R, immediately after the number.

4. RADIATION DETECTORS: ONE NUMBER, preceded by a hyphen (−)
   The NUMBER indicates the depletion layer in $\mu$m. The resolution is indicated by a version LETTER.

5. ARRAY OF RADIATION DETECTORS and GENERATORS: ONE NUMBER, preceded by a stroke (/)
   The NUMBER indicates how many basic devices are assembled into the array.

* When these serial numbers are exhausted the serial number for consumer types may be extended to four figures, and that for industrial types to three figures.
RATING SYSTEMS

The rating systems described are those recommended by the International Electrotechnical Commission (IEC) in its Publication 134.

DEFINITIONS OF TERMS USED

*Electronic device.* An electronic tube or valve, transistor or other semiconductor device.

*Note*
This definition excludes inductors, capacitors, resistors and similar components.

*Characteristic.* A characteristic is an inherent and measurable property of a device. Such a property may be electrical, mechanical, thermal, hydraulic, electro-magnetic, or nuclear, and can be expressed as a value for stated or recognized conditions. A characteristic may also be a set of related values, usually shown in graphical form.

*Bogey electronic device.* An electronic device whose characteristics have the published nominal values for the type. A bogey electronic device for any particular application can be obtained by considering only those characteristics which are directly related to the application.

*Rating.* A value which establishes either a limiting capability or a limiting condition for an electronic device. It is determined for specified values of environment and operation, and may be stated in any suitable terms.

*Note*
Limiting conditions may be either maxima or minima.

*Rating system.* The set of principles upon which ratings are established and which determine their interpretation.

*Note*
The rating system indicates the division of responsibility between the device manufacturer and the circuit designer, with the object of ensuring that the working conditions do not exceed the ratings.

ABSOLUTE MAXIMUM RATING SYSTEM

Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type as defined by its published data, which should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electronic devices in the equipment.

The equipment manufacturer should design so that, initially and throughout life, no absolute maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, equipment control adjustment, load variations, signal variation, environmental conditions, and variations in characteristics of the device under consideration and of all other electronic devices in the equipment.
DESIGN MAXIMUM RATING SYSTEM

Design maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the electronic device under consideration.

The equipment manufacturer should design so that, initially and throughout life, no design maximum value for the intended service is exceeded with a bogey device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, variation in characteristics of all other devices in the equipment, equipment control adjustment, load variation, signal variation and environmental conditions.

DESIGN CENTRE RATING SYSTEM

Design centre ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under normal conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device in average applications, taking responsibility for normal changes in operating conditions due to rated supply voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all electronic devices.

The equipment manufacturer should design so that, initially, no design centre value for the intended service is exceeded with a bogey electronic device in equipment operating at the stated normal supply voltage.
LETTER SYMBOLS FOR TRANSISTORS AND SIGNAL DIODES
based on IEC Publication 148

LETTER SYMBOLS FOR CURRENTS, VOLTAGES AND POWERS

Basic letters
The basic letters to be used are:

\[ I, i = \text{current} \]
\[ V, v = \text{voltage} \]
\[ P, p = \text{power}. \]

Lower-case basic letters shall be used for the representation of instantaneous values which vary with time.
In all other instances upper-case basic letters shall be used.

Subscripts

A, a Anode terminal
(AV), (av) Average value
B, b Base terminal, for MOS devices: Substrate
(BR) Breakdown
C, c Collector terminal
D, d Drain terminal
E, e Emitter terminal
F, f Forward
G, g Gate terminal
K, k Cathode terminal
M, m Peak value
O, o As third subscript: The terminal not mentioned is open circuited
R, r As first or second subscript: Source terminal (for FETS only)
As first subscript: Reverse. As second subscript: Repetitive.
As third subscript: With a specified resistance between the terminal not mentioned and the reference terminal.
(RMS), (rms) R.M.S. value
As first or second subscript: Source terminal (for FETS only)
S, s As second subscript: Non-repetitive (not for FETS)
As third subscript: Short circuit between the terminal not mentioned and the reference terminal
X, x Specified circuit
Z, z Replaces R to indicate the actual working voltage, current or power of voltage reference and voltage regulator diodes.

Note: No additional subscript is used for d.c. values.
Upper-case subscripts shall be used for the indication of:

a) continuous (d.c.) values (without signal)  
   Example $I_B$

b) instantaneous total values  
   Example $i_B$

c) average total values  
   Example $I_B(AV)$

d) peak total values  
   Example $I_B(M)$

e) root-mean-square total values  
   Example $I_B(RMS)$

Lower-case subscripts shall be used for the indication of values applying to the varying component alone:

a) instantaneous values  
   Example $i_b$

b) root-mean-square values  
   Example $I_b(rms)$

c) peak values  
   Example $I_{b(m)}$

d) average values  
   Example $I_b(av)$

Note: If more than one subscript is used, subscript for which both styles exist shall either be all upper-case or all lower-case.

Additional rules for subscripts

Subscripts for currents

Transistors: If it is necessary to indicate the terminal carrying the current, this should be done by the first subscript (conventional current flow from the external circuit into the terminal is positive).

Examples: $I_B, i_B, i_b, I_{b(m)}$

Diodes: To indicate a forward current (conventional current flow into the anode terminal) the subscript $F$ or $f$ should be used; for a reverse current (conventional current flow out of the anode terminal) the subscript $R$ or $r$ should be used.

Examples: $I_F, I_R, i_F, i_f(rms)$
Subscripts for voltages

Transistors: If it is necessary to indicate the points between which a voltage is measured, this should be done by the first two subscripts. The first subscript indicates the terminal at which the voltage is measured and the second the reference terminal or the circuit node. Where there is no possibility of confusion, the second subscript may be omitted.

Examples: $V_{BE}$, $V_{BE'}$, $V_{be}$, $V_{bem}$

Diodes: To indicate a forward voltage (anode positive with respect to cathode), the subscript $F$ or $f$ should be used; for a reverse voltage (anode negative with respect to cathode) the subscript $R$ or $r$ should be used.

Examples: $V_F$, $V_R$, $v_F$, $V_{rm}$

Subscripts for supply voltages or supply currents

Supply voltages or supply currents shall be indicated by repeating the appropriate terminal subscript.

Examples: $V_{CC}$, $I_{EE}$

Note: If it is necessary to indicate a reference terminal, this should be done by a third subscript

Example: $V_{CCE}$

Subscripts for devices having more than one terminal of the same kind

If a device has more than one terminal of the same kind, the subscript is formed by the appropriate letter for the terminal followed by a number; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

Examples: $I_{B2}$ = continuous (d.c.) current flowing into the second base terminal

$V_{B2-E}$ = continuous (d.c.) voltage between the terminals of second base and emitter

Subscripts for multiple devices

For multiple unit devices, the subscripts are modified by a number preceding the letter subscript; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

Examples: $I_{2C}$ = continuous (d.c.) current flowing into the collector terminal of the second unit

$V_{1C-2C}$ = continuous (d.c.) voltage between the collector terminals of the first and the second unit.
Application of the rules

The figure below represents a transistor collector current as a function of time. It consists of a continuous (d.c.) current and a varying component.

LETTER SYMBOLS FOR ELECTRICAL PARAMETERS

Definition

For the purpose of this publication, the term "electrical parameter" applies to four-pole matrix parameters, elements of electrical equivalent circuits, electrical impedances and admittances, inductances and capacitances.

Basic letters

The following is a list of the most important basic letters used for electrical parameters of semiconductor devices.

\[
\begin{align*}
B, b &= \text{susceptance; imaginary part of an admittance} \\
C &= \text{capacitance} \\
G, g &= \text{conductance; real part of an admittance} \\
H, h &= \text{hybrid parameter} \\
L &= \text{inductance} \\
R, r &= \text{resistance; real part of an impedance} \\
X, x &= \text{reactance; imaginary part of an impedance} \\
Y, y &= \text{admittance;} \\
Z, z &= \text{impedance;}
\end{align*}
\]
Upper-case letters shall be used for the representation of:

a) electrical parameters of external circuits and of circuits in which the device forms only a part;

b) all inductances and capacitances.

Lower-case letters shall be used for the representation of electrical parameters inherent in the device (with the exception of inductances and capacitances).

**Subscripts**

**General subscripts**

The following is a list of the most important general subscripts used for electrical parameters of semiconductor devices:

- \( F, f \) = forward; forward transfer
- \( l, i \) (or \( 1 \)) = input
- \( L, l \) = load
- \( O, o \) (or \( 2 \)) = output
- \( R, r \) = reverse; reverse transfer
- \( S, s \) = source

Examples: \( Z_S, h_f, h_F \)

The upper-case variant of a subscript shall be used for the designation of static (d.c.) values.

Examples: \( h_{FE} \) = static value of forward current transfer ratio in common-emitter configuration (d.c. current gain)
\( R_E \) = d.c. value of the external emitter resistance.

Note: The static value is the slope of the line from the origin to the operating point on the appropriate characteristic curve, i.e. the quotient of the appropriate electrical quantities at the operating point.

The lower-case variant of a subscript shall be used for the designation of small-signal values.

Examples: \( h_{fe} \) = small-signal value of the short-circuit forward current transfer ratio in common-emitter configuration
\( Z_e = R_e + jX_e \) = small-signal value of the external impedance

Note: If more than one subscript is used, subscripts for which both styles exist shall either be all upper-case or all lower-case

Examples: \( h_{FE}', y_{RE}', h_{fe} \)
Subscripts for four-pole matrix parameters

The first letter subscript (or double numeric subscript) indicates input, output, forward transfer or reverse transfer.

Examples: $h_i$ (or $h_{11}$), $h_o$ (or $h_{22}$), $h_f$ (or $h_{21}$), $h_r$ (or $h_{12}$)

A further subscript is used for the identification of the circuit configuration. When no confusion is possible, this further subscript may be omitted.

Examples: $h_{fe}$ (or $h_{21e}$), $h_{FE}$ (or $h_{21E}$)

Distinction between real and imaginary parts

If it is necessary to distinguish between real and imaginary parts of electrical parameters, no additional subscripts should be used. If basic symbols for the real and imaginary parts exist, these may be used.

Examples: $Z_i = R_i + jX_i$

$y_{fe} = g_{fe} + jb_{fe}$

If such symbols do not exist or if they are not suitable, the following notation shall be used:

Examples: $\text{Re} (h_{ib})$ etc. for the real part of $h_{ib}$

$\text{Im} (h_{ib})$ etc. for the imaginary part of $h_{ib}$
SCATTERING PARAMETERS

In distinction to the conventional h, y and z-parameters, s-parameters relate to travelling wave conditions. The figure below shows a two-port network with the incident and reflected waves $a_1$, $b_1$, $a_2$ and $b_2$.

$$Z_0 = \text{characteristic impedance of the transmission line in which the two-port is connected.}$$

$$V_i = \text{incident voltage}$$

$$V_r = \text{reflected (generated) voltage}$$

The four-pole equations for s-parameters are:

$$b_1 = s_{11}a_1 + s_{12}a_2$$

$$b_2 = s_{21}a_1 + s_{22}a_2$$

Using the subscripts i for 11, r for 12, f for 21 and o for 22, it follows that:

$$s_i = s_{11} = \frac{b_1}{a_1} \quad a_2 = 0$$

$$s_r = s_{12} = \frac{b_1}{a_2} \quad a_1 = 0$$

$$s_f = s_{21} = \frac{b_2}{a_1} \quad a_2 = 0$$

$$s_o = s_{22} = \frac{b_2}{a_2} \quad a_1 = 0$$

1) The squares of these quantities have the dimension of power.
The s-parameters can be named and expressed as follows:

\[ s_i = s_{11} \] = Input reflection coefficient.
The complex ratio of the reflected wave and the incident wave at the input,
under the conditions \( Z_1 = Z_0 \) and \( V_{S2} = 0 \).

\[ s_r = s_{12} \] = Reverse transmission coefficient.
The complex ratio of the generated wave at the input and the incident wave at
the output, under the conditions \( Z_S = Z_0 \) and \( V_{S1} = 0 \).

\[ s_f = s_{21} \] = Forward transmission coefficient.
The complex ratio of the generated wave at the output and the incident wave at
the input, under the conditions \( Z_1 = Z_0 \) and \( V_{S2} = 0 \).

\[ s_o = s_{22} \] = Output reflection coefficient.
The complex ratio of the reflected wave and the incident wave at the output,
under the conditions \( Z_S = Z_0 \) and \( V_{S1} = 0 \).
RECOMMENDATIONS FOR MOUNTING FLANGE R.F. POWER TRANSISTORS

Flange r.f. transistors are easy to mount but for optimum performance we offer the following recommendations:

- Holes or tapped holes in the heatsink should be free from burrs and spaced at 18,42 mm (+ 0,05; -0,05) between centres. They must have a depth of at least 6 mm. Recommended screw: for SOT-119, SOT-121 and SOT-161 cheese-head 4-40 UNC/2A, for SOT-123 and SOT-160 also M3. A washer to spread the joint pressure is also recommended.

- For transistors dissipating up to 80 W the heatsink thickness should be at least 3 mm copper (> 99.9%, ETP-Cu) or 5 mm aluminium (> 99.0% Al). For transistors dissipating more power, the thickness should be increased proportionally.

- The flatness of the heatsink mounting surface must be > 0,02 mm with a surface roughness $R_a < 0.5 \mu m$ (preferably by grinding or lapping).

- The sparing use of evenly distributed heatsink compound on the transistor flange is recommended. Suitable heatsink compound brands are: Dow Corning 340, Eccotherm TC-5 (E&C), Wakefield 120.

- The screws through the flange holes should first both be tightened to 0,05 Nm (finger tight), and then tightened to 0,6 to 0,75 Nm, to achieve the published thermal resistance between the mounting base and heatsink.

- When a transistor is removed from the heatsink, the flange will almost certainly have been distorted by the joint pressure. Grinding or lapping of the flange according to the information above is necessary if the transistor is remounted.
RECOMMENDATIONS FOR MOUNTING ¼", ⅜" AND ½" CAPSTAN HEADERS AS USED FOR R.F. POWER TRANSISTORS

A nickel plated brass nut is supplied with each transistor for securing it to a heatsink.

Screw threads, diameter and nuts:

<table>
<thead>
<tr>
<th>mounting base diameter</th>
<th>thread</th>
<th>maximum diameter of threaded stud</th>
<th>nut thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>¼&quot;</td>
<td>8-32UNC-2A(B)</td>
<td>4,14 mm</td>
<td>3.5 and 5 mm</td>
</tr>
<tr>
<td>⅜&quot;</td>
<td>10-32UNF-2A(B)</td>
<td>4,80 mm</td>
<td>5 mm</td>
</tr>
<tr>
<td>½&quot;</td>
<td>⅞ x 28UNF-2A(B)</td>
<td>6.33 mm</td>
<td>5.5 mm</td>
</tr>
</tbody>
</table>

To ensure optimum heat transfer and to avoid damage to the threaded stud of the transistor the following recommendations should be observed.

- Diameter of the mounting hole in the heatsink:
  - ¼" stud diameter 4,15 +0,05; -0 mm
  - ⅜" stud diameter 4,85 +0,05; -0 mm
  - ½" stud diameter 6,35 +0,05; -0 mm

Heatsink surfaces at the mounting hole to be flat, parallel, and free of burrs or oxidation.

- Mounting nut torque:
  - ¼" nut minimum 0,75 Nm (7,5 kg cm) maximum 0,85 Nm (8,5 kg cm)
  - ⅜" nut minimum 1,5 Nm (15 kg cm) maximum 1,7 Nm (17 kg cm)
  - ½" nut minimum 2,3 Nm (23 kg cm) maximum 2,7 Nm (27 kg cm)

- Recommended distance from the surface of the heatsink to the top surface of the printed-circuit board:
  - ¼" capstan header 2,9 + 0; -0,2 mm
  - ⅜" capstan header 3,8 + 0; -0,2 mm
  - ½" capstan header 4,8 + 0; -0,2 mm

It is important that the above maximum printed-circuit board mounting heights are not exceeded in order to prevent stress being applied to the encapsulation. Upward lead bending, in particular, can damage the encapsulation and impair the sealing of the header.

- Experience indicates that flux or flux solutions can penetrate even hermetically sealed ceramic-capped transistors. To prevent this, tin and wash the printed-circuit boards before mounting the power transistors, then solder the transistors in place without using flux.
- The leads may be tinned by dipping them, full length, into a solder bath at about 230 °C. Note, no flux should be used during tinning.
- The full mounting-nut torque (specified above) should be applied only once during the life of the transistor. For pre-assembly testing, apply no more than two thirds of the specified torque.
- Since locking washers are much harder than most heatsink materials, their locking action might deteriorate during the life of the transistor. The use of locking washers is therefore not recommended. Instead, tighten the nuts to their specified torque, allow about 30 minutes for them to bed down, then re-tighten. After this, apply locking paint.
DEVICE DATA
V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B or C operated mobile transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. The BFQ42 is especially suited as a driver transistor for the BLW29 in a two-stage wideband or semi-wideband v.h.f. amplifier delivering 15 W output power. It has a TO-39 metal envelope with the collector connected to the case.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ (V)</th>
<th>$f$ (MHz)</th>
<th>$P_L$ (W)</th>
<th>$G_D$ (dB)</th>
<th>$\eta$ (%)</th>
<th>$\overline{Z_i}$ (Ω)</th>
<th>$\overline{Y_L}$ (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w. class-B</td>
<td>13,5</td>
<td>175</td>
<td>2</td>
<td>&gt; 11</td>
<td>&gt; 60</td>
<td>7,8 – j4,6</td>
<td>22 – j18</td>
</tr>
<tr>
<td>c.w. class-B</td>
<td>12,5</td>
<td>175</td>
<td>2</td>
<td>typ. 10,5</td>
<td>typ. 65</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-39; collector connected to case.

Maximum lead diameter is guaranteed only for 12,7 mm.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage \( (V_{BE} = 0) \)
   peak value

Collector-emitter voltage (open base)

Emitter-base voltage (open collector)

Collector current (average)

Collector current (peak value); \( f > 1 \text{ MHz} \)

Total power dissipation up to \( T_{mb} = 25 \, ^\circ\text{C} \)

Storage temperature

Junction temperature

![Graph](image)

(1) Mounted on a heatsink.

(2) Free-air operation; using a spring cooling clip.

Fig. 2 D.C. SOAR.

![Graph](image)

(1) Short-time r.f. operation during mismatch;
   \( R_{th \, mb-h} = 3 \, \text{K/W}; R_{th \, c-a} = 32 \, \text{K/W}; \)
   \( f > 1 \text{ MHz}. \)

(2) Continuous d.c. and r.f. operation;
   \( R_{th \, mb-h} = 3 \, \text{K/W}; R_{th \, c-a} = 32 \, \text{K/W}. \)

Fig. 3 Total power dissipation; \( V_{CE} \leq 16.5 \, \text{V}. \)

- - - Mounted on a heatsink.

- - - Free-air operation; using a spring cooling clip having a thermal resistance of 32 \( \text{K/W}. \)
V.H.F. power transistor

BFQ42

THERMAL RESISTANCE
From junction to mounting base
From junction to case
From mounting base to heatsink

\[ R_{th \, j-mb} = 24 \, \text{K/W} \]
\[ R_{th \, j-c} = 29 \, \text{K/W} \]
\[ R_{th \, mb-h} = 3 \, \text{K/W} \]

CHARACTERISTICS
\( T_j = 25 \, ^\circ\text{C} \)
Collector-emitter breakdown voltage
\( V_{BE} = 0; I_C = 2 \, \text{mA} \)
Collector-emitter breakdown voltage open base; \( I_C = 25 \, \text{mA} \)
Emitter-base breakdown voltage open collector; \( I_E = 1 \, \text{mA} \)
Collector cut-off current
\( V_{BE} = 0; V_{CE} = 18 \, \text{V} \)
Second breakdown energy; \( L = 25 \, \text{mH}; f = 50 \, \text{Hz} \)
open base
\( R_{BE} = 10 \, \Omega \)
D.C. current gain *
\( I_C = 0.25 \, \text{A}; V_{CE} = 5 \, \text{V} \)
Collector-emitter saturation voltage *
\( I_C = 0.75 \, \text{A}; I_B = 0.15 \, \text{A} \)
Transition frequency at \( f = 100 \, \text{MHz} * \)
\( I_E = 0.25 \, \text{A}; V_{CB} = 13.5 \, \text{V} \)
\( I_E = 0.75 \, \text{A}; V_{CB} = 13.5 \, \text{V} \)
Collector capacitance at \( f = 1 \, \text{MHz} \)
\( I_E = I_e = 0; V_{CB} = 13.5 \, \text{V} \)
Feedback capacitance at \( f = 1 \, \text{MHz} \)
\( I_C = 20 \, \text{mA}; V_{CE} = 13.5 \, \text{V} \)

\( V_{(BR)CES} > 36 \, \text{V} \)
\( V_{(BR)CEO} > 18 \, \text{V} \)
\( V_{(BR)EBO} > 4 \, \text{V} \)
\( I_{CES} < 1 \, \text{mA} \)
\( E_{SO} > 0.5 \, \text{mJ} \)
\( E_{SBR} > 0.5 \, \text{mJ} \)
\( h_{FE} \) typ. 30
10 to 60
\( V_{CESat} \) typ. 0.9 \text{ V}
\( f_T \) typ. 750 \text{ MHz}
\( f_T \) typ. 625 \text{ MHz}
\( C_C \) typ. 8.6 \text{ pF}
\( C_{re} \) typ. 3.8 \text{ pF}

* Measured under pulse conditions: \( t_p \leq 200 \, \mu\text{s}; \delta \leq 0.02 \).
Fig. 4 Typical values; $T_j = 25\, ^\circ\text{C}$.

Fig. 5 $I_E = I_F = 0$; $f = 1\, \text{MHz}$; $T_j = 25\, ^\circ\text{C}$.

Fig. 6 $V_{CB} = 13,5\, \text{V}$; $f = 100\, \text{MHz}$; $T_j = 25\, ^\circ\text{C}$. 
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

\[ T_{\text{amb}} = 25 ^\circ C; \; R_{\text{th c-a}} = 32 ^\circ C/W \]

<table>
<thead>
<tr>
<th>( f ) (MHz)</th>
<th>( V_{\text{CE}} ) (V)</th>
<th>( P_L ) (W)</th>
<th>( P_S ) (W)</th>
<th>( G_D ) (dB)</th>
<th>( I_C ) (A)</th>
<th>( \eta ) (%)</th>
<th>( \bar{z}_i ) (Ω)</th>
<th>( Y_L ) (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>13,5</td>
<td>2</td>
<td>&lt;0,16</td>
<td>&gt; 11</td>
<td>&lt;0,25</td>
<td>&gt; 60</td>
<td>7,8 – j4,6</td>
<td>22 – j18</td>
</tr>
<tr>
<td>175</td>
<td>12,5</td>
<td>2</td>
<td>–</td>
<td>typ. 10,5</td>
<td>–</td>
<td>typ. 65</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

Fig. 7 Test circuit; c.w. class-B.

List of components:
- \( C_1 = C_2 = C_5 = 4 \) to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
- \( C_3 = 100 \) pF ceramic capacitor
- \( C_4 = 100 \) nF polyester capacitor
- \( C_6 = 2,5 \) to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
- \( L_1 = 3 \) turns enamelled Cu wire (1,0 mm); int. dia. 4,0 mm; length 4 mm; leads 2 x 5 mm
- \( L_2 = L_4 = \) Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- \( L_3 = L_5 = 4 \) turns Cu wire (1,0 mm); int. dia. 6,0 mm; length 6 mm; leads 2 x 5 mm
- \( R_1 = 220 \) Ω carbon resistor
- \( R_2 = 10 \) Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.
Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

Material of printed-circuit board: 1.6 mm epoxy fibre-glass.

The length of the external emitter lead is 1.2 mm.
Fig. 9  Typical values; \( f = 175 \) MHz; 
\( T_{\text{amb}} = 25 ^\circ \text{C}; \ R_{\text{th c-a}} = 32 \ \text{K/W}. \)

Fig. 10  Typical values; \( f = 175 \) MHz; 
\( T_{\text{amb}} = 25 ^\circ \text{C}; \ --- \ V_{\text{CE}} = 13.5 \) V; 
--- --- \( V_{\text{CE}} = 12.5 \) V; \( R_{\text{th c-a}} = 32 \ \text{K/W}. \)
APPLICATION INFORMATION (continued)

Fig. 11 R.F. SOAR (short-time operation during mismatch); $f = 175$ MHz; $T_h = 70$ °C; $R_{\text{th mb-h}} = 3$ K/W; $V_{C\text{E} \text{nom}} = 13.5$ V or $12.5$ V; $P_s = P_{\text{nom}}$ at $V_{C\text{E} \text{nom}}$ and $V_{\text{SWR}} = 1$.

Fig. 12 R.F. SOAR (short-time operation during mismatch); $f = 175$ °C; $T_{\text{amb}} = 70$ °C; $R_{\text{th ca}} = 32$ K/W; $V_{C\text{E} \text{nom}} = 13.5$ V or $12.5$ V; $P_s = P_{\text{nom}}$ at $V_{C\text{E} \text{nom}}$ and $V_{\text{SWR}} = 1$.

Note to Figs 11 and 12:
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions ($V_{\text{SWR}} = 1$), as a function of the expected supply over-voltage ratio with $V_{\text{SWR}}$ as parameter.

The graph applies to the situation in which the drive ($P_s/P_{\text{nom}}$) increases linearly with supply over-voltage ratio.
OPERATING NOTE Below 100 MHz a base-emitter resistor of 22 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

Fig. 13.

Fig. 14.

Fig. 15.

Conditions for Figs 13, 14 and 15:
Typical values: \( V_{CE} = 13.5 \text{ V} \); \( P_L = 2 \text{ W} \);
\( T_{amb} = 25 \degree \text{C} \); \( R_{th \ c-a} = 32 \text{ } \degree \text{K/W} \).
V.H.F. POWER TRANSISTORS

N-P-N silicon planar epitaxial transistors intended for use in class-A, B or C operated mobile transmitters with a nominal supply voltage of 13,5 V. The transistors are resistance stabilized and guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. The BFQ43 and BFQ43S are especially suited as driver transistors for the BLW31 in a two-stage wideband or semi-wideband v.h.f. amplifier delivering 28 W output power.

The BFQ43 and BFQ43S have a TO-39 metal envelope with the emitter connected to the case which enables excellent heatsinking and emitter grounding.

QUICK REFERENCE DATA

R.F. performance up to \( T_h = 25 \, ^\circ C \)

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>( V_{CE} ) V</th>
<th>( f ) MHz</th>
<th>( P_L ) W</th>
<th>( G_p ) dB</th>
<th>( \eta ) %</th>
<th>( \bar{Z}_i ) Ω</th>
<th>( \bar{Y}_L ) mS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w. class-B</td>
<td>13,5</td>
<td>175</td>
<td>4</td>
<td>&gt; 12</td>
<td>&gt; 55</td>
<td>3,2 + j0,03</td>
<td>53 – j29</td>
</tr>
<tr>
<td>c.w. class-B</td>
<td>12,5</td>
<td>175</td>
<td>4</td>
<td>typ. 12</td>
<td>typ. 60</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1  TO-39; emitter connected to case.

Maximum lead diameter is guaranteed only for 12,7 mm.

* Max. 4,9 for BFQ43S.
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage \((V_{BE} = 0)\)
- peak value

Collector-emitter voltage (open base)

Emitter-base voltage (open collector)

Collector current (average)

Collector current (peak value); \(f > 1\) MHz

Total power dissipation up to \(T_{mb} = 25\) °C

Storage temperature

Operating junction temperature

---

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(V_{CESM}) max.</td>
<td>36 V</td>
</tr>
<tr>
<td>(V_{CEO}) max.</td>
<td>18 V</td>
</tr>
<tr>
<td>(V_{EBO}) max.</td>
<td>4 V</td>
</tr>
<tr>
<td>(I_{C(AV)}) max.</td>
<td>1.25 A</td>
</tr>
<tr>
<td>(I_{CM}) max.</td>
<td>3.75 A</td>
</tr>
<tr>
<td>(P_{tot}) max.</td>
<td>12 W</td>
</tr>
<tr>
<td>(T_{stg})</td>
<td>-65 to +175 °C</td>
</tr>
<tr>
<td>(T_j) max.</td>
<td>200 °C</td>
</tr>
</tbody>
</table>

---

Fig. 2 D.C. SOAR.

(1) Short-time r.f. operation during mismatch; \(f \geq 1\) MHz.

(2) Continuous d.c. and r.f. operation; derate by 0.05 W/°C.

Fig. 3 Total power dissipation; \(V_{CE} \leq 16.5\) V.

THERMAL RESISTANCE (dissipation = 4 W; \(T_{mb} = 82\) °C, i.e. \(T_h = 70\) °C)

From junction to mounting base

From mounting base to heatsink

\[
R_{th\ j-mb} = 18 \text{ K/W} \\
R_{th\ mb-h} = 3 \text{ K/W}
\]
CHARACTERISTICS

Tj = 25 °C

Collector-emitter breakdown voltage
V_{BE} = 0; I_C = 5 mA

Collector-emitter breakdown voltage
open base; I_C = 50 mA

Emitter-base breakdown voltage
open collector; I_E = 2 mA

Collector cut-off current
V_{BE} = 0; V_{CE} = 18 V

Second breakdown energy; L = 25 mH; f = 50 Hz
open base
R_{BE} = 10 Ω

D.C. current gain *
I_C = 0,5 A; V_{CE} = 5 V

Collector-emitter saturation voltage *
I_C = 1,5 A; I_B = 0,3 A

Transition frequency at f = 100 MHz *
- I_E = 0,5 A; V_{CB} = 13,5 V
- I_E = 1,5 A; V_{CB} = 13,5 V

Collector capacitance at f = 1 MHz
I_E = I_E = 0; V_{CB} = 13,5 V

Feedback capacitance at f = 1 MHz
I_C = 20 mA; V_{CE} = 13,5 V

\[ V_{(BR)CES} > 36 \text{ V} \]
\[ V_{(BR)CEO} > 18 \text{ V} \]
\[ V_{(BR)EBO} > 4 \text{ V} \]
\[ I_{CES} < 2 \text{ mA} \]
\[ E_{SBO} > 0,5 \text{ mJ} \]
\[ E_{SBR} > 0,5 \text{ mJ} \]
\[ h_{FE} \text{ typ. 40 to 80} \]
\[ V_{CEsat} \text{ typ. 0,9 V} \]
\[ f_T \text{ typ. 750 MHz} \]
\[ f_T \text{ typ. 625 MHz} \]
\[ C_C \text{ typ. 15 pF} \]
\[ C_{re} \text{ typ. 7,3 pF} \]

* Measured under pulse conditions: \( t_p \ll 200 \mu s; \delta \ll 0,02. \)
Fig. 4 Typical values; $T_j = 25 \, ^\circ C$.

Fig. 5 $I_E = I_e = 0$; $f = 1 \, MHz$; $T_j = 25 \, ^\circ C$.

Fig. 6 $V_{CB} = 13.5 \, V$; $f = 100 \, MHz$; $T_j = 25 \, ^\circ C$. 
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

$T_h = 25 \, ^\circ C$

<table>
<thead>
<tr>
<th>$f$ (MHz)</th>
<th>$V_{CE}$ (V)</th>
<th>$P_L$ (W)</th>
<th>$P_S$ (W)</th>
<th>$G_p$ (dB)</th>
<th>$I_C$ (A)</th>
<th>$\eta$ (%)</th>
<th>$Z_i$ ($\Omega$)</th>
<th>$\Lambda_L$ (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>13.5</td>
<td>4</td>
<td>$&lt; 0.25$</td>
<td>$&gt; 12$</td>
<td>$&lt; 0.54$</td>
<td>$&gt; 55$</td>
<td>$3.2 + j0.03$</td>
<td>$53 - j29$</td>
</tr>
<tr>
<td>175</td>
<td>12.5</td>
<td>4</td>
<td>—</td>
<td>typ. 12</td>
<td>—</td>
<td>typ. 60</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

List of components:

- $C1 = C5 = 2.5$ to $20 \, \mu F$ film dielectric trimmer (cat. no. 2222 809 07004)
- $C2 = C6 = 4$ to $40 \, \mu F$ film dielectric trimmer (cat. no. 2222 809 07008)
- $C3 = 100 \, \mu F$ ceramic capacitor
- $C4 = 100 \, nF$ polyester capacitor
- $L1 = 2$ turns Cu wire (1.0 mm); int. dia. 4.0 mm; length 3 mm; leads 2 x 5 mm
- $L2 = 7$ turns enamelled Cu wire (0.5 mm); int. dia. 3.0 mm; length 4 mm; leads 2 x 5 mm
- $L3 = L5 = \text{Ferroxcube wide-band h.f. choke, grade 3B}$ (cat. no. 4312 020 36640)
- $L4 = 4$ turns enamelled Cu wire (1.0 mm); int. dia. 5.5 mm; length 5 mm; leads 2 x 5 mm
- $L6 = 5$ turns enamelled Cu wire (1.0 mm); int. dia. 5.5 mm; length 7.5 mm; leads 2 x 5 mm
- $R1 = R2 = 10 \, \Omega$ carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.
Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

Material of printed-circuit board: 1.6 mm epoxy fibre-glass.

The case is directly grounded on the printed-circuit board.
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive \( \frac{P_S}{P_{S\text{nom}}} \) increases linearly with supply over-voltage ratio.
OPERATING NOTE Below 140 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

Conditions for Figs 12, 13 and 14:
Typical values; $V_{CE} = 13.5$ V; $P_L = 4$ W; $T_h = 25$ °C.
V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 13,5 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions with a supply over-voltage to 16,5 V. It has a TO-39 metal envelope with the collector connected to the case.

QUICK REFERENCE DATA

R.F. performance up to $T_{mb} = 25 \degree C$ in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_P$ dB</th>
<th>$\eta$ %</th>
<th>$Z_i$ $\Omega$</th>
<th>$\overline{Y}_L$ mS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>13,5</td>
<td>175</td>
<td>4</td>
<td>$&gt; 8$</td>
<td>$&gt; 60$</td>
<td>3,9 + j2,2</td>
<td>37 – j22</td>
</tr>
<tr>
<td>c.w.</td>
<td>12,5</td>
<td>175</td>
<td>4</td>
<td>typ. 8</td>
<td>typ. 60</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-39; collector connected to case.

Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories: 56245 (distance disc).
RATINGS  Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)  
peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current (average)
Collector current (peak value)  f > 1 MHz

Total power dissipation up to  T_{mb} = 25 \, ^\circ\text{C}  
f > 1\text{MHz}

Storage temperature
Operating junction temperature

THERMAL RESISTANCE
From junction to mounting base
From mounting base to heatsink
with a boron nitride washer
for electrical insulation

\begin{align*}
V_{CBOM} & \quad \text{max.} \quad 36 \, \text{V} \\
V_{CEO} & \quad \text{max.} \quad 18 \, \text{V} \\
V_{EBO} & \quad \text{max.} \quad 4 \, \text{V} \\
I_{C(AV)} & \quad \text{max.} \quad 0.75 \, \text{A} \\
I_{CM} & \quad \text{max.} \quad 2.25 \, \text{A} \\
P_{\text{tot}} & \quad \text{max.} \quad 8 \, \text{W} \\
T_{\text{stg}} & \quad -65 \text{ to } +200 \, ^\circ\text{C} \\
T_{j} & \quad \text{max.} \quad 200 \, ^\circ\text{C} \\
R_{\text{th j-mb}} & = 22 \, \text{K/W} \\
R_{\text{th mb-h}} & = 2.5 \, \text{K/W}
\end{align*}
V.H.F. power transistor

CHARACTERISTICS

$T_j = 25^\circ C$ unless otherwise specified

Collector cut-off current

$I_B = 0; V_{CE} = 14 \text{ V}$

$V_{CEO} < 5 \text{ mA}$

Breakdown voltages

Collector-base voltage

opened emitter, $I_C = 1 \text{ mA}$

$V_{(BR)CBO} > 36 \text{ V}$

Collector-emitter voltage

opened base, $I_C = 10 \text{ mA}$

$V_{(BR)CEO} > 18 \text{ V}$

Emitter-base voltage

opened collector, $I_E = 1 \text{ mA}$

$V_{(BR)EBO} > 4 \text{ V}$

Transient energy

$L = 25 \text{ mH}; f = 50 \text{ Hz}$

opened base

$E > 0.5 \text{ mS}$

$-V_{BE} = 1.5 \text{ V}; R_{BE} = 33 \Omega$

$E > 0.5 \text{ mS}$

D.C. current gain

$I_C = 500 \text{ mA}; V_{CE} = 5 \text{ V}$

$h_{FE} > 5$

Transition frequency

$I_C = 350 \text{ mA}; V_{CE} = 10 \text{ V}$

$f_T \text{ typ.} 700 \text{ MHz}$

Collector capacitance at $f = 1 \text{ MHz}$

$I_E = I_e = 0; V_{CB} = 15 \text{ V}$

$C_c \text{ typ.} 15 \text{ pF}$

Feedback capacitance at $f = 1 \text{ MHz}$

$I_C = 50 \text{ mA}; V_{CE} = 15 \text{ V}$

$C_{re} \text{ typ.} 11 \text{ pF}$

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APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

\[ f = 175 \text{ MHz}; \quad T_{mb} \text{ up to } 25 \text{ °C} \]

<table>
<thead>
<tr>
<th>( V_{CC}(V) )</th>
<th>( P_S(W) )</th>
<th>( P_L(W) )</th>
<th>( I_C(A) )</th>
<th>( G_P(dB) )</th>
<th>( \eta(%) )</th>
<th>( Z_I(\Omega) )</th>
<th>( Y_L(mS) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.5</td>
<td>&lt; 0.63</td>
<td>4</td>
<td>&lt; 0.49</td>
<td>&gt; 8</td>
<td>&gt; 60</td>
<td>3.9 + j2.2</td>
<td>37 - j22</td>
</tr>
<tr>
<td>12.5</td>
<td>typ. 0.63</td>
<td>4</td>
<td>typ. 0.53</td>
<td>typ. 8</td>
<td>typ. 60</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Test circuit

```
C1 = C6 = 4 to 29 pF air trimmer with insulated rotor
C2 = C7 = 4 to 29 pF air trimmer with non-insulated rotor
C3 = 39 pF ceramic
C4 = 100 pF ceramic
C5 = 15 nF polyester
L1 = 1 turn enamelled Cu wire (1.0 mm); int. diam. 10 mm; leads 2 x 10 mm
L2 = 6 turns enamelled Cu wire (0.7 mm); int. diam. 4 mm; leads 2 x 10 mm
L3 = L6 = ferroxcube choke (code number 4312 020 36640)
L4 = 8 turns enamelled Cu wire (0.7 mm); int. diam. 4 mm; leads 2 x 10 mm
L5 = 5 turns enamelled Cu wire (1.0 mm); winding pitch 1.0 mm; int. diam. 8 mm; leads 2 x 10 mm
L7 = 7 turns enamelled Cu wire (1.0 mm); winding pitch 1.0 mm; int. diam. 6 mm; leads 2 x 5 mm
R1 = R2 = 10 Ω carbon
```

May 1974
BFS22A

\[ f = 175\text{MHz} \]
\[ T_{mb} = 25^\circ\text{C} \]

- \( V_{CC} = 13.5\text{V} \)
- \( V_{CC} = 12.5\text{V} \)

\[ \text{Typ} \]

Graph showing the relationship between power \( P_L \) and power \( P_I \).
V.H.F. power transistor

**BFS22A**

**Conditions for R.F. SOAR:**

\[
f = 175 \text{ MHz} \quad P_{\text{Snom}} = P_S \text{ at } V_{CC} = V_{CC\text{nom}} \text{ and V.S.W.S.} = 1
\]

\[
T_{mb} = 70 \degree C \quad V_{CC\text{nom}} = 12.5 \text{ or } 13.5 \text{ V}
\]

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graphs above for safe operation at supply voltages other than the nominal. The graphs show the allowable output power under nominal conditions, as a function of the supply overvoltage ratio, with V. S. W. R. as parameter.

The left hand graph applies to the situation in which the drive \(P_S/P_{\text{Snom}}\) increases linearly with supply overvoltage ratio.

The right hand graph shows the derating factor to be applied when the drive \(P_S/P_{\text{Snom}}\) increases as the square of the supply overvoltage ratio \(V_{CC}/V_{CC\text{nom}}\).

Depending on the operating conditions, the appropriate derating factor may lie in the region between the linear and the square-law functions.
OPERATING NOTE Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.
V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 28 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions.

It has a TO-39 metal envelope with the collector connected to the case.

QUICK REFERENCE DATA

R.F. performance up to $T_{mb} = 25 \, ^\circ C$ in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_D$ dB</th>
<th>$\eta$ %</th>
<th>$\bar{Z}_{ij}$ $\Omega$</th>
<th>$\bar{Y}_L$ mS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>28</td>
<td>175</td>
<td>4</td>
<td>&gt;10</td>
<td>&gt;65</td>
<td>2,3 + j1,6</td>
<td>8,9 – j18,1</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 TO-39; collector connected to case.

Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories: 56245 (distance disc).
RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter) peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current (average)
Collector current (peak value) f > 1 MHz

Total power dissipation up to T_{mb} = 25 °C f > 1 MHz

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_{CBOM} max.</td>
<td>65 V</td>
</tr>
<tr>
<td>V_{CEO} max.</td>
<td>36 V</td>
</tr>
<tr>
<td>V_{EBO} max.</td>
<td>4 V</td>
</tr>
<tr>
<td>I_{C(AV)} max.</td>
<td>0.5 A</td>
</tr>
<tr>
<td>I_{CM} max.</td>
<td>1.5 A</td>
</tr>
<tr>
<td>P_{tot} max.</td>
<td>8 W</td>
</tr>
</tbody>
</table>

Storage temperature
Operating junction temperature

THERMAL RESISTANCE

From junction to mounting base
From mounting base to heatsink with a boron nitride washer for electrical insulation

<table>
<thead>
<tr>
<th>Resistance</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>R_{th j-mb}</td>
<td>22 K/W</td>
</tr>
<tr>
<td>R_{th mb-h}</td>
<td>2.5 K/W</td>
</tr>
</tbody>
</table>

T_{stg} -65 to +200 °C
T_{j} max. 200 °C
V.H.F. power transistor

BFS23A

CHARACTERISTICS

$T_j = 25 \, ^\circ C$ unless otherwise specified

Collector cut-off current

$I_B = 0; \, V_{CE} = 28 \, V$

Breakdown voltages

Collector-base voltage

open emitter, $I_C = 1 \, mA$

$V_{(BR)CBO} > 65 \, V$

Collector-emitter voltage

open base, $I_C = 10 \, mA$

$V_{(BR)CEO} > 36 \, V$

Emitter-base voltage

open collector; $I_E = 1 \, mA$

$V_{(BR)EBO} > 4 \, V$

Transient energy

$L = 25 \, mH; \, f = 50 \, Hz$

open base

$E > 0.5 \, ms$

$-V_{BE} = 1.5 \, V; \, R_{BE} = 33 \, \Omega$

$E > 0.5 \, ms$

D.C. current gain

$I_C = 500 \, mA; \, V_{CE} = 5 \, V$

$h_{FE} > 5$

Transition frequency

$I_C = 400 \, mA; \, V_{CE} = 20 \, V$

$f_T \quad \text{typ.} \quad 500 \, MHz$

Collector capacitance at $f = 1 \, MHz$

$I_E = I_E = 0; \, V_{CB} = 30 \, V$

$C_C \quad \text{typ.} \quad 10 \, pF$

Feedback capacitance at $f = 1 \, MHz$

$I_C = 25 \, mA; \, V_{CE} = 30 \, V$

$-C_{re} \quad \text{typ.} \quad 7.5 \, pF$
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

\[ V_{CC} = 28 \, \text{V}; \, T_{mb} \text{ up to } 25 \, ^\circ\text{C} \]

<table>
<thead>
<tr>
<th>( f(\text{MHz}) )</th>
<th>( P_s , (\text{W}) )</th>
<th>( P_L , (\text{W}) )</th>
<th>( I_C , (\text{A}) )</th>
<th>( G_p , (\text{dB}) )</th>
<th>( \eta , (%) )</th>
<th>( \bar{Z}_i , (\Omega) )</th>
<th>( \bar{Y}_L , (\text{mS}) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>&lt; 0.40</td>
<td>4</td>
<td>&lt; 0.22</td>
<td>&gt; 10</td>
<td>&gt; 65</td>
<td>2.3+j1.6</td>
<td>8.9 -j18.1</td>
</tr>
</tbody>
</table>

Test circuit

C1 = C6 = 4 to 29 pF air trimmer with insulated rotor
C2 = C7 = 4 to 29 pF air trimmer with non-insulated rotor
C3 = 39 pF ceramic
C4 = 100 pF ceramic
C5 = 15 nF polyester
L1 = 1 turn enameled Cu wire (1.0 mm); int. diam. 10 mm; leads 2 x 10 mm
L2 = 6 turns enameled Cu wire (0.7 mm); int. diam. 4 mm; leads 2 x 10 mm
L3 = L6 = ferroxcube choke (code number 4312 020 36640)
L4 = 8 turns enameled Cu wire (0.7 mm); int. diam. 4 mm; leads 2 x 10 mm
L5 = 5 turns enameled Cu wire (1.0 mm); winding pitch 1.0 mm; int. diam. 8 mm; leads 2 x 10 mm
L7 = 4 turns enameled Cu wire (1.0 mm); winding pitch 1.0 mm; int. diam. 6 mm; leads 2 x 5 mm
R1 = R2 = 10 \, \Omega \, \text{carbon}
For high voltage operation, a stabilized power supply is generally used. The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heat-sink temperature as parameter.
OPERATING NOTE Below 100 MHz a base-emitter resistor of 10 $\Omega$ is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.
U.H.F. POWER AMPLIFIER MODULES

Broadband amplifier modules primarily designed for mobile applications operating directly from 12 V vehicle electrical systems. The module will produce 2,5 W output into a 50 Ω load over the bands 380 to 512 MHz for the BGY22, and 420 to 480 MHz for the BGY22A.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>type number</th>
<th>mode of operation</th>
<th>freq. range MHz</th>
<th>( V_B ) V</th>
<th>( P_D ) mW</th>
<th>( P_L ) W</th>
<th>( \eta ) %</th>
<th>( Z_S = Z_L ) Ω</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGY22</td>
<td>c.w.</td>
<td>380 to 512</td>
<td>13,5</td>
<td>50</td>
<td>&gt; 2,5</td>
<td>&gt; 40</td>
<td>50</td>
</tr>
<tr>
<td>BGY22A</td>
<td>c.w.</td>
<td>420 to 480</td>
<td>12,5</td>
<td>50</td>
<td>&gt; 2,5</td>
<td>&gt; 40</td>
<td>50</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-75A.

To ensure good thermal contact between mounting base and heatsink, burrs or thickening at the edges of the heatsink holes should be removed and the package bolted down onto a flat surface.

Devices may be soldered directly into a circuit with a soldering iron at a maximum iron temperature of 245 °C for 10 seconds at least 1 mm from the plastic.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

D.C. voltages (with respect to flange)

Supply terminal

Input terminal

Output terminal

Current

Supply current (d.c.)

Drive power

\[ V_B = 13.5 \text{ V}; \quad Z_L = 50 \Omega \]

Temperatures

Storage temperature

Operating heatsink temperature

\[ T_{stg} = -40 \text{ to } +100 \text{ °C} \]

\[ T_h \text{ max. } 90 \text{ °C} \]

\[ P_L \text{ for normal operation} \]

\[ P_L \text{ for fault condition} \]

Where \( P_{L\text{nom}} = P_L \) at \( V_B = 13.5 \text{ V}; \quad Z_L = 50 \Omega \) (BGY22)

and \( P_{L\text{nom}} = P_L \) at \( V_B = 12.5 \text{ V}; \quad Z_L = 50 \Omega \) (BGY22A)

\[ P_{L\text{nom}} = 150 \text{ mW} \]
CHARACTERISTICS

$T_H = 25 \, ^\circ C$ unless otherwise specified

Reference planes at r.f. input and output terminals are 1 mm from the plastic encapsulation.

Frequency range 380-512 MHz; $V_B = 13.5 \, V$ (BGY22)
Frequency range 420-480 MHz; $V_B = 12.5 \, V$ (BGY22A)

Quiescent current

$P_D = 0$

Load power

$P_D = 50 \, mW$

Efficiency

$P_D = 50 \, mW$

Supply current

$P_D = 50 \, mW$

Harmonic content

$P_D = 50 \, mW$

Input VSWR with respect to 50 $\Omega$

$P_D = 50 \, mW$

Temperature coefficient of $P_L$

$P_D = 50 \, mW; \, T_H = 25 \text{ to } 70 \, ^\circ C$

Stability

$V_B = 10.5 \text{ to } 15 \, V; \, P_D = 10 \, mW \text{ to } 100 \, mW$

$T_H = -40 \text{ to } +90 \, ^\circ C$

Output load VSWR $\leq 3$, all phases

Output load VSWR $\leq 10$, all phases

Any harmonic is at least 20 dB down relative to carrier

Input VSWR $< 2$

Typ. $-10 \, mW/\circ C$

No instabilities

No appreciable instabilities
**APPLICATION INFORMATION**

R.F. performance in c.w. operation; $T_H = 25 \, ^\circ\!C$.

Drive source and load impedance $Z_S = Z_L = 50 \, \Omega$

<table>
<thead>
<tr>
<th>type number</th>
<th>$f$ MHz</th>
<th>$V_B$ V</th>
<th>$P_D$ mW</th>
<th>$P_L$ W</th>
<th>$\eta$ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGY22</td>
<td>380 to 512</td>
<td>15,0</td>
<td>typ. 3,5</td>
<td>typ. 47</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>13,5</td>
<td>&gt; 2,5</td>
<td>&gt; 40</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>13,5</td>
<td>typ. 2,9</td>
<td>typ. 47</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>12,5</td>
<td>typ. 2,5</td>
<td>typ. 47</td>
<td></td>
</tr>
<tr>
<td>BGY22A</td>
<td>420 to 480</td>
<td>12,5</td>
<td>&gt; 2,5</td>
<td>&gt; 40</td>
<td></td>
</tr>
</tbody>
</table>

The modules are designed to withstand full load mismatch under the following conditions:

$P_D = P_{D\text{nom}} + 20\%; \; T_H = 70 \, ^\circ\!C$

$V_B = 16,5 \, V$ (BGY22)

$V_B = 15,0 \, V$ (BGY22A)

$\text{VSWR} = 50$ at any phase

where $P_{D\text{nom}} = P_D$ for 2,5 W module output under nominal conditions.
Typical variation of input impedance with frequency

$V_B = 13.5 \text{ V}$

$f = 470 \text{ MHz}$

Typical variation of power dissipation with load impedance
U.H.F. power amplifier modules

$V_B = 13.5 \, V$
$P_D = 50 \, mW$
$f = 470 \, MHz$

Typical variation of load power with load impedance

$V_B = 13.5 \, V$
$P_D = 50 \, mW$
$f = 470 \, MHz$

Typical variation of efficiency with load impedance
U.H.F. POWER AMPLIFIER MODULES

Broadband amplifier modules primarily designed for mobile applications operating directly from 12 V vehicle electrical systems. The modules are suitable for driving directly from the BGY22 and BGY22A respectively, and when so driven will produce 7 W output into a 50 Ω load over the band 380 to 480 MHz for the BGY23, and 7 W over the band 420 to 480 MHz for the BGY23A.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>type number</th>
<th>mode of operation</th>
<th>freq. range MHz</th>
<th>V_B V</th>
<th>P_D W</th>
<th>P_L W</th>
<th>η %</th>
<th>Z_S = Z_L Ω</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGY23</td>
<td>c.w.</td>
<td>380 to 480</td>
<td>13,5</td>
<td>2,5</td>
<td>&gt; 7,0</td>
<td>&gt; 60</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>380 to 480</td>
<td>13,5</td>
<td>2,5</td>
<td></td>
<td>typ. 71</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>480 to 512</td>
<td></td>
<td>typ. 7,5</td>
<td>7,0</td>
<td>&gt; 60</td>
<td>50</td>
</tr>
<tr>
<td>BGY23A</td>
<td>c.w.</td>
<td>420 to 480</td>
<td>12,5</td>
<td>2,5</td>
<td>&gt; 7,0</td>
<td>&gt; 60</td>
<td>50</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-75A.

To ensure good thermal contact between mounting base and heatsink, burrs or thickening at the edges of the heatsink holes should be removed and the package bolted down onto a flat surface.

Devices may be soldered directly into a circuit with a soldering iron at a maximum iron temperature of 245 °C for 10 seconds at least 1 mm from the plastic.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134) (with respect to flange)

Supply terminal
Input terminal (no external d.c. connection)
Output terminal
Supply current (d.c.)
$V_B = 13.5\, V;\, Z_L = 50\, \Omega$
Storage temperature
Operating heatsink temperature

$P_L$ for normal operation

Where $P_{L\text{nom}} = P_L$ at $V_B = 13.5\, V;\, Z_L = 50\, \Omega$ (BGY23)
and $P_{L\text{nom}} = P_L$ at $V_B = 12.5\, V;\, Z_L = 50\, \Omega$ (BGY23A)
U.H.F. power amplifier modules

CHARACTERISTICS

$T_h = 25 \, ^\circ C$ unless otherwise specified.

Reference planes at r.f. input and output terminals are 1 mm from the plastic encapsulation.

Frequency range 380-512 MHz; $V_B = 13.5 \, V$ (BGY23)
Frequency range 420-480 MHz; $V_B = 12.5 \, V$ (BGY23A)

Quiescent current

$P_D = 0$

Load power

$P_D = 2.5 \, W; f = 380-480 \, MHz$  
$P_D = 2.5 \, W; f = 480-512 \, MHz$  
$P_D = 2.5 \, W; f = 420-480 \, MHz$

$P_D = 0$

<table>
<thead>
<tr>
<th>$I_B Q$</th>
<th>$\leq , 5.0 , mA$</th>
<th>$P_L$</th>
<th>$7.0$ to $9.5 , W$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$PGY23$</td>
<td>$7.5 , W$ typ.</td>
<td>$P_L$</td>
<td>$7.0$ to $9.5 , W$</td>
</tr>
<tr>
<td>$PGY23A$</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Efficiency

$P_D = 2.5 \, W$

$\eta > 60 \%$

Supply current

$P_D = 2.5 \, W$

$I_{tot}$ typ. $900 \, mA$

Harmonic content

$P_D = 2.5 \, W$

Any harmonic is at least 20 dB down relative to carrier

Input VSWR with respect to 50 $\Omega$

$P_D = 2.5 \, W$

$VSWR < 2$

Temperature coefficient of $P_L$

$P_D = 2.5 \, W; T_h = 25$ to $70 \, ^\circ C$

typ. $-20 \, mW/\circ C$

Stability

$V_B = 10.5 \, V$ to $15 \, V; P_D = 1 \, W$ to $3.5 \, W$

$T_h = -40 \, ^\circ C$ to $+90 \, ^\circ C$

Output load VSWR $\leq 3$, all phases

Output load VSWR $\leq 10$, all phases

No instabilities

No appreciable instabilities
Typical values:

- \( P_D = 2.5 \text{ W} \)
- \( T_h = 25 \text{°C} \)

- \( V_B = 13.5 \text{ V} \)
- \( T_h = 25 \text{°C} \)

- \( V_B = 15 \text{ V} \)
- \( T_h = 25 \text{°C} \)

- \( V_B = 12.5 \text{ V} \)
- \( T_h = 25 \text{°C} \)

- \( f (\text{MHz}) \) range from 350 to 550 MHz.
U.H.F. power amplifier modules

APPLICATION INFORMATION

R.F. performance in c.w. operation; \( T_h = 25 \, ^\circ C \)

Drive source and load impedance \( Z_S = Z_L = 50 \, \Omega \)

<table>
<thead>
<tr>
<th>Type number</th>
<th>( f ) (MHz)</th>
<th>( V_B ) (V)</th>
<th>( P_D ) (W)</th>
<th>( P_L ) (W)</th>
<th>( \eta ) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGY23</td>
<td>380 to 512</td>
<td>15, 0</td>
<td>2, 5</td>
<td>typ. 9, 0</td>
<td>typ. 65</td>
</tr>
<tr>
<td>BGY23</td>
<td>380 to 480</td>
<td>13, 5</td>
<td>2, 5</td>
<td>&gt; 7, 0</td>
<td>&gt; 60</td>
</tr>
<tr>
<td>BGY23</td>
<td>380 to 480</td>
<td>13, 5</td>
<td>2, 5</td>
<td>typ. 8, 3</td>
<td>typ. 71</td>
</tr>
<tr>
<td>BGY23</td>
<td>480 to 512</td>
<td>13, 5</td>
<td>2, 5</td>
<td>typ. 7, 5</td>
<td>typ. 69</td>
</tr>
<tr>
<td>BGY23A</td>
<td>380 to 512</td>
<td>12, 5</td>
<td>2, 5</td>
<td>typ. 7, 4</td>
<td>typ. 70</td>
</tr>
<tr>
<td>BGY23A</td>
<td>420 to 480</td>
<td>12, 5</td>
<td>&gt; 7, 0</td>
<td>&gt; 60</td>
<td></td>
</tr>
</tbody>
</table>

Connection of the BGY22/BGY22A to the BGY23/BGY23A respectively can be either by 50 \( \Omega \) transmission line or directly with a total lead length not greater than 2 mm.

The modules are designed to withstand full load mismatch under the following conditions:

\[
\begin{align*}
P_D &= P_{D\text{nom}} + 20\% ; \, T_h = 70 \, ^\circ C \\
V_B &= 16, 5 \, V \, (\text{BGY23}) \\
V_B &= 15, 0 \, V \, (\text{BGY23A}) \\
\text{VSWR} &= 50 \, \text{at any phase}
\end{align*}
\]

where \( P_{D\text{nom}} = P_D \) for 7.0 W module output under nominal conditions.
Typical variation of input impedance with frequency

$V_B = 13.5 \text{ V}$
$f = 470 \text{ MHz}$

BGY22/23 or BGY22A/23A cascaded amplifier

Typical variation of overall power dissipation with load impedance
U.H.F. power amplifier modules

VB = 13.5 V
f = 470 MHz

BGY22/23 or
BGY22A/23A
cascaded amplifier

Typical variation of load power with load impedance

VB = 13.5 V
f = 470 MHz

BGY22/23 or
BGY22A/23A
cascaded amplifier

Typical variation of overall efficiency with load impedance
V.H.F. POWER AMPLIFIER MODULES

A range of broadband amplifier modules designed for mobile communications equipments, operating directly from 12 V vehicle electrical systems. The devices will produce 18 W output into a 50 Ω load. The modules consist of a two stage r.f. amplifier using n-p-n transistor chips, together with lumped-element matching components.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>type number</th>
<th>mode of operation</th>
<th>frequency range f (MHz)</th>
<th>nominal supply voltages $V_{B1} = V_{B2}$ (V)</th>
<th>drive power $P_D$ (mW)</th>
<th>load power $P_L$ (W)</th>
<th>nominal input impedance $z_i$ (Ω)</th>
<th>nominal load impedance $Z_L$ (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGY32</td>
<td>c.w.</td>
<td>68 to 88</td>
<td>12,5</td>
<td>100</td>
<td>&gt; 18 typ 23</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>BGY33</td>
<td>c.w.</td>
<td>80 to 108</td>
<td>12,5</td>
<td>100</td>
<td>&gt; 18 typ 22</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>BGY35</td>
<td>c.w.</td>
<td>132 to 156</td>
<td>12,5</td>
<td>150</td>
<td>&gt; 18 typ 22</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>BGY36</td>
<td>c.w.</td>
<td>148 to 174</td>
<td>12,5</td>
<td>150</td>
<td>&gt; 18 typ 21</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

CIRCUIT DIAGRAM

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
Mounting and soldering recommendations

To ensure good thermal transfer the module should be mounted using heatsink compound onto a heatsink with a flat surface; if an isolation washer is used heatsink compound should be used on both sides of the insulator. Burrs and thickening of the holes in the heatsink should be removed and 3 mm bolts tightened to torques of 0.5 Nm minimum.

Devices may be soldered directly into a circuit with a soldering iron at maximum iron temperature of 245 °C for 10 seconds at least 1 mm from the plastic.
V.H.F. power amplifier modules

RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

D.C. voltages (with respect to flange)

<table>
<thead>
<tr>
<th>Terminals</th>
<th>V&lt;sub&gt;B1&lt;/sub&gt; and V&lt;sub&gt;B2&lt;/sub&gt; max</th>
<th>±V&lt;sub&gt;I&lt;/sub&gt; max</th>
<th>±V&lt;sub&gt;O&lt;/sub&gt; max</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.C. supply terminals</td>
<td>15 V</td>
<td>25 V</td>
<td>25 V</td>
</tr>
<tr>
<td>R.F. input terminal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R.F. output terminal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input drive power BGY32 and BGY33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input drive power BGY35 and BGY36</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load power</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Storage temperature

T<sub>Stg</sub> ≥ -40 to 100 °C

Operating heatsink temperature

T<sub>h</sub> max 90 °C

July 1977
CHARACTERISTICS

$T_h = 25 \, ^\circ C$

Quiescent current

$V_{B1} = V_{B2} = 12,5 \, V; \, P_D = 0; \\
R_S = R_L = 50 \, \Omega$

<table>
<thead>
<tr>
<th></th>
<th>BGY32</th>
<th>BGY33</th>
<th>BGY35</th>
<th>BGY36</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_{BQ1}$</td>
<td>typ 6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>$I_{BQ2}$</td>
<td>typ 13</td>
<td>13</td>
<td>13</td>
<td>13</td>
</tr>
</tbody>
</table>

Frequency range

$P_L \quad typ \quad 18 \quad 18$  
$\eta \quad typ \quad 18 \quad 18$  
$P_L \quad typ \quad > 40$  
$\eta \quad typ \quad > 50$

Load power

$V_{B1} = V_{B2} = 12,5 \, V; \, R_S = R_L = 50 \, \Omega$  
BGY32 and BGY33; $P_D = 100 \, mW$  
BGY35 and BGY36; $P_D = 150 \, mW$

Harmonic output

Any single harmonic will be at least 25 dB down relative to carrier

Input VSWR with respect to 50 Ω

typ 1,5

Stability

The module is stable with load VSWR up to 3 (all phases) when operated with matched output power greater than 6 W.

Ruggedness

The modules are capable of withstanding load mismatch of up to 50 VSWR for short period overload conditions, with $P_D, V_{B1}$ and $V_{B2}$ at maximum values providing the combination does not result in the matched r.f. output power rating being exceeded.

APPLICATION INFORMATION

Supply

An electrolytic capacitor of 10 µF (25 V), in parallel with a polyester capacitor of 100 nF to earth, is recommended as decoupling arrangement for each power supply pin.

Power rating

In general it is recommended that the output power from the module under nominal design conditions should not exceed 23 W in order to provide adequate safety margin under fault conditions.

Gain control

Power output can be controlled by variation of the driver stage supply voltage $V_{B1}$. The supply required is a voltage regulator with a current rating of 0.75 A, and an output voltage range of 3 V to 12 V.
V.H.F. power amplifier modules

**Typical Values**

- **$P_0 = 100$ mW**
- **$V_{B1} = V_{B2} = 12.5$ V**
- **$P_D = 100$ mW**

**Graphs**

- **$P_L$ vs. $f$ (MHz)**
- **$V_B$ vs. $P_L$ (W)**
- **$P_L$ vs. $V_{B1}$**
- **$\eta$ vs. $f$ (MHz)**
V.H.F. power amplifier modules

V_{B2} = 12.5 V
P_D = 100 mW
typical values

V_{B1} = V_{B2} = 12.5 V
P_D = 100 mW
typical values

\eta = \frac{P_0}{P_D} \times 100\%

\eta_{typ} = \frac{P_0}{P_D} \times 100\%

\Delta G_p = \frac{P_0}{P_L} \times 100\%

BGY32 BGY33
BGY35 BGY36
V.H.F. power amplifier modules

\[ V_{B1} = V_{B2} = 12.5 \text{ V} \]
\[ P_D = 150 \text{ mW} \]
typical values

\[ P_L = 23 \text{ W} \]

July 1977
U.H.F. POWER AMPLIFIER MODULES

A range of broadband u.h.f. modules, primarily designed for mobile communication equipment, operating directly from 12 V electrical systems.

The BGY40,41 series produce minimum output powers of 7.5 W and 13 W respectively in the u.h.f. communications bands, the ‘A’ types covering 400 to 440 MHz and the ‘B’ types covering 440 to 470 MHz.

The modules consist of a three-stage r.f. amplifier using n-p-n transistor chips with lumped element matching components in a plastic stripline encapsulation.

The negative supply is internally connected to the flange.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Mode of operation</th>
<th>BGY40A</th>
<th>BGY41A</th>
<th>BGY40B</th>
<th>BGY41B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltages</td>
<td>Vs1, Vs2</td>
<td>nom.</td>
<td>12.5 V</td>
<td>12.5 V</td>
</tr>
<tr>
<td>Input impedance</td>
<td>Z_i</td>
<td>nom.</td>
<td>50 Ω</td>
<td>50 Ω</td>
</tr>
<tr>
<td>Output load impedance</td>
<td>Z_L</td>
<td>nom.</td>
<td>50 Ω</td>
<td>50 Ω</td>
</tr>
</tbody>
</table>

R.f. performance

<table>
<thead>
<tr>
<th>Frequency of operation</th>
<th>BGY40A</th>
<th>BGY41A</th>
<th>BGY40B</th>
<th>BGY41B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical drive power</td>
<td>P_D</td>
<td>75 mW</td>
<td>150 mW</td>
<td>150 mW</td>
</tr>
<tr>
<td>Typical load power</td>
<td>P_L</td>
<td>11.5 W</td>
<td>15.6 W</td>
<td>10 W</td>
</tr>
<tr>
<td>Typical efficiency</td>
<td>η</td>
<td>4%</td>
<td>40%</td>
<td>40%</td>
</tr>
</tbody>
</table>

MECHANICAL DATA (see Fig. 15)

Fig. 1 Circuit of the u.h.f. modules.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
**RATINGS**

Limiting values in accordance with the Absolute Maximum System (IEC134)

**Voltages (with respect to flange)**

<table>
<thead>
<tr>
<th>Terminals</th>
<th>VS1 and VS2</th>
<th>±Vin</th>
<th>±Vout</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.C. supply terminals</td>
<td>max.</td>
<td>16.5</td>
<td>V</td>
</tr>
<tr>
<td>R.F. input terminal</td>
<td>max.</td>
<td>25</td>
<td>V</td>
</tr>
<tr>
<td>R.F. output terminal</td>
<td>max.</td>
<td>25</td>
<td>V</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Component</th>
<th>BGY40A, 40B</th>
<th>BGY41A, 41B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load power (see Fig.2)</td>
<td>PL</td>
<td>PL</td>
</tr>
<tr>
<td>max.</td>
<td>12</td>
<td>16.5</td>
</tr>
<tr>
<td>Input drive power</td>
<td>PD</td>
<td>PD</td>
</tr>
<tr>
<td>max.</td>
<td>150</td>
<td>200</td>
</tr>
</tbody>
</table>

Storage temperature range

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>T_stg</td>
<td>-40 to +100 °C</td>
</tr>
<tr>
<td>T_h</td>
<td>max.</td>
</tr>
<tr>
<td></td>
<td>90 °C</td>
</tr>
</tbody>
</table>

**Fig.2 Load power derating; VSWR = 1**
CHARACTERISTICS

$T_h = 25 \, ^{\circ}C$ unless otherwise specified;

$V_{S1} = V_{S2} = 12.5 \, V; \; R_S = 50 \, \Omega; \; R_L = 50 \, \Omega$

<table>
<thead>
<tr>
<th></th>
<th>BGY40A</th>
<th>BGY41A</th>
<th>BGY40B</th>
<th>BGY41B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of operation</td>
<td>$f$</td>
<td>400 to 440 MHz</td>
<td>440 to 470 MHz</td>
<td></td>
</tr>
<tr>
<td>Minimum load power</td>
<td>$P_L$</td>
<td>7.5 W</td>
<td>13 W</td>
<td>7.5 W</td>
</tr>
<tr>
<td>Nominal drive power</td>
<td>$P_D$</td>
<td>100 mW</td>
<td>150 mW</td>
<td>100 mW</td>
</tr>
<tr>
<td>Minimum efficiency</td>
<td>$\eta$</td>
<td>35 %</td>
<td>35 %</td>
<td>35 %</td>
</tr>
<tr>
<td>Typical load power</td>
<td>$P_L$</td>
<td>11.5 W</td>
<td>15.6 W</td>
<td>10 W</td>
</tr>
<tr>
<td>Typical drive power</td>
<td>$P_D$</td>
<td>75 mW</td>
<td>150 mW</td>
<td>100 mW</td>
</tr>
<tr>
<td>Typical efficiency</td>
<td>$\eta$</td>
<td>40 %</td>
<td>40 %</td>
<td>40 %</td>
</tr>
</tbody>
</table>

Harmonic output

Any single harmonic will be at least 40 dB down from the carrier.

Input VSWR (with respect to 50 $\Omega$)

Typ. 1.5

Stability

The modules are stable with load VSWR up to 3 (all phases) when operated within the following limits:

<table>
<thead>
<tr>
<th></th>
<th>BGY40A, BGY40B</th>
<th>BGY41A, BGY41B</th>
</tr>
</thead>
<tbody>
<tr>
<td>$P_D$</td>
<td>30 to 150 mW</td>
<td>30 to 200 mW</td>
</tr>
<tr>
<td>$V_{S1} = V_{S2}$</td>
<td>8 to 16.5 V</td>
<td>8 to 16.5 V</td>
</tr>
<tr>
<td>$P_L$</td>
<td>5 to 12 W</td>
<td>5 to 16.5 W</td>
</tr>
</tbody>
</table>

Ruggedness

The modules will withstand load VSWR of 50 (all phases) for short period overload conditions with $P_D$, $V_{S1}$ and $V_{S2}$ at maximum values, providing the combination does not result in the matched r.f. output power rating being exceeded.

Mounting

To ensure good thermal transfer, the module should be mounted onto a heatsink with a flat surface, with heat conducting compound between module and heatsink. If an isolation washer is used, heatsink compound should be applied to both sides of the washer. Burrs and thickening of the holes in the heatsink should be removed and 3 mm bolts tightened to a torque of 0.5 Nm.

Devices may be soldered directly into a circuit using a soldering iron with a maximum temperature of 245 $^{\circ}C$ for not more than 10 seconds at a distance of at least 1 mm from the plastic.
Fig. 3 Typical values; $V_{S1} = V_{S2} = 12.5$ V

Fig. 4 Typical values; $V_{S2} = 12.5$ V; $P_D = 100$ mW

Fig. 5 Typical values; $V_{S1} = V_{S2} = 12.5$ V

Fig. 6 Typical values; $V_{S2} = 12.5$ V; $P_D = 100$ mW
U.H.F. power amplifier modules

Fig. 7 Typical values; \( P_D = 100 \) mW

Fig. 8 Typical values; \( V_{S1} = V_{S2} = 12.5 \) V; \( P_D = 100 \) mW

Fig. 9 Typical values; \( V_{S1} = V_{S2} = 12.5 \) V; \( P_D = 100 \) mW

Fig. 10 Typical values; \( V_{S1} = V_{S2} = 12.5 \) V; \( P_D = 100 \) mW
Fig. 11 Typical values; $V_{S1} = V_{S2} = 12.5$ V

Fig. 12 Typical values; $V_{S2} = 12.5$ V; $P_D = 150$ mW

Fig. 13 Typical values; $V_{S1} = V_{S2} = 12.5$ V

Fig. 14 Typical values; $V_{S2} = 12.5$ V; $P_D = 150$ mW
MECHANICAL DATA
Fig. 15 SOT-132C.

Dimensions in mm

Lead reference
1 = Input
2 = Earth
3 = \(V_{S1}\)
4 = Earth
5 = \(V_{S2}\)
6 = Earth
7 = Output

Dimensions in mm

U.H.F. power amplifier modules
V.H.F. POWER AMPLIFIER MODULE

A broadband v.h.f. amplifier module primarily designed for mobile communications equipment, operating directly from 12 V electrical systems. The module will produce a minimum output of 13 W into a 50 Ω load over the frequency range 148 to 174 MHz.

The module consists of a two stage r.f. amplifier using n-p-n transistor chips with lumped-element matching components in a plastic stripline encapsulation. The negative supply is internally connected to the flange.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Mode of operation</th>
<th>c.w.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency range</td>
<td>f 148 to 174 MHz</td>
</tr>
<tr>
<td>Drive power</td>
<td>PD (\text{max.} 150 \text{ mW} )</td>
</tr>
<tr>
<td></td>
<td>PD (\text{typ.} 80 \text{ mW} )</td>
</tr>
<tr>
<td>Load power</td>
<td>PL (&gt;13 \text{ W} )</td>
</tr>
<tr>
<td>Supply voltages</td>
<td>(V_{S1} \text{ and } V_{S2}) nom. 12.5 V</td>
</tr>
<tr>
<td>Input impedance</td>
<td>(Z_i) nom. 50 Ω</td>
</tr>
<tr>
<td>Output load impedance</td>
<td>(Z_L) nom. 50 Ω</td>
</tr>
</tbody>
</table>

MECHANICAL DATA (see Fig. 10)

![Circuit of the v.h.f. module.](image)

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages (with respect to flange)

<table>
<thead>
<tr>
<th>Terminals</th>
<th>Voltage Symbol(s)</th>
<th>Symbol(s)</th>
<th>Maximum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.C. supply terminals</td>
<td>$V_{S_1}$ and $V_{S_2}$</td>
<td>max.</td>
<td>16.5 V</td>
</tr>
<tr>
<td>R.F. input terminal</td>
<td>$\pm V_i$</td>
<td>max.</td>
<td>25 V</td>
</tr>
<tr>
<td>R.F. output terminal</td>
<td>$\pm V_o$</td>
<td>max.</td>
<td>25 V</td>
</tr>
</tbody>
</table>

Load power (see below)

<table>
<thead>
<tr>
<th>Terminals</th>
<th>Symbol</th>
<th>Maximum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load power (see below)</td>
<td>$P_L$</td>
<td>max.</td>
</tr>
<tr>
<td>Input drive power</td>
<td>$P_D$</td>
<td>max.</td>
</tr>
</tbody>
</table>

Storage temperature range

<table>
<thead>
<tr>
<th>Terminals</th>
<th>Symbol</th>
<th>Range</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage temperature range</td>
<td>$T_{stg}$</td>
<td>-40 to +100 °C</td>
<td>°C</td>
</tr>
<tr>
<td>Operating heatsink temperature</td>
<td>$T_h$</td>
<td>max.</td>
<td>90 °C</td>
</tr>
</tbody>
</table>

Fig.2 Load power derating; VSWR = 1
CHARACTERISTICS

$T_h = 25 \, ^\circ C$ unless otherwise specified

$V_{S1} = V_{S2} = 12.5 \, V$; $R_S = 50 \, \Omega$; frequency range 148 to 174 MHz; $R_L = 50 \, \Omega$

**Quiescent currents**

<table>
<thead>
<tr>
<th>$P_D$</th>
<th>$I_Q1$ typ.</th>
<th>5 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$I_Q2$ typ.</td>
<td>15 mA</td>
</tr>
</tbody>
</table>

**R.F. drive power**

<table>
<thead>
<tr>
<th>$P_L$</th>
<th>$P_D$ &lt;</th>
<th>150 mW</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 W</td>
<td>$P_D$ typ.</td>
<td>80 mW</td>
</tr>
</tbody>
</table>

**Efficiency**

<table>
<thead>
<tr>
<th>$P_L$</th>
<th>$\eta &gt;$</th>
<th>40 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 W</td>
<td>$\eta$ typ.</td>
<td>48 %</td>
</tr>
</tbody>
</table>

**Harmonic output**

Input VSWR (with respect to 50 $\Omega$) typ. 1.5

Any single harmonic will be at least 25 dB down from the carrier, with typical rejection of 34 dB.

**Stability**

The module is stable with load VSWR up to 3 (all phases) when operated with:

$V_{S1} = V_{S2} = 10$ to 16.5 $V$; $f = 148$ to 174 MHz; $P_D = 30$ to 300 mW; $P_L \leq 18$ W (matched)

**Ruggedness**

The modules will withstand load VSWR of 50 for short period overload conditions, with $P_D$, $V_{S1}$ and $V_{S2}$ at maximum values, providing the combination does not result in the matched r.f. output power rating being exceeded.

**Mounting**

To ensure good thermal transfer the module should be mounted onto a heatsink with a flat surface, with heat conducting compound between module and heatsink. If an isolation washer is used, heatsink compound should be applied to both sides of the washer. Burrs and thickening of the holes in the heatsink should be removed and 3 mm bolts tightened to a torque of 0.5 Nm.

Devices may be soldered directly into a circuit using a soldering iron with a maximum temperature of 245 $^\circ C$ for not more than 10 seconds at a distance of at least 1 mm from the plastic.
APPLICATION INFORMATION

A technical publication (M80—0056) entitled 'Transmitter design using v.h.f. broadband amplifier modules' is available on request.

Power rating

In general it is recommended that the output power from the module under nominal conditions should not exceed 16 W in order to provide adequate safety margin under fault conditions.

Gain control

Power output can be controlled by variation of the driver stage supply voltage $V_{S1}$. The supply required is a voltage regulator with a current rating of 0.75 A, and an output voltage range of 3 V to 12 V.

---

### Power amplifier

- $V_{S2}$ (power amplifier supply)
- 100 nF
- 100 nF
- 10 nF 25 V

### Driver stage

- $V_{S1}$ (driver stage supply)
- 100 nF
- 100 nF
- 10 nF 25 V

---

Fig. 3 Test jig for v.h.f. modules

Fig. 4 Recommended decoupling arrangement
V.H.F. power amplifier module

Fig. 5 Typical values; \( P_D = 150 \text{ mW} \)

Fig. 6 Typical values; \( V_{S1} = V_{S2} = 12.5 \text{ V}; f = 160 \text{ MHz} \)
Fig. 7 Typical values; \( V_{S2} = 12.5 \text{ V}; P_D = 150 \text{ mW} \)

Fig. 8 Typical values; \( V_{S1} = V_{S2} = 12.5 \text{ V}; P_D = 150 \text{ mW} \)
Fig. 9 Typical values; $V_{S1} = V_{S2} = 12.5$ V; $P_D = 150$ mW
MECHANICAL DATA
Fig. 10 SOT-132B.

Dimensions in mm

Lead reference
1 = Input
2 = Earth
3 = $V_{S1}$
4 = Earth
5 = $V_{S2}$
6 = Earth
7 = Output
V.H.F. BROADBAND POWER MODULE

V.H.F. broadband power amplifier module primarily designed for mobile communications equipment, operating directly from 12,5 V systems. The module will produce a minimum output of 30 W into a 50 Ω load over the frequency range 68 to 88 MHz.

The module consists of a two-stage amplifier using n-p-n transistor chips with lumped-element matching components in a plastic stripline encapsulation. The negative supply is internally connected to the flange.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Mode of operation</th>
<th>Frequency range</th>
<th>68 to 88 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.C. supply voltage (terminal 2)</td>
<td>VS1</td>
<td>12,5 V</td>
</tr>
<tr>
<td>D.C. supply voltage (terminal 3)</td>
<td>VS2</td>
<td>12,5 V</td>
</tr>
</tbody>
</table>
| Drive power | PDR | typ. 50 mW  
 | max. 150 mW |
| Load power | PL | 30 W |
| Efficiency | η | typ. 40 %  
 | max. 30 W |
| Operating heatsink temperature | Th | max. 90 °C |

MECHANICAL DATA

Fig. 1 SOT-183.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

D.C. supply terminal voltages* $V_{S1}; V_{S2}$ max. 16.5 V*

Input terminal voltage* $\pm V_i$ max. 25 V*

Output terminal voltage* $\pm V_o$ max. 25 V*

Load power $P_L$ max. 40 W**

Drive power $P_{DR}$ max. 300 mW

Storage temperature $T_{stg}$ -40 to 100 °C

Operating temperature $T_h$ max. 90 °C

CHARACTERISTICS

$V_{S1} = V_{S2} = 12.5$ V; $Z_S = Z_L = 50 \Omega; T_h = 25$ °C

Quiescent currents

$P_{DR} = 0$

$I_{Q1}$ typ. 10 mA

$I_{Q2}$ typ. 25 mA

max. 35 mA

Frequency range

$f$ 68 to 88 MHz

Efficiency

$\eta$ min. 37 %

typ. 40 %

R.F. drive power

$P_L = 30$ W

$P_{DR}$ typ. 50 mW

max. 150 mW

Second-harmonic rejection

$P_L = 30$ W

typ. 45 dB

min. 30 dB

Input VSWR

with respect to 50 $\Omega$

typ. 1,5 : 1

max. 2,0 : 1

Stability

The module is stable with load VSWR up to 3 : 1 (all phases) when operated within the following conditions:

$V_{S1} = 6$ to 16.5 V; $V_{S2} = 10$ to 16.5 V; $f = 68$ to 88 MHz; $P_D = 30$ to 300 mW

provided the maximum ratings of the module are not exceeded.

Ruggedness

The modules will withstand load VSWR of 20 : 1 for short overload conditions, with $P_{DR}, V_{S1}$ and $V_{S2}$ at maximum values, providing the combination does not cause the matched r.f. output power rating to be exceeded.

Mounting

To ensure good thermal transfer the module should be mounted onto a heatsink with a flat surface with heat-conducting compound sparingly applied between module and heatsink. Any burrs on the heatsink should be removed. The connectors may be soldered directly onto a circuit using a soldering iron with a maximum temperature of 245 °C for not more than 10 seconds at a distance of at least 1 mm from the plastic.

* With respect to the flange.  ** See Fig. 2.
V.H.F. broadband power module

Power rating
In general, it is recommended that the output power from the module under nominal condition should not exceed 35 W in order to provide adequate safety margins under fault conditions.

Gain control
Power output can be controlled by variation of the driver stage supply voltage $V_{S1}$. The supply needed is a voltage regulator with a current rating of 1.2 A and an output voltage range of 4 V to 12.5 V.
Fig. 2 Load power derating; VSWR = 1:1.

Fig. 3 $V_{S1} = V_{S2} = 12.5\,\text{V}$; $T_h = 25\,\text{°C}$; typ. values.

Fig. 4 $P_{DR} = 150\,\text{mW}$; $V_{S1} = V_{S2} = 12.5\,\text{V}$; typ. values.

Fig. 5 $P_{DR} = 150\,\text{mW}$; $V_{S2} = 12.5\,\text{V}$; typ. values.

Fig. 6 $V_{S1} = V_{S2} = 12.5\,\text{V}$; $P_{DR} = 150\,\text{mW}$; typ. values.

Fig. 7 $V_{S1} = V_{S2} = 12.5\,\text{V}$; $P_L = 30\,\text{W}$; typ. values.
V.H.F. BROADBAND POWER MODULE

V.H.F. broadband power amplifier module primarily designed for mobile communications equipment, operating directly from 12.5 V systems. The module will produce a minimum output of 30 W into a 50 Ω load over the frequency range 148 to 174 MHz.

The module consists of a two-stage amplifier using n-p-n transistor chips with lumped-element matching components in a plastic stripline encapsulation. The negative supply is internally connected to the flange.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Mode of operation</th>
<th>c.w.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency range</td>
<td>148 to 174 MHz</td>
</tr>
<tr>
<td>D.C. supply voltage (terminal 2)</td>
<td>VS1</td>
</tr>
<tr>
<td>D.C. supply voltage (terminal 3)</td>
<td>VS2</td>
</tr>
<tr>
<td>Drive power</td>
<td>PDR</td>
</tr>
<tr>
<td>Load power</td>
<td>PL</td>
</tr>
<tr>
<td>Efficiency</td>
<td>η</td>
</tr>
<tr>
<td>Operating heatsink temperature</td>
<td>Th</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-183.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

D.C. supply terminal voltages* 
Vs1;Vs2 max. 16,5 V*
±Vi max. 25 V*
±Vo max. 25 V*

Load power 
PL max. 40 W**

Drive power 
PDR max. 400 mW

Storage temperature 
Tstg -40 to 100 °C

Operating temperature 
Th max. 90 °C

CHARACTERISTICS

Vs1 = Vs2 = 12,5 V; ZS = ZL = 50 Ω; Th = 25°C

Quiescent currents 
PDR = 0

IQ1 typ. 10 mA
IQ2 typ. 25 mA
max. 35 mA

Frequency range 

f 148 - 174 MHz

Efficiency 

η min. 40 %
typ. 45 %

R.F. drive power 

PL = 30 W

PDR max. 300 mW
typ. 150 mW

Second-harmonic rejection 

PL = 30 W
typ. 35 dB
min. 30 dB

Input VSWR 
with respect to 50 Ω
typ. 1,5 : 1
max. 2,0 : 1

Stability
The module is stable with load VSWR up to 3 : 1 (all phases) when operated within the following conditions:

Vs1 = 6 to 16,5 V; Vs2 = 10 to 16,5 V; f = 148 to 174 MHz; PD = 150 to 400 mW provided the maximum ratings of the module are not exceeded.

Ruggedness
The modules will withstand load VSWR of 20 : 1 for short overload conditions, with PDR, Vs1 and Vs2 at maximum values, providing the combination does not cause the matched r.f. output power rating to be exceeded.

Mounting
To ensure good thermal transfer the module should be mounted onto a heatsink with a flat surface with heat-conducting compound sparingly applied between module and heatsink. Any burrs on the heatsink should be removed. The connectors may be soldered directly onto a circuit using a soldering iron with a maximum temperature of 245 °C for not more than 10 seconds at a distance of at least 1 mm from the plastic.

* With respect to the flange. ** See Fig. 2.

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V.H.F. broadband power module

Power rating
In general, it is recommended that the output power from the module under nominal condition should not exceed 35 W in order to provide adequate safety margins under fault conditions.

Gain control
Power output can be controlled by variation of the driver stage supply voltage $V_{S1}$. The supply needed is a voltage regulator with a current rating of 1.2 A and an output voltage range of 3 V to 12 V.
Fig. 2 Load power derating.

Fig. 3 $V_{S1} = V_{S2} = 12.5\, \text{V;}$ $T_h = 25\, ^\circ\text{C;}$ typ. values.

Fig. 4 $P_{DR} = 300\, \text{mW;}$ $V_{S1} = V_{S2} = 12.5\, \text{V;}$ typ. values.

Fig. 5 $P_{DR} = 300\, \text{mW;}$ $V_{S2} = 12.5\, \text{V;}$ typ. values.

Fig. 6 $V_{S1} = V_{S2} = 12.5\, \text{V;}$ $P_{DR} = 300\, \text{mW;}$ typ. values.

Fig. 7 $V_{S1} = V_{S2} = 12.5\, \text{V;}$ $P_{DR} = 300\, \text{mW;}$ typ. values.
U.H.F. AMPLIFIER MODULES

U.H.F. amplifier modules designed for use in portable transmitters operating from a 9.6 V supply. The modules are two-stage amplifiers using n-p-n transistors mounted on thin-film metallized alumina substrates with stripline matching circuits.

The BGY46A and BGY46B will produce a minimum of 1.4 W into a 50 Ω load over the 400 to 440 MHz and 430 to 470 MHz frequency ranges respectively.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Mode of operation</th>
<th>continuous wave</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency range</td>
<td></td>
</tr>
<tr>
<td>BGY46A</td>
<td>400 to 440 MHz</td>
</tr>
<tr>
<td>BGY46B</td>
<td>430 to 470 MHz</td>
</tr>
<tr>
<td>R.F. load power</td>
<td></td>
</tr>
<tr>
<td>$V_{S1} = 7.5 \text{ V}$; $V_{S2} = 9.6 \text{ V}$; $P_{DR} = 45 \text{ mW}$</td>
<td>$&gt; 1.4 \text{ W}$</td>
</tr>
<tr>
<td>R.F. drive power</td>
<td></td>
</tr>
<tr>
<td>$V_{S1} = 7.5 \text{ V}$; $V_{S2} = 9.6 \text{ V}$; $P_L = 1.4 \text{ W}$</td>
<td>$&lt; 45 \text{ mW}$</td>
</tr>
</tbody>
</table>

Input and output impedances

<table>
<thead>
<tr>
<th>Dimensions in mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>26 max</td>
</tr>
<tr>
<td>3.0</td>
</tr>
<tr>
<td>2.5</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-181.

Lead reference
1. R.F. input
2. Earth
3. $V_{S1}$
4. $V_{S2}$
5. Earth
6. R.F. output
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

D.C. supply terminal voltages*  
\( V_{S1}/V_{S2} \)  max.  12 V*  
\( \pm V_i \)  max.  25 V*  
\( \pm V_o \)  max.  25 V*  

R.F. input voltage*  
\( P_L \)  max.  2.5 W  

R.F. output voltage*  
\( P_{DR} \)  max.  90 mW  

Load power  
Storage temperature  
Operating heatsink temperature  

CHARACTERISTICS

Quiescent currents  
\( V_{S1} = 7.5 \text{ V}; V_{S2} = 9.6 \text{ V}; P_{DR} = 0; T_h = 25 \text{ °C} \)
\( I_{Q1} \)  <  7 mA  
\( I_{Q2} \)  <  0.1 mA  

Efficiency  
\( V_{S1} = 7.5 \text{ V}; V_{S2} = 9.6 \text{ V}; P_{DR} = 45 \text{ mW}; R_S = R_L = 50 \Omega \)
\( \eta \)  >  40 %  

Harmonic output  
\( V_{S1} = 7.5 \text{ V}; V_{S2} = 9.6 \text{ V}; P_{DR} = 45 \text{ mW}; R_S = R_L = 50 \Omega \)
any harmonic  <  -30 dB  

Input VSWR  
\( V_{S1} = 7.5 \text{ V}; V_{S2} = 9.6 \text{ V}; P_{DR} = 45 \text{ mW}; R_S = R_L = 50 \Omega \)
\( V_{SWR} \)  max.  2  

Stability

The modules will produce no spurious signals with a load mismatch of up to 5 VSWR (all phases) when operated within the following conditions:
\( V_{S1} = 4 \text{ to } 12 \text{ V}; V_{S2} = 6 \text{ to } 12 \text{ V}; P_{DR} = 17 \text{ to } 70 \text{ mW}. \)

Ruggedness

The modules will withstand a load mismatch VSWR of 50 (all phases) when operated within the following conditions:
\( V_{S1} < 12 \text{ V}; V_{S2} < 12 \text{ V}; P_{DR} < 70 \text{ mW}; T_h < 90 \text{ °C}. \)

* With respect to flange.
U.H.F. AMPLIFIER MODULES

A range of U.H.F. amplifier modules designed for use in portable transmitters operating from a 9.6 V supply. The modules are two-stage amplifiers using n-p-n transistors mounted on thin-film metallized alumina substrates with stripline matching circuits.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Mode of operation</th>
<th>frequency modulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>R.F. performance</td>
<td></td>
</tr>
<tr>
<td>f MHz</td>
<td>V_{S1} V</td>
</tr>
<tr>
<td>BGY47A</td>
<td>400 to 470</td>
</tr>
<tr>
<td>BGY47F</td>
<td>460 to 512</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-181.

Dimensions in mm

Lead reference
1. R.F. input
2. Earth
3. V_{S1}
4. V_{S2}
5. Earth
6. R.F. output
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

- D.C. supply terminal voltages* 
  \[ V_{S1}/V_{S2} \text{ max. 12 V*} \]
- R.F. input voltage* 
  \[ \pm V_i \text{ max. 25 V*} \]
- R.F. output voltage* 
  \[ \pm V_o \text{ max. 25 V*} \]
- Load power 
  \[ P_L \text{ max. 5 W} \]
- Drive power 
  \[ P_{DR} \text{ max. 90 mW} \]
- Storage temperature 
  \[ T_{stg} \text{ -40 to 100 °C} \]
- Operating heatsink temperature 
  \[ T_h \text{ max. 90 °C} \]

CHARACTERISTICS

Quiescent currents

- \[ V_{S1} = 7,5 \text{ V; } V_{S2} = 9,6 \text{ V; } P_{DR} = 0; T_h = 25 ^\circ \text{C} \]
- \[ I_{Q1} < 7 \text{ mA} \]
- \[ I_{Q2} < 0,1 \text{ mA} \]

Efficiency

- When operated under nominal conditions
  - BGY47A
    \[ \eta > 40 \% \]
  - BGY47F
    \[ \eta > 36 \% \]

Harmonic output

- \[ V_{S1} = V_{S2} = 9,6 \text{ V; } P_{DR} = 50 \text{ mW} \]
  - BGY47A
    \[ \text{any harmonic} < -30 \text{ dB} \]
  - \[ V_{S1} = 7,5 \text{ V; } V_{S2} = 9,6 \text{ V; } P_{DR} = 50 \text{ mW} \]
    - BGY47F
      \[ \text{any harmonic} < -30 \text{ dB} \]

Stability

The modules will produce no spurious signals with a load mismatch of up to 5 VSWR (all phases) when operated within the following conditions:

- \[ V_{S1} = 6 \text{ to 12 V; } V_{S2} = 8 \text{ to 12 V; } P_{DR} = 25 \text{ to 100 mW.} \]

Ruggedness

The modules will withstand a load mismatch VSWR of 50 (all phases) when operated within the following conditions:

- \[ V_{S1} < 12 \text{ V; } V_{S2} < 12 \text{ V; } P_{DR} < 100 \text{ mW; } T_h < 90 \text{ °C.} \]

* With respect to flange.
DEVELOPMENT DATA
This data sheet contains advance information and specifications are subject to change without notice.

U.H.F. AMPLIFIER MODULES

A range of U.H.F. amplifier modules designed for use in portable transmitters operating from a 9,6 V electrical supply. The modules are three-stage amplifiers consisting of bipolar silicon n-p-n transistors and lumped element matching circuits.

The BGY48A, BGY48B and BGY48C will produce a minimum of 5 W into a 50 Ω load over the 400 to 440 MHz, 430 to 470 MHz and 460 to 512 MHz frequency ranges respectively.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Mode of operation</th>
<th>Frequency range</th>
<th>R.F. load power</th>
<th>R.F. drive power</th>
<th>Input and output impedances</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>continuous wave</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BGY48A</td>
<td>400 to 440 MHz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BGY48B</td>
<td>430 to 470 MHz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BGY48C</td>
<td>460 to 512 MHz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vs1 = Vs2 = 9,6 V; PDR = 50 mW</td>
<td>&gt; 5,0 W</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vs1 = Vs2 = 9,6 V; PL = 5,0 W</td>
<td>&lt; 35 mW</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>nom. 50 Ω</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-182.

Dimensions in mm

Lead reference
1. R.F. input
2. Earth
3. Vs1 and second stage bias
4. Earth
5. Vs2
6. Earth
7. R.F. output

July 1986
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

- D.C. supply terminal voltages* \( V_{S1}/V_{S2} \) max. 13.5 V*
- R.F. input voltage* \( \pm V_i \) max. 25 V*
- R.F. output voltage* \( \pm V_o \) max. 25 V*
- Load power \( P_L \) max. 9 W
- Drive power \( P_{DR} \) max. 70 mW
- Storage temperature \( T_{stg} \) -40 to 100 °C
- Operating heatsink temperature \( T_h \) max. 90 °C

CHARACTERISTICS

Quiescent currents
- second stage current with first stage open circuit \( V_{S2} = 9.6 \, V; P_{DR} = 0; R_S = R_L = 50 \, \Omega; I_{S1} = 0 \)
  \( I_{Q2} \) typ. 0.1 mA
- first stage current \( V_{S1} = 7.1 \, V; V_{S2} = 9.6 \, V; P_{DR} = 0; R_S = R_L = 50 \, \Omega \)
  \( I_{Q1} \) typ. 2 mA

Efficiency
- \( V_{S1} = V_{S2} = 9.6 \, V; P_L = 5.0 \, W; R_S = R_L = 50 \, \Omega \)
  \( \eta \) typ. 42 %

Harmonic output
- \( V_{S1} = V_{S2} = 9.6 \, V; P_{DR} = 35 \, mW; R_S = R_L = 50 \, \Omega \)
  any harmonic (relative to carrier) < -40 dB typ. -50 dB

Input VSWR
- \( V_{S1} = V_{S2} = 9.6 \, V; P_{DR} = 35 \, mW; R_S = R_L = 50 \, \Omega \)
  VSWR max. 2

Stability

The modules will produce no signals at frequencies other than that of the carrier and harmonics of the carrier frequency when operated with a load mismatch of 5 VSWR (all phases) and when operated within the following conditions:
- \( V_{S1} \leq V_{S2} = 4 \) to 11.2 V; \( P_{DR} = 17 \) to 70 mW; \( P_L < 9.0 \, W \).

Ruggedness

The modules will withstand a load VSWR of 50 for short period overload conditions, with \( P_{D}, V_{S1} \) and \( V_{S2} \) at maximum values, providing the combination does not result in the matched r.f. output power derating curve being exceeded. \( T_h = 90 \, ^\circ C \).

* With respect to earth pins.
Fig. 2 Load power derating; VSWR = 1 : 1.
U.H.F. POWER MODULE

The BGY90A is a two stage u.h.f. power module designed for use in mobile transmitting equipment operating from a 12 V power supply.

The module consists of two n-p-n silicon planar transistors mounted on a metallized ceramic substrate together with matching and bias circuitry. The module produces an output of 7.5 W into a 50 Ω load over the frequency range of 806 to 890 MHz when operated under nominal conditions.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>D.C. supply terminal voltages</th>
<th>VS1:VS2</th>
<th>nom.</th>
<th>12.5 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>f</td>
<td></td>
<td>806 to 890 MHz</td>
</tr>
<tr>
<td>R.F. load power at P_D = 200 mW</td>
<td>P_L</td>
<td>&gt;</td>
<td>7.5 W</td>
</tr>
<tr>
<td>R.F. input drive power at P_L = 7.5 W</td>
<td>P_D</td>
<td>&lt;</td>
<td>200 mW</td>
</tr>
<tr>
<td>Input and output impedance</td>
<td>Z_S;Z_L</td>
<td>nom.</td>
<td>50 Ω</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-197.

Dimensions in mm

Lead reference:
1 = r.f. input
2 = VS1
3 = VS2
4 = r.f. output

R 2.0

2.54

7295379

September 1985
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

D.C. terminal supply voltages
D.C. voltage on r.f. input
D.C. voltage on r.f. output
Load power (r.f.)
Drive power (r.f.)
Storage temperature
Operating heatsink temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.C. terminal supply voltages</td>
<td>Vs1/Vs2</td>
<td>max. 16.5 V</td>
<td></td>
</tr>
<tr>
<td>D.C. voltage on r.f. input</td>
<td>±Vi</td>
<td>max. 25 V</td>
<td></td>
</tr>
<tr>
<td>D.C. voltage on r.f. output</td>
<td>±Vo</td>
<td>max. 25 V</td>
<td></td>
</tr>
<tr>
<td>Load power (r.f.)</td>
<td>P_L</td>
<td>max. 9 W</td>
<td></td>
</tr>
<tr>
<td>Drive power (r.f.)</td>
<td>P_D</td>
<td>max. 400 mW</td>
<td></td>
</tr>
<tr>
<td>Storage temperature</td>
<td>T_stg</td>
<td>-40 to +100 °C</td>
<td></td>
</tr>
<tr>
<td>Operating heatsink temperature</td>
<td>T_h</td>
<td>max. 90 °C</td>
<td></td>
</tr>
</tbody>
</table>

CHARACTERISTICS

VS1 = VS2 = 12.5 V; f = 806 - 890 MHz; ZS = ZL = 50 Ω unless otherwise specified

Quiescent currents

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PQ1</td>
<td>IQ1</td>
<td>typ. 40 mA</td>
<td></td>
</tr>
<tr>
<td>PQ2</td>
<td>IQ2</td>
<td>typ. 25 mA</td>
<td></td>
</tr>
</tbody>
</table>

R.F. input drive power at P_L = 7.5 W

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD</td>
<td>&lt;</td>
<td>200 mW</td>
<td></td>
</tr>
</tbody>
</table>

R.F. output power at P_D = 200 mW

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PL</td>
<td>&gt;</td>
<td>7.5 W</td>
<td></td>
</tr>
</tbody>
</table>

Efficiency at P_L = 7.5 W

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;</td>
<td>&gt;</td>
<td>35 %</td>
<td></td>
</tr>
</tbody>
</table>

Harmonic rejection at P_L = 7.5 W

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;</td>
<td>35 dB</td>
<td></td>
</tr>
</tbody>
</table>

Stability
The module will produce no spurious signals with a load mismatch of up to 3 VSWR when operated within the following conditions:

VS1 = 0 to 15 V; VS2 = 6 to 15 V; PD = 0 to 400 mW; TH < 90 °C; P_L (into 50 Ω) ≤ 9 W.

Ruggedness
The module will withstand a load mismatch VSWR of 50 when operated within the following conditions:

VS1 = 15 V max.; VS2 = 15 V; PD = 400 mW max.; TH < 90 °C; providing the module is adjusted for P_L < 9 W (into 50 Ω). This adjustment may be performed by control of either PD or VS1.
Fig. 2 Output power versus frequency; $P_D = 200$ mW; $V_S = 12.5$ V; typical values.

Fig. 3 Output power versus 1st stage supply voltage; $f = 850$ MHz; $P_D = 200$ mW; $V_{S2} = 12.5$ V; typical values.

Fig. 4 Output power versus input drive power; $V_S = 12.5$ V; typical values.

Fig. 5 Output power versus supply voltage; $P_D = 200$ mW; typical values.
U.H.F. POWER MODULE

The BGY90B is a two stage u.h.f. power module designed for use in mobile transmitting equipment operating from a 12 V power supply.

The module consists of two n-p-n silicon planar transistors mounted on a metallized ceramic substrate together with matching and bias circuitry. The module produces an output power of 7,5 W into a 50 Ω load over the frequency range of 870 to 950 MHz when operated under nominal conditions.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.C. supply terminal voltages</td>
<td>VS1:VS2 nom. 12.5 V</td>
</tr>
<tr>
<td>Frequency</td>
<td>f 870 to 950 MHz</td>
</tr>
<tr>
<td>R.F. load power at PD = 200 mW</td>
<td>PL &gt; 7.5 W</td>
</tr>
<tr>
<td>R.F. input drive power at PL = 7.5 W</td>
<td>PD &lt; 200 mW</td>
</tr>
<tr>
<td>Input and output impedances</td>
<td>ZS:ZL nom. 50 Ω</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-197.

Dimensions in mm

Lead reference:
1 = r.f. input
2 = VS1
3 = VS2
4 = r.f. output
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

D.C. terminal supply voltages
\[ V_{S1}; V_{S2} \leq 16.5 \, V \]

D.C. voltage on r.f. input
\[ \pm V_i \leq 25 \, V \]

D.C. voltage on r.f. output
\[ \pm V_o \leq 25 \, V \]

Load power (r.f.)
\[ P_L \leq 9 \, W \]

Drive power (r.f.)
\[ P_D \leq 400 \, mW \]

Storage temperature
\[ T_{stg} \leq -40 \, ^{\circ}C \quad \text{to} \quad +100 \, ^{\circ}C \]

Operating heatsink temperature
\[ T_h \leq 90 \, ^{\circ}C \]

CHARACTERISTICS

\[ V_{S1} = V_{S2} = 12.5 \, V; \quad f = 870 - 950 \, MHz; \quad Z_S = Z_L = 50 \, \Omega \quad \text{unless otherwise specified} \]

Quiescent currents
\[ P_D = 0 \]
\[ I_{Q1} \leq 101 \, mA \quad \text{typ.} \quad 15 \, mA \]
\[ I_{Q2} \leq 102 \, mA \quad \text{typ.} \quad 25 \, mA \]

R.F. input drive power at \[ P_L = 7.5 \, W \]
\[ P_D < 200 \, mW \]

R.F. output power at \[ P_D = 200 \, mW \]
\[ P_L > 7.5 \, W \]

Efficiency at \[ P_L = 7.5 \, W \]
\[ n > 35 \% \]

Harmonic rejection at \[ P_L = 7.5 \, W \]
\[ > 35 \, dB \]

Stability

The module will produce no spurious signals with a load mismatch of up to 3 VSWR when operated within the following conditions:

\[ V_{S1} < V_{S2} = 0 \, \text{to} \, 15 \, V; \quad P_D = 0 \, \text{to} \, 400 \, mW; \quad T_h < 90 \, ^{\circ}C; \quad \text{providing maximum ratings are not exceeded.} \]

Ruggedness

The module will withstand a load mismatch VSWR of 50 when operated within the following conditions:

\[ V_{S1} = 15 \, V \, \text{max.}; \quad V_{S2} = 15 \, V; \quad P_D = 400 \, mW \, \text{max.}; \quad T_h < 90 \, ^{\circ}C; \quad \text{providing the module is adjusted for} \quad P_L < 9 \, W \, (\text{into} \, 50 \, \Omega). \quad \text{This adjustment may be performed by control of either} \quad P_D \text{ or } V_{S1}. \]
U.H.F. power module

Fig. 2 Output power versus frequency; 
\( P_D = 200 \text{ mW}; \, V_{S1} = V_{S2} = 12.5 \text{ V}; \) 
typical values.

Fig. 3 Output power versus 1st stage 
supply voltage; \( V_{S2} = 12.5 \text{ V}; \, f = 890 \text{ MHz}, \) 
\( P_L = 9 \text{ W (at 890 MHz)}; \) typical values.

Fig. 4 Output power versus input drive power; \( V_{S1} = V_{S2} = 12.5 \text{ V}; \) typ. values.

Fig. 5 Output power versus supply voltage; 
\( V_S = V_{S1} = V_{S2}; \, f = 890 \text{ MHz}; \) 
\( P_L = 9 \text{ W (at 890 MHz)}; \) typ. values.

Fig. 6 Efficiency versus frequency; 
\( V_{S1} = V_{S2} = 12.5 \text{ V}; \, P_L = 7.5 \text{ W}; \) 
typical values.
V.H.F. AMPLIFIER MODULES

A range of V.H.F. amplifier modules designed for use in portable transmitters operating from a 9,6 V supply. The modules are two-stage amplifiers consisting of n-channel FET crystals and lumped element matching circuits.

The BGY93A, BGY93B and BGY93C will produce a minimum of 2 W into a 50 Ω load over the 68 to 88 MHz, 136 to 156 MHz and 148 to 174 MHz frequency ranges respectively.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Mode of operation</th>
<th>continuous wave</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency range</td>
<td>BGY93A  68 to 88 MHz</td>
</tr>
<tr>
<td></td>
<td>BGY93B  136 to 156 MHz</td>
</tr>
<tr>
<td></td>
<td>BGY93C  148 to 174 MHz</td>
</tr>
<tr>
<td>R.F. load power</td>
<td>V&lt;sub&gt;S1&lt;/sub&gt; = V&lt;sub&gt;S2&lt;/sub&gt; = 9,6 V; P&lt;sub&gt;DR&lt;/sub&gt; = 35 mW</td>
</tr>
<tr>
<td></td>
<td>&gt; 2,0 W</td>
</tr>
<tr>
<td>R.F. drive power</td>
<td>V&lt;sub&gt;S1&lt;/sub&gt; = V&lt;sub&gt;S2&lt;/sub&gt; = 9,6 V; P&lt;sub&gt;L&lt;/sub&gt; = 2,0 W</td>
</tr>
<tr>
<td></td>
<td>&lt; 35 mW</td>
</tr>
<tr>
<td>Input and output impedances</td>
<td>nom. 50 Ω</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-182.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.C. supply terminal voltages*</td>
<td>$V_{S1/S2}$</td>
<td>max. 13.5 V*</td>
</tr>
<tr>
<td>R.F. input voltage*</td>
<td>$\pm V_i$</td>
<td>max. 25 V*</td>
</tr>
<tr>
<td>R.F. output voltage*</td>
<td>$\pm V_o$</td>
<td>max. 25 V*</td>
</tr>
<tr>
<td>Load power</td>
<td>$P_L$</td>
<td>max. 4 W</td>
</tr>
<tr>
<td>Drive power</td>
<td>$P_{DR}$</td>
<td>max. 70 mW</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>$T_{stg}$</td>
<td>-40 to 100 °C</td>
</tr>
<tr>
<td>Operating heatsink temperature</td>
<td>$T_h$</td>
<td>max. 90 °C</td>
</tr>
</tbody>
</table>

CHARACTERISTICS

Quiescent currents

Second stage current with first stage open circuit

$V_{S2} = 9.6$ V; $P_{DR} = 0$;
$R_S = R_L = 50$ Ω; $I_{S1} = 0$

$I_{Q2}$ typ. 0.1 mA

Second stage current with first stage connected

$V_{S1} = 9.3$ V; $V_{S2} = 9.6$ V;
$P_{DR} = 0$; $R_S = R_L = 50$ Ω

$I_{Q2}$ typ. 270 mA

First stage current

$V_{S1} = 9.3$ V; $V_{S2} = 9.6$ V;
$P_{DR} = 0$; $R_S = R_L = 50$ Ω

$I_{Q1}$ typ. 70 mA

Efficiency

$V_{S1} = V_{S2} = 9.6$ V; $P_{DR} = 35$ mW;
$R_S = R_L = 50$ Ω

$>$ 40 %

Harmonic output

$V_{S1} = V_{S2} = 9.6$ V (relative to carrier);
$P_{DR} = 35$ mW; $R_S = R_L = 50$ Ω

any harmonic $<$ -30 dB

Input VSWR

$V_{S1} = V_{S2} = 9.6$ V; $P_{DR} = 35$ mW;
$R_S = R_L = 50$ Ω

VSWR max. 2

Stability

The modules will produce no signals at frequencies other than that of the carrier frequency when operated with a load mismatch of 8 VSWR (all phases) and when operated within the following conditions:

$V_{S1} \leq V_{S2} = 4$ to 11.2 V; $P_{DR} = 17$ to 70 mW.

Ruggedness

The modules will withstand a load mismatch VSWR of 50 (all phases) when operated within the following conditions:

$V_{S1} \leq V_{S2} \leq 11.2$ V; $P_{DR} < 70$ mW; $T_h < 90$ °C.

* With respect to flange.
V.H.F. AMPLIFIER MODULES

A range of V.H.F. amplifier modules designed for use in portable transmitters operating from a 9.6 V supply. The modules are two-stage amplifiers consisting of n-channel FET crystals and lumped element matching circuits.

The BGY94A, BGY94B and BGY94C will produce a minimum of 5 W into a 50 Ω load over the 68 to 88 MHz, 132 to 156 MHz and 148 to 174 MHz frequency ranges respectively.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Mode of operation</th>
<th>Frequency range</th>
<th>R.F. load power</th>
<th>R.F. drive power</th>
<th>Input and output impedances</th>
</tr>
</thead>
<tbody>
<tr>
<td>continuous wave</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BGY94A</td>
<td>68 to 88 MHz</td>
<td>&gt; 5.0 W</td>
<td>V_{S1} = V_{S2} = 9.6 V; P_{DR} = 50 mW</td>
<td></td>
</tr>
<tr>
<td>BGY94B</td>
<td>132 to 156 MHz</td>
<td>&gt; 35 mW</td>
<td>V_{S1} = V_{S2} = 9.6 V; P_{L} = 5.0 W</td>
<td></td>
</tr>
<tr>
<td>BGY94C</td>
<td>148 to 174 MHz</td>
<td>&lt; 35 mW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>nom.</td>
<td></td>
<td>50 Ω</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-182.

Dimensions in mm

Lead reference
1. R.F. input
2. Earth
3. V_{S1} and second stage bias
4. Earth
5. V_{S2}
6. Earth
7. R.F. output

---

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RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

D.C. supply terminal voltages*  \( V_{S1}/V_{S2} \) max. 13.5 V*
R.F. input voltage*  \( \pm V_i \) max. 25 V*
R.F. output voltage*  \( \pm V_o \) max. 25 V*
Load power  \( P_L \) max. 9 W
Drive power  \( P_{DR} \) max. 70 mW
Storage temperature  \( T_{Stg} \) –40 to 100 °C
Operating heatsink temperature  \( T_h \) max. 90 °C

CHARACTERISTICS

Quiescent currents
second stage current with first stage open circuit
\( V_{S2} = 9.6 \, V; \, P_{DR} = 0; \, R_S = R_L = 50 \, \Omega; \, I_{S1} = 0 \)
\( I_{Q2} \) < 0.5 mA
first stage current
\( V_{S1} = V_{S2} = 9.6 \, V; \, P_{DR} = 0; \, R_S = R_L = 50 \, \Omega \)
\( I_{Q1} \) typ. 125 mA

Efficiency
\( V_{S1} = V_{S2} = 9.6 \, V; \, P_L = 5 \, W; \, R_S = R_L = 50 \, \Omega \)
\( \eta \) > 40 %

Harmonic output
\( V_{S1} = V_{S2} = 9.6 \, V \)
\( P_{DR} = 35 \, mW; \, R_S = R_L = 50 \, \Omega \)
any harmonic (relative to carrier) < -35 dB

Input VSWR
\( V_{S1} = V_{S2} = 9.6 \, V; \, P_{DR} = 35 \, mW; \, R_S = R_L = 50 \, \Omega \)
VSWR max. 2

Stability
The modules will produce no signals at frequencies other than that of the carrier frequency when operated with a load mismatch of 8 VSWR (all phases) and when operated within the following conditions:
\( V_{S1} \leq V_{S2} = 4 \) to 11.2 V; \( P_{DR} = 17 \) to 70 mW; \( P_L = 9.0 \, W \) (matched)

Ruggedness
The modules will withstand a load VSWR of 50 for short period overload conditions, with \( P_{D} \), \( V_{S1} \) and \( V_{S2} \) at maximum values, providing the combination does not result in the matched r.f. output power derating curve being exceeded. \( T_h = 90 \, °C \).

Gain control
Power output can be controlled by variation of the driver stage supply voltage \( V_{S1} \). The supply required is a voltage regulator with a current rating of 0.25 A and an output voltage range of 4.0 V to 9.6 V. \( V_{S1} \) must not exceed \( V_{S2} \).

* With respect to earth pins.
V.H.F. amplifier modules

Fig. 2 Load power derating; VSWR = 1 : 1.
The BGY95 is a three-stage u.h.f. amplifier module designed primarily for mobile transmitting equipment operating from a nominal 7,5 V power supply.

The module consists of three N-P-N silicon planar transistors mounted on a metallized ceramic substrate, together with matching and bias circuitry. The BGY95A and BGY95B produce an output power of 2,5 W into a 50 Ω load over the frequency band 825-845 MHz and 890-915 MHz respectively. The output power can be controlled by means of a DC voltage (V51).

**QUICK REFERENCE DATA**

<table>
<thead>
<tr>
<th>Mode of operation</th>
<th>c.w.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency range</td>
<td>BGY95A 825-845 MHz</td>
</tr>
<tr>
<td>R.F. power output</td>
<td>BGY95B 890-915 MHz</td>
</tr>
<tr>
<td>R.F. input drive power</td>
<td>V51 = V52 = V53 = 7,5 V; P_D = 20 mW</td>
</tr>
<tr>
<td>Output load impedance</td>
<td>P_L min. 2,5 W</td>
</tr>
<tr>
<td></td>
<td>P_D ≤ 20 mW</td>
</tr>
<tr>
<td></td>
<td>Z_L nom. 50 Ω</td>
</tr>
</tbody>
</table>

**MECHANICAL DATA**

Fig. 1 SOT-200.

Dimensions in mm

Lead reference

- Pin 1 = r.f. input
- 2 = V_S1
- 3 = not connected
- 4 = V_S2
- 5 = V_S3
- 6 = not connected
- 7 = r.f. Earth

case = Earth
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltagess with respect to case
- r.f. input pin
- r.f. output pin

Supply pins

R.F. output power
R.F. input drive power
Storage temperature
Operating heatsink temperature

CHARACTERISTICS
Performance:
BGY95A: f = 825-845 MHz; R_S = R_L = 50 Ω; V_S1 = V_S2 = V_S3 = 7,5 V
BGY95B: f = 890-915 MHz; R_S = R_L = 50 Ω; V_S1 = V_S2 = V_S3 = 7,5 V

R.F. output power
\[ P_L = 20 \text{ mW} \]

R.F. input drive power
\[ P_D \leq 20 \text{ mW} \]

Efficiency
\[ P_L = 2,5 \text{ W} \]

Harmonic rejection
\[ P_L = 2,5 \text{ W} \]

Input VSWR
with respect to 50 Ω;
\[ P_D = 20 \text{ mW} \]

Gain control:
\[ P_D = 20 \text{ mW}; \]
at \( V_{S1} = 0,5 \text{ V} \)
at \( V_{S1} = 6,0 \text{ V} \)

Stability:
The module will produce no spurious signals with a load mismatch VSWR < 3 : 1 when operated with
\[ V_{S1} = 0,5 \text{ to } 7,5 \text{ V}, \ V_{S2} = V_{S3} = 6 \text{ to } 10 \text{ V}, P_D = 10 \text{ to } 40 \text{ mW and } T_h < 90 \text{ °C}, \]
provided maximum ratings are not exceeded.

Ruggedness:
The module will withstand a load mismatch of 50 : 1 when operated with \( V_{S1} = 0 \text{ to } 8 \text{ V}, \ V_{S2} = V_{S3} = 0 \text{ to } 11 \text{ V}, P_D = 0 \text{ to } 40 \text{ mW and } T_h = 90 \text{ °C}, \)
provided maximum ratings are not exceeded.
The BGY96 is a three-stage u.h.f. amplifier module designed primarily for mobile transmitting equipment operating from a nominal 9.6 V power supply.

The module consists of three N-P-N silicon planar transistors mounted on a metallized ceramic substrate, together with matching and bias circuitry. The BGY96A and BGY96B produce an output power of 2.5 W into a 50 Ω load over the frequency band 825-845 MHz and 890-915 MHz respectively. The output power can be controlled by means of a DC voltage (VS1).

### QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Mode of operation</th>
<th>Frequency range</th>
<th>Power output</th>
<th>Power input</th>
<th>Load impedance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>BGY96A</td>
<td>f</td>
<td>825-845 MHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BGY96B</td>
<td>f</td>
<td>890-915 MHz</td>
</tr>
<tr>
<td>R.F. power output</td>
<td>VS1 = 6 V; VS2 = VS3 = 9.6 V; PD = 20 mW</td>
<td>PL min.</td>
<td>2.5 W</td>
<td></td>
</tr>
<tr>
<td>R.F. input drive power</td>
<td>VS1 = 6 V; VS2 = VS3 = 9.6 V; PL = 2.5 W</td>
<td>PD ≤</td>
<td>20 mW</td>
<td></td>
</tr>
</tbody>
</table>

### MECHANICAL DATA

- **Dimensions in mm**
  - Lead reference
  - Pin 1 = r.f. input
  - 2 = V_S1
  - 3 = not connected
  - 4 = V_S2
  - 5 = V_S3
  - 6 = not connected
  - 7 = r.f. output
  - case = Earth

- Fig. 1 SOT-200.
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltagess with respect to case
- r.f. input pin
- r.f. output pin

Supply pins
- VS1
- VS2
- VS3

R.F. output power
- PL

R.F. input drive power
- PD

Storage temperature
- Tsstg

Operating heatsink temperature
- Th

CHARACTERISTICS

Performance:
- BGY96A: f = 825-845 MHz; Rs = RL = 50 Ω; VS1 = 6 V; VS2 = VS3 = 9.6 V
- BGY96B: f = 890-915 MHz. Rs = RL = 50 Ω; VS1 = 6 V; VS2 = VS3 = 9.6 V

R.F. output power
- PL = 20 mW

R.F. input drive power
- PD ≤ 20 mW

Efficiency
- η = 35 %

Harmonic rejection
- PL = 2.5 W

Input VSWR
- with respect to 50 Ω;
- PD = 20 mW

Gain control: PD = 20 mW;
- at VS1 = 0.5 V
- at VS1 = 6.0 V

Stability:
The module will produce no spurious signals with a load mismatch VSWR < 3 : 1 when operated with VS1 = 0.5 to 6 V, VS2 = VS3 = 7.9 to 12 V, PD = 10 to 40 mW and Th ≤ 90 °C, provided maximum ratings are not exceeded.

Ruggedness:
The module will withstand a load mismatch of 50 : 1 when operated with VS1 = 0 to 8 V, VS2 = VS3 = 0 to 13 V, PD = 0 to 50 mW and Th = 90 °C, provided maximum ratings are not exceeded.
R.F. POWER MOSFET

N-channel enhancement mode vertical D-MOS transistor intended for use in professional transmitters in the HF range.

The transistor has a 4-lead flange envelope with a ceramic cap (SOT-121). All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance at \( T_h = 25 \, ^\circ\text{C} \) in common-source class-AB circuit.

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>( f ) MHz</th>
<th>( V_{DS} ) V</th>
<th>( P_L ) (PEP) W</th>
<th>( G_p ) (2-tone) %</th>
<th>( d_3 ) dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.S.B.</td>
<td>28</td>
<td>28</td>
<td>80</td>
<td>&gt; 18</td>
<td>&gt; 35</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-121.

Note: Protect the gate-source input against static charge during transport or handling.

PRODUCT SAFETY  This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134).

- Drain-source voltage \( V_{DS} \) max. 65 V
- Gate-source voltage \( \pm V_{GS} \) max. 20 V
- Drain current (D.C.) \( I_D \) max. 7 A
- Total power dissipation \( P_{tot} \) max. 130 W
- Storage temperature \( T_{stg} \) -65 to +150 °C
- Operating junction temperature \( T_j \) max. 200 °C

THERMAL RESISTANCE
- From junction to mounting base \( R_{th j-mb} \) max. 1.35 K/W
- From mounting base to heatsink \( R_{th mb-h} \) max. 0.2 K/W

CHARACTERISTICS
- \( T_j = 25 \) °C unless otherwise specified
- Drain-source breakdown voltage \( I_D = 50 \) mA; \( V_{GS} = 0 \)
- Drain-source leakage current \( V_{DS} = 28 \) V; \( V_{GS} = 0 \)
- Gate-source leakage current \( \pm V_{GS} = 20 \) V, \( V_{DS} = 0 \)
- Gate threshold voltage \( I_D = 50 \) mA; \( V_{DS} = 10 \) V
- Forward transconductance \( I_D = 5 \) A; \( V_{DS} = 10 \) V
- Drain-source ON resistance \( I_D = 5 \) A; \( V_{GS} = 10 \) V
- On-state drain current \( V_{DS} = 10 \) V; \( V_{GS} = 10 \) V
- Input capacitance at \( f = 1 \) MHz \( V_{DS} = 28 \) V; \( V_{GS} = 0 \)
- Output capacitance at \( f = 1 \) MHz \( V_{DS} = 28 \) V; \( V_{GS} = 0 \)
- Feedback capacitance at \( f = 1 \) MHz \( V_{DS} = 28 \) V; \( V_{GS} = 0 \)
APPLICATION INFORMATION

R.F. performance in SSB operation (common-source class-AB circuit)

\[ f_1 = 28.000 \text{ MHz}; \quad f_2 = 28.001 \text{ MHz}; \quad T_h = 25 \text{ °C}; \quad I_{DO} = 0.6 \text{ A}; \quad R_GS = 18 \Omega \]

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>( f ) (MHz)</th>
<th>( V_{DS} ) (V)</th>
<th>( P_L ) (PEP) (W)</th>
<th>( G_p ) (2-tone) (db)</th>
<th>( \eta ) (%)</th>
<th>( d_3 ) (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.S.B.</td>
<td>28</td>
<td>28</td>
<td>80</td>
<td>&gt; 18</td>
<td>&gt; 35</td>
<td>&lt; -30</td>
</tr>
</tbody>
</table>

Optimum load impedance: \( 3.3 + j0.5 \\Omega \)

The intermodulation products are measured with respect to the level of one tone.

LOAD MISMATCH

The device is capable of withstanding a full load mismatch (VSWR = 50; all phases) at rated load power and supply voltage (\( T_h = 25 \text{ °C} \)).
R.F. POWER MOSFET

N-channel enhancement mode vertical D-MOS transistor intended for use in professional transmitters in the VHF range.

The transistor has a 4-lead flange envelope with a ceramic cap (SOT-123). All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance at $T_h = 25^\circ$C in common-source class-B circuit.

<table>
<thead>
<tr>
<th>Mode of operation</th>
<th>$V_{DS}$ (V)</th>
<th>$f$ (MHz)</th>
<th>$P_L$ (W)</th>
<th>$G_p$ (dB)</th>
<th>$\eta$ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>28</td>
<td>175</td>
<td>5</td>
<td>&gt; 13</td>
<td>&gt; 50</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.

Note: Protect gate-source input against static charge during transport or handling.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134).

Drain-source voltage
Gate-source voltage
Drain current (D.C.)
Total power dissipation
Storage temperature
Operating junction temperature

THERMAL RESISTANCE
From junction to mounting base
From mounting base to heatsink

CHARACTERISTICS
Tj = 25 °C unless otherwise specified

Drain-source breakdown voltage
Drain-source leakage current
Gate-source leakage current
Gate threshold voltage
Forward tranconductance

Drain-source ON resistance
On-state drain current
Input capacitance at f = 1 MHz
Output capacitance at f = 1 MHz
Feedback capacitance at f = 1 MHz
APPLICATION INFORMATION

R.F. performance in c.w. operation (common-source class-B circuit)

\( f = 175 \text{ MHz}; \quad T_h = 25 \, ^\circ\text{C}; \quad I_DQ = 10 \, \text{mA}; \quad R_{GS} = 46 \, \Omega \)

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>( V_{DS} ) (V)</th>
<th>( P_L ) (W)</th>
<th>( P_S ) (W)</th>
<th>( G_D ) (dB)</th>
<th>( I_D ) (A)</th>
<th>( \eta ) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>28</td>
<td>5</td>
<td>&lt; 0,25</td>
<td>&gt; 13</td>
<td>&lt; 0,36</td>
<td>&gt; 50</td>
</tr>
<tr>
<td></td>
<td>28</td>
<td>5</td>
<td>typ. 0,12</td>
<td>typ. 16</td>
<td>typ. 0,3</td>
<td>typ. 60</td>
</tr>
</tbody>
</table>

Optimum load impedance : \( 19 + j\, 38 \, \Omega \)

Input impedance : \( 9,4 - j\, 22 \, \Omega \)

LOAD MISMATCH

The device is capable of withstanding a full load mismatch (VSWR = 50; all phases) at rated load power and supply voltage (\( T_h = 25 \, ^\circ\text{C} \)).
R.F. POWER MOSFET

N-channel enhancement mode vertical D-MOS transistor intended for use in professional transmitters in the VHF range.

The transistor has a 4-lead flange envelope with a ceramic cap (SOT-123). All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance at $T_h = 25\,^\circ C$ in common-source class-C circuit.

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{DS}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_p$ dB</th>
<th>$\eta_d$ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>28</td>
<td>175</td>
<td>15</td>
<td>$&gt;13$</td>
<td>$&gt;50$</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-123.

Note: Protect the gate-source input against static charge during transport or handling.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
### RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain-source voltage</td>
<td>$V_{DS}$</td>
<td>max. 65 V</td>
</tr>
<tr>
<td>± Gate-source voltage</td>
<td>$V_{GS}$</td>
<td>max. 20 V</td>
</tr>
<tr>
<td>Drain current (d.c.)</td>
<td>$I_D$</td>
<td>max. 1.5 A</td>
</tr>
<tr>
<td>Total power dissipation</td>
<td>$P_{tot}$</td>
<td>max. 30 W</td>
</tr>
<tr>
<td>up to $T_{mb} = 25 , ^\circ C$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage temperature</td>
<td>$T_{stg}$</td>
<td>-65 to + 150 $^\circ$ C</td>
</tr>
<tr>
<td>Operating junction temperature</td>
<td>$T_j$</td>
<td>max. 200 $^\circ$ C</td>
</tr>
</tbody>
</table>

### THERMAL RESISTANCE

<table>
<thead>
<tr>
<th>Thermal Resistance</th>
<th>Symbol</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>From junction to mounting base</td>
<td>$R_{th , j-mb}$</td>
<td>max. 5.8 K/W</td>
</tr>
<tr>
<td>From mounting base to heatsink</td>
<td>$R_{th , mb-h}$</td>
<td>max. 0.3 K/W</td>
</tr>
</tbody>
</table>

### CHARACTERISTICS

$T_j = 25 \, ^\circ C$ unless otherwise specified

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Symbol</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain-source breakdown voltage</td>
<td>$V_{BR}DS$</td>
<td>min. 65 V</td>
</tr>
<tr>
<td>Drain-source leakage current</td>
<td>$I_{DS}$</td>
<td>max. 1 mA</td>
</tr>
<tr>
<td>Gate-source leakage current</td>
<td>$I_{GS}$</td>
<td>max. 1 $\mu$A</td>
</tr>
<tr>
<td>Gate threshold voltage</td>
<td>$V_{GS(th)}$</td>
<td>2 to 4.5 V</td>
</tr>
<tr>
<td>Forward transconductance</td>
<td>$G_{fs}$</td>
<td>min. 0.5 S, typ. 0.8 S</td>
</tr>
<tr>
<td>On-state drain current</td>
<td>$I_{DSX}$</td>
<td>typ. 4.5 A</td>
</tr>
<tr>
<td>Input capacitance at $f = 1$ MHz</td>
<td>$C_{iss}$</td>
<td>typ. 60 $\mu$F</td>
</tr>
<tr>
<td>Output capacitance at $f = 1$ MHz</td>
<td>$C_{oss}$</td>
<td>typ. 40 $\mu$F</td>
</tr>
<tr>
<td>Feedback capacitance at $f = 1$ MHz</td>
<td>$C_{rss}$</td>
<td>typ. 4 $\mu$F</td>
</tr>
<tr>
<td>Drain-flange capacitance</td>
<td>$C_{df}$</td>
<td>typ. 2 $\mu$F</td>
</tr>
</tbody>
</table>
APPLICATION INFORMATION

R.F. performance in c.w. operation (common-source class-C circuit) \( f = 175 \text{ MHz} \); \( T_H = 25 \text{ °C} \);
\( V_{GS} = 1.8 \text{ V} \)

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>( V_{DS} ) V</th>
<th>( P_L ) W</th>
<th>( P_S ) W</th>
<th>( G_D ) dB</th>
<th>( I_D ) A</th>
<th>( \eta_d ) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>28</td>
<td>15</td>
<td>&lt; 0.75</td>
<td>&gt; 13</td>
<td>&lt; 1.07</td>
<td>&gt; 50</td>
</tr>
<tr>
<td></td>
<td>28</td>
<td>15</td>
<td>typ. 0.3</td>
<td>typ. 17</td>
<td>typ. 0.9</td>
<td>typ. 60</td>
</tr>
</tbody>
</table>

Optimum load impedance : \( 6.4 + j9.7 \Omega \)
Input impedance : \( 2.4 - j11 \Omega \)

LOAD MISMATCH

The device is capable of withstanding a full load mismatch (VSWR = 50; all phases) at rated load power and supply voltage (\( T_H = 25 \text{ °C} \)).

![Class-C test circuit at \( f = 175 \text{ MHz} \).](image)
List of components:

R1 = 23 Ω, metal film (46,4 Ω // 46,4 Ω, 2 x ¼ W)
R2 = 10 Ω, metal film
C1 = 680 pF, ATC chip
C2 = 20 pF, ATC chip
C3, C4 = 5-60 pF, PTFE trimmer, cat. no. 2222 809 08003
C5 = 75 pF, ATC chip
C6 = 10 nF, chip capacitor, cat. no. 2222 852 47103
C7 = 100 pF ATC chip
C8 = 47 pF, ATC chip
C9 = 5-60 pF, PTFE trimmers, cat. no 2222 809 08003
C10, C11 = 11 pF, ATC chip
C12 = 680 pF, ATC chip
C13 = 2,2 μF, tantalum electrolytic capacitor
C14 = 100 nF, chip capacitor, cat. no. 2222 852 47104
L1 = 32 nH, 4 turns of enamelled Cu-wire (1 mm) int. diam. 3 mm, leads: 2 x 5 mm, length: 6,3 mm
L2 = 12,2 nH, 1 turn of enamelled Cu-wire (1 mm) int. diam. 5,6 mm, leads: 2 x 5 mm
L3, L4 = 30 Ω striplines, width 6,0 mm, length 15 mm
L5 = 118,8 nH, 6 turns of enamelled Cu-wire (1 mm) int. diam. 6 mm, leads: 2 x 5 mm, length: 10,4 mm
L6 = RF choke, grade 3B, cat. no. 4312 020 36640
L7 = 19 nH, 2 turns of enamelled Cu-wire (1 mm) int. diam. 3 mm, leads: 2 x 5 mm, length: 2,4 mm
L8 = 28,5 nH, 4 turns of enamelled Cu-wire (1 mm) int. diam. 3 mm, leads: 2 x 5 mm, length: 8,5 mm

P.C.B. material: epoxy fibre glass, thickness 1/16 inch, $\varepsilon_r = 4,5$

---

Fig. 3 Output power versus input power.
$f = 175$ MHz; $V_{DS} = 28$ V.

Fig. 4 Power gain and drain efficiency versus output power.
$f = 175$ MHz; $V_{DS} = 28$ V; $T_h = 25$ °C.
R.F. POWER MOSFET

N-channel enhancement mode vertical D-MOS transistor intended for use in professional transmitters in the VHF range.

The transistor has a 4-lead flange envelope with a ceramic cap (SOT-123). All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance at $T_h = 25 \, ^\circ C$ in common-source class-B circuit.

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{DS}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_p$ dB</th>
<th>$\eta_D$ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>28</td>
<td>175</td>
<td>30</td>
<td>$&gt; 13$</td>
<td>$&gt; 50$</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-123.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage

\[ V_{DS \text{ max.}} = 65 \text{ V} \]

Gate-source voltage

\[ \pm V_{GS \text{ max.}} = 20 \text{ V} \]

Drain current (d.c.)

\[ I_D \text{ max.} = 3 \text{ A} \]

Total power dissipation

\[ P_{\text{tot max.}} = 55 \text{ W} \]

up to \( T_{mb} = 25 \degree \text{C} \)

Storage temperature

\[ T_{\text{stg}} = -65 \to +150 \degree \text{C} \]

Operating junction temperature

\[ T_j \text{ max.} = 200 \degree \text{C} \]

THERMAL RESISTANCE

From junction to mounting base

\[ R_{th \text{ j-mb max.}} = 3,2 \text{ K/W} \]

From mounting base to heatsink

\[ R_{th \text{ mb-h max.}} = 0,3 \text{ K/W} \]

CHARACTERISTICS

\( T_j = 25 \degree \text{C} \) unless otherwise specified

Drain-source breakdown voltage

\[ I_D = 10 \text{ mA}; V_{GS} = 0 \]

Drain-source leakage current

\[ V_{DS} = 28 \text{ V}; V_{GS} = 0 \]

Gate-source leakage current

\[ \pm V_{GS} = 20 \text{ V}; V_{DS} = 0 \]

Gate threshold voltage

\[ I_D = 10 \text{ mA}; V_{DS} = V_{GS} \]

Forward transconductance

\[ V_{DS} = 10 \text{ V}; I_D = 1,5 \text{ A} \]

On-state drain current

\[ V_{DS} = 10 \text{ V}; V_{GS} = 10 \text{ V} \]

Input capacitance at \( f = 1 \text{ MHz} \)

\[ V_{DS} = 28 \text{ V}; V_{GS} = 0 \]

Output capacitance at \( f = 1 \text{ MHz} \)

\[ V_{DS} = 28 \text{ V}; V_{GS} = 0 \]

Feedback capacitance at \( f = 1 \text{ MHz} \)

\[ V_{DS} = 28 \text{ V}; V_{GS} = 0 \]

Drain-flange capacitance
APPLICATION INFORMATION

R.F. performance in c.w. operation (common-source class-B circuit) f = 175 MHz; T\textsubscript{h} = 25 °C; I\textsubscript{DO} = 50 mA

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>V\textsubscript{DS} V</th>
<th>P\textsubscript{L} W</th>
<th>P\textsubscript{S} W</th>
<th>G\textsubscript{D} dB</th>
<th>I\textsubscript{D} A</th>
<th>\eta\textsubscript{D} %</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>28</td>
<td>30</td>
<td>&lt; 1,5</td>
<td>&gt; 13</td>
<td>&lt; 2,14</td>
<td>&gt; 50</td>
</tr>
<tr>
<td></td>
<td>28</td>
<td>30</td>
<td>typ. 0,7</td>
<td>typ. 16</td>
<td>typ. 1,6</td>
<td>typ. 65</td>
</tr>
</tbody>
</table>

Optimum load impedance : 5,1 + j5,0 Ω
Input impedance : 2,0 − j6,5 Ω

LOAD MISMATCH

The device is capable of withstanding a full load mismatch (VSWR of 50, varied through all phases) at rated load power and supply voltage (T\textsubscript{h} = 25 °C).

Fig. 2 Class-B test circuit at f = 175 MHz.
List of components:

R1 = 1 kΩ, metal film
R2 = 10 Ω, metal film
C1 = 4-40 pF, PTFE trimmer
C2 = 5-60 pF, PTFE trimmer
C3 = 100 pF chip + 100 nF chip
C4 = 100 pF ceramic plate cap.
C5 = 100 nF polyester
C6 = 5-60 pF, PTFE trimmer + 18 pF chip
C7 = 27 pF chip + 24 pF chip
L1 = 18 nH; 3 turns of 0,5 mm copper wire, int. diam. 2 mm, length 3.3 mm leads: 2 x 5 mm
L2 = 30 Ω stripline; W = 6 mm, L = 10 mm
L3 = 30 Ω stripline; W = 6 mm, L = 10 mm
L4 = 100 nH; 6 turns of 1,5 mm enamelled copper wire, int. diam. 5 mm, length 12,6 mm, leads: 2 x 5 mm
L5 = Ferroxcube RF choke, grade 3B, cat. no. 4312 020 36640
L6 = 27 nH; 2 turns of 1,5 mm enamelled copper wire int. diam. 5 mm, length 4,1 mm, leads: 2 x 5 mm

P.C.B. material: epoxy fibre glass, thickness 1/16 inch, εr = 4.5

Fig. 3 Output power versus input power. 
f = 175 MHz; VDS = 28 V.

Fig. 4 Power gain and drain efficiency versus output power. 
f = 175 MHz; VDS = 28 V; Th = 25 °C.
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in handheld radio stations in the 900 MHz communications band.

This device has been designed specifically for class-B operation.

Features:

• the device can be applied at rated load power without an external heatsink when it is mounted on a printed circuit board (see Fig. 4).

• gold metallization ensures excellent reliability.

The transistor has a 4-lead studless envelope with a ceramic cap (SOT-172D). All leads are isolated from the mounting base.

QUICK REFERENCE DATA

R.F. performance at $T_a = 25\,\text{°C}$ in a common-emitter class-B circuit.*

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_O$ W</th>
<th>$G_P$ dB</th>
<th>$\eta_{C}$ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w. (class-B)</td>
<td>7,5</td>
<td>900</td>
<td>0,75</td>
<td>&gt; 7,0</td>
<td>&gt; 50</td>
</tr>
</tbody>
</table>

* Device mounted on a printed circuit board (see Fig. 4).

MECHANICAL DATA

Fig. 1 SOT-172D. Dimensions in mm

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)  \( V_{CBO} \) max. 20 V
Collector-emitter voltage (open base)  \( V_{CEO} \) max. 10 V
Emitter-base voltage (open collector)  \( V_{EBO} \) max. 3 V
Collector current
average  \( I_C \), peak value; \( f > 1 \) MHz  \( I_{C(AV)} \) max. 250 mA
(peak value); \( f > 1 \) MHz  \( I_{CM} \) max. 750 mA
Total power dissipation
at \( T_{amb} = 50 \) °C; \( f > 1 \) MHz*  \( P_{tot(rf)} \) max. 2.3 W
Storage temperature
Operating junction temperature

THERMAL RESISTANCE
Dissipation = 2.5 W; \( T_{mb} = 25 \) °C
From junction to ambient* (\( f > 1 \) MHz)
From junction to mounting base  \( R_{th \_ja(rf)} \) max. 65 K/W
(\( f > 1 \) MHz)  \( R_{th \_jm\_mb(rf)} \) max. 25 K/W

\* Device mounted on a printed circuit board (see Fig. 4).
CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage
open emitter; I_C = 2.5 mA

Collector-emitter breakdown voltage
open base; I_C = 5 mA

Emitter-base breakdown voltage
open collector; I_E = 0.5 mA

Collector cut-off current
V_{BE} = 0; V_{CE} = 10 V

Second breakdown energy
L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω

D.C. current gain
I_C = 0.15 A; V_{CE} = 5 V

Collector capacitance at f = 1 MHz
I_E = I_E = 0; V_{CB} = 7.5 V

Feedback capacitance at f = 1 MHz
I_C = 0; V_{CE} = 7.5 V

Collector-mounting base capacitance

\begin{align*}
V_{(BR)CBO} & > 20 \text{ V} \\
V_{(BR)CEO} & > 10 \text{ V} \\
V_{(BR)EBO} & > 3 \text{ V} \\
I_{CES} & < 1 \text{ mA} \\
E_{SBR} & > 0.3 \text{ mJ} \\
h_{FE} & > 25 \\
C_{c} & \text{ typ. } 2.8 \text{ pF} \\
C_{re} & \text{ typ. } 1.6 \text{ pF} \\
C_{c-mb} & \text{ typ. } 0.5 \text{ pF}
\end{align*}

Fig. 2 I_E = I_E = 0; f = 1 MHz; typical values.
APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter circuit; class-B): f = 900 MHz; T_a = 25 °C

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>V_{CE} V</th>
<th>P_L W</th>
<th>G_p dB</th>
<th>η_C %</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>7,5</td>
<td>0,75</td>
<td>&gt;7,0</td>
<td>&gt;50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>typ. 8,5</td>
<td>typ. 63</td>
</tr>
</tbody>
</table>

List of components:

- C1 = 3 pF multilayer ceramic chip capacitor*
- C2 = C4 = C7 = C10 = 1,4 to 5,5 pF film dielectric trimmer (cat.no. 2222 809 09001)
- C3 = C6 = 3,9 pF multilayer ceramic chip capacitor*
- C5 = C8 = C11 = 180 pF multilayer ceramic chip capacitor
- C9 = 1 µF (35 V) tantalum capacitor
- L1 = 50 Ω stripline (38 mm x 2,4 mm)
- L2 = L5 = 35 Ω stripline (14 mm x 4 mm)
- L3 = 60 nH; 4 turns closely wound enamelled Cu wire (0,4 mm); int. dia. 3 mm; leads 2 x 5 mm
- L4 = L8 = Ferroxcube wideband h.f. choke, grade 3B (cat.no. 4312 020 36642)
- L6 = 50 nH; 5 turns closely wound enamelled Cu wire (0,6 mm); int. dia. 3 mm; leads 2 x 5 mm
- L7 = 50 Ω stripline (12,2 mm x 2,4 mm)
- L9 = 50 Ω stripline (30,5 mm x 2,4 mm)
- R1 = R2 = 10 ± 5%; 0,25 W metal film resistor

The striplines on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric (ε_r = 2,2); thickness 1/32 inch; thickness of copper-sheet 2 x 35 µm.

Fig. 3 Class-B test circuit at f = 900 MHz.

* American Technical Ceramics capacitor type 100A or capacitor of same quality.
Fig. 4 Printed circuit board and component lay out for 900 MHz class-B test circuit.

Note
The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper serving as groundplane. Earth connections are made by hollow rivets and also by fixing-screws and copper straps around the board and under the emitters to provide a direct contact between the copper on the component side and the groundplane.
Conditions for Figs 5 and 6:
\[ f = 900 \text{ MHz}; \quad T_a = 25 \text{ °C}; \quad \text{class-B operation}; \quad \text{typical values}. \]
\[ V_{CE} = 7.5 \text{ V} (\ldots); \quad V_{CE} = 5.0 \text{ V} (\ldots\ldots) \]
(transistor mounted on printed circuit board, shown in Fig. 4, without applying an external heatsink).

**RUGGEDNESS**
The device is capable of withstanding a full load mismatch (VSWR = 50; all phases) at rated load power up to a supply voltage of 9.0 V at \( T_a = 25 \text{ °C} \). Device mounted on a printed circuit board (see Fig. 4).

Conditions for Figs 7, 8 and 9:
\[ V_{CE} = 7.5 \text{ V}; \quad P_L = 0.75 \text{ W}; \quad f = 800 - 960 \text{ MHz}; \quad T_a = 25 \text{ °C}; \quad \text{class-B operation}; \quad \text{typical values}. \]
Fig. 9 Power gain vs. frequency.
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in handheld radio stations in the 900 MHz communications band. This device has been designed specifically for class-B operation.

Features:
- The device can be applied at rated load power without an external heatsink when it is mounted on a printed wiring board.
- Gold metallization ensures excellent reliability.

The transistor has a 4-lead studless envelope with a ceramic cap (SOT-172D). All leads are isolated from the mounting base.

QUICK REFERENCE DATA

R.F. performance at $T_a = 25$ °C in a common-emitter class-B circuit.

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_D$ dB</th>
<th>$\eta_C$ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w. (class-B)</td>
<td>7,5</td>
<td>900</td>
<td>1,5</td>
<td>&gt; 6,0</td>
<td>&gt; 50</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-172D.

PRODUCT SAFETY  This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)  $V_{CBO}^{max.} = 20 \text{ V}$

Collector-emitter voltage (open base)  $V_{CEO}^{max.} = 10 \text{ V}$

Emitter-base voltage (open collector)  $V_{EBO}^{max.} = 3 \text{ V}$

Collector current  
Average (peak value); $f > 1 \text{ MHz}$  

Collector current, average (peak value); $f > 1 \text{ MHz}$  

$n$  

Total power dissipation  
At $T_{amb} = 50 \text{ °C}$; $f > 1 \text{ MHz}$  

Total power dissipation  

$P_{tot}(rf)^{max.} = 3.0 \text{ W}$

Storage temperature  

$T_{stg} = -65\text{ to } +150 \text{ °C}$

Operating junction temperature  

$T_j^{max.} = 200 \text{ °C}$

THERMAL RESISTANCE

Dissipation = 4.5 W; $T_{mb} = 25 \text{ °C}$

From junction to ambient* $(f > 1 \text{ MHz})$

From junction to mounting base $(f > 1 \text{ MHz})$

$R_{th\ j-a}(rf)^{max.} = 50 \text{ K/W}$

$R_{th\ j-mb}(rf)^{max.} = 20 \text{ K/W}$

* Device mounted on a printed wiring board (see Fig. 4).
CHARACTERISTICS

$T_j = 25\, ^\circ C$ unless otherwise specified

Collector-base breakdown voltage
open emitter; $I_C = 5\, mA$

Collector-emitter breakdown voltage
open base; $I_C = 10\, mA$

Emitter-base breakdown voltage
open collector; $I_E = 1\, mA$

Collector cut-off current
$V_{BE} = 0; V_{CE} = 10\, V$

Second breakdown energy
$L = 25\, mH; f = 50\, Hz; R_{BE} = 10\, \Omega$

D.C. current gain
$I_C = 300\, mA; V_{CE} = 5\, V$

Collector capacitance at $f = 1\, MHz$
$I_E = i_e = 0; V_{CB} = 7.5\, V$

Feedback capacitance at $f = 1\, MHz$
$I_C = 0; V_{CE} = 7.5\, V$

Collector-mounting base capacitance

\[
\begin{align*}
V_{(BR)CBO} & > 20\, V \\
V_{(BR)CEO} & > 10\, V \\
V_{(BR)EBO} & > 3\, V \\
I_{CES} & < 2.5\, mA \\
E_{SBR} & > 0.55\, mJ \\
h_{FE} & > 25 \\
C_c & \text{typ.} 4.5\, pF \\
C_{re} & \text{typ.} 3\, pF \\
C_{c-mb} & \text{typ.} 0.5\, pF
\end{align*}
\]

Fig. 2 $I_E = i_e = 0; f = 1\, MHz$; typical values.
APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter circuit; class-B): \( f = 900 \text{ MHz; } T_a = 25 \degree \text{C} \)

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>( V_{CE} ) ( V )</th>
<th>( P_L ) ( W )</th>
<th>( G_D ) ( \text{dB} )</th>
<th>( \eta_C ) ( % )</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>7,5</td>
<td>1,5</td>
<td>&gt; 6,0</td>
<td>&gt; 50</td>
</tr>
<tr>
<td></td>
<td>typ. 7,0</td>
<td></td>
<td>typ. 65</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 3 Class-B test circuit at \( f = 900 \text{ MHz} \).

List of components:

- \( C_1 = C_6 = 2 \text{ pF multilayer ceramic chip capacitor}^* \)
- \( C_2 = C_4 = C_7 = C_{10} = 1,4 \text{ to } 5,5 \text{ pF film dielectric trimmer (cat. no. 2222 809 09001)} \)
- \( C_3 = 4,7 \text{ pF multilayer ceramic chip capacitor}^* \)
- \( C_5 = C_8 = C_{11} = 180 \text{ pF multilayer ceramic chip capacitor} \)
- \( C_9 = \mu \text{F (35 V) tantalum capacitor} \)
- \( L_1 = 50 \text{ } \Omega \text{ stripline (40 mm x 2,4 mm)} \)
- \( L_2 = L_5 = 35 \text{ } \Omega \text{ stripline (14 mm x 4,0 mm)} \)
- \( L_3 = 100 \text{ nH; 8 turns closely wound enamelled Cu wire (0,4 mm); int. dia. 3 mm; leads 2 x 5 mm} \)
- \( L_4 = L_8 = \text{Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36642)} \)
- \( L_6 = 30 \text{ nH; 2 turns Cu wire (1,0 mm); int. dia. 5,5 mm; length 4,5 mm; leads 2 x 5 mm}; \)
- \( L_7 = 50 \text{ } \Omega \text{ stripline (6,0 mm x 2,4 mm)} \)
- \( L_9 = 50 \text{ } \Omega \text{ stripline (30,3 mm x 2,4 mm)} \)
- \( R_1 = R_2 = 10 \text{ } \Omega \pm 5\%; 0,25 \text{ W metal film resistor} \)

The striplines on a double Cu-clad printed wiring board with P.T.F.E. fibre-glass dielectric \((\varepsilon_r = 2,2); \)

thickness 1/32 inch; thickness of copper-sheet 2 x 35 \mu m.

* American Technical Ceramics capacitor type 100A or capacitor of same quality.
Fig. 4 Printed wiring board and component lay-out for 900 MHz class-B test circuit.

Note
The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper serving as a groundplane. Earth connections are made by hollow rivets and also by fixing screws and copper straps under the emitters to provide a direct contact between the copper on the component side and the groundplane.
Fig. 5 Load power vs. source power.

Fig. 6 Power gain and efficiency vs. load power.

Conditions for Figs 5 and 6:
\( f = 900 \text{ MHz}; T_a = 25 \text{ oC}; \text{ class-B operation}; \text{ typical values.} \)

\( V_C E = 7,5 \text{ V} \) (———); \( V_C E = 5,0 \text{ V} \) (............)

(transistor mounted on printed wiring board, shown in Fig. 4, without applying an external heatsink).

RUGGEDNESS

The device is capable of withstanding a full load mismatch (VSWR = 50; all phases) at rated load power up to a supply voltage of 9,0 V at \( T_a = 25 \text{ oC}. \)

Fig. 7 Input impedance (series components).

Fig. 8 Load impedance (series components).

Conditions for Figs 7, 8 and 9:
\( V_C E = 7,5 \text{ V}; P_L = 1,5 \text{ W}; f = 800 \cdot 960 \text{ MHz}; T_a = 25 \text{ oC}; \text{ class-B operation}; \text{ typical values.} \)
Fig. 9 Power gain vs. frequency.
DEVELOPMENT DATA
This data sheet contains advance information and specifications are subject to change without notice.

U.H.F. POWER TRANSistor

N-P-N silicon planar epitaxial transistor primarily intended for use in handheld radio stations in the 900 MHz communications band.
This device has been designed specifically for class-B operation.
The transistor has a 4-lead studless envelope with a ceramic cap (SOT-122D). All leads are isolated from the mounting base.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>( V_{CE} ) V</th>
<th>( f ) MHz</th>
<th>( P_L ) W</th>
<th>( G_p ) dB</th>
<th>( \eta_C ) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w. (class-B)</td>
<td>7,5</td>
<td>900</td>
<td>3</td>
<td>&gt; 7,0</td>
<td>&gt; 50</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-122D.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter) \( V_{CBO} \) max. 20 V
Collector-emitter voltage (open base) \( V_{CEO} \) max. 10 V
Emitter-base voltage (open collector) \( V_{EBO} \) max. 3 V
Collector current (peak value); \( f > 1 \) MHz \( I_{CM} \) max. 1.8 A
Total power dissipation at \( T_{mb} = 65 \) °C; \( f > 1 \) MHz \( P_{tot(rf)} \) max. 10 W
Storage temperature \( T_{stg} \) -65 to +150 °C
Operating junction temperature \( T_{j} \) max. 200 °C

THERMAL RESISTANCE
From junction to mounting base (\( f > 1 \) MHz) \( R_{th \ j-mb} \) max. 6 K/W

CHARACTERISTICS
\( T_{j} = 25 \) °C unless otherwise specified
D.C. current gain \( I_{C} = 0.6 \) A; \( V_{CE} = 5 \) V \( h_{FE} \) min. 25

Ruggedness
The device is capable of withstanding a full load mismatch (VSWR = 50 through all phases) at 3 W load power up to a supply voltage of 9.0 V and \( T_{mb} = 25 \) °C.
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in mobile radio transmitters in the 470 MHz communications band.

Features:
- multi-base structure and emitter-ballasting resistors for an optimum temperature profile
- gold metallization ensures excellent reliability.
- internal matching to achieve an optimum wideband capability and high power gain.

The transistor has a 6-lead flange envelope with a ceramic cap (SOT-119). All leads are isolated from the flange.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Envelope</th>
<th>SOT-119</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode of operation</td>
<td>class-B; c.w.</td>
</tr>
<tr>
<td>Collector-emitter voltage (d.c.)</td>
<td>$V_{CE}$ 12.5 V</td>
</tr>
<tr>
<td>Frequency</td>
<td>$f$ 470 MHz</td>
</tr>
<tr>
<td>Load power</td>
<td>$P_L$ 20 W</td>
</tr>
<tr>
<td>Power gain</td>
<td>$G_P$ &gt; 6.5 dB</td>
</tr>
<tr>
<td>Collector efficiency</td>
<td>$\eta_C$ &gt; 55 %</td>
</tr>
<tr>
<td>Heatsink temperature</td>
<td>$T_h$ 25 °C</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

SOT-119 (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
MECHANICAL DATA

Fig. 1 SOT-119.

Dimensions in mm

Torque on screw:
- min. 0.6 Nm (6 kg.cm)
- max. 0.75 Nm (7.5 kg.cm)

Heatsink compound must be applied sparingly and evenly distributed.
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134).

Collector-base voltage (open emitter)
  peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)

Collector current
  d.c. or average
  (peak value); f > 1 MHz

Total power dissipation
  at T_{mb} = 25 °C
  f > 1 MHz; T_{mb} = 25 °C

Storage temperature

Operating junction temperature

---

\( V_{\text{CBOM}} \) max. 36 V
\( V_{\text{CEO}} \) max. 16.5 V
\( V_{\text{EBO}} \) max. 4 V
\( I_C \) max. 4 A
\( I_{CM} \) max. 12 A
\( P_{\text{tot (d.c.)}} \) max. 38 W
\( P_{\text{tot (r.f.)}} \) max. 44 W
\( T_{\text{stg}} \) -65 to +150 °C
\( T_j \) max. 200 °C

---

![Fig. 2 D.C.SOA.R.](image1)
R_{\text{th mb-h}} = 0.2 K/W

![Fig. 3 Power/temperature derating curves](image2)
I  Continuous operation
II Continuous operation (f > 1 MHz)
III Short-time operation during mismatch; (f > 1 MHz)

THERMAL RESISTANCE (dissipation = 37 W; T_{mb} = 25 °C, i.e. T_h = 18 °C)

From junction to mounting base
  (d.c. dissipation)
  (r.f. dissipation)
From mounting base to heatsink

\( R_{\text{th j-mb(d.c.)}} \) max 4.6 K/W
\( R_{\text{th j-mb(r.f.)}} \) max 4.1 K/W
\( R_{\text{th mb-h}} \) max 0.2 K/W
CHARACTERISTICS

$T_j = 25 \, ^\circ C$ unless otherwise specified

Collector-base breakdown voltage

$I_C = 25 \, mA$; open emitter

Collector–emitter breakdown voltage

$I_C = 50 \, mA$; open base

Emitter–base breakdown voltage

$I_E = 5 \, mA$; open collector

Collector cut-off current

$V_{BE} = 0$; $V_{CE} = 20 \, V$

Second breakdown energy

$L = 25 \, mH$; $f = 50 \, Hz$; $R_{BE} = 10 \, \Omega$

D.C. current gain

$I_C = 2.7 \, A$; $V_{CE} = 10 \, V$

Collector capacitance at $f = 1 \, MHz$

$I_E = i_e = 0$; $V_{CE} = 12.5 \, V$

Feed-back capacitance at $f = 1 \, MHz$

$I_C = 0$; $V_{CE} = 12.5 \, V$

Collector-flange capacitance

$V_{(BR)CBO} > 36 \, V$

$V_{(BR)CEO} > 16.5 \, V$

$V_{(BR)EBO} > 4 \, V$

$I_{CES} < 12.5 \, mA$

$E_{SBR} > 5.3 \, mJ$

$h_{FE} > 15$

$typ.$

$60$

$53 \, pF$

$C_e$ typ.$$

$33 \, pF$

$C_{cf}$ typ.$$

$3 \, pF$

Fig. 4 $T_j = 25 \, ^\circ C$; typ. values.

Fig. 5 $I_E = i_e = 0$; $f = 1 \, MHz$; typ. values.
APPLICATION INFORMATION

Mode of operation
Collector-emitter voltage (d.c.)
Frequency
Load power
Power gain
Collector efficiency
Heatsink temperature

in narrow band test circuit;
class-B; c.w.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_{CE}</td>
<td>12.5 V</td>
</tr>
<tr>
<td>f</td>
<td>470 MHz</td>
</tr>
<tr>
<td>P_L</td>
<td>20 W</td>
</tr>
<tr>
<td>G_p</td>
<td>&gt; 6.5 dB</td>
</tr>
<tr>
<td>\eta_c</td>
<td>&gt; 55 %</td>
</tr>
<tr>
<td>\eta_c_ttyp</td>
<td>typ. 7.8 dB</td>
</tr>
<tr>
<td>\eta_c_ttyp</td>
<td>typ. 64 %</td>
</tr>
<tr>
<td>T_h</td>
<td>25 °C</td>
</tr>
</tbody>
</table>

Fig. 6 Class-B test circuit at f = 470 MHz.

List of components:

- C1 = C9 = 1.8 to 10 pF film dielectric trimmer (cat.no. 2222 809 05002)
- C2 = 2 to 9 pF film dielectric trimmer (cat.no. 2222 809 09002)
- C3 = C4 = 8.2 pF multilayer ceramic chip capacitor (100A type)*
- C5 = 100 nF polyester film capacitor
- C6 = 120 pF multilayer ceramic chip capacitor
- C7 = 8.2 pF multilayer ceramic chip capacitor (100B type)*
- C8 = 2 to 18 pF film dielectric trimmer (cat.no. 2222 809 09003)
- C10 = 2.2 µF electrolytic capacitor
- L1 = 50 Ω stripline (43.5 mm x 4.0 mm)
- L2 = 100 nH; 5 turns closely wound enamelled Cu-wire (0.5 mm); int. diam. 4 mm; leads 2 x 5 mm
- L3 = 37.6 Ω stripline (8.0 mm x 6.0 mm)
- L4 = 37.6 Ω stripline (9.0 mm x 6.0 mm)
- L5 = 74.4 Ω stripline (22.5 mm x 2.0 mm)
- L6 = 37.6 Ω stripline (18.0 mm x 6.0 mm)
- L7 = L8 = Ferroxcube wideband h.f. choke, grade 3B (cat.no. 4312 020 36642)
- R1 = 1 Ω ± 5%; 0.4 W metal film resistor (MR25 type)
- R2 = 10 Ω ± 5%; 0.4 W metal film resistor (MR25 type)

L1, L3, L4, L5 and L6 are striplines on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric (\( \varepsilon_r = 2.74 \)); thickness 1/16 inch.

* American Technical Ceramics capacitor or capacitor of same quality.
Fig. 7 P.C. board for 470 MHz, class-B test circuit.

Fig. 8 Component lay-out of 470 MHz, class-B test circuit.

Note:
The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper serving as groundplane. Earth connections are made by hollow rivets and also by copper straps under the emitters and around the board to provide a direct contact between the copper on the component side and the ground plane.
Fig. 9 Load power vs. source power.

Fig. 10 Power gain and efficiency vs. load power.

Conditions for Figs. 9 and 10:

\[ V_{CE} = 12.5 \text{ V}; f = 470 \text{ MHz}; \text{class-B operation}; T_h = 25 \text{ °C and 70 °C}; R_{th \, mb-h} = 0.2 \text{ K/W}; \text{typical values}. \]

**RUGGEDNESS**

The device is capable of withstanding a full load mismatch (VSWR = 50; all phases) up to 25 W under the following conditions:

\[ V_{CE} = 15.5 \text{ V}; f = 470 \text{ MHz}; T_h = 25 \text{ °C}; R_{th \, mb-h} = 0.2 \text{ K/W}. \]
Fig. 11 Input impedance (series components).

Conditions for Figs. 11, 12, and 13:
V_{CE} = 12.5 V; P_L = 20 W; f = 400–512 MHz; T_h = 25 °C; class-B operation; R_{th mb-h} = 0.2 K/W; typical values.

Fig. 12 Load impedance (series components).

Fig. 13 Power gain versus frequency.
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in mobile radio transmitters in the 470 MHz communications band.

Features:
- multi-base structure and emitter-ballasting resistors for an optimum temperature profile
- gold metallization ensures excellent reliability
- internal matching to achieve an optimum wideband capability and high power gain

The transistor has a 6-lead flange envelope with a ceramic cap (SOT-119). All leads are isolated from the flange.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Envelope</th>
<th>SOT-119</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode of operation</td>
<td>class-B; c.w.</td>
</tr>
<tr>
<td>Collector-emitter voltage (d.c.)</td>
<td>V_{CE} 12.5 V</td>
</tr>
<tr>
<td>Frequency</td>
<td>f 470 MHz</td>
</tr>
<tr>
<td>Load power</td>
<td>P_L 30 W</td>
</tr>
<tr>
<td>Power gain</td>
<td>G_P &gt; 6.0 dB</td>
</tr>
<tr>
<td>Collector efficiency</td>
<td>\eta_C &gt; 55 %</td>
</tr>
<tr>
<td>Heatsink temperature</td>
<td>T_h 25 °C</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

SOT-119 (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
MECHANICAL DATA

Fig. 1 SOT-119.

Dimensions in mm

Torque on screw:  
- min. 0.6 Nm (6 kg.cm)  
- max. 0.75 Nm (7.5 kg.cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)
  peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)

Collector current
  d.c. or average
  (peak value); f > 1 MHz

Total power dissipation
  f > 1 MHz; T_{mb} = 25 °C

Storage temperature

Operating junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_{CBOM} max.</td>
<td>36 V</td>
</tr>
<tr>
<td>V_{CEO} max.</td>
<td>16.5 V</td>
</tr>
<tr>
<td>V_{EBO} max.</td>
<td>4 V</td>
</tr>
<tr>
<td>I_{C} max.</td>
<td>6 A</td>
</tr>
<tr>
<td>I_{CM} max.</td>
<td>18 A</td>
</tr>
<tr>
<td>P_{tot} (r.f.) max.</td>
<td>65 W</td>
</tr>
<tr>
<td>T_{stg}</td>
<td>-65 to +150 °C</td>
</tr>
<tr>
<td>T_{j} max.</td>
<td>200 °C</td>
</tr>
</tbody>
</table>

Fig. 2 D.C. SOAR.
R_{th \text{mb-h}} = 0.2 K/W

Fig. 3 Power/temperature derating curves

I Continuous operation (f > 1 MHz)
II Short-time operation during mismatch; (f > 1 MHz)

THERMAL RESISTANCE (dissipation = 45 W; T_{mb} = 25 °C).

From junction to mounting base
  (r.f. dissipation)
R_{th j-mb(r.f.)} max. 2.45 K/W

From mounting base to heatsink
R_{th mb-h} max. 0.2 K/W
CHARACTERISTICS

$T_j = 25 \, ^\circ C$ unless otherwise specified

Collector-base breakdown voltage

$I_C = 50 \, mA$; open emitter

Collector-emitter breakdown voltage

$I_C = 100 \, mA$; open base

Emitter-base breakdown voltage

$I_E = 10 \, mA$; open collector

Collector cut-off current

$V_{BE} = 0$; $V_{CE} = 16 \, V$

Second breakdown energy

$L = 25 \, mH$; $f = 50 \, Hz$; $R_{BE} = 10 \, \Omega$

D.C. current gain

$I_C = 4 \, A$; $V_{CE} = 10 \, V$

Collector capacitance at $f = 1 \, MHz^*$

$I_E = i_e = 0$; $V_{CB} = 12,5 \, V$

Feed-back capacitance at $f = 1 \, MHz^*$

$I_C = 0$; $V_{CE} = 12,5 \, V$

Collector-flange capacitance

$V_{(BR)CBO} > 36 \, V$

$V_{(BR)CEO} > 16,5 \, V$

$V_{(BR)EBO} > 4 \, V$

$I_{CES} < 22 \, mA$

$E_{SBR} > 8 \, mJ$

$h_{FE} > 15$ typ.

$C_c$ typ. $85 \, pF$

$C_{re}$ typ. $52 \, pF$

$C_{cf}$ typ. $3 \, pF$

* Device mounted in SOT-119 envelope without inputmatching.
APPLICATION INFORMATION

Mode of operation
In narrow-band test circuit; class-B; c.w.

Collector-emitter voltage (d.c.)

V_{CE} = 12.5 V

Frequency

f = 470 MHz

Load power

P_L > 6.0 W

Power gain

G_p > 7.4 dB
typ. 7.4 dB

Collector efficiency

η_C > 55%
typ. 66%

Heatsink temperature

T_h = 25°C

![Fig. 6 Class-B test circuit at f = 470 MHz.](attachment:image.png)

List of components:

- C1 = C2 = C7 = CB = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
- C3 = C6 = 3.9 pF ceramic capacitor (500 V)
- C4 = 100 pF feed-through capacitor
- C5 = 100 nF polyester film capacitor
- L1 = stripline (24.0 mm x 6.7 mm)
- L2 = 10 turns closely wound enamelled Cu-wire (0.4 mm); int. diam. 4 mm
- L3 = 2 turns enamelled Cu-wire (0.6 mm); Ferroxcube tube core, grade 3B5 (cat. no. 4313 020 15170)
- L4 = 12.6 nH; 2.5 turns enamelled Cu-wire (0.7 mm); int. diam. 4 mm; length 3 mm; leads 2 x 5 mm
- L5 = Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36642)
- L6 = stripline (28.4 mm x 6.7 mm)
- R1 = R2 = 10 Ω carbon resistor

Component lay-out and printed-circuit board for 470 MHz test circuit are shown in Figs 7 and 8.
Fig. 7 Component lay-out of 470 MHz, class-B test circuit.

Fig. 8 P.c. board for 470 MHz, class-B test circuit.

Note:
The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side fully metallized serving as groundplane. Earth connections are made by hollow rivets and also by copper straps under the emitter to provide a direct contact between the copper on the component side and the ground plane.
Fig. 9 Load power vs. source power.

Fig. 10 Power gain and efficiency vs. load power.

Conditions for Figs 9 and 10:

\[ V_{CE} = 12.5 \text{ V}; f = 470 \text{ MHz}; \text{class-B operation}; T_h = 25 ^\circ \text{C} \text{ and } 70 ^\circ \text{C}; R_{th \ mb-h} = 0.2 \text{ K/W}; \text{typical values.} \]

RUGGEDNESS

The device is capable of withstanding a full load mismatch (VSWR = 50; all phases) up to 38 W under the following conditions:

\[ V_{CE} = 15.5 \text{ V}; f = 470 \text{ MHz}; T_h = 25 ^\circ \text{C}; R_{th \ mb-h} = 0.2 \text{ K/W.} \]
Fig. 11 Input impedance (series components).

Fig. 12 Load impedance (series components).

Conditions for Figs 11, 12 and 13:

$V_{CE} = 12.5\, \text{V}$; $P_L = 30\, \text{W}$; $f = 400\text{–}512\, \text{MHz}$; $T_h = 25\, ^\circ\text{C}$; class-B operation; $R_{th\text{mb-h}} = 0.2\, \text{K/W}$; typical values.

Fig. 13 Power gain versus frequency.
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor in SOT-119 envelope primarily intended for use in mobile radio transmitters in the 470 MHz communications band.

Features

- multi-base structure and emitter-ballasting resistors for an optimum temperature profile.
- internal matching to achieve an optimum wideband capability and high power gain.
- gold metallization ensures excellent reliability.

The transistor has a 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25 \degree C$ in a common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_p$ dB</th>
<th>$\eta_C$ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12,5</td>
<td>470</td>
<td>45</td>
<td>&gt; 4,8</td>
<td>&gt; 55</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

SOT-119 (see Fig. 1).

PRODUCT SAFETY  This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
MECHANICAL DATA
Fig. 1 SOT-119

Dimensions in mm

- Torque on screw: min. 0.6 Nm (6 kg.cm), max. 0.75 Nm (7.5 kg.cm)
- Recommended screw: cheese-head 4-40 UNC/2A
- Heatsink compound must be applied and evenly distributed.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)
  peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current
  d.c. or average
  (peak value); f > 1 MHz
Total power dissipation
  at Tmb = 25 °C; f > 1 MHz
Storage temperature
Operating junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Lim. Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-base voltage</td>
<td>VCBOM</td>
<td>max. 36 V</td>
</tr>
<tr>
<td>Collector-emitter voltage</td>
<td>VCEO</td>
<td>max. 16.5 V</td>
</tr>
<tr>
<td>Emitter-base voltage</td>
<td>VEBO</td>
<td>max. 4 V</td>
</tr>
<tr>
<td>Collector current</td>
<td>IC</td>
<td>max. 9 A</td>
</tr>
<tr>
<td>(peak value); f &gt; 1 MHz</td>
<td>ICM</td>
<td>max. 27 A</td>
</tr>
<tr>
<td>Total power dissipation</td>
<td>Ptot</td>
<td>max. 87 W</td>
</tr>
<tr>
<td>at Tmb = 25 °C; f &gt; 1 MHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage temperature</td>
<td>Tstg</td>
<td>-65 to +150 °C</td>
</tr>
<tr>
<td>Operating junction temperature</td>
<td>Tj</td>
<td>max. 200 °C</td>
</tr>
</tbody>
</table>

Fig. 2 Power/temperature derating curves.
I  Continuous operation (f > 1 MHz).
II  Short-time operation during mismatch (f > 1 MHz).

MAXIMUM THERMAL RESISTANCE
Dissipation = 54 W; Tamb = 25 °C

<table>
<thead>
<tr>
<th>Thermal Resistance</th>
<th>Symbol</th>
<th>Lim. Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>From junction to mounting base</td>
<td>Rth j-mb</td>
<td>max. 1.7 K/W</td>
</tr>
<tr>
<td>From mounting base to heatsink</td>
<td>Rth mb-h</td>
<td>max. 0.2 K/W</td>
</tr>
</tbody>
</table>
CHARACTERISTICS

$T_j = 25 \, ^\circ C$ unless otherwise specified

Collector-base breakdown voltage
open emitter; $I_C = 100 \, mA$

Collector-emitter breakdown voltage
open base; $I_C = 200 \, mA$

Emitter-base breakdown voltage
open collector; $I_E = 20 \, mA$

Collector cut-off current
$V_{BE} = 0; V_{CE} = 16 \, V$

Second breakdown energy
$L = 25 \, mH; f = 50 \, Hz; R_{BE} = 10 \, \Omega$

D.C. current gain
$V_{CE} = 10 \, V; I_C = 8 \, A$

Collector capacitance at $f = 1 \, MHz$
$I_E = i_e = 0; V_{CB} = 12,5 \, V$

Feedback capacitance at $f = 1 \, MHz$
$I_C = 0; V_{CE} = 12,5$

Collector-flange capacitance

---

$V_{(BR)CBO}$ min. 36 $V$
$V_{(BR)CEO}$ min. 16,5 $V$
$V_{(BR)EBO}$ min. 4 $V$

$I_{CES}$ max. 44 $mA$

$E_{SBR}$ min. 15 $mJ$

$h_{FE}$ min. 15
typ. 60

$C_C$ typ. 170 $pF$
$C_{re}$ typ. 100 $pF$

$C_{cf}$ typ. 3 $pF$

---

Fig. 3 D.C. current gain versus collector current; $T_j = 25 \, ^\circ C$.

Fig. 4 Output capacitance versus $V_{CB}$; $I_E = i_e = 0; f = 1 \, MHz$. 
APPLICATION INFORMATION

R.F. performance at $T_H = 25\,^\circ C$ in a common-emitter class-B circuit mode of operation

<table>
<thead>
<tr>
<th>$V_{CE}$ (V)</th>
<th>$f$ (MHz)</th>
<th>$P_L$ (W)</th>
<th>$G_P$ (dB)</th>
<th>$\eta_C$ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12.5</td>
<td>470</td>
<td>45</td>
<td>$&gt;4.8$ typ. 5.8</td>
</tr>
</tbody>
</table>

![Fig. 5 Class-B test circuit at $f = 470$ MHz.](image)

List of components:

- $C_1 = C_{13} = 1.8$ to $10$ pF film dielectric trimmer (cat. no. 2222 809 05002)
- $C_2 = C_{11} = 1.4$ to $5.5$ pF film dielectric trimmer (cat. no. 2222 809 09001)
- $C_3 = 12$ pF multilayer ceramic chip capacitor*
- $C_4 = C_5 = 8.2$ pF multilayer ceramic chip capacitor**
- $C_6 = C_7 = 15$ pF multilayer ceramic chip capacitor*
- $C_8 = 110$ pF multilayer ceramic chip capacitor*
- $C_9 = 3 \times 100$ nF multilayer ceramic chip capacitor in parallel
- $C_{10} = 2.2$ µF (35 V) electrolytic capacitor
- $C_{12} = 5.6$ pF multilayer ceramic chip capacitor*
- $L_1 = 34.6$ Ω stripline (17 mm x 4 mm)
- $L_2 = L_5 = 25.3$ Ω stripline (6 mm x 6 mm)
- $L_3 = 45$ nH; 4 turns, closely wound enamelled Cu-wire (0.5 mm); int. dia. 2.5 mm; leads 2 x 5 mm
- $L_4 = L_8 =$ Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36642)
- $L_6 = 29.2$ Ω stripline (25.5 mm x 5 mm)
- $L_7 = 10$ nH; 1 turn Cu-wire (1.0 mm); int. dia. 5 mm; leads 2 x 5 mm
- $R_1 = 1$ Ω ± 5% (0.4 W) metal film resistor
- $R_2 = 10$ Ω ± 5% (1.0 W) metal film resistor

* American Technical Ceramics capacitor type B or capacitor of the same quality.
** Idem type A.
Striplines are on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric ($\varepsilon_r = 2.2$); thickness 1/32 inch.

Fig. 6 Printed circuit board and component layout for 470 MHz class-B test circuit.

The circuit and the components are on one side of the PTFE fibre-glass board; the other side is unetched copper serving as a ground plane. Earth connections are made by fixing screws, hollow rivets and copper straps around the board and under the bases to provide a direct contact between the copper on the component side and the ground plane.
Fig. 7 Load power versus source power.

Fig. 8 Power gain and efficiency versus load power.

Conditions for Figs 7 and 8:
Typical values: $V_{CE} = 12.5$ V; $f = 470$ MHz; $T_h = 25$ °C (---) and 70 °C (---); $R_{th mb-h} = 0.2$ K/W; class-B operation.

RUGGEDNESS
The BLU45/12 is capable of withstanding a full load mismatch (VSWR = 50 through all phases) up to 55 W under the following conditions: $V_{CE} = 15.5$ V; $f = 470$ MHz; $T_h = 25$ °C; $R_{th mb-h} = 0.2$ K/W.
Fig. 9 Input impedance (series components).

Fig. 10 Load impedance (series components).

Conditions for Figs 9, 10 and 11 (class-B operation):
Typical values; $V_{CE} = 12.5$ V; $P_L = 45$ W; $f = 400$ to $512$ MHz; $T_h = 25$ °C;
$R_{th, mb-h} = 0.2$ K/W.

Fig. 11 Power gain versus frequency.
V.H.F./U.H.F. PUSH-PULL POWER TRANSISTOR

N-P-N silicon planar epitaxial push-pull transistor designed for use in military and professional wideband applications in the 30 to 400 MHz range.

Features:
- Diffused emitter ballasting resistors providing excellent current sharing and ruggedness;
- Gold metallization ensures excellent reliability;
- Multicell geometry giving good balance of dissipated power and low thermal resistance;
- Internal input matching to achieve an optimum wideband capability and high power gain.

The envelope is an 8-lead flange type with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance in a common-emitter class-B wideband (100–400 MHz) circuit at $T_h = 25 \, ^\circ C$

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ (V)</th>
<th>$f$ (MHz)</th>
<th>$P_L$ (W)</th>
<th>$G_P$ (dB)</th>
<th>$\eta$ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>28</td>
<td>400</td>
<td>30</td>
<td>$&gt;10$</td>
<td>$&gt;50$</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-161.

Dimensions in mm

Torque on screw: min. 0,60 Nm (6,0 kg.cm)  
max. 0,75 Nm (7,5 kg.cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heat sink compound must be sparingly applied and evenly distributed.

PRODUCT SAFETY  This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)
Collector-emitter voltage ($R_{BE} = 10 \, \Omega$)
Emitter-base voltage (open collector)
Collector current d.c.
Total power dissipation *
at $T_{mb} = 75 \, ^\circ C$
Storage temperature
Operating junction temperature

THERMAL RESISTANCE (total device)
From junction to mounting base

CHARACTERISTICS
$T_{mb} = 25 \, ^\circ C$ unless otherwise specified

Collector-emitter breakdown voltage
$V_{BE} = 0; \, I_{C} = 10 \, mA$

Emitter-base breakdown voltage
open collector; $I_{E} = 10 \, mA$

Collector-base capacitance
$I_{E} = i_{e} = 0; \, V_{CB} = 28 \, V$

$V_{CBO}$ max. 60 V
$V_{CER}$ max. 45 V
$V_{EBO}$ max. 3.5 V
$I_{C}$ max. $2 \times 1.8 \, A$

$P_{tot}$ max. 45 W*
$T_{stg}$ -65 to + 150 °C
$T_{j}$ max. 200 °C

$R_{thj-mb}$ max. 2.7 K/W

$V(\text{BR})_{CES}$ > 60 V
$V(\text{BR})_{EBO}$ > 3.5 V
$C_{cb}$ typ. $2 \times 10 \, pF$

Fig. 2 Input impedance (series components; either section).

Fig. 3 Load impedance (series components; either section).

Conditions for Figs 2 and 3:
Typical values; $V_{CE} = 28 \, V; \, P_{L} = 30 \, W; \, T_{h} = 25 \, ^\circ C$; class-B operation.

* Dissipation of either transistor section should not exceed half rated dissipation.
V.H.F./U.H.F. PUSH-PULL POWER TRANSISTOR

N-P-N silicon planar epitaxial push-pull transistor designed for use in military and professional wideband applications in the 30 to 400 MHz range.

Features:
- Diffused emitter ballasting resistors providing excellent current sharing and ruggedness;
- Gold metallization ensures excellent reliability;
- Multicell geometry giving good balance of dissipated power and low thermal resistance;
- Internal input matching to achieve an optimum wideband capability and high power gain.

The envelope is an 8-lead flange type with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance in a common-emitter class-B wideband (100–400 MHz) circuit at \( T_h = 25 \, ^\circ\text{C} \)

<table>
<thead>
<tr>
<th>( V_{CE} ) (V)</th>
<th>( f ) (MHz)</th>
<th>( P_L ) (W)</th>
<th>( G_P ) (dB)</th>
<th>( \eta_C ) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>400</td>
<td>45</td>
<td>&gt;9</td>
<td>&gt;50</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-161.

Torque on screw: min. 0,60 Nm (6,0 kg.cm)  
max. 0,75 Nm (7,5 kg.cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be sparingly applied and evenly distributed

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)
Collector-emitter voltage \( R_{BE} = 10 \Omega \)
Emitter-base voltage (open collector)
Collector current d.c.
Total power dissipation* at \( T_{mb} = 75 \, ^\circ C \)
Storage temperature
Operating junction temperature

THERMAL RESISTANCE (total device)

From junction to mounting base

CHARACTERISTICS

\( T_{mb} = 25 \, ^\circ C \) unless otherwise specified

Collector-emitter breakdown voltage
\( V_{BE} = 0 \); \( I_C = 20 \, mA \)
Emitter-base breakdown voltage
open collector; \( I_E = 10 \, mA \)
Collector-base capacitance
\( I_E = i_e = 0 \); \( V_{CB} = 28 \, V \)

\[ \begin{align*}
V_{CBO} & \quad \text{max.} \quad 60 \, V \\
V_{CER} & \quad \text{max.} \quad 45 \, V \\
V_{EBO} & \quad \text{max.} \quad 3,5 \, V \\
I_C & \quad \text{max.} \quad 2 \times 2,5 \, A \\
P_{\text{tot}} & \quad \text{max.} \quad 65 \, W^* \\
T_{\text{stg}} & \quad -65 \text{ to } +150 \, ^\circ C \\
T_j & \quad \text{max.} \quad 200 \, ^\circ C \\
R_{th\,j-mb} & \quad \text{max.} \quad 2 \, K/W \\
V_{(BR)CES} & \quad > \quad 60 \, V \\
V_{(BR)EBO} & \quad > \quad 3,5 \, V \\
C_{cb} & \quad \text{typ.} \quad 2 \times 15 \, pF
\end{align*} \]

* Dissipation of either transistor section should not exceed half rated dissipation.

Fig. 2 Input impedance (series components; either section).
Fig. 3 Load impedance (series components; either section).

Conditions for Figs 2 and 3:
Typical values; \( V_{CE} = 28 \, V \); \( P_L = 45 \, W \); \( T_h = 25 \, ^\circ C \); class-B operation.
V.H.F./U.H.F. PUSH-PULL POWER TRANSISTOR

N-P-N silicon planar epitaxial push-pull transistor designed for use in military and professional wideband applications in the 30 to 400 MHz range.

Features:
- Diffused emitter ballasting resistors providing excellent current sharing and ruggedness;
- Gold metallization ensures excellent reliability;
- Multicell geometry giving good balance of dissipated power and low thermal resistance;
- Internal input matching to achieve an optimum wideband capability and high power gain.

The envelope is an 8-lead flange type with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance in a common-emitter class-B wideband (100–400 MHz) circuit at \( T_h = 25 \, ^\circ C \)

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>( V_{CE} ) [V]</th>
<th>( f ) [MHz]</th>
<th>( P_L ) [W]</th>
<th>( G_p ) [dB]</th>
<th>( \eta_C ) [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>28</td>
<td>400</td>
<td>60</td>
<td>&gt; 8</td>
<td>&gt; 50</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-161.

- Dimensions in mm

- Torque on screw: min. 0,60 Nm (6,0 kg.cm) max. 0,75 Nm (7,5 kg.cm)

- Recommended screw: cheese-head 4-40 UNC/2A

- Heatsink compound must be sparingly applied and evenly distributed

PRODUCT SAFETY  This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)
Collector-base voltage (open emitter)
Collector-emitter voltage (\(R_{BE} = 10 \, \Omega\))
Emitter-base voltage (open collector)
Collector current d.c.
Total power dissipation*
at \(T_{mb} = 75 \, ^\circ\text{C}\)
Storage temperature
Operating junction temperature

THERMAL RESISTANCE (total device)
From junction to mounting base

CHARACTERISTICS
\(T_{mb} = 25 \, ^\circ\text{C}\) unless otherwise specified
Collector-emitter breakdown voltage
\(V_{BE} = 0; I_C = 20 \, \text{mA}\)
Emitter-base breakdown voltage
open collector; \(I_E = 10 \, \text{mA}\)
Collector-base capacitance
\(I_E = I_e = 0; V_{CB} = 28 \, \text{V}\)

\[
\begin{align*}
V_{CBO} & \quad \text{max.} \quad 60 \, \text{V} \\
V_{CER} & \quad \text{max.} \quad 45 \, \text{V} \\
V_{EBO} & \quad \text{max.} \quad 3,5 \, \text{V} \\
I_C & \quad \text{max.} \quad 2 \times 4 \, \text{A} \\
P_{tot} & \quad \text{max.} \quad 95 \, \text{W}\star \\
T_{stg} & \quad -65 \text{ to } +150 \, ^\circ\text{C} \\
T_j & \quad \text{max.} \quad 200 \, ^\circ\text{C} \\
R_{th j-mb} & \quad \text{max.} \quad 1,3 \, \text{K/W} \\
V_{(BR)CES} & > \quad 60 \, \text{V} \\
V_{(BR)EBO} & > \quad 3,5 \, \text{V} \\
C_{cb} & \quad \text{typ.} \quad 2 \times 22 \, \text{pF} \\
\end{align*}
\]

Conditions for Figs 2 and 3:
Typical values; \(V_{CE} = 28 \, \text{V}; P_L = 60 \, \text{W}; T_h = 25 \, ^\circ\text{C}; \) class-B operation.
* Dissipation of either transistor section should not exceed half rated dissipation.
V.H.F./U.H.F. PUSH-PULL POWER TRANSISTOR

N-P-N silicon planar epitaxial push-pull transistor designed for use in military and professional wideband applications in the 30 to 400 MHz range.

Features:
- Diffused emitter ballasting resistors providing excellent current sharing and ruggedness;
- Gold metallization ensures excellent reliability;
- Multicell geometry giving good balance of dissipated power and low thermal resistance;
- Internal input matching to achieve an optimum wideband capability and high power gain.

The envelope is an 8-lead flange type with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance in a common-emitter class-C wideband circuit at $T_h = 25$ °C

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_p$ dB</th>
<th>$\eta_C$ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>28</td>
<td>225–400</td>
<td>100</td>
<td>&gt;7</td>
<td>&gt;55</td>
</tr>
<tr>
<td>c.w.</td>
<td>28</td>
<td>100–400</td>
<td>100</td>
<td>&gt;6</td>
<td>&gt;50</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-161.

Dimensions in mm

Torque on screw: min. 0,60 Nm (6,0 kg.cm)
max. 0,75 Nm (7,5 kg.cm)

Recommended screw: cheese-head 4-40 UNC/2A
Heatsink compound must be sparingly applied and evenly distributed

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

- Collector-base voltage (open emitter): $V_{CBO}$ max. 60 V
- Collector-emitter voltage ($R_{BE} = 10 \Omega$): $V_{CER}$ max. 45 V
- Emitter-base voltage (open collector): $V_{EBO}$ max. 3.5 V
- Collector current d.c.: $I_{C}$ max. 2 x 5 A
- Total power dissipation* at $T_{mb} = 75 \, ^\circ C$: $P_{tot}$ max. 125 W*
- Storage temperature: $T_{stg}$ -65 to + 150 °C
- Operating junction temperature: $T_{j}$ max. 200 °C

THERMAL RESISTANCE (total device)
From junction to mounting base: $R_{thj-mb}$ max. 1.0 K/W

CHARACTERISTICS

- Collector-emitter breakdown voltage: $V_{BE} = 0; I_{C} = 100 \, mA$
  - $V_{(BR)CES}$ > 60 V
- Emitter-base breakdown voltage:
  - open collector; $I_{E} = 10 \, mA$
  - $V_{(BR)EBO}$ > 3.5 V
- Collector-base capacitance:
  - $I_{E} = i_{e} = 0; V_{CB} = 28 \, V$
  - $C_{cb}$ typ. 2 x 30 pF

* Dissipation of either transistor section should not exceed half rated dissipation.
V.H.F./U.H.F. push-pull power transistor

Conditions for Figs 3 and 4:
Typical values: \( V_{CE} = 28 \) V; \( P_L = 100 \) W; \( T_h = 25 \) °C; class-C operation.

Conditions for Figs 5 and 6:
Typical values: \( V_{CE} = 18 \) V; \( P_L = 70 \) W; \( T_h = 25 \) °C; class-C operation.

**APPLICATION INFORMATION**

R.F. performance in a common-emitter class-C wideband circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>( V_{CE} ) V</th>
<th>( f ) MHz</th>
<th>( P_L ) W</th>
<th>( G_p ) dB</th>
<th>( \eta C ) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>28</td>
<td>100–400</td>
<td>100</td>
<td>&gt; 6</td>
<td>&gt; 50</td>
</tr>
<tr>
<td>c.w.</td>
<td>28</td>
<td>225–400</td>
<td>100</td>
<td>&gt; 7</td>
<td>&gt; 55</td>
</tr>
</tbody>
</table>

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U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor in SOT-119 envelope primarily intended for use in mobile radio transmitters in the 470 MHz communications band.

Features
● multi-base structure and emitter-ballasting resistors for an optimum temperature profile.
● internal matching to achieve an optimum wideband capability and high power gain.
● gold metallization ensures excellent reliability.

The transistor has a 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>V_{CE} V</th>
<th>f MHz</th>
<th>P_{L} W</th>
<th>G_{D} dB</th>
<th>ηC %</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12.5</td>
<td>470</td>
<td>60</td>
<td>&gt; 4.4</td>
<td>&gt; 55</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

SOT-119 (see Fig. 1).

PRODUCT SAFETY  This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
MECHANICAL DATA

Fig. 1 SOT-119.

Torque on screw:
min. 0,6 Nm (6 kg.cm)
max. 0,75 Nm (7,5 kg.cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)

peak value

Collector-emitter voltage (open base)

Emitter-base voltage (open collector)

Collector current
d.c. or average
(peak value); f > 1 MHz

Total power dissipation
at Tmb = 25 °C; f > 1 MHz

Storage temperature

Operating junction temperature

\[ \begin{align*}
V_{CBOM} & \quad \text{max.} \quad 36 \, \text{V} \\
V_{CEO} & \quad \text{max.} \quad 16,5 \, \text{V} \\
V_{EBO} & \quad \text{max.} \quad 4 \, \text{V} \\
I_C & \quad \text{max.} \quad 12 \, \text{A} \\
I_{CM} & \quad \text{max.} \quad 36 \, \text{A} \\
P_{\text{tot}} & \quad \text{max.} \quad 110 \, \text{W} \\
T_{\text{stg}} & \quad -65 \text{ to } +150 \, \text{°C} \\
T_j & \quad \text{max.} \quad 200 \, \text{°C}
\end{align*} \]

Fig. 2 Power/temperature derating curves.

I Continuous operation (f > 1 MHz).
II Short-time operation during mismatch (f > 1 MHz).

MAXIMUM THERMAL RESISTANCE

Dissipation = 72 W; T_{amb} = 25 °C

From junction to mounting base (r.f. operation)

From mounting base to heatsink

\[ \begin{align*}
R_{th \, j-mb} & \quad \text{max.} \quad 1,4 \, \text{K/W} \\
R_{th \, mb-h} & \quad \text{max.} \quad 0,2 \, \text{K/W}
\end{align*} \]
CHARACTERISTICS

\( T_j = 25 \, ^\circ\text{C} \) unless otherwise specified

Collector-base breakdown voltage

open emitter; \( I_C = 100 \, \text{mA} \)

Collector-emitter breakdown voltage

open base; \( I_C = 200 \, \text{mA} \)

Emitter-base breakdown voltage

open collector; \( I_E = 20 \, \text{mA} \)

Collector cut-off current

\( V_{BE} = 0; \, V_{CE} = 16 \, \text{V} \)

Second breakdown energy

\( L = 25 \, \text{mH}; \, f = 50 \, \text{Hz}; \, R_{BE} = 10 \, \Omega \)

D.C. current gain

\( V_{CE} = 10 \, \text{V}; \, I_C = 8 \, \text{A} \)

Collector capacitance at \( f = 1 \, \text{MHz} \)

\( I_E = I_c = 0; \, V_{CEB} = 12.5 \, \text{V} \)

Feedback capacitance at \( f = 1 \, \text{MHz} \)

\( I_C = 0; \, V_{CEB} = 12.5 \, \text{V} \)

Collector-flange capacitance

\[ C_c \quad \text{typ.} \quad 170 \, \text{pF} \]

\[ C_{cf} \quad \text{typ.} \quad 3 \, \text{pF} \]

\[ h_{FE} \quad \text{min.} \quad 15 \, \text{mJ} \]

\[ V_{(BR)CBO} \quad \text{min.} \quad 36 \, \text{V} \]

\[ V_{(BR)CEO} \quad \text{min.} \quad 16.5 \, \text{V} \]

\[ V_{(BR)EBO} \quad \text{min.} \quad 4 \, \text{V} \]

\[ I_{CES} \quad \text{max.} \quad 44 \, \text{mA} \]

\[ V_{CE} = 12.5 \, \text{V} \]

\[ I_C = 8 \, \text{A} \]

\[ V_{CE} = 10 \, \text{V} \]

Fig. 3 D.C. current gain versus collector current; \( T_j = 25 \, ^\circ\text{C} \).

Fig. 4 Output capacitance versus \( V_{CB} \); \( I_E = I_c = 0; \, f = 1 \, \text{MHz} \).
APPLICATION INFORMATION

R.F. performance at $T_h = 25 \, ^\circ\text{C}$ in a common-emitter class-B circuit mode of operation

<table>
<thead>
<tr>
<th>$V_{CE} , \text{V}$</th>
<th>$f , \text{MHz}$</th>
<th>$P_L , \text{W}$</th>
<th>$G_P , \text{dB}$</th>
<th>$\eta_C , %$</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12,5</td>
<td>470</td>
<td>60</td>
<td>&gt; 4,4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>typ. 5,5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>typ. 62</td>
</tr>
</tbody>
</table>

Fig. 5 Class-B test circuit at $f = 470 \, \text{MHz}$.

List of components:

- $C_1 = C_{13} = 1,8$ to $10 \, \text{pF}$ film dielectric trimmer (cat. no. 2222 809 05002)
- $C_2 = C_{11} = 1,4$ to $5,5 \, \text{pF}$ film dielectric trimmer (cat. no. 2222 809 09001)
- $C_3 = 12 \, \text{pF}$ multilayer ceramic chip capacitor*
- $C_4 = C_5 = 8,2 \, \text{pF}$ multilayer ceramic chip capacitor**
- $C_6 = C_7 = 15 \, \text{pF}$ multilayer ceramic chip capacitor*
- $C_8 = 110 \, \text{pF}$ multilayer ceramic chip capacitor*
- $C_9 = 3 \times 100 \, \text{nF}$ multilayer ceramic chip capacitor in parallel
- $C_{10} = 2,2 \, \mu\text{F}$ (35 V) electrolytic capacitor
- $C_{12} = 5,6 \, \text{pF}$ multilayer ceramic chip capacitor*
- $L_1 = 34,6 \, \Omega$ stripline (17 mm x 4 mm)
- $L_2 = L_5 = 25,3 \, \Omega$ stripline (6 mm x 6 mm)
- $L_3 = 45 \, \text{nH}$; 4 turns, closely wound enamelled Cu-wire (0,5 mm); int. dia. 2,5 mm; leads 2 x 5 mm
- $L_4 = L_8 = \text{Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36642)}$
- $L_6 = 29,2 \, \Omega$ stripline (25,5 mm x 5 mm)
- $L_7 = 10 \, \text{nH}$; 1 turn Cu-wire (1,0 mm); int. dia. 5 mm; leads 2 x 5 mm
- $R_1 = 1 \, \Omega \pm 5\%$ (0,4 W) metal film resistor
- $R_2 = 10 \, \Omega \pm 5\%$ (1,0 W) metal film resistor

* American Technical Ceramics capacitor type B or capacitor of the same quality.
** Idem type A.
Striplines are on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric ($E_r = 2.2$); thickness 1/32 inch.

**Fig. 6** Printed circuit board and component layout for 470 MHz class-B test circuit.

The circuit and the components are on one side of the PTFE fibre-glass board; the other side is unetched copper serving as a ground plane. Earth connections are made by fixing screws, hollow rivets and copper straps around the board and under the bases to provide a direct contact between the copper on the component side and the ground plane.
Fig. 7 Load power versus source power.

Fig. 8 Power gain and efficiency versus load power.

Conditions for Figs 7 and 8:
Typical values; $V_{CE} = 12.5$ V; $f = 470$ MHz; $T_h = 25$ °C (---) and $70$ °C (-- -- --);
$R_{th \, mb-h} = 0.2$ K/W; class-B operation.

RUGGEDNESS
The BLU60/12 is capable of withstanding a full load mismatch (VSWR = 50 through all phases) up to $70$ W under the following conditions; $V_{CE} = 15.5$ V; $f = 470$ MHz; $T_h = 25$ °C; $R_{th \, mb-h} = 0.2$ K/W.
Conditions for Figs 9, 10 and 11 (class-B operation):
Typical values: $V_{CE} = 12.5$ V; $P_L = 60$ W; $f = 400$ to $512$ MHz; $T_h = 25$ °C; $R_{th \text{mb-h}} = 0.2$ K/W.
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor designed for use in mobile radio transmitters in the 470 MHz band.

Features:
- multi-base structure and emitter-ballasting resistors for an optimum temperature profile.
- gold metallization ensures excellent reliability.

The transistor has a 4-lead stud envelope with a ceramic cap (SOT-122). All leads are isolated from the stud.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ (V)</th>
<th>$f$ (MHz)</th>
<th>$P_L$ (W)</th>
<th>$G_p$ (dB)</th>
<th>$\eta_C$ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12.5</td>
<td>470</td>
<td>7</td>
<td>&gt;8.5</td>
<td>&gt; 55</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-122.

Torque on put: min. 0.75 Nm (7.5 kg.cm) max. 0.85 Nm (8.5 kg.cm)

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY  This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current
  d.c. or average
  (peak value); f > 1 MHz

Total power dissipation
  at $T_{mb} = 52 \, ^\circ C$
  $f > 1 \, MHz; T_{mb} = 52 \, ^\circ C$

Storage temperature

Operating junction temperature

Fig. 2 D.C. SOAR.

$$R_{th \, mb-h} = 0.6 \, K/W.$$ 

Fig. 3 Power/temperature derating curves.

Continuous operation
Continuous operation ($f > 1 \, MHz$)
Short-time operation during mismatch; ($f > 1 \, MHz$).

THERMAL RESISTANCE

Dissipation = 15 W; $T_{mb} = 25 \, ^\circ C$
From junction to mounting base
  (d.c. dissipation)
  (r.f. dissipation)
From mounting base to heatsink

$$R_{th \, j-mb (dc)} = 7.5 \, K/W$$
$$R_{th \, j-mb (rf)} = 5.6 \, K/W$$
$$R_{th \, mb-h} = 0.6 \, K/W$$
U.H.F. power transistor

CHARACTERISTICS

$T_j = 25 \, ^\circ\text{C}$ unless otherwise specified

- Collector-base breakdown voltage, open emitter; $I_C = 15 \, \text{mA}$
- Collector-emitter breakdown voltage, open base; $I_C = 30 \, \text{mA}$
- Emitter-base breakdown voltage, open collector; $I_E = 1.5 \, \text{mA}$
- Collector cut-off current, $V_{BE} = 0$; $V_{CE} = 16 \, \text{V}$
- Second breakdown energy, $L = 25 \, \text{mH}$; $f = 50 \, \text{Hz}$; $R_{BE} = 10 \, \Omega$

D.C. current gain, $I_C = 0.9 \, \text{A}$; $V_{CE} = 10 \, \text{V}$

- Transition frequency at $f = 500 \, \text{MHz}$*, $-I_E = 0.9 \, \text{A}$; $V_{CB} = 12.5 \, \text{V}$
- Collector capacitance at $f = 1 \, \text{MHz}$, $I_E = i_E = 0$; $V_{CB} = 12.5 \, \text{V}$
- Feed-back capacitance at $f = 1 \, \text{MHz}$, $I_C = 0$; $V_{CE} = 12.5 \, \text{V}$
- Collector-stud capacitance

\begin{align*}
V_{(BR)CEO} & > 16 \, \text{V} \\
V_{(BR)EBO} & > 3 \, \text{V} \\
I_{CES} & < 7.5 \, \text{mA} \\
E_{SBR} & > 2.3 \, \text{mJ} \\
h_{FE} & > 25 \\
f_T & \text{typ.} \ 4.0 \, \text{GHz} \\
C_C & \text{typ.} \ 10 \, \text{pF} \\
C_E & \text{typ.} \ 7 \, \text{pF} \\
C_{CS} & \text{typ.} \ 1.2 \, \text{pF}
\end{align*}

\begin{align*}
V_{(BR)CBO} & > 36 \, \text{V} \\
V_{(BR)CEO} & > 16 \, \text{V} \\
V_{(BR)EBO} & > 3 \, \text{V} \\
I_{CES} & < 7.5 \, \text{mA} \\
E_{SBR} & > 2.3 \, \text{mJ} \\
h_{FE} & > 25 \\
f_T & \text{typ.} \ 4.0 \, \text{GHz} \\
C_C & \text{typ.} \ 10 \, \text{pF} \\
C_E & \text{typ.} \ 7 \, \text{pF} \\
C_{CS} & \text{typ.} \ 1.2 \, \text{pF}
\end{align*}

Fig. 4 $T_j = 25 \, ^\circ\text{C}$; $V_{CE} = 10 \, \text{V}$; typical values.

Fig. 5 $V_{CB} = 12.5 \, \text{V}$; $f = 500 \, \text{MHz}$; $t_p = 50 \, \mu\text{s}$; $T_j = 25 \, ^\circ\text{C}$; typical values.

Fig. 6 $I_E = i_e = 0$; $f = 1 \, \text{MHz}$; typical values.

* Measured under pulse conditions: $t_p = 50 \, \mu\text{s}$; $\delta < 1\%$. 

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APPLICATION INFORMATION

R.F. performance in common-emitter circuit; class-B: \( f = 470 \text{ MHz} \); \( T_h = 25 ^\circ \text{C} \)

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>( V_{CE} ) V</th>
<th>( P_L ) W</th>
<th>( P_S ) W</th>
<th>( G_P ) dB</th>
<th>( I_C ) A</th>
<th>( \eta_C ) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12.5</td>
<td>7</td>
<td>&lt; 0.99</td>
<td>&gt; 8.5</td>
<td>&lt; 1.0</td>
<td>&gt; 55</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>typ. 0.55</td>
<td>typ. 11.0</td>
<td>typ. 0.8</td>
<td>typ. 70</td>
</tr>
</tbody>
</table>

Fig. 7 Class-B test circuit at \( f = 470 \text{ MHz} \).

List of components:

- \( C_1 = 2.7 \text{ pF multilayer ceramic chip capacitor}^* \)
- \( C_2 = C_7 = C_8 = 1.4 \text{ to } 5.5 \text{ pF film dielectric trimmer (cat. no. 2222 809 09001)} \)
- \( C_3 = 7.5 \text{ pF multilayer ceramic chip capacitor}^* \)
- \( C_4 = 2 \text{ to } 9 \text{ pF film dielectric trimmer (cat. no. 2222 809 09002)} \)
- \( C_5 = 100 \text{ pF multilayer ceramic chip capacitor} \)
- \( C_6 = 100 \text{ nF metallized film capacitor} \)
- \( L_1 = 38 \text{ } \Omega \text{ stripline (22.5 mm x 6.0 mm)} \)
- \( L_2 = 15 \text{ nH; 1 turn Cu wire (1.0 mm); int. dia. 5 mm; leads 2 x 5 mm} \)
- \( L_3 = L_4 = \text{Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36642)} \)
- \( L_5 = 29 \text{ nH; 2 turns enamelled Cu wire (1.0 mm); int. dia. 6 mm; length 3.5 mm; leads 2 x 5 mm} \)
- \( L_6 = 38 \text{ } \Omega \text{ stripline (10.0 mm x 6.0 mm)} \)
- \( L_7 = 7 \text{ nH; 1/2 turn Cu wire (1.0 mm); int. dia. 5.0 mm; leads 2 x 5 mm} \)
- \( R_1 = R_2 = 10 \Omega \pm 10\%; 0.25 \text{ W metal film resistor} \)

\( L_1 \) and \( L_6 \) are striplines on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric \( (\varepsilon_r = 2.74) \); thickness 1/16 inch.

* American Technical Ceramics capacitor type 100A or capacitor of same quality.
Fig. 8 Printed circuit board and component lay-out for 470 MHz class-B test circuit.

Note
The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper serving as ground plane. Earth connections are made by hollow rivets and also by copper straps under the emitters.
Fig. 9 Load power vs. source power.

Fig. 10 Power gain and efficiency vs. load power.

Conditions for Figs 9 and 10:
$V_{CE} = 12.5\, \text{V}$; $f = 470\, \text{MHz}$; $T_h = 25\, \text{°C}$; class-B operation; typical values.

RUGGEDNESS
The device is capable of withstanding a full load mismatch ($\text{VSWR} = 50$; all phases) at rated load power up to a supply voltage of $15.5\, \text{V}$ and $T_h = 25\, \text{°C}$.

Fig. 11 Input impedance (series components).

Fig. 12 Load impedance (series components).

Conditions for Figs 11 and 12:
$V_{CE} = 12.5\, \text{V}$; $P_L = 7\, \text{W}$; $f = 400-520\, \text{MHz}$; $T_h = 25\, \text{°C}$; class-B operation; typical values.
Fig. 13 Power gain vs. frequency.
$V_{CE} = 12.5 \text{ V}; \quad P_L = 7 \text{ W}; \quad f = 400-520 \text{ MHz}; \quad T_h = 25 ^\circ \text{C};$
class-B operation; typical values.
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor designed for use in mobile radio transmitters in the 900 MHz band.

Features:
- emitter-ballasting resistors for an optimum temperature profile
- gold metallization ensures excellent reliability.

The transistor is encapsulated in a subminiature plastic transfer-moulded cross package (SOT-103).

QUICK REFERENCE DATA

R.F. performance at $T_{\text{amb}} = 25 \, ^\circ\text{C}$ in a common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_P$ dB</th>
<th>%C</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12.5</td>
<td>900</td>
<td>0.5</td>
<td>&gt; 8.0</td>
<td>&gt; 50</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-103.

Dimensions in mm
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter) \( V_{CBO} \) max. 36 V
Collector-emitter voltage (open base) \( V_{CEO} \) max. 16 V
Emitter-base voltage (open collector) \( V_{EBO} \) max. 3 V

Collector current
  d.c. or average \( I_C \) max. 150 mA
  (peak value); \( f > 1 \text{ MHz} \)

Total power dissipation
  at \( T_{coll. \ tap} = 75 \text{ °C} \) \( P_{tot} \) max. 1,65 W

Total power dissipation*
  at \( T_{amb} = 25 \text{ °C} \) \( P_{tot} \) max. 1,0 W

Storage temperature \( T_{stg} \)

Operating junction temperature \( T_j \) max. 175 °C

THERMAL RESISTANCE*

From junction to collector tap (d.c.) \( R_{th \ j-ct(dc)} \) = 60 K/W
From junction to ambient (d.c.) \( R_{th \ j-a(dc)} \) = 150 K/W

CHARACTERISTICS

\( T_j = 25 \text{ °C} \) unless otherwise specified

Collector-base breakdown voltage
  open emitter; \( I_C = 2,5 \text{ mA} \)

Collector-emitter breakdown voltage
  open base; \( I_C = 10 \text{ mA} \)

Emitter-base breakdown voltage
  open collector; \( I_E = 0,5 \text{ mA} \)

Collector cut-off current
  \( V_{BE} = 0; \ V_{CE} = 16 \text{ V} \)

D.C. current gain
  \( I_C = 100 \text{ mA}; \ V_{CE} = 10 \text{ V} \)
  \( h_{FE} \) > 25

Transition frequency at \( f = 500 \text{ MHz}^{**} \)
  \( -I_E = 100 \text{ mA}; \ V_{CB} = 12,5 \text{ V} \)
  \( f_T \) typ. 4,0 GHz

Collector capacitance at \( f = 1 \text{ MHz} \)
  \( I_E = i_e = 0; \ V_{CB} = 12,5 \text{ V} \)
  \( C_C \) typ. 2,1 pF

Feed-back capacitance at \( f = 1 \text{ MHz} \)
  \( I_C = 0; \ V_{CE} = 12,5 \text{ V} \)
  \( C_{re} \) typ. 1,3 pF

* Transistor mounted on a p.c. board with a collector area of 50 mm².
** Measured under pulse conditions: \( t_p = 50 \mu s; \delta < 1\% \).
Fig. 2 $T_j = 25 \, ^\circ C$; typical values.

Fig. 3 $V_{CB} = 12.5 \, V$; $f = 500 \, MHz$; $T_j = 25 \, ^\circ C$; typical values.

Fig. 4 $I_E = i_e = 0$; $f = 1 \, MHz$; typical values.
APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter circuit; class-B): f = 900 MHz; T_{amb} = 25 °C

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>V_{CE} V</th>
<th>P_{L} W</th>
<th>P_{S} W</th>
<th>G_{P} dB</th>
<th>I_{C} mA</th>
<th>\eta_{C} %</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12,5</td>
<td>0,5</td>
<td>&lt; 0,079</td>
<td>&gt; 8,0</td>
<td>&lt; 80</td>
<td>&gt; 50</td>
</tr>
</tbody>
</table>

List of components:
- C1 = C6 = C10 = 330 pF multilayer ceramic chip capacitor
- C2 = C3 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
- C4 = C5 = 6,8 pF multilayer ceramic chip capacitor*
- C7 = 6,8 µF (63 V) electrolytic capacitor
- C8 = 1,0 to 3,5 pF film dielectric trimmer (cat. no. 2222 809 05001)
- C9 = 1,2 pF multilayer ceramic chip capacitor*
- L1 = 50 Ω stripline (24,0 mm x 2,4 mm)
- L2 = 50 Ω stripline (8,0 mm x 2,4 mm)
- L3 = 60 nH; 4 turns closely wound enamelled Cu wire (0,4 mm); int. dia. 3 mm; leads 2 x 5 mm
- L4 = L7 = Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36642)
- L5 = 50 Ω stripline (14,0 mm x 2,4 mm)
- L6 = 245 nH; 9 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 5 mm; leads 2 x 3 mm
- L8 = 50 Ω stripline (32,5 mm x 2,4 mm)
- L9 = 50 Ω stripline (10,0 mm x 2,4 mm)
- R1 = 10 Ω ± 10%; 0,25 W metal film resistor

L1, L2, L5, L8 and L9 are striplines on a double Cu-clad printed circuit board with P.T.F.E. fiberglass dielectric (\epsilon_r = 2,2); thickness 1/32 inch.

* American Technical Ceramics capacitor type 100A or capacitor of same quality.
Fig. 6 Printed circuit board and component lay-out for 900 MHz class-B test circuit.

Note
The circuit and the components are on one side of P.T.F.E. fibre-glass board; the other side is unetched copper serving as ground plane. Earth connections are made by fixing-screws and copper straps around the board and under the emitters to provide a direct contact between the copper on the component side and the ground plane.
Conditions for Figs 7 and 8:
V\text{CE} = 12,5 \text{ V}; f = 900 \text{ MHz}; T\text{amb} = 25 \text{ °C}; class-B operation; test circuit tuned at P_L = 0,5 \text{ W}; typical values.

RUGGEDNESS
The transistor is capable of withstanding a full load mismatch (VSWR = 50; all phases) at rated load power up to a supply voltage of 15,5 \text{ V} and T\text{amb} = 25 \text{ °C}.

Conditions for Figs 9 and 10:
V\text{CE} = 12,5 \text{ V}; P_L = 0,5 \text{ W}; f = \text{800-960 MHz}; T\text{amb} = 25 \text{ °C}; class-B operation; typical values.
Fig. 11  Power gain vs. frequency.

\[ V_{CE} = 12.5 \, \text{V}; \, P_L = 0.5 \, \text{W}; \, f = 800-960 \, \text{MHz}; \, T_{amb} = 25 \, \text{°C}; \]

class-B operation; typical values.
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in mobile radio transmitters in the u.h.f. band. The transistor is also very suitable for application in the 900 MHz mobile radio band.

Features:
- multi-base structure and diffused emitter-ballasting resistors for an optimum temperature profile;
- gold metallization ensures excellent reliability.

The transistor has a 4-lead stud envelope with a ceramic cap (SOT-122). All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance at T_h = 25 °C in a common-emitter class-B circuit.

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>V_CE V</th>
<th>f MHz</th>
<th>P_L W</th>
<th>Gp dB</th>
<th>η_C %</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12,5</td>
<td>470</td>
<td>5</td>
<td>&gt; 10,5</td>
<td>&gt; 60</td>
</tr>
<tr>
<td></td>
<td>12,5</td>
<td>900</td>
<td>4</td>
<td>typ. 7,0</td>
<td>typ. 60</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.

Torque on nut: min. 0,75 Nm (7,5 kg.cm) max. 0,85 Nm (8,5 kg.cm)
Diameter of clearance hole in heatsink: max. 4,2 mm
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current
  d.c. or average
  peak value; f > 1 MHz
→ D.C. power dissipation up to T_{mb} = 50°C
R.F. power dissipation
  f > 1 MHz; T_{mb} = 25°C

Storage temperature
Operating junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-base voltage</td>
<td>36 V</td>
</tr>
<tr>
<td>Collector-emitter voltage</td>
<td>16 V</td>
</tr>
<tr>
<td>Emitter-base voltage</td>
<td>3 V</td>
</tr>
<tr>
<td>Collector current</td>
<td>0.8 A</td>
</tr>
<tr>
<td>Emitter-base current</td>
<td>2.5 A</td>
</tr>
<tr>
<td>Collector current (peak)</td>
<td>2.5 A</td>
</tr>
<tr>
<td>Emitter-base current (peak)</td>
<td>1.2 A</td>
</tr>
<tr>
<td>D.C. power dissipation</td>
<td>12.5 W</td>
</tr>
<tr>
<td>R.F. power dissipation</td>
<td>19 W</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-65 to +150°C</td>
</tr>
<tr>
<td>Operating junction temperature</td>
<td>200°C</td>
</tr>
</tbody>
</table>

THERMAL RESISTANCE (dissipation = 9 W; T_{mb} = 25°C)

From junction to mounting base
  (d.c. dissipation)
From junction to mounting base
  (r.f. dissipation)
From mounting base to heatsink

<table>
<thead>
<tr>
<th>Resistance</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>R_{th j-mb(dc)}</td>
<td>10 K/W</td>
</tr>
<tr>
<td>R_{th j-mb(rf)}</td>
<td>7.5 K/W</td>
</tr>
<tr>
<td>R_{th mb-h}</td>
<td>0.6 K/W</td>
</tr>
</tbody>
</table>
CHARACTERISTICS

\( T_j = 25^\circ C \) unless otherwise specified

Collector-base breakdown voltage
  open emitter; \( I_C = 10 \text{ mA} \)

Collector-emitter breakdown voltage
  open base; \( I_C = 20 \text{ mA} \)

Emitter-base breakdown voltage
  open collector; \( I_E = 1 \text{ mA} \)

Collector cut-off current
  \( V_{BE} = 0; V_{CE} = 16 \text{ V} \)

Second breakdown energy; \( L = 25 \text{ mH}; f = 50 \text{ Hz} \)
  \( R_{BE} = 10 \Omega \)

D.C. current gain**
  \( I_C = 0.6 \text{ A}; V_{CE} = 10 \text{ V} \)

Transition frequency at \( f = 500 \text{ MHz}^* \)
  \( I_C = 0.6 \text{ A}; V_{CE} = 12.5 \text{ V} \)

Collector capacitance at \( f = 1 \text{ MHz} \)
  \( I_E = I_E = 0; V_{CB} = 12.5 \text{ V} \)

Feedback capacitance at \( f = 1 \text{ MHz} \)
  \( I_C = 0; V_{CE} = 12.5 \text{ V} \)

Collector-stud capacitance

\( V_{(BR)CBO} > 36 \text{ V} \)
\( V_{(BR)CEO} > 16 \text{ V} \)
\( V_{(BR)EBO} > 3 \text{ V} \)
\( I_{CES} < 5 \text{ mA} \)
\( E_{SBR} > 1 \text{ mJ} \)
\( h_{FE} > 25 \text{ typ. 100} \)
\( f_T \text{ typ. 4.0 GHz} \)
\( C_c \text{ typ. 7.5 pF} \)
\( C_{re} \text{ typ. 5 pF} \)
\( C_{cs} \text{ typ. 1.2 pF} \)

* Measured under pulse conditions: \( t_d = 50 \mu s; \delta < 0.01 \).
** Measured under pulse conditions: \( t_d = 300 \mu s; \delta < 0.01 \).
Fig. 4 $V_{CE} = 10 \text{ V}; \ T_j = 25 ^\circ\text{C};$
typ. values.

Fig. 5 $V_{CB} = 12,5 \text{ V}; \ f = 500 \text{ MHz};$
$T_j = 25 ^\circ\text{C};$ typ. values.

Fig. 6 $I_E = i_E = 0; \ f = 1 \text{ MHz};$
typ. values.
APPLYING INFORMATION (part I)
R.F. performance in c.w. operation (common-emitter class-B circuit) at $f = 470$ MHz; $T_h = 25$ °C.

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$P_L$ W</th>
<th>$P_S$ W</th>
<th>$G_P$ dB</th>
<th>$I_C$ A</th>
<th>$\eta_C$ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12,5</td>
<td>5</td>
<td>&lt; 0,45</td>
<td>&gt; 10,5</td>
<td>&lt; 0,665</td>
<td>&gt; 60</td>
</tr>
</tbody>
</table>

Typical values:
- $P_L$ = 0,32 W
- $G_P$ = 12 dB
- $I_C$ = 0,60 A
- $\eta_C$ = 66%

Fig. 7 Class-B test circuit at $f = 470$ MHz.

List of components:
- $C_1 = 2,7$ pF multilayer ceramic chip capacitor*
- $C_2 = C_7 = C_8 = 1,4-5,5$ pF film dielectric trimmer (cat.no. 2222 809 09001)
- $C_3 = 7,5$ pF multilayer ceramic chip capacitor*
- $C_4 = 2-9$ pF film dielectric trimmer (cat.no. 2222 809 09002)
- $C_5 = 100$ pF multilayer ceramic chip capacitor (cat. no. 2222 852 13101)
- $C_6 = 100$ nF metallized film capacitor (cat. no. 2222 352 45104)
- $L_1 =$ stripline, 22,5 mm x 6,0 mm
- $L_2 =$ 1 turn Cu-wire (1,0 mm), int. dia. 5,5 mm, leads 2 x 5 mm
- $L_3 =$ $L_4 =$ Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36642)
- $L_5 =$ 4 turns enamelled Cu-wire (1,0 mm), int. dia. 6 mm, length 7,5 mm, leads 2 x 5 mm
- $L_6 =$ stripline, 10,0 mm x 6,0 mm
- $L_7 =$ 1 turn Cu-wire (1,0 mm), int. dia. 5 mm, leads 2 x 5 mm
- $R_1 =$ $R_2 =$ 10 $\Omega$ metal film resistor, 0,25 W

$L_1$ and $L_6$ are striplines on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric ($\epsilon_r = 2,74$) and a thickness of 1/16 inch.

* American Technical Ceramics capacitor type 100 A or capacitor of same quality.
Fig. 8 Printed circuit board and component layout for 470 MHz.

The circuits and the components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper to serve as ground plane. Earth connections are made by hollow rivets.
U.H.F. power transistor

Fig. 9 Output power.

Fig. 10 Power gain and efficiency:

Conditions for Figs 9 and 10:
f = 470 MHz; class-B operation; \( T_H = 25 \, ^\circ\text{C} \); typ. values.

RUGGEDNESS:
The device is capable of withstanding a load mismatch with \( \text{VSWR} = 50 \) (all phases) up to a supply voltage of 15,5 V at rated load power.
Fig. 11 Input impedance (series components).

Fig. 12 Load impedance (series components).

Fig. 13 Power gain.

Conditions for Figs 11, 12 and 13:
$V_{CE} = 12.5 \, \text{V}$; $P_L = 5 \, \text{W}$; $T_h = 25 \, ^\circ\text{C}$; $f = 400-520 \, \text{MHz}$; typical values.
APPLICATION INFORMATION (part II)

R.F. performance in c.w. operation (common-emitter class-B circuit) at $f = 900$ MHz; $T_h = 25^\circ$C

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ (V)</th>
<th>$P_L$ (W)</th>
<th>$P_S$ (W)</th>
<th>$G_P$ (dB)</th>
<th>$I_C$ (A)</th>
<th>$\eta_C$ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12,5</td>
<td>4</td>
<td>typ. 0,8</td>
<td>typ. 7,0</td>
<td>typ. 0,54</td>
<td>typ. 60</td>
</tr>
</tbody>
</table>

Fig. 14 Class-B test circuit at $f = 900$ MHz.

List of components:

C1 = C12 = 33 pF multilayer ceramic chip capacitor*
C2 = C13 = 1,4-5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = C11 = 1,2-3,5 pF film dielectric trimmer (cat. no. 2222 809 05001)
C4 = C5 = C10 = 6,2 pF multilayer ceramic chip capacitor*
C6 = 1 pF multilayer ceramic chip capacitor*
C7 = 10 pF ceramic feed-through capacitor
C8 = 330 pF ceramic feed-through capacitor
C9 = 2,2 µF tantalum electrolytic capacitor
L1 = stripline, 21,0 mm x 1,85 mm
L2 = stripline, 5,0 mm x 1,85 mm
L3 = 60 nH, 4 turns enamelled Cu-wire (0,4 mm), close wound, int. dia. 3 mm
L4 = L9 = Ferroxcube wideband h.f. choke, grade 3B (cat. no 4312 020 36642)
L5 = stripline, 11,3 mm x 6,0 mm
L6 = stripline, 10,0 mm x 6,0 mm
L7 = stripline, 15,9 mm x 1,85 mm
L8 = 280 nH, 15 turns enamelled Cu-wire (0,4 mm), close wound, int. dia. 3 mm
L10 = stripline, 28,0 mm x 1,85 mm
R1 = R2 = 10 Ω metal film resistor, 0,25 W

L1, L2, L5, L6, L7 and L10 are striplines on a double Cu-clad printed circuit board with P.T.F.E. fiberglass dielectric ($\varepsilon_r = 2,74$) and thickness of 1/32 in.

* American Technical Ceramics capacitor type 100 A or capacitor of same quality.
Fig. 15 Printed circuit board and component layout for a 900 MHz test circuit.

The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper to serve as a ground plane. Earth connections are made by hollow rivets and also by fixing screws and copper straps around the board and under the emitters to provide a direct contact between the copper on the component side and the ground plane.

**RUGGEDNESS**

The device is capable of withstanding a load mismatch with VSWR = 50 (all phases) up to a supply voltage of 15.5 V at rated load power.
U.H.F. power transistor

Fig. 16 Output power.

Fig. 17 Power gain and efficiency.

Conditions for Figs 16 and 17:
f = 900 MHz; \( V_{CE} = 12.5 \) V; class-B operation; \( T_h = 25 ^\circ C \); typ. values.

Conditions for Figs 18 and 19:
f = 800-960 MHz; \( V_{CE} = 12.5 \) V; \( P_L = 4 \) W; \( T_h = 25 ^\circ C \); typ. values.

Fig. 18 Input impedance (series components).

Fig. 19 Load impedance (series components).

Fig. 20 Power gain.
N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, h.f. and v.h.f. transmitters with a nominal supply voltage of 13.5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16.5 V. It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25 \degree C$ in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ (V)</th>
<th>$f$ (MHz)</th>
<th>$P_L$ (W)</th>
<th>$G_p$ (dB)</th>
<th>$\eta$ (%)</th>
<th>$\bar{z}_i$ ($\Omega$)</th>
<th>$\bar{V}_L$ (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>13.5</td>
<td>175</td>
<td>8</td>
<td>&gt; 9.0</td>
<td>&gt; 70</td>
<td>2.8 + j1.2</td>
<td>76 - j16</td>
</tr>
<tr>
<td>c.w.</td>
<td>12.5</td>
<td>175</td>
<td>8</td>
<td>typ. 10.5</td>
<td>typ. 75</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-123.

Torque on screw: min. 0.6 Nm (6 kg cm)
max. 0.75 Nm (7.5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
BLV10

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$)
  peak value

Collector-emitter voltage (open base)

Emitter-base voltage (open collector)

Collector current (average)

Collector current (peak value); $f > 1$ MHz

R.F. power dissipation ($f > 1$ MHz); $T_{mb} = 25 \, ^\circ\text{C}$

Storage temperature

Operating junction temperature

---

Fig. 2 D.C. SOAR.

Fig. 3 R.F. power dissipation; $V_{CE} \leq 16,5 \, \text{V}; f > 1$ MHz.

I Continuous d.c. operation

II Continuous r.f. operation

III Short-time operation during mismatch

---

THERMAL RESISTANCE (dissipation = 8 W; $T_{mb} = 72,4 \, ^\circ\text{C}$, i.e. $T_h = 70 \, ^\circ\text{C}$)

From junction to mounting base (d.c. dissipation)

From junction to mounting base (r.f. dissipation)

From mounting base to heatsink

---

$V_{CESM}$ max. 36 V

$V_{CEO}$ max. 18 V

$V_{EBO}$ max. 4 V

$I_{C(AV)}$ max. 1,5 A

$I_{CM}$ max. 4,0 A

$P_{rf}$ max. 20 W

$T_{stg}$ $-65 \, \text{to} \, +150 \, ^\circ\text{C}$

$T_j$ max. 200 $^\circ\text{C}$

$R_{th\ j-mb\ (dc)} = 10,7 \, \text{K/W}$

$R_{th\ j-mb\ (rf)} = 8,6 \, \text{K/W}$

$R_{th\ mb-h} = 0,3 \, \text{K/W}$
CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage
V_BE = 0; IC = 5 mA
V(BR)CES > 36 V

Collector-emitter breakdown voltage
open base; IC = 25 mA
V(BR)CEO > 18 V

Emitter-base breakdown voltage
open collector; IE = 1 mA
V(BR)EBO > 4 V

Collector cut-off current
V_BE = 0; V_CE = 18 V
ICE < 2 mA

Second breakdown energy; L = 25 mH; f = 50 Hz
open base
R_BE = 10 Ω
ESBO > 0,5 mJ
ESBR > 0,5 mJ

D.C. current gain *
IC = 0,75 A; V_CE = 5 V
h_FE typ. 40

Collector-emitter saturation voltage *
IC = 2 A; IB = 0,4 A
V_CEsat typ. 0,85 V

Transition frequency at f = 100 MHz *
-I_E = 0,75 A; V_CB = 13,5 V
f_T typ. 950 MHz

Collector capacitance at f = 1 MHz
I_E = I_E = 0; V_CB = 13,5 V
C_C typ. 16,5 pF

Feedback capacitance at f = 1 MHz
I_C = 100 mA; V_CE = 13,5 V
C_re typ. 12 pF

Collector-flange capacitance
C_cf typ. 2 pF

* Measured under pulse conditions: t_p ≤ 200 μs; δ ≤ 0,02.
Fig. 4 Typical values; $T_j = 25$ °C.

Fig. 5 $I_E = I_o = 0; f = 1$ MHz; $T_j = 25$ °C.

Fig. 6 Typical values; $f = 100$ MHz; $T_j = 25$ °C.
APPLICATION INFORMATION
R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

\[ T_h = 25 \, ^\circ C \]

<table>
<thead>
<tr>
<th>f (MHz)</th>
<th>( V_C E ) (V)</th>
<th>( P_L ) (W)</th>
<th>( P_S ) (W)</th>
<th>( G_P ) (dB)</th>
<th>( I_C ) (A)</th>
<th>( \eta ) (%)</th>
<th>( Z_i ) (( \Omega ))</th>
<th>( Y_L ) (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>13,5</td>
<td>8</td>
<td>(&lt; 1,0)</td>
<td>9,0</td>
<td>(&lt; 0,85)</td>
<td>70</td>
<td>2,8 + j1,2</td>
<td>76 – j16</td>
</tr>
<tr>
<td>175</td>
<td>12,5</td>
<td>8</td>
<td>–</td>
<td>typ. 10,5</td>
<td>–</td>
<td>typ. 75</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

List of components:

- \( C_1 = 2,5 \) to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
- \( C_2 = C_6 = 4 \) to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
- \( C_3 = 47 \) pF ceramic capacitor (500 V)
- \( C_4 = 120 \) pF ceramic capacitor (500 V)
- \( C_5 = 100 \) nF polyester capacitor
- \( C_7 = 5 \) to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
- \( L_1 = 2 \) turns Cu wire (1,6 mm); int. dia. 4,5 mm; length 5,7 mm; leads 2 x 5 mm
- \( L_2 = L_6 = \) Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- \( L_3 = L_4 = \) strip (12 mm x 6 mm); tap for \( C_3 \) at 5 mm from transistor
- \( L_5 = 3 \) turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 7,5 mm; leads 2 x 5 mm
- \( L_7 = 3 \) turns Cu wire (1,6 mm); int. dia. 6,5 mm; length 7,4 mm; leads 2 x 5 mm
- \( L_3 \) and \( L_4 \) are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".
- \( R_1 = 10 \, \Omega \) carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.
Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.
Fig. 9 Typical values; \( f = 175 \text{ MHz} \);

\[
\begin{align*}
V_{\text{CE}} &= 13.5 \text{ V} ; \\
V_{\text{CE}} &= 12.5 \text{ V} .
\end{align*}
\]

Fig. 10 Typical values; \( f = 175 \text{ MHz} \);

\[
\begin{align*}
V_{\text{CE}} &= 13.5 \text{ V} ; \\
V_{\text{CE}} &= 12.5 \text{ V} .
\end{align*}
\]

Fig. 11 R.F. SOAR (short-time operation during mismatch); \( f = 175 \text{ MHz} ; \) \( T_{\text{h}} = 70 \text{ °C} \);

\[
R_{\text{th mb-h}} = 0.3 \text{ K/W} ; V_{\text{CEnom}} = 13.5 \text{ V} \text{ or } 12.5 \text{ V} ; P_S = P_{\text{Snom}} \text{ at } V_{\text{CEnom}} \text{ and } \text{VSWR} = 1.
\]

Note to Fig. 11:
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive \( (P_S/P_{\text{Snom}}) \) increases linearly with supply over-voltage ratio.
Fig. 12 Input impedance (series components).

Fig. 13 Load impedance (parallel components).

Conditions for Figs 12, 13 and 14:
Typical values: $V_{CE} = 13.5$ V; $P_L = 8$ W; $T_h = 25^\circ$C.

OPERATING NOTE
Below 70 MHz a base-emitter resistor of 10 $\Omega$ is recommended to avoid oscillation. This resistor must be effective for r.f. only.
V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, h.f. and v.h.f. transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a 3/8” flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25 \, ^\circ C$ in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_D$ dB</th>
<th>$\eta$ %</th>
<th>$\bar{z}_i$ Ω</th>
<th>$\bar{V}_L$ mS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>13,5</td>
<td>175</td>
<td>15</td>
<td>$&gt; 8,0$</td>
<td>$&gt; 60$</td>
<td>2,3 + j2,2</td>
<td>130 – j4,4</td>
</tr>
<tr>
<td>c.w.</td>
<td>12,5</td>
<td>175</td>
<td>15</td>
<td>typ. 7,5</td>
<td>typ. 67</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage \( V_{BE} = 0 \)
  - peak value

Collector-emitter voltage (open base)

Emitter-base voltage (open collector)

Collector current (average)

Collector current (peak value); \( f > 1 \) MHz

R.F. power dissipation (\( f > 1 \) MHz); \( T_{mb} = 25 \) °C

Storage temperature

Operating junction temperature

\[
\begin{align*}
V_{CESM} & \quad \text{max.} \quad 36 \text{ V} \\
V_{CEO} & \quad \text{max.} \quad 18 \text{ V} \\
V_{EBO} & \quad \text{max.} \quad 4 \text{ V} \\
lc(AV) & \quad \text{max.} \quad 3 \text{ A} \\
lc(M) & \quad \text{max.} \quad 8 \text{ A} \\
P_{rf} & \quad \text{max.} \quad 36 \text{ W} \\
T_{stg} & \quad -65 \text{ to } +150 \text{ °C} \\
T_j & \quad \text{max.} \quad 200 \text{ °C}
\end{align*}
\]

Fig. 2 D.C. SOAR.

Fig. 3 R.F. power dissipation; \( V_{CE} \leq 16,5 \text{ V} \);
  - \( f > 1 \) MHz.
  - I Continuous d.c. operation
  - II Continuous r.f. operation
  - III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 15 W; \( T_{mb} = 74,5 \) °C, i.e. \( T_h = 70 \) °C)

- From junction to mounting base (d.c. dissipation)
  \[ R_{th\ j-mb(dc)} = 6,55 \text{ K/W} \]

- From junction to mounting base (r.f. dissipation)
  \[ R_{th\ j-mb(rf)} = 4,95 \text{ K/W} \]

- From mounting base to heatsink
  \[ R_{th\ mb-h} = 0,3 \text{ K/W} \]
### CHARACTERISTICS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-emitter breakdown voltage</td>
<td>( V_{BE} = 0 ); ( I_C = 10 \text{ mA} )</td>
<td>( V_{(BR)CES} &gt; 36 \text{ V} )</td>
</tr>
<tr>
<td>Collector-emitter breakdown voltage</td>
<td>( V_{BE} = 0 ); ( V_{CE} = 18 \text{ V} )</td>
<td>( V_{(BR)CEO} &gt; 18 \text{ V} )</td>
</tr>
<tr>
<td>Collector-emitter breakdown voltage</td>
<td>( I_C = 50 \text{ mA} )</td>
<td>( V_{(BR)EBO} &gt; 4 \text{ V} )</td>
</tr>
<tr>
<td>Emitter-base breakdown voltage</td>
<td>( I_E = 4 \text{ mA} )</td>
<td>( I_{CES} &lt; 4 \text{ mA} )</td>
</tr>
<tr>
<td>Collector cut-off current</td>
<td>( R_{BE} = 10 \Omega )</td>
<td>( E_{SBO} &gt; 2.5 \text{ mJ} )</td>
</tr>
<tr>
<td>Second breakdown energy; ( L = 25 \text{ mH} ); ( f = 50 \text{ Hz} )</td>
<td>( E_{SBR} &gt; 2.5 \text{ mJ} )</td>
<td></td>
</tr>
<tr>
<td>D.C. current gain *</td>
<td>( I_C = 1.5 \text{ A}; V_{CE} = 5 \text{ V} )</td>
<td>( h_{FE} \text{ typ.} 40 )</td>
</tr>
<tr>
<td>Collector-emitter saturation voltage *</td>
<td>( I_C = 4.5 \text{ A}; I_B = 0.9 \text{ A} )</td>
<td>( V_{CEsat} \text{ typ.} 1.0 \text{ V} )</td>
</tr>
<tr>
<td>Transition frequency at ( f = 100 \text{ MHz} * )</td>
<td>( -I_E = 1.5 \text{ A}; V_{CB} = 13.5 \text{ V} )</td>
<td>( f_T \text{ typ.} 850 \text{ MHz} )</td>
</tr>
<tr>
<td></td>
<td>( -I_E = 4.5 \text{ A}; V_{CB} = 13.5 \text{ V} )</td>
<td>( f_T \text{ typ.} 800 \text{ MHz} )</td>
</tr>
<tr>
<td>Collector capacitance at ( f = 1 \text{ MHz} )</td>
<td>( I_E = I_E = 0; V_{CB} = 13.5 \text{ V} )</td>
<td>( C_C \text{ typ.} 32 \text{ pF} )</td>
</tr>
<tr>
<td>Feedback capacitance at ( f = 1 \text{ MHz} )</td>
<td>( I_C = 200 \text{ mA}; V_{CE} = 13.5 \text{ V} )</td>
<td>( C_{re} \text{ typ.} 23 \text{ pF} )</td>
</tr>
<tr>
<td>Collector-flange capacitance</td>
<td>( C_{cf} \text{ typ.} 2 \text{ pF} )</td>
<td></td>
</tr>
</tbody>
</table>

* Measured under pulse conditions: \( t_p \leq 200 \mu s; \delta \leq 0.02 \).
Fig. 4 Typical values; $T_j = 25$ °C.

Fig. 5 $I_E = I_B = 0$; $f = 1$ MHz; $T_j = 25$ °C.

Fig. 6 Typical values; $f = 100$ MHz; $T_j = 25$ °C.
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

\( T_h = 25 \, ^\circ C \)

<table>
<thead>
<tr>
<th>( f ) (MHz)</th>
<th>( V_{CE} ) (V)</th>
<th>( P_L ) (W)</th>
<th>( P_S ) (W)</th>
<th>( G_p ) (dB)</th>
<th>( I_C ) (A)</th>
<th>( \eta ) (%)</th>
<th>( Z_1 ) (( \Omega ))</th>
<th>( Y_L ) (( mS ))</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>13,5</td>
<td>15</td>
<td>(&lt; 2,4)</td>
<td>( &lt; 1,85 )</td>
<td>( &gt; 60 )</td>
<td>( 2,3 + j2,2)</td>
<td>130 – j4,4</td>
<td></td>
</tr>
<tr>
<td>175</td>
<td>12,5</td>
<td>15</td>
<td>–</td>
<td>typ. 7,5</td>
<td>–</td>
<td>typ. 67</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

Fig. 7 Test circuit; c.w. class-B.

List of components:

- C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
- C2 = C6 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
- C3 = 47 pF ceramic capacitor (500 V)
- C4 = 120 pF ceramic capacitor (500 V)
- C5 = 100 nF polyester capacitor
- C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
- L1 = 2 turns Cu wire (1,6 mm); int. dia. 4,5 mm; length 5,7 mm; leads 2 x 5 mm
- L2 = L6 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- L3 = L4 = strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor
- L5 = 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 7,5 mm; leads 2 x 5 mm
- L7 = 3 turns Cu wire (1,6 mm); int. dia. 6,5 mm; length 7,4 mm; leads 2 x 5 mm
- L3 and L4 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16”.
- R1 = 10 \( \Omega \) carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.
Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.
Fig. 9 Typical values; f = 175 MHz; 
- - VcE = 13,5 V; — — VcE = 12,5 V.

Fig. 10 Typical values; f = 175 MHz; 
- - VcE = 13,5 V; — — VcE = 12,5 V.

Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; Th = 70 °C; 
Rth mb-h = 0,3 K/W; VcE nom = 13,5 V or 12,5 V; P_S = P_Snom at VcE nom and VSWR = 1.

Note to Fig. 11:
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_Snom) increases linearly with supply over-voltage ratio.
Fig. 12 Input impedance (series components).

Fig. 13 Load impedance (parallel components).

Conditions for Figs 12, 13 and 14:
Typical values: \( V_{CE} = 13.5 \text{ V}; P_L = 15 \text{ W}; T_H = 25 \text{ °C}. \)

OPERATING NOTE
Below 50 MHz a base-emitter resistor of 10 \( \Omega \) is recommended to avoid oscillation.
This resistor must be effective for r.f. only.
V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a 3/8” flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25$ °C in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_D$ dB</th>
<th>$\eta$ %</th>
<th>$\overline{z}_1$ $\Omega$</th>
<th>$\overline{V_L}$ mS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>28</td>
<td>175</td>
<td>8</td>
<td>&gt; 12</td>
<td>&gt; 65</td>
<td>1,8 + j0,7</td>
<td>18 – j20</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-123.

Dimensions in mm

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

Torque on screw: min. 0,6 Nm (6 kg cm) max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$)
- peak value

Collector-emitter voltage (open base)

Emitter-base voltage (open collector)

Collector current (average)

Collector current (peak value); $f > 1$ MHz

R.F. power dissipation ($f > 1$ MHz); $T_{mb} = 25$ °C

Storage temperature

Operating junction temperature

---

![Graph](image1)

Fig. 2 D.C. SOAR.

![Graph](image2)

Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; $f > 1$ MHz.

I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 8 W; $T_{mb} = 72,4$ °C, i.e. $T_{h} = 70$ °C)

From junction to mounting base (d.c. dissipation) $R_{th j-mb}(dc) = 10,7$ K/W

From junction to mounting base (r.f. dissipation) $R_{th j-mb}(rf) = 8,6$ K/W

From mounting base to heatsink $R_{th mb-h} = 0,3$ K/W
CHARACTERISTICS

\( T_j = 25 ^\circ C \)

**Collector-emitter breakdown voltage**

\( V_{BE} = 0; \ I_C = 2 \ mA \)

**Collector-emitter breakdown voltage**

open base; \( I_C = 10 \ mA \)

**Emitter-base breakdown voltage**

open collector; \( I_E = 1 \ mA \)

**Collector cut-off current**

\( V_{BE} = 0; \ V_{CE} = 36 \ V \)

Second breakdown energy; \( L = 25 \ mH; \ f = 50 \ Hz \)

open base
\( R_{BE} = 10 \ \Omega \)

**D.C. current gain** *

\( I_C = 0,4 \ A; \ V_{CE} = 5 \ V \)

**Collector-emitter saturation voltage** *

\( I_C = 1,25 \ A; \ I_B = 0,25 \ A \)

**Transition frequency at f = 100 MHz** *

\(-I_E = 0,4 \ A; \ V_{CB} = 28 \ V\)
\(-I_E = 1,25 \ A; \ V_{CB} = 28 \ V\)

**Collector capacitance at f = 1 MHz**

\( I_E = I_e = 0; \ V_{CB} = 28 \ V \)

**Feedback capacitance at f = 1 MHz**

\( I_C = 50 \ mA; \ V_{CE} = 28 \ V \)

**Collector-flange capacitance**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-emitter breakdown voltage</td>
<td>( V_{(BR)CES} )</td>
<td>( &gt; 65 \ V )</td>
</tr>
<tr>
<td>Collector-emitter breakdown voltage</td>
<td>( V_{(BR)CEO} )</td>
<td>( &gt; 36 \ V )</td>
</tr>
<tr>
<td>Collector-emitter breakdown voltage</td>
<td>( V_{(BR)EBO} )</td>
<td>( &gt; 4 \ V )</td>
</tr>
<tr>
<td>Collector cut-off current</td>
<td>( I_{CES} )</td>
<td>( &lt; 1 \ mA )</td>
</tr>
<tr>
<td>Second breakdown energy</td>
<td>( E_{SBO} )</td>
<td>( &gt; 0,5 \ mJ )</td>
</tr>
<tr>
<td>Second breakdown energy</td>
<td>( E_{SBR} )</td>
<td>( &gt; 0,5 \ mJ )</td>
</tr>
<tr>
<td>D.C. current gain</td>
<td>( h_{FE} )</td>
<td>typ. 50</td>
</tr>
<tr>
<td>D.C. current gain</td>
<td>typ. 10 to 100</td>
<td></td>
</tr>
<tr>
<td>Collector-emitter saturation voltage</td>
<td>( V_{CEsat} )</td>
<td>typ. 0,8 \ V</td>
</tr>
<tr>
<td>Transition frequency at f = 100 MHz</td>
<td>( f_T )</td>
<td>typ. 600 \ MHz</td>
</tr>
<tr>
<td>Transition frequency at f = 100 MHz</td>
<td>typ. 520 \ MHz</td>
<td></td>
</tr>
<tr>
<td>Collector capacitance at f = 1 MHz</td>
<td>( C_C )</td>
<td>typ. 10 \ pF</td>
</tr>
<tr>
<td>Collector capacitance at f = 1 MHz</td>
<td>( C_{re} )</td>
<td>typ. 7,1 \ pF</td>
</tr>
<tr>
<td>Collector capacitance at f = 1 MHz</td>
<td>( C_{cf} )</td>
<td>typ. 2 \ pF</td>
</tr>
</tbody>
</table>

* Measured under pulse conditions: \( t_p \leq 200 \ \mu s; \ \delta \leq 0,02. \)
Fig. 4 Typical values; $T_j = 25 \, ^\circ C$.

Fig. 5 $I_E = I_e = 0$; $f = 1 \, MHz$; $T_j = 25 \, ^\circ C$.

Fig. 6 Typical values; $f = 100 \, MHz$; $T_j = 25 \, ^\circ C$. 

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

\[ T_h = 25 \, ^\circ C \]

<table>
<thead>
<tr>
<th>( f ) (MHz)</th>
<th>( V_{CE} ) (V)</th>
<th>( P_L ) (W)</th>
<th>( P_S ) (W)</th>
<th>( G_P ) (dB)</th>
<th>( I_C ) (A)</th>
<th>( \eta ) (%)</th>
<th>( \overline{Z}_L ) (Ω)</th>
<th>( \overline{Y}_L ) (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>28</td>
<td>8</td>
<td>&lt;0.5</td>
<td>&gt;12</td>
<td>&lt;0.44</td>
<td>&gt;65</td>
<td>1.8 + j0.7</td>
<td>18 – j20</td>
</tr>
</tbody>
</table>

**Fig. 7 Test circuit; c.w. class-B.**

List of components:

- **C1 = C7 = 2.5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)**
- **C2 = C6 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)**
- **C3 = 27 pF ceramic capacitor (500 V)**
- **C4 = 120 pF ceramic capacitor (500 V)**
- **C5 = 100 nF polyester capacitor**
- **L1 = 1 turn Cu wire (1.6 mm); int. dia. 8.4 mm; leads 2 x 5 mm**
- **L2 = 7 turns closely wound enamelled Cu wire (0.5 mm); int. dia. 3 mm; leads 2 x 5 mm**
- **L3 = L8 = Ferroxcube wide band h.f. choke, grade 3B (cat. no. 4312 020 36640)**
- **L4 = L5 = strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor**
- **L6 = 3 turns closely wound enamelled Cu wire (1.0 mm); int. dia. 9.0 mm; leads 2 x 5 mm**
- **L7 = 3 turns closely wound enamelled Cu wire (1.0 mm); int. dia. 8.2 mm; leads 2 x 5 mm**
- **L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".**
- **R1 = R2 = 10 Ω carbon resistor**

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.
Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.
Fig. 9 Typical values; $V_{CE} = 28\, V$; $f = 175\, MHz$.

Fig. 10 Typical values; $V_{CE} = 28\, V$; $f = 175\, MHz$.

Fig. 11 R.F. SOAR; c.w. class-B operation; $f = 175\, MHz$; $V_{CE} = 28\, V$; $R_{th\, mb-h} = 0,3\, K/W$. The graph shows the permissible output power under nominal conditions ($VSWR = 1$) as a function of the expected $VSWR$ during short-time mismatch conditions with heatsink temperatures as parameter.
Conditions for Figs 12, 13 and 14.
Typical values; $V_{CE} = 28\, \text{V}$; $P_L = 8\, \text{W}$; $T_h = 25\, ^\circ\text{C}$.

**OPERATING NOTE**
Below 100 MHz a base-emitter resistor of 10 $\Omega$ is recommended to avoid oscillation. This resistor must be effective for r.f. only.
V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a 3/8” flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to \( T_h = 25 \, ^\circ\text{C} \) in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>( V_{CE} ) (V)</th>
<th>( f ) (MHz)</th>
<th>( P_L ) (W)</th>
<th>( G_D ) (dB)</th>
<th>( \eta ) (%)</th>
<th>( \bar{z}_i ) (( \Omega ))</th>
<th>( Y_L ) (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>28</td>
<td>175</td>
<td>15</td>
<td>&gt; 10</td>
<td>&gt; 65</td>
<td>1,4 + j1,85</td>
<td>33 – j27,5</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-123.

Dimensions in mm

- Torque on screw: min. 0,6 Nm (6 kg cm)
  max. 0,75 Nm (7,5 kg cm)

- Recommended screw: cheese-head
  4-40 UNC/2A

- Heatsink compound must be applied sparingly and evenly distributed.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$)
- peak value

Collector-emitter voltage (open base)

Emitter-base voltage (open collector)

Collector current (average)

Collector current (peak value); $f > 1\ MHz$

R.F. power dissipation ($f > 1\ MHz$); $T_{mb} = 25\ ^\circ C$

Storage temperature

Operating junction temperature

THERMAL RESISTANCE (dissipation = 15 W; $T_{mb} = 74.5\ ^\circ C$, i.e. $T_h = 70\ ^\circ C$)

From junction to mounting base (d.c. dissipation)

From junction to mounting base (r.f. dissipation)

From mounting base to heatsink

---

Fig. 2 D.C. SOAR.

Fig. 3 R.F. power dissipation; $V_{CE} \leq 28\ V$; $f > 1\ MHz$.

I Continuous d.c. operation

II Continuous r.f. operation

III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 15 W; $T_{mb} = 74.5\ ^\circ C$, i.e. $T_h = 70\ ^\circ C$)

From junction to mounting base (d.c. dissipation)

From junction to mounting base (r.f. dissipation)

From mounting base to heatsink

---

|$R_{th\ j-mb(dc)}| = 6.55\ K/W$

|$R_{th\ j-mb(rf)}| = 4.95\ K/W$

|$R_{th\ mb-h}| = 0.3\ K/W$
CHARACTERISTICS

$T_j = 25 \, ^\circ C$

Collector-emitter breakdown voltage

$V_{BE} = 0; \quad I_C = 5 \, mA$

Collector-emitter breakdown voltage

open base; $I_C = 25 \, mA$

Emitter-base breakdown voltage

open collector; $I_E = 2 \, mA$

Collector cut-off current

$V_{BE} = 0; \quad V_{CE} = 36 \, V$

Second breakdown energy; $L = 25 \, mH; \quad f = 50 \, Hz$

open base

$R_{BE} = 10 \, \Omega$

D.C. current gain *

$I_C = 0.7 \, A; \quad V_{CE} = 5 \, V$

Collector-emitter saturation voltage *

$I_C = 2 \, A; \quad I_B = 0.4 \, A$

Transition frequency at $f = 100 \, MHz$

$-I_E = 0.7 \, A; \quad V_{CB} = 28 \, V$

$-I_E = 2 \, A; \quad V_{CB} = 28 \, V$

Collector capacitance at $f = 1 \, MHz$

$I_E = I_e = 0; \quad V_{CE} = 28 \, V$

Feedback capacitance at $f = 1 \, MHz$

$I_C = 100 \, mA; \quad V_{CE} = 28 \, V$

$C_{cf}$

Collector-flange capacitance

$C_{cf}$

$V_{(BR)CES} > 65 \, V$

$V_{(BR)CEO} > 36 \, V$

$V_{(BR)EBO} > 4 \, V$

$I_{CES} < 2 \, mA$

$E_{SBO} > 2.5 \, mJ$

$E_{SBR} > 2.5 \, mJ$

$h_{FE}$

typ. 50

10 to 100

$V_{CESat}$

typ. 0.65 \, V

$f_T$ typ. 650 \, MHz

$f_T$ typ. 625 \, MHz

$C_C$ typ. 18 \, pF

$C_{re}$ typ. 12.8 \, pF

$C_{cf}$ typ. 2 \, pF

* Measured under pulse conditions: $t_p \leq 200 \, \mu s; \quad \delta \leq 0.02$. 

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Fig. 4 Typical values; $T_j = 25 \, ^\circ\text{C}$.

Fig. 5 $I_E = I_C = 0$; $f = 1 \, \text{MHz}$; $T_j = 25 \, ^\circ\text{C}$.

Fig. 6 Typical values; $f = 100 \, \text{MHz}$; $T_j = 25 \, ^\circ\text{C}$. 
### APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

\[ T_h = 25 \, ^\circ C \]

<table>
<thead>
<tr>
<th>f (MHz)</th>
<th>( V_{CE} ) (V)</th>
<th>( P_L ) (W)</th>
<th>( P_S ) (W)</th>
<th>( G_p ) (dB)</th>
<th>( I_C ) (A)</th>
<th>( \eta ) (%)</th>
<th>( Z_L ) (Ω)</th>
<th>( Y_L ) (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>28</td>
<td>15</td>
<td>&lt;1,5</td>
<td>&gt;10</td>
<td>&lt;0,83</td>
<td>&gt;65</td>
<td>1,4 + j1,85</td>
<td>33 – j27,5</td>
</tr>
</tbody>
</table>

**List of components:**

- \( C_1 = C_7 = 2,5 \) to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
- \( C_2 = C_6 = 5 \) to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
- \( C_3 = 27 \) pF ceramic capacitor (500 V)
- \( C_4 = 120 \) pF ceramic capacitor (500 V)
- \( C_5 = 100 \) nF polyester capacitor
- \( L_1 = 1 \) turn Cu wire (1,6 mm); int. dia. 8,4 mm; leads 2 x 5 mm
- \( L_2 = 7 \) turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
- \( L_3 = L_8 = \) Ferroxcube wide band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- \( L_4 = L_5 = \) strip (12 mm x 6 mm); tap for \( C_3 \) at 5 mm from transistor
- \( L_6 = 3 \) turns closely wound enamelled Cu wire (1,0 mm); int. dia. 9,0 mm; leads 2 x 5 mm
- \( L_7 = 3 \) turns closely wound enamelled Cu wire (1,0 mm); int. dia. 8,2 mm; leads 2 x 5 mm
- \( L_4 \) and \( L_5 \) are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16”.
- \( R_1 = R_2 = 10 \) Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.
Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.
V.H.F. power transistor

Fig. 9 Typical values; $V_{CE} = 28\,V$; $f = 175\,MHz$.

Fig. 10 Typical values; $V_{CE} = 28\,V$; $f = 175\,MHz$.

Fig. 11 R.F. SOAR; c.w. class-B operation; $f = 175\,MHz$; $V_{CE} = 28\,V$; $R_{th\,mb-h} = 0.3\,K/W$ The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.
Fig. 12 Input impedance (series components).

Fig. 13 Load impedance (parallel components).

Conditions for Figs 12, 13 and 14.
Typical values; $V_{CE} = 28$ V; $P_L = 15$ W; $T_h = 25$ °C.

OPERATING NOTE
Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation.
This resistor must be effective for r.f. only.
V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily for use in v.h.f.-f.m. broadcast transmitters.

Features:
• internally matched input for wideband operation and high power gain;
• multi-base structure and diffused emitter ballasting resistors for an optimum temperature profile;
• gold-metallization ensures excellent reliability.

The transistor has a ½in 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25\,^\circ C$ in an unneutralized common-emitter class-B circuit.

<table>
<thead>
<tr>
<th>mode operation</th>
<th>$V_{CE}$</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$P_S$ W</th>
<th>$G_D$ dB</th>
<th>$\eta$</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>28</td>
<td>108</td>
<td>175</td>
<td>$&lt; 17.5$</td>
<td>$&gt; 10.0$</td>
<td>$&gt; 65$</td>
</tr>
</tbody>
</table>

MECHANICAL DATA
SOT-119 (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

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Torque on screw: min. 0.6 Nm (6 kg cm)  
max. 0.75 Nm (7.5 kg cm)  
Recommended screw: cheese-head 4-40 UNC/2A  
Heatsink compound must be applied sparingly and evenly distributed.
V.H.F. power transistor

**RATINGS**

Limiting values in accordance with the Absolute Maximum System (IEC 134)

- **Collector-emitter voltage**
  - (peak value); $V_{BE} = 0$
  - open base
- **Emitter-base voltage (open collector)**
- **Collector current**
  - d.c. or average
  - (peak value); $f > 1$ MHz
- **Total power dissipation at** $T_{mb} = 25$ °C
- **R.F. power dissipation** ($f > 1$ MHz); $T_{mb} = 25$ °C
- **R.F. power dissipation** ($f > 1$ MHz); $T_h = 70$ °C
- **Storage temperature**
- **Operating junction temperature**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Max. Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CE SM}$</td>
<td>65 V</td>
<td></td>
</tr>
<tr>
<td>$V_{CEO}$</td>
<td>33 V</td>
<td></td>
</tr>
<tr>
<td>$V_{EBO}$</td>
<td>4 V</td>
<td></td>
</tr>
<tr>
<td>$I_C$</td>
<td>17.5 A</td>
<td></td>
</tr>
<tr>
<td>$I_{CM}$</td>
<td>35 A</td>
<td></td>
</tr>
<tr>
<td>$P_{tot (d.c.)}$</td>
<td>220 W</td>
<td></td>
</tr>
<tr>
<td>$P_{tot (r.f.)}$</td>
<td>270 W</td>
<td></td>
</tr>
<tr>
<td>$P_{tot (r.f.)}$</td>
<td>146 W</td>
<td></td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>-65 to +150 °C</td>
<td></td>
</tr>
<tr>
<td>$T_j$</td>
<td>200 °C</td>
<td></td>
</tr>
</tbody>
</table>

(1) Second breakdown limit.

**Fig. 2** D.C. SOAR.

**Fig. 3** Power derating curves vs. temperature.

I  Continuous d.c. operation
II Continuous r.f. operation ($f > 1$ MHz)
III Short-time operation during mismatch; ($f > 1$ MHz).

**THERMAL RESISTANCE** (dissipation = 150 W; $T_{mb} = 72$ °C, i.e. $T_h = 42$ °C)

<table>
<thead>
<tr>
<th>Resistance</th>
<th>Max. Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{th j-mb (dc)}$</td>
<td>0.85 K/W</td>
<td></td>
</tr>
<tr>
<td>$R_{th j-mb (rf)}$</td>
<td>0.60 K/W</td>
<td></td>
</tr>
<tr>
<td>$R_{th mb-h}$</td>
<td>0.2 K/W</td>
<td></td>
</tr>
</tbody>
</table>

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**CHARACTERISTICS**

\[ T_j = 25 \degree C \]

- **Collector-emitter breakdown voltage**
  \[ V_{BE} = 0; \, I_C = 50 \, mA \]
  open base; \( I_C = 200 \, mA \)

- **Emitter-base breakdown voltage**
  open collector; \( I_E = 20 \, mA \)

- **Collector cut-off current**
  \[ V_{BE} = 0; \, V_{CE} = 33 \, V \]

- **Second breakdown energy**
  \[ L = 25 \, mH; \, f = 50 \, Hz \]
  open base
  \[ R_{BE} = 10 \, \Omega \]

- **D.C. current gain**
  \[ I_C = 8.5 \, A; \, V_{CE} = 25 \, V \]

- **Collector-emitter saturation voltage**
  \[ I_C = 20 \, A; \, I_B = 4.0 \, A \]

- **Transition frequency at** \( f = 100 \, MHz \)**
  \[ - I_E = 8.5 \, A; \, V_C = 25 \, V \]
  \[ - I_E = 20 \, A; \, V_C = 25 \, V \]

- **Collector capacitance at** \( f = 1 \, MHz \)
  \[ I_E = I_C = 0; \, V_{CB} = 25 \, V \]

- **Feedback capacitance at** \( f = 1 \, MHz \)
  \[ I_C = 100 \, mA; \, V_{CE} = 25 \, V \]

- **Collector-flange capacitance**

\[ V_{(BR)CES} > 65 \, V \]
\[ V_{(BR)CEO} > 33 \, V \]
\[ V_{(BR)EBO} > 4 \, V \]
\[ I_{CES} < 25 \, mA \]
\[ E_{SBO} > 20 \, mJ \]
\[ E_{SBR} > 20 \, mJ \]
\[ h_{FE} \text{ typ.} \, 50 \text{ to } 100 \]
\[ V_{CEsat} \text{ typ.} \, 1.6 \, V \]
\[ f_T \text{ typ.} \, 600 \, MHz \]
\[ f_T \text{ typ.} \, 600 \, MHz \]
\[ C_c \text{ typ.} \, 275 \, pF \]
\[ C_re \text{ typ.} \, 155 \, pF \]
\[ C_{cf} \text{ typ.} \, 3 \, pF \]

* Measured under pulse conditions: \( t_P \leq 300 \, \mu s; \, \delta \leq 0.02. \)

** Measured under pulse conditions: \( t_P \leq 50 \, \mu s; \, \delta \leq 0.01. \)
V.H.F. power transistor

Fig. 4  $V_{CE} = 25 \text{ V}; \ T_j = 25 \degree \text{C}$.

Fig. 5  $V_{CB} = 25 \text{ V}; \ f = 100 \text{ MHz}; \ T_j = 25 \degree \text{C}$.

Fig. 6  $I_E = I_e = 0; \ f = 1 \text{ MHz}; \ T_j = 25 \degree \text{C}$.
APPLICATION INFORMATION

R.F. performance in narrow band c.w. operation (common-emitter class-B circuit) \(T_h = 25^\circ C\)

<table>
<thead>
<tr>
<th>(f) MHz</th>
<th>(V_{CE}) V</th>
<th>(P_L) W</th>
<th>(P_S) W</th>
<th>(G_p) dB</th>
<th>(I_C) A</th>
<th>(n) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>108</td>
<td>28</td>
<td>&lt; 17,5</td>
<td>&gt; 10,0</td>
<td>&lt; 9,6</td>
<td>&gt; 65</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>typ. 13,9</td>
<td>typ. 11,0</td>
<td>typ. 8,9</td>
<td>typ. 70</td>
<td></td>
</tr>
</tbody>
</table>

![Class-B test circuit at \(f = 108\) MHz.]

**Fig. 7**

**List of components**

- \(C1 = C3 = 7\) to 100 pF film dielectric trimmer (cat. no. 2222 809 07015)
- \(C2 = C4 = C5 = C6 = C7 = 100\) pF (500 V) multilayer ceramic chip capacitor (ATC\(^\wedge\)); except for C2 these capacitors are placed 7 mm from transistor edge
- \(C8 = C10 = 470\) pF multilayer ceramic chip capacitor (cat. no. 2222 856 13471)
- \(C9 = C15 = 40\) pF, parallel connection of 4 x 10 pF lead feed-through capacitors (cat.no. 2222 702 05109)
- \(C11 = 100\) nF multilayer ceramic chip capacitor (cat. no. 2222 852 59104)
- \(C12 = C16 = 7\) to 47 pF precision tuning capacitor (cat. no. 2222 805 00174)
- \(C13 = 19\) pF, parallel connection of 4 x 4,7 pF lead feed-through capacitors (cat. no. 2222 702 04478)
- \(C14 = 6,8\) µF/63 V electrolytic capacitor
- \(L1 = Cu\) strip (10 mm x 4 mm x 0,5 mm)
- \(L2 =\) strip on printed-circuit board
- \(L3 = 7\) turns closely wound enamelled Cu wire (0,3 mm); int. dia. 3,0 mm; leads 2 x 6 mm
- \(L4 = L8 = L9 =\) Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- \(L5 = 3\) turns enamelled Cu wire (1,6 mm); int. dia. 8 mm; length 9 mm; leads 2 x 5 mm
- \(L6 = Cu\) strip (27 mm x 9 mm x 0,5 mm)
- \(L7 = 2\) turns enamelled Cu wire (1,6 mm); int. dia. 8 mm; length 9 mm; leads 2 x 10 mm

\(L2\) is strip on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16 in.

- \(R1 = 10\) Ω carbon resistor

\(^\wedge\) ATC means American Technical Ceramics.
Fig. 8 Component layout and printed-circuit board for 108 MHz class-B test circuit. (Dimensions in mm.)

The circuit and the components are on one side of the epoxy fibre-glass board, the other side is unetched copper to serve as a ground-plane. Earth connections are made by means of fixing screws. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.

Fig. 9 R.F. SOAR. ——— f > 1 MHz (continuous);
———— short time operation during mismatch (f > 1 MHz).
Fig. 10 Load power as a function of source power.

Fig. 11 Power gain and efficiency as a function of source power.

Fig. 12 Input impedance (series components).

Fig. 13 Load impedance (series components).

Fig. 14 Power gain as a function of frequency.

Conditions for Figs 10 and 11:
Test circuit tuned for each power level; typical values; $V_{CE} = 28$ V; $f = 108$ MHz; $T_h = 25^\circ$C; class-B operation.

Conditions for Figs 12, 13 and 14:
Typical values; $V_{CE} = 28$ V; $P_L = 175$ W; $T_h = 25^\circ$C; class-B operation.

OPERATING NOTE for Figs 12, 13 and 14:
Below 50 MHz a base-emitter resistor of 4,7 Ω is recommended to avoid oscillation.
This resistor must be effective for r.f. only.
V.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in linear v.h.f. amplifiers for television transmitters and transposers. Diffused emitter ballasting resistors and the application of gold sandwich metallization ensure an optimum temperature profile and excellent reliability properties.

The transistor has a ⅛" capstan envelope with ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Class-A; linear amplifier</th>
<th>f_{vision} MHz</th>
<th>V_{CE} V</th>
<th>I_{C} A</th>
<th>T_{h} °C</th>
<th>d_{im} dB</th>
<th>P_{o sync} W</th>
<th>G_{p} dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>224.25</td>
<td>25</td>
<td>0.46</td>
<td>70</td>
<td>-60</td>
<td>&gt; 1.5</td>
<td>&gt; 18</td>
<td></td>
</tr>
<tr>
<td>224.25</td>
<td>25</td>
<td>0.46</td>
<td>25</td>
<td>-60</td>
<td>typ. 1.7</td>
<td>typ. 20</td>
<td></td>
</tr>
</tbody>
</table>

* Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Torque on nut: min. 0.75 Nm (7.5 kg cm) max. 0.85 Nm (8.5 kg cm)

Diameter of clearance hole in heatsink: max. 4.2 mm.

Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (peak value); $V_{BE} = 0$
open base

Emitter-base voltage (open collector)

Collector current
d.c. or average (peak value); $f > 1$ MHz

Total power dissipation at $T_{mb} = 25$ °C

Storage temperature

Operating junction temperature

---

$$V_{CESM} \text{ max. } 60 \text{ V}$$
$$V_{CEO} \text{ max. } 30 \text{ V}$$
$$V_{EBO} \text{ max. } 4 \text{ V}$$

$$I_C; I_{C(AV)} \text{ max. } 1,5 \text{ A}$$
$$I_{CM} \text{ max. } 3,5 \text{ A}$$
$$P_{tot} \text{ max. } 32,5 \text{ W}$$

$T_{stg} = -65$ to $+150$ °C

$T_j \text{ max. } 200$ °C

---

(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

---

THERMAL RESISTANCE (see Fig. 4)

From junction to mounting base (dissipation = 12 W; $T_{mb} = 77$ °C; i.e. $T_h = 70$ °C)

From mounting base to heatsink

$$R_{th j-mb} = 5,6 \text{ K/W}$$
$$R_{th mb-h} = 0,6 \text{ K/W}$$

---

Fig. 3 Power derating curve vs. temperature.
Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. \( R_{\text{th mb-h}} = 0.6 \, \text{K/W} \).

**Example**

Nominal class-A operation; \( V_{\text{CE}} = 25 \, \text{V} \); \( I_{\text{C}} = 0.46 \, \text{A} \); \( T_{\text{h}} = 70 \, ^\circ\text{C} \).

Fig. 4 shows:
- \( R_{\text{th j-h max.}} = 6.13 \, \text{K/W} \)
- \( T_{\text{j max.}} = 140.5 \, ^\circ\text{C} \)

Typical device:
- \( R_{\text{th j-h typ.}} = 5.45 \, \text{K/W} \)
- \( T_{\text{j typ.}} = 133 \, ^\circ\text{C} \)
BLV30

CHARACTERISTICS

$T_j = 25 \, ^\circ\text{C}$

Collector-emitter breakdown voltage

$V_{BE} = 0; I_C = 10 \, \text{mA}$
open base; $I_C = 50 \, \text{mA}$

Emitter-base breakdown voltage
open collector; $I_E = 4 \, \text{mA}$

Collector cut-off current

$V_{BE} = 0; V_{CE} = 30 \, \text{V}$

Second breakdown energy; $L = 25 \, \text{mH}; f = 50 \, \text{Hz}$
open base
$R_{BE} = 10 \, \Omega$

D.C. current gain *

$I_C = 0.5 \, \text{A}; V_{CE} = 25 \, \text{V}$

Collector-emitter saturation voltage *

$V_{ICES} < 4 \, \text{mA}$

Transition frequency at $f = 500 \, \text{MHz}$**

$-I_E = 0.5 \, \text{A}; V_{CB} = 25 \, \text{V}$

$-I_E = 1.0 \, \text{A}; V_{CB} = 25 \, \text{V}$

Collector capacitance at $f = 1 \, \text{MHz}$

$I_E = I_C = 0; V_{CE} = 25 \, \text{V}$

Feedback capacitance at $f = 1 \, \text{MHz}$

$I_C = 20 \, \text{mA}; V_{CE} = 25 \, \text{V}$

$\rightarrow$ Collector-stud capacitance

$V_{(BR)CES} > 60 \, \text{V}$
$V_{(BR)CEO} > 30 \, \text{V}$
$V_{(BR)EBO} > 4 \, \text{V}$
$I_{CES} < 4 \, \text{mA}$
$E_{ESBO} > 2 \, \text{mJ}$
$E_{ESBR} > 2 \, \text{mJ}$
$h_{FE} \text{ typ. } 65$
$15 \text{ to } 120$
$V_{CEsat} \text{ typ. } 0.8 \, \text{V}$
$f_T \text{ typ. } 1.20 \, \text{GHz}$
$f_T \text{ typ. } 1.15 \, \text{GHz}$
$C_C \text{ typ. } 18 \, \text{pF}$
$C_{re} \text{ typ. } 9.2 \, \text{pF}$
$C_{cs} \text{ typ. } 1.2 \, \text{pF}$

* Measured under pulse conditions: $t_p \leq 300 \, \mu\text{s}; \delta \leq 0.02$

** Measured under pulse conditions: $t_p \leq 50 \, \mu\text{s}; \delta \leq 0.01$
V.H.F. linear power transistor

Fig. 5 Typical values; \( T_j = 25 \, ^\circ\text{C} \).

Fig. 6 \( I_E = I_e = 0; f = 1 \, \text{MHz}; T_j = 25 \, ^\circ\text{C} \).

Fig. 7 \( V_{CB} = 25 \, \text{V}; f = 500 \, \text{MHz}; T_j = 25 \, ^\circ\text{C} \).
APPLICATION INFORMATION

R.F. performance in v.h.f. class-A operation (linear power amplifier)

<table>
<thead>
<tr>
<th>f_vision (MHz)</th>
<th>V_Ce (V)</th>
<th>I_C (A)</th>
<th>T_h (°C)</th>
<th>d_im (dB)*</th>
<th>P_o_sync (W)*</th>
<th>G_p (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>224.25</td>
<td>25</td>
<td>0.46</td>
<td>70</td>
<td>-60</td>
<td>&gt; 1.5</td>
<td>&gt; 18</td>
</tr>
<tr>
<td>224.25</td>
<td>25</td>
<td>0.46</td>
<td>70</td>
<td>-60</td>
<td>typ. 1.7</td>
<td>typ. 19.5</td>
</tr>
<tr>
<td>224.25</td>
<td>25</td>
<td>0.46</td>
<td>25</td>
<td>-60</td>
<td>typ. 1.8</td>
<td>typ. 20</td>
</tr>
</tbody>
</table>

*Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -16 dB), zero dB corresponds to peak sync level.

List of components:

- C1 = 1.8 to 10 pF film dielectric trimmer (cat. no. 2222 809 05002)
- C2 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
- C3 = C4 = 82 pF multilayer ceramic chip capacitor (ATC*), placed 7 mm from transistor edge
- C5 = C7 = C14 = 680 pF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 852 13681)
- C6 = C8 = 330 nF polyester capacitor
- C9 = 43 pF (500 V) multilayer ceramic chip capacitor (ATC*)
- C10 = C13 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
- C11 = 10 µF/40 V solid aluminium electrolytic capacitor
- C12 = 18 pF (500 V) multilayer ceramic chip capacitor (ATC*)
- L1 = 49 nH; 4 turns enamelled Cu wire (1.0 mm); int. dia. 3.6 mm; length 6.3 mm; leads 2 x 5 mm
- L2 = L5 = 30 Ω stripline (10.0 mm x 6.0 mm)
- L3 = 0.1 µH; microchoke (cat. no. 4322 057 01070)
- L4 = 130 nH; 6 turns enamelled Cu wire (1.0 mm); int. dia. 6.0 mm; length 10.7 mm; leads 2 x 5 mm
- L6 = 60 Ω stripline (50.5 mm x 2.0 mm)
- L7 = 30 nH; 4 turns enamelled Cu wire (1.0 mm); int. dia. 3.0 mm; length 7.9 mm; leads 2 x 5 mm
- L2, L5 and L6 are striplines on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric (ε_r ≈ 4.5); thickness 1/16”.
- R1 = 10 Ω carbon resistor

* ATC means American Technical Ceramics.
Fig. 9 Component layout and printed-circuit board for 224.25 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.
Fig. 10 Intermodulation distortion (\(d_{im}^*\)) and cross-modulation distortion (\(d_{cm}^{**}\)) as a function of output power.

Fig. 11 Power gain as a function of output power.

Conditions for Figs 10 and 11:
Typical values; \(V_{CE} = 25\) V; \(I_C = 0,46\) A; \(f_{vision} = 224,25\) MHz.

* Three-tone test method (vision carrier \(-8\) dB, sound carrier \(-7\) dB, sideband signal \(-16\) dB), zero dB corresponds to peak sync level.
  Intermodulation distortion of input signal \(\leq -75\) dB.

** Two-tone test method (vision carrier 0 dB, sound carrier \(-7\) dB), zero dB corresponds to peak sync level.
  Cross-modulation distortion (\(d_{cm}^{**}\)) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to \(-20\) dB.
V.H.F. linear power transistor

Fig. 12. Input impedance (series components).

Fig. 13. Load impedance (series components).

Conditions for Figs 12, 13 and 14:
Typical values; \( V_{CE} = 25 \, V; I_C = 0,46 \, A; \)
\( T_h = 70 \, ^\circ C. \)
N-P-N silicon planar epitaxial transistor primarily intended for use in linear v.h.f. amplifiers for television transmitters and transposers. Diffused emitter ballasting resistors and the application of gold sandwich metallization ensure an optimum temperature profile and excellent reliability properties. The transistor has a \( \frac{1}{4} \)" capstan envelope with ceramic cap. All leads are isolated from the stud.

**QUICK REFERENCE DATA**

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>( f_{\text{vision}} ) MHz</th>
<th>( V_{CE} ) V</th>
<th>( I_C ) A</th>
<th>( T_h ) °C</th>
<th>( d_{im} ) dB</th>
<th>( P_{o \ sync} ) W</th>
<th>( G_p ) dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>class-A; linear amplifier</td>
<td>224,25</td>
<td>25</td>
<td>0,8</td>
<td>70</td>
<td>-58</td>
<td>&gt; 5</td>
<td>&gt; 15</td>
</tr>
<tr>
<td></td>
<td>224,25</td>
<td>25</td>
<td>0,8</td>
<td>25</td>
<td>-58</td>
<td>typ. 7</td>
<td>typ. 16,5</td>
</tr>
</tbody>
</table>

* Three-tone test method (vision carrier \(-8\) dB, sound carrier \(-7\) dB, sideband signal \(-16\) dB), zero dB corresponds to peak sync level.

**MECHANICAL DATA**

Fig. 1 SOT-122.

Dimensions in mm

- Torque on nut: min. 0.75 Nm (7.5 kg cm) max. 0.85 Nm (8.5 kg cm)
- Diameter of clearance hole in heatsink: max. 4.2 mm.
- Mounting hole to have no burrs at either end.
- De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

**PRODUCT SAFETY** This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage
(peak value); $V_{BE} = 0$
open base
Emitter-base voltage (open collector)
Collector current
d.c. or average
(peak value); $f > 1 \text{ MHz}$
Total power dissipation at $T_{mb} = 25 ^\circ \text{C}$
Storage temperature
Operating junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CESM}$</td>
<td>max. 60 V</td>
</tr>
<tr>
<td>$V_{CEO}$</td>
<td>max. 30 V</td>
</tr>
<tr>
<td>$V_{EBO}$</td>
<td>max. 4 V</td>
</tr>
<tr>
<td>$I_{C; IC(AV)}$</td>
<td>max. 3 A</td>
</tr>
<tr>
<td>$I_{CM}$</td>
<td>max. 6 A</td>
</tr>
<tr>
<td>$P_{tot}$</td>
<td>max. 48 W</td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>-65 to +150 ^\circ \text{C}</td>
</tr>
<tr>
<td>$T_j$</td>
<td>max. 200 ^\circ \text{C}</td>
</tr>
</tbody>
</table>

(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

THERMAL RESISTANCE (see Fig. 4)
From junction to mounting base
(dissipation = 20 W; $T_{mb} = 82 ^\circ \text{C}$; i.e. $T_h = 70 ^\circ \text{C}$)
From mounting base to heatsink

<table>
<thead>
<tr>
<th>Resistance</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{th j-mb}$</td>
<td>3.45 K/W</td>
</tr>
<tr>
<td>$R_{th mb-h}$</td>
<td>0.6 K/W</td>
</tr>
</tbody>
</table>

Fig. 3 Power derating curve vs. temperature.

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Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. \(R_{th\,mb-h} = 0.6 \, K/W.\)

**Example**

Nominal class-A operation: \(V_{CE} = 25 \, V; I_C = 0.8 \, A; T_h = 70 \, ^\circ C.\)

Fig. 4 shows:
- \(R_{th\,j-h\,\max} = 4.05 \, K/W\)
- \(T_{J\,\max} = 151 \, ^\circ C\)

Typical device:
- \(R_{th\,j-h\,\text{typ}} = 3.80 \, K/W\)
- \(T_{J\,\text{typ}} = 146 \, ^\circ C\)
**CHARACTERISTICS**

$T_j = 25 \, ^\circ\text{C}$ unless otherwise specified

**Collector-emitter breakdown voltage**
- $V_{BE} = 0; \, I_C = 25 \, \text{mA}$
- open base; $I_C = 100 \, \text{mA}$

**Emitter-base breakdown voltage**
- open collector; $I_E = 10 \, \text{mA}$

**Collector cut-off current**
- $V_{BE} = 0; \, V_{CE} = 30 \, \text{V}$

Second breakdown energy; $L = 25 \, \text{mH}; \, f = 50 \, \text{Hz}$
- open base
  - $R_{BE} = 10 \, \Omega$

D.C. current gain *
- $I_C = 0,8 \, \text{A}; \, V_{CE} = 25 \, \text{V}$

**Collector-emitter saturation voltage** *
- $I_C = 2,0 \, \text{A}; \, I_B = 0,2 \, \text{A}$

**Transition frequency at $f = 500 \, \text{MHz}$**
- $-I_E = 0,8 \, \text{A}; \, V_{CB} = 25 \, \text{V}$
- $-I_E = 2,0 \, \text{A}; \, V_{CB} = 25 \, \text{V}$

**Collector capacitance at $f = 1 \, \text{MHz}$**
- $I_E = I_B = 0; \, V_{CE} = 25 \, \text{V}$

**Feedback capacitance at $f = 1 \, \text{MHz}$**
- $I_C = 100 \, \text{mA}; \, V_{CE} = 25 \, \text{V}$

**Collector-stud capacitance**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{(BR)CES}$</td>
<td>$&gt; 60 , \text{V}$</td>
</tr>
<tr>
<td>$V_{(BR)CEO}$</td>
<td>$&gt; 30 , \text{V}$</td>
</tr>
<tr>
<td>$V_{(BR)EBO}$</td>
<td>$&gt; 4 , \text{V}$</td>
</tr>
<tr>
<td>$I_{CES}$</td>
<td>$&lt; 10 , \text{mA}$</td>
</tr>
<tr>
<td>$E_{SBO}$</td>
<td>$&gt; 3 , \text{mJ}$</td>
</tr>
<tr>
<td>$E_{SR}$</td>
<td>$&gt; 3 , \text{mJ}$</td>
</tr>
<tr>
<td>$h_{FE}$</td>
<td>typ. 75 15 to 120</td>
</tr>
<tr>
<td>$V_{CEsat}$</td>
<td>typ. $1,0 , \text{V}$</td>
</tr>
<tr>
<td>$f_T$</td>
<td>typ. $1,0 , \text{GHz}$</td>
</tr>
<tr>
<td>$f_T$</td>
<td>typ. $1,1 , \text{GHz}$</td>
</tr>
<tr>
<td>$C_C$</td>
<td>typ. $35 , \text{pF}$</td>
</tr>
<tr>
<td>$C_{re}$</td>
<td>typ. $20 , \text{pF}$</td>
</tr>
<tr>
<td>$C_{cs}$</td>
<td>typ. $1,2 , \text{pF}$</td>
</tr>
</tbody>
</table>

* Measured under pulse conditions: $t_p \leq 300 \, \mu\text{s}; \, \delta \leq 0,02$.
** Measured under pulse conditions: $t_p \leq 50 \, \mu\text{s}; \, \delta \leq 0,01$. 

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V.H.F. linear power transistor

Fig. 5 Typical values; $T_j = 25^\circ$C.

Fig. 6 $I_E = I_e = 0$; $f = 1$ MHz; $T_j = 25^\circ$C.

Fig. 7 $V_{CB} = 25$ V; $f = 500$ MHz; $T_j = 25^\circ$C.
### APPLICATION INFORMATION

R.F. performance in v.h.f. class-A operation (linear power amplifier)

<table>
<thead>
<tr>
<th>$f_{\text{vision}}$ (MHz)</th>
<th>$V_{\text{CE}}$ (V)</th>
<th>$I_{\text{c}}$ (A)</th>
<th>$T_{\text{h}}$ (°C)</th>
<th>$d_{\text{im}}$ (dB)$^*$</th>
<th>$P_{\text{o sync}}$ (W)$^*$</th>
<th>$G_{\text{p}}$ (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>224,25</td>
<td>25</td>
<td>0,8</td>
<td>70</td>
<td>-58</td>
<td>&gt; 5</td>
<td>&gt; 15</td>
</tr>
<tr>
<td>224,25</td>
<td>25</td>
<td>0,8</td>
<td>70</td>
<td>-58</td>
<td>typ. 5,8</td>
<td>typ. 16,2</td>
</tr>
<tr>
<td>224,25</td>
<td>25</td>
<td>0,8</td>
<td>25</td>
<td>-58</td>
<td>typ. 7</td>
<td>typ. 16,5</td>
</tr>
</tbody>
</table>

$^*$ Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -16 dB), zero dB corresponds to peak sync level.

Fig. 8 Test circuit at $f_{\text{vision}} = 224,25$ MHz.

**List of components:**

- $C_1 = 1.8$ to $10$ pF film dielectric trimmer (cat. no. 2222 809 05002)
- $C_2 = 2$ to $9$ pF film dielectric trimmer (cat. no. 2222 809 09002)
- $C_3 = C_4 = 82$ pF multilayer ceramic chip capacitor (ATC\(^\Delta\)), placed 7 mm from transistor edge
- $C_5 = C_7 = C_{14} = 680$ pF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 852 13681)
- $C_6 = C_8 = 330$ nF polyester capacitor
- $C_9 = 43$ pF (500 V) multilayer ceramic chip capacitor (ATC\(^\Delta\))
- $C_{10} = C_{13} = 2$ to $18$ pF film dielectric trimmer (cat. no. 2222 809 09003)
- $C_{11} = 10 \mu F/40$ V solid aluminium electrolytic capacitor
- $C_{12} = 18$ pF (500 V) multilayer ceramic chip capacitor (ATC\(^\Delta\))
- $L_1 = 49$ nH; 4 turns enameled Cu wire (1.0 mm); int. dia. 3.6 mm; length 6.3 mm; leads 2 x 5 mm
- $L_2 = L_5 = 30 \Omega$ stripline (10.0 mm x 6.0 mm)
- $L_3 = 0.1 \mu H$; microchoke (cat. no. 4322 057 01070)
- $L_4 = 130$ nH; 6 turns enameled Cu wire (1.0 mm); int. dia. 6.0 mm; length 10.7 mm; leads 2 x 5 mm
- $L_6 = 60 \Omega$ stripline (50.5 mm x 2.0 mm)
- $L_7 = 30$ nH; 4 turns enameled Cu wire (1.0 mm); int. dia. 3.0 mm; length 7.9 mm; leads 2 x 5 mm
- $L_2$, $L_5$ and $L_6$ are striplines on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric ($\varepsilon_r \approx 4.5$); thickness 1/16”.
- $R_1 = 10 \Omega$ carbon resistor

\(^\Delta\) ATC means American Technical Ceramics.
Fig. 9 Component layout and printed-circuit board for 224,25 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.
Fig. 10 Intermodulation distortion ($d_{im^*}$) and cross-modulation distortion ($d_{cm^{**}}$) as a function of output power.

Conditions for Figs 10 and 11:
Typical values; $V_{CE} = 25$ V; $I_C = 0.8$ A; $f_{vision} = 224.25$ MHz.

* Three-tone test method (vision carrier $-8$ dB, sound carrier $-7$ dB, sideband signal $-16$ dB), zero dB corresponds to peak sync level.
  Intermodulation distortion of input signal $<-75$ dB.
** Two-tone test method (vision carrier 0 dB, sound carrier $-7$ dB), zero dB corresponds to peak sync level.
  Cross-modulation distortion ($d_{cm}$) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to $-20$ dB.
Fig. 12 Input impedance (series components).

Fig. 13 Load impedance (series components).

Conditions for Figs 12, 13 and 14:
Typical values; $V_{CE} = 25 \text{ V}$; $I_C = 0.8 \text{ A}$; $T_h = 70 \text{ °C}$. 

Figure 14.
V.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in linear v.h.f. amplifiers of television transmitters and transposers.

Features:
- diffused emitter ballasting resistors for an optimum temperature profile;
- gold metallization ensures excellent reliability.

The transistor has a 3/8" 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Mode of operation</th>
<th>f_{vision} MHz</th>
<th>V_{CE} V</th>
<th>I_C A</th>
<th>T_H °C</th>
<th>d_{im} dB</th>
<th>P_{o sync} W</th>
<th>G_p dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>class-A</td>
<td>224,25</td>
<td>25</td>
<td>1,5</td>
<td>70</td>
<td>-55</td>
<td>&gt; 10</td>
<td>&gt; 16</td>
</tr>
<tr>
<td>class-A</td>
<td>224,25</td>
<td>25</td>
<td>1,5</td>
<td>25</td>
<td>-55</td>
<td>typ. 12,5</td>
<td>typ. 17,2</td>
</tr>
</tbody>
</table>

* Three-tone test method (vision carrier —8 dB, sound carrier —7 dB, sideband signal —16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

SOT-160 (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
MECHANICAL DATA
Fig. 1 SOT-160.

Dimensions in mm

Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage
(peak value); $V_{BE} = 0$

open base

Emitter-base voltage (open collector)

d.c. or average
(peak value); $f > 1$ MHz

Collector current

Total power dissipation at $T_{mb} = 25$ °C

R.F. power dissipation ($f > 1$ MHz); $T_{mb} = 25$ °C

Storage temperature

Operating junction temperature

(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

THERMAL RESISTANCE (dissipation = 37.5 W; $T_{mb} = 82$ °C, i.e. $T_h = 70$ °C)

From junction to mounting base (d.c. dissipation)

From junction to mounting base (r.f. dissipation)

From mounting base to heatsink

$R_{th\,j-mb\,(dc)} = 2.55$ K/W

$R_{th\,j-mb\,(rf)} = 2.10$ K/W

$R_{th\,mb-h} = 0.3$ K/W
Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. \( R_{th \, mb-h} = 0.3 \, \text{K/W} \).

**Example**

Nominal class-A operation (without r.f. signal): \( V_{CE} = 25 \, \text{V} \); \( I_C = 1.5 \, \text{A} \); \( T_H = 70 \, ^\circ \text{C} \).

Fig. 4 shows: \( R_{th \, j-h} \max. \, 2.85 \, \text{K/W} \)

\( T_j \max. \, 177 \, ^\circ \text{C} \)

Typical device: \( R_{th \, j-h} \typ. \, 2.30 \, \text{K/W} \)

\( T_j \typ. \, 156 \, ^\circ \text{C} \)
V.H.F. linear power transistor

CHARACTERISTICS

$T_j = 25 \, ^\circ\text{C}$

Collector-emitter breakdown voltage

$V_{BE} = 0; I_C = 15 \, \text{mA}$

open base; $I_C = 100 \, \text{mA}$

Emitter-base breakdown voltage

open collector; $I_E = 10 \, \text{mA}$

Collector cut-off current

$V_{BE} = 0; V_{CE} = 32 \, \text{V}$

Second breakdown energy; $L = 25 \, \text{mH}; f = 50 \, \text{Hz}$

open base

$R_{BE} = 10 \, \Omega$

D.C. current gain*

$I_C = 1,6 \, \text{A}; V_{CE} = 25 \, \text{V}$

Collector-emitter saturation voltage*

$I_C = 3,5 \, \text{A}; I_B = 0,35 \, \text{A}$

Transition frequency at $f = 500 \, \text{MHz}$**

$-I_E = 1,6 \, \text{A}; V_{CB} = 25 \, \text{V}$

$-I_E = 3,5 \, \text{A}; V_{CB} = 25 \, \text{V}$

Collector capacitance at $f = 1 \, \text{MHz}$

$I_E = I_C = 0; V_{CB} = 25 \, \text{V}$

Feedback capacitance at $f = 1 \, \text{MHz}$

$I_C = 50 \, \text{mA}; V_{CE} = 25 \, \text{V}$

Collector-flange capacitance

$V_{(BR)CES} > 60 \, \text{V}$

$V_{(BR)CEO} > 32 \, \text{V}$

$V_{(BR)EBO} > 4 \, \text{V}$

$I_{CES} < 5 \, \text{mA}$

$E_{SO} > 4,5 \, \text{mJ}$

$E_{SR} > 4,5 \, \text{mJ}$

$h_{FE}$ typ. 50

20 to 120

$V_{CEsat}$ typ. 1,4 \, \text{V}$

$f_T$ typ. 2 \, \text{GHz}$

$f_{T'}$ typ. 2 \, \text{GHz}$

$C_C$ typ. 50 \, \text{pF}$

$C_{re}$ typ. 31 \, \text{pF}$

$C_{cf}$ typ. 2 \, \text{pF}$

* Measured under pulse conditions: $t_p \leq 300 \, \mu\text{s}; \delta \leq 0.02$.

** Measured under pulse conditions: $t_p \leq 50 \, \mu\text{s}; \delta \leq 0.01$. 

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Fig. 5 Typical values; $T_j = 25 \, ^\circ C$.

Fig. 6 $I_E = I_e = 0; f = 1 \, MHz; T_j = 25 \, ^\circ C$.

Fig. 7 $V_{CB} = 25 \, V; f = 500 \, MHz; T_j = 25 \, ^\circ C$.

Fig. 8 Typical values; $V_{CE} = 25 \, V$. 
APPLICATION INFORMATION

R.F. performance in v.h.f. class-A operation (linear power amplifier)

<table>
<thead>
<tr>
<th>$f_{\text{vision}}$ (MHz)</th>
<th>$V_{\text{CE}}$ (V)*</th>
<th>$I_{\text{C}}$ (A)</th>
<th>$T_{\text{h}}$ (°C)</th>
<th>$d_{\text{im}}$ (dB)**</th>
<th>$P_{\text{o sync}}$ (W)**</th>
<th>$G_{\text{p}}$ (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>224.25</td>
<td>25</td>
<td>1.5</td>
<td>70</td>
<td>-55</td>
<td>&gt; 10</td>
<td>&gt; 16</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>25</td>
<td>-55</td>
<td>typ. 11</td>
<td>typ. 16.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>70</td>
<td>-52</td>
<td>typ. 13</td>
<td>typ. 16.8</td>
</tr>
</tbody>
</table>

* The transistor is capable of operating up to 28 V.
** Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

List of components:

- C1 = C9 = 330 nF polyester capacitor
- C2 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 05003)
- C3 = C11 = C13 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
- C4 = C7 = C14 = 680 pF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 852 13681)
- C5 = C6 = 68 pF (500 V) multilayer ceramic chip capacitor (ATC™)
- C8 = 10 μF/63 V solid tantalum capacitor
- C10 = 82 pF (500 V) multilayer ceramic chip capacitor (ATC™)
- C12 = 30 pF (500 V) multilayer ceramic chip capacitor (ATC™)
- L1 = 1 µH microchoke (cat. no. 4322 057 01080)
- L2 = 3 turns enamelled Cu wire (1.6 mm); int. dia. 4.5 mm; length 14.0 mm; leads 2 x 3 mm
- L3 = L4 = 32 Ω stripline (6.0 mm x 10.0 mm)
- L5 = 4 turns enamelled Cu wire (1.6 mm); int. dia. 5.5 mm; length 10.0 mm; leads 2 x 2 mm
- L6 = 62 Ω stripline (2.0 mm x 22.5 mm)
- L7 = 2 turns enamelled Cu wire (1.6 mm); int. dia. 4.5 mm; length 4.0 mm; leads 2 x 3 mm
- L3, L4 and L6 are striplines on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric ($\varepsilon_r \approx 4.5$); thickness 1/16".
- R1 = 27 Ω carbon resistor

▲ ATC means American Technical Ceramics.
Fig. 10 Component layout and printed-circuit board for 224.25 MHz class-A test circuit.

The circuit and the components are on one side of the epoxy fibre-glass board, the other side is unetched copper to serve as a ground-plane. Earth connections are made by hollow rivets. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.
Fig. 11 Intermodulation distortion ($d_{im}$)* and power gain as a function of output power.

Fig. 12 Cross-modulation distortion ($d_{cm}$)** as a function of output power.

Conditions for Figs 11 and 12:
Typical values; $V_{CE} = 25$ V; $I_C = 1.5$ A; $T_h = 25$ °C; $T_h = 70$ °C; $f_{vision} = 224.25$ MHz.

Ruggedness in class-A operation
The BLV32F is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 15 W (r.m.s. value) or 20 W (P.E.P.) under the following conditions:
$V_{CE} = 25$ V; $I_C = 1.5$ A; $T_h = 70$ °C; $f = 224.25$ MHz; $R_{th mb-h} = 0.3$ K/W.

* Three-tone test method (vision carrier $-8$ dB, sound carrier $-7$ dB, sideband signal $-16$ dB), zero dB corresponds to peak sync level.
  Intermodulation distortion of input signal $\leq -70$ dB.

** Two-tone test method (vision carrier 0 dB, sound carrier $-7$ dB), zero dB corresponds to peak sync level.
  Cross-modulation distortion ($d_{cm}$) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to $-20$ dB.
Fig. 13 Input impedance (series components).

Fig. 14 Load impedance (series components).

Conditions for Figs 13, 14 and 15:
Typical values; $V_{CE} = 25 \text{ V}$; $I_C = 1.5 \text{ A}$; class-A operation; $T_H = 70 \text{ °C}$.
V.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in linear v.h.f. amplifiers for television transmitters and transposers. Diffused emitter ballasting resistors and the application of gold sandwich metallization ensure an optimum temperature profile and excellent reliability properties.

The transistor has a ½" capstan envelope with ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance in linear amplifier

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>f_{vision} MHz</th>
<th>V_{CE} V</th>
<th>I_C (ZS) A</th>
<th>T_{h} °C</th>
<th>d_{im} dB</th>
<th>P_{o sync}* W</th>
<th>G_{p} dB</th>
<th>sync compr.**</th>
<th>.sync in (%) / sync out (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>class-A</td>
<td>224,25</td>
<td>25</td>
<td>3,20</td>
<td>70</td>
<td>-55</td>
<td>&gt; 19</td>
<td>&gt; 9</td>
<td>typ. 26</td>
<td>typ. 9,7</td>
</tr>
<tr>
<td>class-AB</td>
<td>224,25</td>
<td>28</td>
<td>0,10</td>
<td>70</td>
<td>-55</td>
<td>typ. 90</td>
<td>typ. 6,5</td>
<td>30/25</td>
<td></td>
</tr>
</tbody>
</table>

* Three-tone test method (vision carrier –8 dB, sound carrier –7 dB, sideband signal –16 dB), zero dB corresponds to peak sync level.

** Television service (negative modulation, C.C.I.R. system).

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-147.

Torque on nut: min. 2,3 Nm (23 kg cm) max. 2,7 Nm (27 kg cm)

Diameter of clearance hole in heatsink: max. 6,4 mm.

Mounting hole to have no burrs at either end.

De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage
(peak value); $V_{BE} = 0$
open base
Emitter-base voltage (open collector)
Collector current
d.c. or average
(peak value); $f > 1$ MHz
Total power dissipation at $T_{mb} = 25$ °C
R.F. power dissipation ($f > 1$ MHz); $T_{mb} = 25$ °C
Storage temperature
Operating junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CESM}$ max.</td>
<td>65 V</td>
</tr>
<tr>
<td>$V_{CEO}$ max.</td>
<td>33 V</td>
</tr>
<tr>
<td>$V_{EBO}$ max.</td>
<td>4 V</td>
</tr>
<tr>
<td>$I_C; I_{C(AV)}$ max.</td>
<td>12.5 A</td>
</tr>
<tr>
<td>$I_{CM}$ max.</td>
<td>20 A</td>
</tr>
<tr>
<td>$P_{tot}$ max.</td>
<td>132 W</td>
</tr>
<tr>
<td>$P_{rf}$ max.</td>
<td>165 W</td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>-65 to +150 °C</td>
</tr>
<tr>
<td>$T_j$ max.</td>
<td>200 °C</td>
</tr>
</tbody>
</table>

(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

Fig. 3 Power derating curve vs. temperature.
I Continuous d.c. (including r.f. class-A) operation
II Continuous r.f. operation

THERMAL RESISTANCE (dissipation = 80 W; $T_{mb} = 82$ °C, i.e. $T_h = 70$ °C)

From junction to mounting base (d.c. dissipation)
From junction to mounting base (r.f. dissipation)
From mounting base to heatsink

$$R_{th\, j-mb\,(dc)} = 1.46 \text{ K/W}$$
$$R_{th\, j-mb\,(rf)} = 1.17 \text{ K/W}$$
$$R_{th\, mb-h} = 0.15 \text{ K/W}$$
Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. (R_{th mb-h} = 0.15 K/W.)

Example
Nominal class A operation: V_{CE} = 25 V; I_C = 3.2 A; T_h = 70 °C.

Fig. 4 shows: 
\[ R_{th j-h} \text{ max. } 1.60 \text{ K/W} \]
\[ T_j \text{ max. } 198 °C \]

Typical device: 
\[ R_{th j-h} \text{ typ. } 1.50 \text{ K/W} \]
\[ T_j \text{ typ. } 190 °C \]
CHARACTERISTICS

$T_j = 25 \degree C$

Collector-emitter breakdown voltage
$V_{BE} = 0; I_C = 25 \text{ mA}$
open base; $I_C = 100 \text{ mA}$

Emitter-base breakdown voltage
open collector; $I_E = 10 \text{ mA}$

Collector cut-off current
$V_{BE} = 0; V_{CE} = 30 \text{ V}$

Second breakdown energy; $L = 25 \text{ mH}; f = 50 \text{ Hz}$
open base
$R_{BE} = 10 \Omega$

D.C. current gain*
$I_C = 3,0 \text{ A}; V_{CE} = 25 \text{ V}$

Collector-emitter saturation voltage*
$I_C = 6,0 \text{ A}; I_B = 0,6 \text{ A}$

Transition frequency at $f = 100 \text{ MHz}$**
$-I_E = 3,0 \text{ A}; V_{CB} = 25 \text{ V}$
$-I_E = 6,0 \text{ A}; V_{CB} = 25 \text{ V}$

Collector capacitance at $f = 1 \text{ MHz}$
$I_E = I_B = 0; V_{CB} = 25 \text{ V}$

Feedback capacitance at $f = 1 \text{ MHz}$
$I_C = 100 \text{ mA}; V_{CE} = 25 \text{ V}$

Collector-stud capacitance

$V_{(BR)CES} > 65 \text{ V}$
$V_{(BR)CEO} > 33 \text{ V}$
$V_{(BR)EBO} > 4 \text{ V}$
$I_{CES} < 10 \text{ mA}$

$E_{SBO} > 12,5 \text{ mJ}$
$E_{SBR} > 12,5 \text{ mJ}$

$h_{FE}$ typ. 50
15 to 100

$V_{CEsat}$ typ. 0,75 V

$f_T$ typ. 680 MHz
$f_T$ typ. 750 MHz

$C_c$ typ. 155 pF

$C_{re}$ typ. 88 pF
$C_{cs}$ typ. 3 pF

* Measured under pulse conditions: $t_p \leq 300 \mu s; \delta \leq 0,02.$
** Measured under pulse conditions: $t_p \leq 50 \mu s; \delta \leq 0,01.$
V.H.F. linear power transistor

**Fig. 5** Typical values; $T_j = 25 \, ^\circ\text{C}$.

**Fig. 6** $I_E = I_e = 0$; $f = 1 \, \text{MHz}$; $T_j = 25 \, ^\circ\text{C}$.

**Fig. 7** $V_{CB} = 25 \, \text{V}$; $f = 100 \, \text{MHz}$; $T_j = 25 \, ^\circ\text{C}$.

**Fig. 8** Typical values; $V_{CE} = 25 \, \text{V}$.
APPLICATION INFORMATION

R.F. performance in v.h.f. class-A operation (linear power amplifier)

<table>
<thead>
<tr>
<th>$f_{vision}$ (MHz)</th>
<th>$V_{CE}$ (V)</th>
<th>$I_C$ (A)</th>
<th>$T_H$ ($^\circ$C)</th>
<th>$d_{im}$ (dB)*</th>
<th>$P_{o\ sync}$ (W)*</th>
<th>$G_P$ (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>224.25</td>
<td>25</td>
<td>3.2</td>
<td>70</td>
<td>-55</td>
<td>&gt; 19</td>
<td>&gt; 9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>70</td>
<td>-55</td>
<td>typ. 22</td>
<td>typ. 9,3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>70</td>
<td>-52</td>
<td>typ. 26,5</td>
<td>typ. 9,3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>25</td>
<td>-55</td>
<td>typ. 26</td>
<td>typ. 9,7</td>
</tr>
</tbody>
</table>

* Three-tone test method (vision carrier $-8$ dB, sound carrier $-7$ dB, sideband signal $-16$ dB), zero dB corresponds to peak sync level.

List of components:

C1 = C14 = 680 pF (500 V) multilayer ceramic chip capacitor (ATC®)
C2 = C11 = C13 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 08002)
C3 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C4 = C9 = 680 pF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 852 13681)
C5 = 24 pF (500 V) multilayer ceramic chip capacitor (ATC®), positioned under C11
C6 = 10 µF/40 V solid aluminium electrolytic capacitor
L1 = 1½ turns closely wound enamelled Cu wire (1.6 mm); int. dia. 4.5 mm; leads 2 x 3 mm
L2 = 30 Ω stripline (6.0 mm x 32.7 mm)
L3 = 1 µH microchoke (cat. no. 4322 057 01080)
L4 = 27 nH; 2 turns enamelled Cu wire (1.1 mm); int. dia. 4.5 mm; length 2.9 mm; leads 2 x 5 mm
L5 = 30 Ω stripline (6.0 mm x 24.0 mm)
L6 = 19 nH; 2 turns enamelled Cu wire (1.1 mm); int. dia. 3.5 mm; length 3.5 mm; leads 2 x 5 mm
L2 and L5 are striplines on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric ($\varepsilon_r \approx 4.5$); thickness 1/16".
R1 = R2 = 10 Ω carbon resistor

▲ ATC means American Technical Ceramics.
Fig. 10 Component layout and printed-circuit board for 224.25 MHz class-A test circuit.

The circuit and the components are on one side of the epoxy fibre-glass board, the other side is un-etched copper to serve as earth. Earth connections are made by hollow rivets. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.
Fig. 11 Intermodulation distortion ($d_{im}$)* and power gain as a function of output power.

Fig. 12 Cross-modulation distortion ($d_{cm}$)** as a function of output power.

Conditions for Figs 11 and 12:
Typical values; $V_{CE} = 25 \text{ V}$; $I_C = 3.2 \text{ A}$; $T_h = 25 \, ^\circ\text{C}$; $T_h = 70 \, ^\circ\text{C}$; $f_{vision} = 224.25 \, \text{MHz}$.

Ruggedness in class-A operation
The BLV33 is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 30 W (r.m.s. value) or 40 W (P.E.P.) under the following conditions:
$V_{CE} = 25 \text{ V}$; $I_C = 3.2 \text{ A}$; $T_h = 70 \, ^\circ\text{C}$; $f = 224.25 \, \text{MHz}$; $R_{th mb-h} = 0.15 \, \text{K/W}$.

* Three-tone test method (vision carrier $-8 \, \text{dB}$, sound carrier $-7 \, \text{dB}$, sideband signal $-16 \, \text{dB}$), zero dB corresponds to peak sync level.
   Intermodulation distortion of input signal $\leq -70 \, \text{dB}$.

** Two-tone test method (vision carrier $0 \, \text{dB}$, sound carrier $-7 \, \text{dB}$), zero dB corresponds to peak sync level.
   Cross-modulation distortion ($d_{cm}$) is the voltage variation (%) of sound carrier when vision carrier is switched from $0 \, \text{dB}$ to $-20 \, \text{dB}$.
V.H.F. linear power transistor

Fig. 13 Input impedance (series components).

Fig. 14 Load impedance (series components).

Conditions for Figs 13, 14 and 15:
Typical values; $V_{CE} = 25$ V; $I_C = 3.2$ A; class-A operation; $T_h = 70$ °C.
APPLICATION INFORMATION

R.F. performance in v.h.f. class-AB operation (c.w.)

<table>
<thead>
<tr>
<th>( f_{vision} ) (MHz)</th>
<th>( V_{CE} ) (V)</th>
<th>( I_{C(ZS)} ) (A)</th>
<th>( T_h ) (ºC)</th>
<th>( P_L ) (W)</th>
<th>( I_C ) (A)</th>
<th>( \eta ) (%)</th>
<th>( G_D ) (dB)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>224,25</td>
<td>28</td>
<td>0,1</td>
<td>70</td>
<td>40</td>
<td>typ. 2,60</td>
<td>typ. 55</td>
<td>typ. 7,5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>90</td>
<td>typ. 4,46</td>
<td>typ. 72</td>
<td>typ. 6,5</td>
</tr>
</tbody>
</table>

* Gain compression point of 1 dB is at typical 90 W (minimum 80 W). Using a 3rd-order amplitude transfer characteristic, 1 dB compression corresponds with 30% sync input/25% sync output compression in television service (negative modulation, C.C.I.R. system).

List of components:

- C1 = C17 = 680 pF (500 V) multilayer ceramic chip capacitor (ATC)
- C2 = 39 pF (500 V) multilayer ceramic chip capacitor (ATC)
- C3 = C16 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
- C4 = 43 pF (500 V) multilayer ceramic chip capacitor (ATC)
- C5 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 08002)
- C6 = C10 = 930 nF polyester capacitor
- C7 = C13 = 680 pF (500 V) multilayer ceramic chip capacitor (ATC)
- C8 = 68 pF (500 V) multilayer ceramic chip capacitor (ATC); placed 2.5 mm from transistor edge
- C11 = C12 = 27 pF (500 V) multilayer ceramic chip capacitor (ATC); placed 7 mm from transistor edge
- C14 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 08003)
- C15 = 10 µF/40 V solid aluminium electrolytic capacitor
- L1 = 25 nH; 2 turns enamelled Cu wire (1.6 mm); int. dia. 4.3 mm; length 3.4 mm; leads 2 x 5 mm
- L2 = 120 nH; 4 turns closely wound enamelled Cu wire (1.1 mm); int. dia. 6.0 mm; leads 2 x 5 mm
- L3 = 30 Ω stripline (6.0 mm x 48.8 mm)
- L4 = 48 Ω stripline (3.0 mm x 27.0 mm) at 3 mm from transistor edge
- L5 = 30 Ω stripline (6.0 mm x 42.9 mm)
- L6 = 24 nH; 2 turns enamelled Cu wire (1.6 mm); int. dia. 4.0 mm; length 3.4 mm; leads 2 x 5 mm
- L3, L4 and L5 are striplines on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric (\( \varepsilon_r = 4.5 \)); thickness 1/16”.
- R1 = R2 = 10 Ω carbon resistor

\( \Delta \) ATC means American Technical Ceramics.
V.H.F. linear power transistor

Fig. 17 $V_{CE} = 28 \, V$; $I_C(ZS) = 0,1 \, A$; $T_h = 70 \, ^oC$; $f_{vision} = 224,25 \, MHz$. 

Fig. 18 $V_{CE} = 28 \, V$; $I_C(ZS) = 0,1 \, A$; $T_h = 70 \, ^oC$; $f_{vision} = 224,25 \, MHz$; typical values.

**Ruggedness in class-AB operation**

The BLV33 is capable of withstanding a load mismatch ($VSWR \leq 2$ through all phases) up to 60 W (r.m.s. value) and 90 W (P.E.P.) under the following conditions:

$V_{CE} = 28 \, V$; $T_h = 70 \, ^oC$; $f = 224,25 \, MHz$; $R_{th\, mb-h} = 0,15 \, K/W$. 

May 1981
Fig. 19 Input impedance (series components).

Fig. 20 Load impedance (series components).

Fig. 21

Conditions for Figs 19, 20 and 21:
Typical values; $V_{CE} = 28$ V; $P_L = 80$ W (P.E.P.);
class-AB operation; $T_h = 70$ °C.
V.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in linear v.h.f. amplifiers for television transmitters and transposers.

Features of this product:

- internally matched input for wideband operation and high power gain;
- diffused emitter ballasting resistors for an optimum temperature profile;
- gold metallization ensures excellent reliability.

The transistor has a ½" 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance in linear amplifier

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>f_vision MHz</th>
<th>V_C E</th>
<th>I_C</th>
<th>T_h oC</th>
<th>d_{im} dB</th>
<th>P_{o sync} W</th>
<th>G_p dB</th>
<th>sync compr.**</th>
</tr>
</thead>
<tbody>
<tr>
<td>class-A</td>
<td>224,25</td>
<td>25</td>
<td>3,20</td>
<td>70</td>
<td>-55</td>
<td>&gt; 16</td>
<td>&gt; 13,5</td>
<td>sync in (%) / sync out (%)</td>
</tr>
<tr>
<td>class-AB</td>
<td>224,25</td>
<td>28</td>
<td>0,20</td>
<td>70</td>
<td>typ. 85</td>
<td>typ. 14,8</td>
<td>30/25</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
** Television service (negative modulation, C.C.I.R. system).

MECHANICAL DATA

SOT-119 (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
MECHANICAL DATA
Fig. 1 SOT-119.

Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.
### RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limitation</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-emitter voltage (peak value); $V_{BE} = 0$</td>
<td>open base</td>
<td></td>
</tr>
<tr>
<td>Emitter-base voltage (open collector)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector current</td>
<td>d.c. or average</td>
<td></td>
</tr>
<tr>
<td>(peak value); $f &gt; 1$ MHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total power dissipation at $T_{mb} = 25$ °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R.F. power dissipation ($f &gt; 1$ MHz); $T_{mb} = 25$ °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating junction temperature</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Fig. 2 D.C. SOAR.](image)

(1) Second breakdown limit (independent of temperature).

![Fig. 3 Power derating curve vs. temperature.](image)

1 Continuous d.c. (including r.f. class-A) operation
2 Continuous r.f. operation

### THERMAL RESISTANCE

(dissipation = 80 W; $T_{mb} = 86$ °C, i.e. $T_{h} = 70$ °C)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{th j-mb(dc)}$</td>
<td>$1,43$ K/W</td>
</tr>
<tr>
<td>$R_{th j-mb(rf)}$</td>
<td>$1,17$ K/W</td>
</tr>
<tr>
<td>$R_{th mb-h}$</td>
<td>$0,2$ K/W</td>
</tr>
</tbody>
</table>
Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\,mb-h} = 0.2 \, K/W$.)

Example

Nominal class-A operation (without r.f. signal): $V_{CE} = 25 \, V; I_C = 3.2 \, A; T_h = 70 \, ^\circ C$.

Fig. 4 shows:
- $R_{th\,j-h}$ max. $1.63 \, K/W$
- $T_{j\,max}$ max. $200 \, ^\circ C$

Typical device:
- $R_{th\,j-h}$ typ. $1.53 \, K/W$
- $T_{j\,typ}$ typ. $192 \, ^\circ C$
V.H.F. linear power transistor

CHARACTERISTICS

$T_j = 25 \, ^\circ\text{C}$

Collector-emitter breakdown voltage
$V_{BE} = 0; \, I_C = 25 \, \text{mA}$
open base; $I_C = 100 \, \text{mA}$

Emitter-base breakdown voltage
open collector; $I_E = 10 \, \text{mA}$

Collector cut-off current
$V_{BE} = 0; \, V_{CE} = 30 \, \text{V}$

Second breakdown energy; $L = 25 \, \text{mH}; \, f = 50 \, \text{Hz}$
open base
$R_{BE} = 10 \, \Omega$

D.C. current gain*
$I_C = 3,0 \, \text{A}; \, V_{CE} = 25 \, \text{V}$

Collector-emitter saturation voltage*
$I_C = 6,0 \, \text{A}; \, I_B = 0,6 \, \text{A}$

Transition frequency at $f = 100 \, \text{MHz}$**
$-I_E = 3,0 \, \text{A}; \, V_{CB} = 25 \, \text{V}$
$-I_E = 6,0 \, \text{A}; \, V_{CB} = 25 \, \text{V}$

Collector capacitance at $f = 1 \, \text{MHz}$
$I_E = I_E = 0; \, V_{CB} = 25 \, \text{V}$

Feedback capacitance at $f = 1 \, \text{MHz}$
$I_C = 50 \, \text{mA}; \, V_{CE} = 25 \, \text{V}$

Collector-flange capacitance

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{(BR)CES}$</td>
<td>$&gt; 65 , \text{V}$</td>
</tr>
<tr>
<td>$V_{(BR)CEO}$</td>
<td>$&gt; 33 , \text{V}$</td>
</tr>
<tr>
<td>$V_{(BR)EBO}$</td>
<td>$&gt; 4 , \text{V}$</td>
</tr>
<tr>
<td>$I_{CES}$</td>
<td>$&lt; 10 , \text{mA}$</td>
</tr>
<tr>
<td>$E_{SBO}$</td>
<td>$&gt; 12,5 , \text{mJ}$</td>
</tr>
<tr>
<td>$E_{SBR}$</td>
<td>$&gt; 12,5 , \text{mJ}$</td>
</tr>
<tr>
<td>$h_{FE}$</td>
<td>typ. 50</td>
</tr>
<tr>
<td></td>
<td>15 to 100</td>
</tr>
<tr>
<td>$V_{CEsat}$</td>
<td>typ. 0,75 , \text{V}</td>
</tr>
<tr>
<td>$f_T$</td>
<td>typ. 680 , \text{MHz}</td>
</tr>
<tr>
<td>$f_T$</td>
<td>typ. 750 , \text{MHz}</td>
</tr>
<tr>
<td>$C_c$</td>
<td>typ. 155 , \text{pF}</td>
</tr>
<tr>
<td>$C_{re}$</td>
<td>typ. 88 , \text{pF}</td>
</tr>
<tr>
<td>$C_{cf}$</td>
<td>typ. 3 , \text{pF}</td>
</tr>
</tbody>
</table>

* Measured under pulse conditions: $t_p \leq 300 \, \mu\text{s}; \, \delta \leq 0,02$.

** Measured under pulse conditions: $t_p \leq 50 \, \mu\text{s}; \, \delta \leq 0,01$. 

May 1981
Fig. 5 Typical values; $T_j = 25\, ^\circ\text{C}$.

Fig. 6 $I_E = I_C = 0$; $f = 1\, \text{MHz}$; $T_j = 25\, ^\circ\text{C}$.

Fig. 7 $V_{CE} = 25\, \text{V}$; $f = 100\, \text{MHz}$; $T_j = 25\, ^\circ\text{C}$.

Fig. 8 Typical values; $V_{CE} = 25\, \text{V}$.
APPLICATION INFORMATION

R.F. performance in v.h.f. class-A operation (linear power amplifier)

<table>
<thead>
<tr>
<th>$f_{vision}$ (MHz)</th>
<th>$V_{CE}$ (V)</th>
<th>$I_C$ (A)</th>
<th>$T_h$ (°C)</th>
<th>$I_m$ (dB)*</th>
<th>$P_{o sync}$ (W)*</th>
<th>$G_p$ (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>224.25</td>
<td>25</td>
<td>3.2</td>
<td>70</td>
<td>-55</td>
<td>&gt; 16</td>
<td>&gt; 13.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>70</td>
<td>-55</td>
<td>typ. 17.5</td>
<td>typ. 14.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>70</td>
<td>-52</td>
<td>typ. 22</td>
<td>typ. 14.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>25</td>
<td>-55</td>
<td>typ. 22</td>
<td>typ. 14.8</td>
</tr>
</tbody>
</table>

* Three-tone test method (vision carrier –8 dB, sound carrier –7 dB, sideband signal –16 dB), zero dB corresponds to peak sync level.

Fig. 9 Class-A test circuit at $f_{vision} = 224.25$ MHz.

List of components:

- C1 = C15 = 560 pF (500 V) multilayer ceramic chip capacitor (ATC ▲)
- C2 = C4 = C12 = C14 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 08002)
- C3 = 10 pF (500 V) multilayer ceramic chip capacitor (ATC ▲)
- C5 = 470 nF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 856 48474)
- C6 = C10 = 680 pF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 852 13681)
- C7 = C8 = 47 pF (500 V) multilayer ceramic chip capacitor (ATC ▲); placed 8 mm from transistor edge
- C9 = 330 nF polyester capacitor
- C11 = 68 pF (500 V) multilayer ceramic chip capacitor (ATC ▲)
- C13 = 6.8 μF/35 V solid tantalum capacitor
- L1 = 2 turns enamelled Cu wire (1.6 mm); int. dia. 5.0 mm; length 5.0 mm; leads 2 x 3 mm
- L2 = 1 μH microchoke (cat. no. 4322 057 01080)
- L3 = 30 Ω stripline (6.0 mm x 32.7 mm)
- L4 = 2 turns closely wound enamelled Cu wire (1.0 mm); int. dia. 5.0 mm; leads 2 x 10 mm
- L5 = 30 Ω stripline (6.0 mm x 24.0 mm)
- L6 = 2 turns enamelled Cu wire (1.6 mm); int. dia. 4.0 mm; length 4.5 mm; leads 2 x 3 mm
- L3 and L5 are striplines on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric ($\varepsilon_r \approx 4.5$); thickness 1/16".
- R1 = 10 Ω carbon resistor

Component layout and printed-circuit board for 224.25 MHz class-A test circuit are shown in Fig. 10.

▲ ATC means American Technical Ceramics.
Fig. 10 Component layout and printed-circuit board for 224.25 MHz class-A test circuit.

The circuit and the components are on one side of the epoxy fibre-glass board, the other side is unetched copper to serve as earth. Earth connections are made by hollow rivets. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.
Fig. 11 Intermodulation distortion \((d_{im})^*\) and power gain as a function of output power.

Fig. 12 Cross-modulation distortion \((d_{cm})^{**}\) as a function of output power.

Conditions for Figs 11 and 12:

Typical values; \(V_{CE} = 25\) V; \(I_C = 3.2\) A; \(T_h = 25\) °C; \(T_h = 70\) °C; \(f_{vision} = 224.25\) MHz.

Ruggedness in class-A operation

The BLV33F is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 30 W (r.m.s. value) or 40 W (P.E.P.) under the following conditions:

\(V_{CE} = 25\) V; \(I_C = 3.2\) A; \(T_h = 70\) °C; \(f = 224.25\) MHz; \(R_{th\ mb-h} = 0.2\) K/W.

---

* Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -16 dB), zero dB corresponds to peak sync level.
  Intermodulation distortion of input signal \(\leq -70\) dB.

** Two-tone test method (vision carrier 0 dB, sound carrier -7 dB), zero dB corresponds to peak sync level.
  Cross-modulation distortion \((d_{cm})\) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to -20 dB.
Fig. 13 Input impedance (series components).

Fig. 14 Load impedance (series components).

Fig. 15.

Conditions for Figs 13, 14 and 15:
Typical values; $V_{CE} = 25\,\text{V}$; $I_{C} = 3.2\,\text{A}$; class-A operation; $T_h = 70\,\text{°C}$.
APPLICATION INFORMATION

R.F. performance in v.h.f. class-AB operation (c.w.)

<table>
<thead>
<tr>
<th>$f_{\text{vision}}$ (MHz)</th>
<th>$V_{CE}$ (V)</th>
<th>$I_{C(ZS)}$ (A)</th>
<th>$T_h$ (°C)</th>
<th>$P_L$ (W)</th>
<th>$I_C$ (A)</th>
<th>$\eta$ (%)</th>
<th>$G_p$ (dB)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>224.25</td>
<td>28</td>
<td>0.2</td>
<td>70</td>
<td>40</td>
<td>typ. 2.75</td>
<td>typ. 52</td>
<td>typ. 11.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>85</td>
<td>typ. 4.25</td>
<td>typ. 71</td>
<td>typ. 10.5</td>
</tr>
</tbody>
</table>

* Gain compression point of 1 dB is at typical 85 W (minimum 75 W). Using a 3rd-order amplitude transfer characteristic, 1 dB compression corresponds with 30% sync input/25% sync output compression in television service (negative modulation, C.C.I.R. system).

List of components (component layout and p.c.b. class-AB test circuit see Fig. 17):

- C1 = C18 = 620 pF (100 V) multilayer ceramic chip capacitor (ATC▲)
- C2 = 27 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
- C3 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
- C4 = 30 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
- C5 = C14 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 08002)
- C6 = C10 = 470 nF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 856 48474)
- C7 = C15 = 680 pF (50 V) multilayer ceramic chip capacitor (2222 852 13681)
- C8 = C9 = 68 pF (500 V) multilayer ceramic chip capacitor (ATC▲); placed 6.4 mm from transistor edge
- C11 = C12 = 43 pF (500 V) multilayer ceramic chip capacitor (ATC▲); placed 10 mm from transistor edge
- C13 = 39 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
- C16 = 3.3 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
- C17 = 1.4 to 5.5 pF film dielectric trimmer (cat. no. 2222 809 09001)
- L1 = 2 turns enamelled Cu wire (1.6 mm); int. dia. 4.5 mm; length 4.0 mm; leads 2 x 4 mm
- L2 = 3 turns closely wound enamelled Cu wire (1.0 mm); int. dia. 5.0 mm; leads 2 x 7 mm
- L3 = 30 Ω stripline (6.0 mm x 47.8 mm)
- L4 = 2 turns closely wound enamelled Cu wire (1.0 mm); int. dia. 5.0 mm; leads 2 x 8 mm
- L5 = 30 Ω stripline (6.0 mm x 42.9 mm)
- L6 = 2 turns enamelled Cu wire (1.6 mm); int. dia. 4.0 mm; length 4.0 mm; leads 2 x 3 mm

L3 and L5 are striplines on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric ($\varepsilon_r \approx 4.5$); thickness 1/16".

R1 = 10 Ω carbon resistor

▲ ATC means American Technical Ceramics.
Fig. 17 Component layout and printed-circuit board for 224.25 MHz class-AB test circuit.

The circuit and the components are on one side of the epoxy fibre-glass board, the other side is unetched copper to serve as earth. Earth connections are made by hollow rivets. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.
Ruggedness in class-AB operation

The BLV33F is capable of withstanding a load mismatch (VSWR ≤ 2 through all phases) up to 60 W (r.m.s. value) and 85 W (P.E.P.) under the following conditions:

\[ V_{CE} = 28 \text{ V};\ T_h = 70 \text{ °C};\ f = 224,25 \text{ MHz};\ R_{th mb-h} = 0,2 \text{ K/W}. \]
Conditions for Figs 20, 21 and 22:
Typical values; $V_{CE} = 28$ V; $P_L = 80$ W (P.E.P.); class-AB operation; $T_h = 70$ °C.
V.H.F. LINEAR PUSH-PULL POWER TRANSISTOR

Two N-P-N silicon planar epitaxial transistor sections in one envelope to be used as a push-pull amplifier. This device is primarily intended for use in linear v.h.f. television transmitters and transposers (vision or sound amplifier).

Features:
- internally matched input for wideband operation and high power gain;
- internal midpoint (r.f. ground) reduces negative feedback and improves power gain;
- increased input and output impedance (compared with single-ended transistors) simplify wideband matching;
- length of external emitter leads is not critical;
- diffused emitter balancing resistors for an optimum temperature profile;
- gold metallization ensures excellent reliability.

The envelope is an 8-lead flange type with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance in push-pull amplifier

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$I_C(ZS)$ A</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$T_h$ °C</th>
<th>$G_P$ dB</th>
<th>$\eta_c$ %</th>
<th>gain compression dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.; class-AB</td>
<td>28</td>
<td>2 x 0,25</td>
<td>224,25</td>
<td>115</td>
<td>25</td>
<td>$\geq$ 11,0</td>
<td>$\geq$ 48</td>
<td>$\leq$ 1,0 *</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>typ. 13,0</td>
<td>typ. 55</td>
<td></td>
</tr>
</tbody>
</table>

* Assuming a 3rd order amplitude transfer characteristic, 1 dB gain compression corresponds with 30% sync input/25% sync output compression in television service (negative modulation, C.C.I.R. system).

MECHANICAL DATA

SOT-161 (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
MECHANICAL DATA
Fig. 1 SOT-161.

Dimensions in mm

Torque on screw: min. 0.60 Nm
max. 0.75 Nm

Recommended screw: cheese-head 4-40 UNC/2A
Heatsink compound must be sparingly applied and evenly distributed.
V.H.F. linear push-pull power transistor

RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (peak value);
(peak value); \( V_{BE} = 0 \)
open base

Emitter-base voltage (open collector)
Collector current per transistor section
d.c. or average
(peak value); \( f > 1 \text{ MHz} \)

Total d.c. power dissipation; \( T_{mb} = 25 \degree \text{C} \)
R.F. power dissipation
\( f > 1 \text{ MHz}; T_{mb} = 25 \degree \text{C} \)

Storage temperature
Operating junction temperature

THERMAL RESISTANCE
(dissipation = 180 W; \( T_{mb} = 25 \degree \text{C} \))*

From junction to mounting base
(d.c. dissipation)
From junction to mounting base
(r.f. dissipation)
From mounting base to heatsink

(1) Second breakdown limit.

Fig. 2 D.C. SOAR.
Conditions for Figs 2 and 3:
\( R_{th \, mb-h} = 0,25 \text{ K/W}; \) Total device*.

THERMAL RESISTANCE
(dissipation = 180 W; \( T_{mb} = 25 \degree \text{C} \)**

From junction to mounting base
(d.c. dissipation)
From junction to mounting base
(r.f. dissipation)
From mounting base to heatsink

* Dissipation of either transistor section shall not exceed half rated power.
** Both transistor sections equally loaded.
CHARACTERISTICS

Apply to either transistor section unless otherwise specified. $T_j = 25 \, ^\circ\text{C}$.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-emitter breakdown voltage</td>
<td></td>
</tr>
<tr>
<td>$V_{BE} = 0$; $I_C = 25 , \text{mA}$; open base; $I_C = 100 , \text{mA}$</td>
<td></td>
</tr>
<tr>
<td>Emitter-base breakdown voltage</td>
<td></td>
</tr>
<tr>
<td>$V_{BE} = 0$; $I_E = 10 , \text{mA}$; open collector</td>
<td></td>
</tr>
<tr>
<td>Collector cut-off current</td>
<td></td>
</tr>
<tr>
<td>$V_{BE} = 0$; $V_{CE} = 33 , \text{V}$</td>
<td></td>
</tr>
<tr>
<td>Second-breakdown energy</td>
<td></td>
</tr>
<tr>
<td>$L = 25 , \text{mH}; f = 50 , \text{Hz}$; $R_{BE} = 10 , \Omega$</td>
<td></td>
</tr>
<tr>
<td>D.C. current gain</td>
<td></td>
</tr>
<tr>
<td>$I_C = 3,5 , \text{A}; V_{CE} = 25 , \text{V}$</td>
<td></td>
</tr>
<tr>
<td>Transition frequency at $f = 100 , \text{MHz}^*$</td>
<td></td>
</tr>
<tr>
<td>$I_E = 3,3 , \text{A}; V_{CB} = 25 , \text{V}$</td>
<td></td>
</tr>
<tr>
<td>$I_E = 10 , \text{A}; V_{CB} = 25 , \text{V}$</td>
<td></td>
</tr>
<tr>
<td>Collector capacitance at $f = 1 , \text{MHz}$</td>
<td></td>
</tr>
<tr>
<td>$I_E = I_e = 0$; $V_{CB} = 25 , \text{V}$</td>
<td></td>
</tr>
<tr>
<td>Feedback capacitance at $f = 1 , \text{MHz}$</td>
<td></td>
</tr>
<tr>
<td>$I_C = 50 , \text{mA}; V_{CE} = 25 , \text{V}$</td>
<td></td>
</tr>
<tr>
<td>Collector-flange capacitance</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{(BR)CES}$</td>
<td>$&gt; 65 , \text{V}$</td>
</tr>
<tr>
<td>$V_{(BR)CEO}$</td>
<td>$&gt; 33 , \text{V}$</td>
</tr>
<tr>
<td>$V_{(BR)EBO}$</td>
<td>$&gt; 4 , \text{V}$</td>
</tr>
<tr>
<td>$I_{CES}$</td>
<td>$&lt; 10 , \text{mA}$</td>
</tr>
<tr>
<td>$E_{SBR}$</td>
<td>$&gt; 10 , \text{mJ}$</td>
</tr>
<tr>
<td>$h_{FE}$</td>
<td>typ. 45</td>
</tr>
<tr>
<td>$f_T$</td>
<td>typ. 575 MHz</td>
</tr>
<tr>
<td>$f_T$</td>
<td>typ. 600 MHz</td>
</tr>
<tr>
<td>$C_c$</td>
<td>typ. 155 pF</td>
</tr>
<tr>
<td>$C_{re}$</td>
<td>typ. 88 pF</td>
</tr>
<tr>
<td>$C_{cf}$</td>
<td>typ. 2 pF</td>
</tr>
</tbody>
</table>

* Measured under pulse conditions: $t_p \leq 300 \, \mu\text{s}; \delta \leq 0,02$. 

August 1983
V.H.F. linear push-pull power transistor

The above graphs apply to either transistor section.
APPLICATION INFORMATION

R.F. performance in v.h.f. class-AB operation (linear push-pull power amplifier) $V_{CE} = 28 \, \text{V}$; $T_H = 25 \, ^\circ\text{C}; f = 224.25\, \text{MHz}$

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$P_L$</th>
<th>$I_C(ZS)$</th>
<th>$G_p$</th>
<th>$\eta_C$</th>
<th>gain compression db</th>
</tr>
</thead>
<tbody>
<tr>
<td>class-AB; c.w.</td>
<td>115</td>
<td>2 x 0.15</td>
<td>$\geq 11.0$</td>
<td>$\geq 48$</td>
<td>$\leq 1.0^*$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>typ. 13.0</td>
<td>typ. 55</td>
<td>typ. 0.5*</td>
</tr>
</tbody>
</table>

* Assuming a 3rd order amplitude transfer characteristic, 1 dB gain compression corresponds with 30% sync input/25% sync output compression in television service (negative modulation, C.C.I.R. system).

![Fig. 8 Class-AB test circuit at 234.25 MHz.](image)

List of components:

C1 = C2 = C24 = C25 = 68 pF (500 V) multilayer ceramic chip capacitor.**
C3 = C11 = C26 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 08002).
C4 = 33 pF (500 V) multilayer ceramic chip capacitor.**
C5 = C8 = 4,7 µF (63 V) electrolytic capacitor.
C6 = C7 = C16 = C17 = 100 nF multilayer ceramic chip capacitor (cat. no. 2222 855 48104).
C9 = 2 x 47 pF (500 V) multilayer ceramic chip capacitors in parallel.**
C10 = C12 = C13 = C14 = 470 pF multilayer ceramic chip capacitor (cat. no. 2222 852 13471).
C15 = C18 = 10 µF (63 V) electrolytic capacitor.
C19 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 0003).
C20 = C22 = 3,3 pF (500 V) multilayer ceramic chip capacitor.**
C21 = parallel connection of 2 x 27 pF (500 V) ceramic chip capacitors.**
C23 = 5,6 pF (500 V) multilayer ceramic chip capacitor.**

(C9 and C11 are connected 11 mm from transistor edge and C19 and C21 18 mm from transistor edge.)

** American Technical Ceramics capacitor type 100A or capacitor of same quality.
L1 = L15 = 50 Ω stripline (2.8 mm × 91.3 mm).
L2 = L16 = 50 Ω semi-rigid cable; outer diameter 2.2 mm; outer conductor length 91.3 mm.
L3 = L4 = L13 = L14 = 60 Ω stripline (2.0 mm × 27.9 mm).
L5 = L8 = 100 nH microchoke.
L6 = L7 = L10 = L11 = 48 Ω stripline (3.0 mm × 14.6 mm).
L9 = L12 = 20.5 nH; 2 turns enamelled Cu wire (1.0 mm); int. dia. 4.5 mm; length 3 mm; leads leads 2 × 10 mm; connected 15 mm from transistor edge.
L1, L3, L4, L6, L7, L10, L11, L13, L14 and L15 are striplines on a double Cu-clad p.c. board with epoxy fibre-glass dielectric (εr = 4.5); thickness 1/16 inch.

The printed circuit board and component layout for a 224.25 MHz, class-AB test are given in Fig. 9 and Fig. 10 respectively.

The circuit and the components are on one side of the epoxy fibre-glass board; the other side is unetched copper to serve as ground plane. Earth connections are made by hollow rivets and in addition by fixing screws and also by copper straps under the emitters and at the input and output.
Fig. 9 Printed circuit board for 224, 25 MHz class-AB test circuit.
V.H.F. linear push-pull power transistor

Fig. 10 Component layout of a 224-25 MHz class AB test circuit.
Conditions for Figs 11 and 12:

\[ V_{CE} = 28 \, \text{V}; \quad I_{C(ZS)} = 2 \times 0.15 \, \text{A}; \quad f = 224.25 \, \text{MHz}; \quad \text{class-AB}. \]
RUGGEDNESS

The BLV36 is capable of continuously withstanding a load mismatch (VSWR = 5, through all phases) up to 80 W under the following conditions:

\[ V_{CE} = 28 \text{ V}; \, |I_C(ZS)| = 2 \times 0.15 \text{ A}; \, T_h = 25 \, ^\circ\text{C}; \, f = 224.25 \text{ MHz}; \, R_{th \, mb-h} = 0.25 \, \Omega/\text{W}. \]

The instantaneous collector current should not exceed 10 A.

Conditions for Figs 13, 14 and 15:
The graphs apply to either transistor section assuming class-AB push-pull operation

\[ V_{CE} = 28 \text{ V}; \, |I_C(ZS)| = 0.15 \text{ A}; \, P_L = 70 \text{ W}; \, T_h = 25 \, ^\circ\text{C}. \]
V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in mobile radio transmitters in the 175 MHz communications band.

Features
- multi-base structure and emitter-ballasting resistors for an optimum temperature profile
- gold metallization ensures excellent reliability
- internal matching to achieve an optimum wideband capability and high power gain

The transistor has a 6-lead flange envelope with a ceramic cap (SOT-119). All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25 \, ^\circ\text{C}$ in a common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$</th>
<th>$f$ (MHz)</th>
<th>$P_L$ (W)</th>
<th>$G_p$ (dB)</th>
<th>$\eta_C$ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12,5</td>
<td>175</td>
<td>45</td>
<td>$&gt;6,5$</td>
<td>$&gt;55$</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

SOT-119 (see Fig. 1)

PRODUCT SAFETY  This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
MECHANICAL DATA
Fig. 1 SOT-119.

Torque on screw:  
  min. 0.6 Nm  
  max. 0.75 Nm

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)
  peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current
  d.c. or average
  peak value; f > 1 MHz
Total power dissipation
  at T_{mb} = 25°C; f > 1 MHz
Storage temperature
Operating junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Maximum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-base voltage (open emitter) peak value</td>
<td>V_{CBOM}</td>
<td>36 V</td>
</tr>
<tr>
<td>Collector-emitter voltage (open base)</td>
<td>V_{CEO}</td>
<td>16.5 V</td>
</tr>
<tr>
<td>Emitter-base voltage (open collector)</td>
<td>V_{EBO}</td>
<td>4 V</td>
</tr>
<tr>
<td>Collector current d.c. or average peak value; f &gt; 1 MHz</td>
<td>I_{C}</td>
<td>9 A</td>
</tr>
<tr>
<td></td>
<td>I_{CM}</td>
<td>27 A</td>
</tr>
<tr>
<td>Total power dissipation</td>
<td>P_{tot}</td>
<td>90 W</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>T_{stg}</td>
<td>-65 to +150°C</td>
</tr>
<tr>
<td>Operating junction temperature</td>
<td>T_{j}</td>
<td>200°C</td>
</tr>
</tbody>
</table>

Fig. 2 D.C. soar. 
R_{th mb-h} = 0.2 K/W.

THERMAL RESISTANCE
Dissipation = 68 W; T_{mb} = 25°C
From junction to mounting base (r.f. operation)
From mounting base to heatsink

<table>
<thead>
<tr>
<th>Resistance</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>R_{th j-mb}</td>
<td>=</td>
<td>1.58 K/W</td>
</tr>
<tr>
<td>R_{th mb-h}</td>
<td>=</td>
<td>0.2 K/W</td>
</tr>
</tbody>
</table>

Fig. 3 Power/temperature derating curves; R_{th mb-h} = 0.2 K/W.
I Continuous operation (f > 1 MHz)
II Short-time operation during mismatch; (f > 1 MHz)
CHARACTERISTICS

$T_j = 25 \, ^\circ\text{C}$ unless otherwise specified

Collector-base breakdown voltage
open emitter; $I_C = 50 \, \text{mA}$

Collector-emitter breakdown voltage
open base; $I_C = 100 \, \text{mA}$

Emitter-base breakdown voltage
open collector; $I_E = 10 \, \text{mA}$

Collector cut-off current
$V_{BE} = 0; \, V_{CE} = 16 \, \text{V}$

Second breakdown energy
$L = 25 \, \text{mH}; \, f = 50 \, \text{Hz}; \, R_{BE} = 10 \, \Omega$

D.C. current gain
$V_{CE} = 10 \, \text{V}; \, I_C = 6 \, \text{A}$

Collector capacitance at $f = 1 \, \text{MHz}$
$I_E = i_e = 0; \, V_{CB} = 12.5 \, \text{V}$

Collector-flange capacitance

Feedback capacitance at $f = 1 \, \text{MHz}$
$I_C = 0; \, V_{CE} = 12.5 \, \text{V}$

- $V(BR)_{CBO} > 36 \, \text{V}$
- $V(BR)_{CEO} > 16.5 \, \text{V}$
- $V(BR)_{EBO} > 4 \, \text{V}$
- $I_{CES} < 22 \, \text{mA}$
- $E_{SBR} > 12.5 \, \text{mJ}$
- $h_{FE} > 15$ typ. $55$
- $C_C$ typ. $130 \, \text{pF}$
- $C_{cf}$ typ. $3 \, \text{pF}$
- $C_{re}$ typ. $80 \, \text{pF}$

![Fig. 4 D.C. current gain versus collector current; $T_j = 25 \, ^\circ\text{C}$](image)

![Fig. 5 Output capacitance versus $V_{CB}$; $I_E = i_e = 0; \, f = 1 \, \text{MHz}; \, T_j = 25 \, ^\circ\text{C}$](image)
APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter circuit; class-B)

f = 175 MHz; T_h = 25 °C; R_th mb-h = 0,2 K/W

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>V_CE V</th>
<th>P_L W</th>
<th>G_P dB</th>
<th>η_C %</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12,5</td>
<td>45</td>
<td>&gt; 6,5</td>
<td>&gt; 55</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>typ. 8,0</td>
<td>typ. 67</td>
</tr>
</tbody>
</table>

Fig. 6 Class-B test circuit at f = 175 MHz.

List of components:

C1 = C11 = C12 = 4 to 40 film dielectric trimmer (cat.no. 2222 809 07008)
C2 = C10 = 10 pF multilayer ceramic chip capacitor *
C3 = 2,5 to 20 pF film dielectric trimmer (cat.no. 2222 809 07004)
C4 = C5 = 91 pF multilayer ceramic chip capacitor *
C6 = 820 pF multilayer ceramic chip capacitor *
C7 = C8 = 2 x 4,7 pF multilayer ceramic chip capacitors* in parallel
C9 = 100 nF polyester capacitor
L1 = strip, 28 mm x 4 mm
L2 = 4 turns Cu wire (1,0 mm); int.dia. 4,0 mm; length 7,5 mm; leads 2 x 3,5 mm
L3 = strip, 22 mm x 6 mm
L4 = 1 turn Cu wire (0,8 mm); int.dia. 3,0 mm; leads 2 x 9 mm
L5 = L9 = Ferroxcube wideband h.f. choke, grade 3B (cat.no. 4312 020 36640)
L6 = strip, 12 mm x 6 mm
L7 = 2 turns enamelled Cu wire (1,6 mm); int.dia. 5,0 mm; length 7,0 mm; leads 2 x 5 mm
L8 = 2 turns enamelled Cu wire (1,6 mm); int.dia. 5,0 mm; length 7,0 mm; leads 2 x 3 mm
L10 = strip, 18 mm x 4 mm
L1, L3, L6 and L10 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16 inch.
R1 = 4,7 Ω ± 10%, carbon resistor

* American Technical Ceramics capacitor type 100B or capacitor of same quality.
Fig. 7 Printed circuit board and component lay-out for 175 MHz class-B test circuit.

The circuit and components are on one side of the epoxy fibre-glass board. The other side, except for the area indicated by the dotted line, is unetched copper serving as a ground plane.

If the p.c.b. is in direct contact with the heatsink, the heatsink area within the dotted line has to be raised at least 0.5 mm to minimize the dielectric losses.

Earth connections are made by hollow rivets and additionally by fixing screws and copper straps under the emitters to provide a direct contact between the copper of the component side and the ground plane.
V.H.F. power transistor

Fig. 8 Load power versus source power.

Condition for Figs 8 and 9:
Typical values; V_{CE} = 12.5 V; f = 175 MHz; T_{h} = 25 °C; R_{th mb-h} = 0.2 K/W.

Ruggedness in class-B operation
The BLV45/12 is capable of withstanding a load mismatch (VSWR = 20 through all phases) at rated load power up to a supply voltage of 15.5 V; T_{h} = 25 °C; R_{th mb-h} = 0.2 K/W.

Power slump
If T_{h} is increased from 25 °C to 70 °C the output power slump for constant P_{S} amounts to typ. 7% (V_{CE} = 12.5; f = 175 MHz; R_{th mb-h} = 0.2 K/W).
Fig. 10 Input impedance (series components).

Fig. 11 Load impedance (series components).

Conditions for Figs 10, 11 and 12:
Typical values; $V_{CE} = 12.5\, \text{V}$; $P_L = 45\, \text{W}$; $f = 50$ to $200\, \text{MHz}$; $R_{th\ mb-h} = 0.2\, \text{K/W}$.

Fig. 12 Power gain versus frequency.
U.H.F. LINEAR PUSH-PULL POWER TRANSISTOR

Two n-p-n silicon planar epitaxial transistor sections in one envelope to be used as push-pull amplifier, primarily intended for use in linear u.h.f. television transmitters and transposers.

Features:
- internally matched input for wideband operation and high power gain;
- internal midpoint (r.f. ground) reduces negative feedback and improves power gain;
- increased input and output impedances (compared with single-ended transistors) simplify wideband matching;
- length of the external emitter leads is not critical;
- diffused emitter ballasting resistors for an optimum temperature profile;
- gold metallization ensures excellent reliability.

The envelope is an 8-lead flange type with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance in linear amplifier

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>f_vision MHz</th>
<th>V_CE V</th>
<th>I_C1 = I_C2 A</th>
<th>I_C(ZS) A</th>
<th>T_IH °C</th>
<th>d_Imin* dB</th>
<th>P_o sync* W</th>
<th>P_L W</th>
<th>G_P dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>class-A</td>
<td>860</td>
<td>25</td>
<td>0,85</td>
<td>—</td>
<td>70</td>
<td>-60</td>
<td>&gt; 6</td>
<td>—</td>
<td>&gt; 8,0</td>
</tr>
<tr>
<td>class-AB</td>
<td>860</td>
<td>25</td>
<td>1,25</td>
<td>2 x 0,1</td>
<td>25</td>
<td>-</td>
<td>—</td>
<td></td>
<td>typ. 9,0</td>
</tr>
</tbody>
</table>

* Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -16 dB), zero dB corresponds to peak sync level.

** Power gain compression is 1 dB.

MECHANICAL DATA

SOT-161 (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
MECHANICAL DATA

Fig. 1 SOT-161.

Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

Dimensions in mm
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage
(peak value); \(V_{BE} = 0\)
open base

Emitter-base voltage (open collector)

Collector current per transistor section
d.c. or average
(peak value); \(f > 1\) MHz

Total power dissipation at \(T_{mb} = 25\,^\circ C\)^*
R.F. power dissipation \((f > 1\) MHz); \(T_{mb} = 25\,^\circ C\)^*

Storage temperature
Operating junction temperature

![Graph 2](image2.png)

**Graph 2.** D.C. SOAR.*

1. Continuous d.c. (including r.f. class-A) operation
2. Continuous r.f. operation

**THERMAL RESISTANCE** (dissipation = 42 W; \(T_{mb} = 80,5\,^\circ C\), i.e. \(T_h = 70\,^\circ C\))

From junction to mounting base (d.c. dissipation)

\[ R_{th\ j-mb(dc)} = 2.43\, K/W\]

From junction to mounting base (r.f. dissipation)

\[ R_{th\ j-mb(rf)} = 1.91\, K/W\]

From mounting base to heatsink

\[ R_{th\ mb-h} = 0.25\, K/W\]

* Dissipation of either transistor section should not exceed half rated dissipation.
Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\ mb-h} = 0.25\ \text{K/W}$.)

Example
Nominal class-A push-pull operation (without r.f. signal): $V_{CE} = 25\ \text{V}; l_{C1} = l_{C2} = 0.85\ \text{A}; T_h = 70\ \text{°C}$. Fig. 4 shows: $R_{th\ j-h}\ \text{max.}\ 2.68\ \text{K/W}$

$T_j\ \text{max.}\ 184\ \text{°C}$

Typical device: $R_{th\ j-h}\ \text{typ.}\ 2.28\ \text{K/W}$

$T_j\ \text{typ.}\ 167\ \text{°C}$
### U.H.F. linear push-pull power transistor

**CHARACTERISTICS** apply to either transistor section unless otherwise specified

\( T_j = 25 \, ^\circ\text{C} \)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-emitter breakdown voltage ( V_{BE} = 0; I_C = 10 , \text{mA} ) open base; ( I_C = 25 , \text{mA} )</td>
<td>( V_{(BR)CES} &gt; 50 , \text{V} ) ( V_{(BR)CEO} &gt; 27 , \text{V} )</td>
</tr>
<tr>
<td>Emitter-base breakdown voltage open collector; ( I_E = 5 , \text{mA} )</td>
<td>( V_{(BR)EBO} &gt; 3.5 , \text{V} )</td>
</tr>
<tr>
<td>Collector cut-off current ( V_{BE} = 0; V_{CE} = 27 , \text{V} )</td>
<td>( I_{CES} &lt; 10 , \text{mA} )</td>
</tr>
<tr>
<td>Second breakdown energy; ( L = 25 , \text{mH}; f = 50 , \text{Hz} ) open base ( R_{BE} = 10 , \Omega )</td>
<td>( E_{SBO} &gt; 2 , \text{mJ} ) ( E_{SBR} &gt; 2 , \text{mJ} )</td>
</tr>
<tr>
<td>D.C. current gain* ( I_C = 0.85 , \text{A}; V_{CE} = 25 , \text{V} )</td>
<td>( h_{FE} &gt; 15 ) typ. 40</td>
</tr>
<tr>
<td>D.C. current gain ratio of transistor sections ( I_C = 0.85 , \text{A}; V_{CE} = 25 , \text{V} )</td>
<td>0.67 to 1.5</td>
</tr>
<tr>
<td>Collector-emitter saturation voltage* ( I_C = 1.7 , \text{A}; I_B = 0.17 , \text{A} )</td>
<td>( V_{CE\text{sat}} ) typ. 0.75 \text{V}</td>
</tr>
<tr>
<td>Transition frequency at ( f = 100 , \text{MHz}^* )</td>
<td>( f_T ) typ. 2.5 \text{GHz} ( f_T ) typ. 2.5 \text{GHz}</td>
</tr>
<tr>
<td>Collector capacitance at ( f = 1 , \text{MHz} ) ( I_E = I_E = 0; V_{CB} = 25 , \text{V} )</td>
<td>( C_c ) typ. 24 \text{pF} &lt; 30 \text{pF}</td>
</tr>
<tr>
<td>Feedback capacitance at ( f = 1 , \text{MHz} ) ( I_C = 50 , \text{mA}; V_{CE} = 25 , \text{V} )</td>
<td>( C_{re} ) typ. 15 \text{pF} ( C_{cf} ) typ. 2 \text{pF}</td>
</tr>
</tbody>
</table>

* Measured under pulse conditions: \( t_p \leq 300 \, \mu\text{s}; \delta \leq 0.02 \).
** Measured under pulse conditions: \( t_p \leq 50 \, \mu\text{s}; \delta \leq 0.01 \).
The graphs apply to either transistor section.

**Fig. 5** Typical values; $V_{CE} = 25$ V.

**Fig. 6** Typical values; $T_j = 25$ °C.

**Fig. 7** $V_{CB} = 25$ V; $f = 500$ MHz; $T_j = 25$ °C.

**Fig. 8** $I_E = I_T = 0$; $f = 1$ MHz; $T_j = 25$ °C.
APPLICATION INFORMATION

R.F. performance in u.h.f. class-A operation (linear push-pull power amplifier)

<table>
<thead>
<tr>
<th>$f_{\text{vision}}$ (MHz)</th>
<th>$V_{CE}$ (V)</th>
<th>$I_{C1} = I_{C2}$ (A)</th>
<th>$T_h$ (°C)</th>
<th>$d_{im}^*$ (dB)</th>
<th>$P_{o,\text{sync}}^*$ (W)</th>
<th>$G_p$ (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>860</td>
<td>25</td>
<td>0.85</td>
<td>70</td>
<td>−60</td>
<td>&gt; 6</td>
<td>&gt; 8.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>70</td>
<td>−60</td>
<td>typ. 7.5</td>
<td>typ. 8.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>70</td>
<td>−55</td>
<td>typ. 10</td>
<td>typ. 8.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>25</td>
<td>−55</td>
<td>typ. 12</td>
<td>typ. 9.0</td>
</tr>
</tbody>
</table>

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

List of components:
- $C_1 = C_6 = C_{16} = 4.7 \mu F$ (500 V) multilayer ceramic chip capacitor (ATC®)
- $C_2 = C_3 = C_{20} = C_{21} = 33 \mu F$ multilayer ceramic chip capacitor (cat. no. 2222 851 13339)
- $C_4 = C_9 = C_{13} = C_{19} = 1.2$ to $3.5 \mu F$ film dielectric trimmer (cat. no. 2222 809 05001)
- $C_5 = C_7 = C_{15} = C_{17} = 100 \mu F$ multilayer ceramic chip capacitor (cat. no. 2222 852 59104)
- $C_{14} = C_{18} = 6.8 \mu F/40 V$ solid aluminium electrolytic capacitor
- $C_{22} = C_{23} = 1 \mu F$ (500 V) multilayer ceramic chip capacitor (ATC®)

$C_9$ and $C_{13}$ are placed 8.0 and 14.0 mm from transistor edge, respectively.

$\Delta$ ATC means American Technical Ceramics.
L1 = L2 = L13 = L14 = 50 Ω semi-rigid cable; outer diameter 2.2 mm; length 29.0 mm. These cables are soldered on 75 Ω striplines (1.1 mm x 28.0 mm). The centre conductors of the cables L1 and L13 are not connected.

L3 = L4 = 52 Ω stripline (2.0 mm x 16.5 mm)
L5 = L8 = 470 nH microchoke
L6 = L7 = 39 Ω stripline (3.1 mm x 8.0 mm)
L9 = L12 = 1 turn Cu wire (1.0 mm); int. dia. 5.5 mm; leads 2 x 3.5 mm
L10 = L11 = 39 Ω stripline (3.1 mm x 34.0 mm)

L3, L4, L6, L7, L10 and L11 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric ($\varepsilon_r = 2.74$); thickness 1/32".

R1 = 10 Ω carbon resistor

The circuit and the components are on one side of the PTFE fibre-glass board, the other side is unetched copper to serve as a ground-plane. Earth connections are made by means of bolts. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.
U.H.F. linear push-pull power transistor

Fig. 11 Intermodulation distortion ($d_{im}$)\(^*\) and power gain as a function of output power.

Fig. 12 Cross-modulation distortion ($d_{cm}$)\(^{**}\) as a function of output power.

Conditions for Figs 11 and 12:
Typical values; $V_{CE} = 25$ V; $I_C = 2 \times 0.85$ A; $T_h = 25$ °C; $T_h = 70$ °C; $f_{vision} = 860$ MHz.

Ruggedness in push-pull class-A operation
The BLV57 is capable of withstanding full load mismatch (VSWR = 50 through all phases) under the following conditions:
$V_{CE} = 25$ V; $I_C = 2 \times 0.85$ A; $T_h = 70$ °C; $P_{o\text{ sync}} \leq 12.5$ W; $f = 860$ MHz; $R_{th\text{ mb-h}} = 0.25$ K/W.
At any other composition of the output signal: $P_L$ (r.m.s. value) $\leq 5$ W.

\* Three-tone test method (vision carrier $-8$ dB, sound carrier $-7$ dB, sideband signal $-16$ dB), zero dB corresponds to peak sync level.
Intermodulation distortion of input signal $\leq -70$ dB.

\** Two-tone test method (vision carrier 0 dB, sound carrier $-7$ dB), zero dB corresponds to peak sync level.
Cross-modulation distortion ($d_{cm}$) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to $-20$ dB.
Conditions for Figs 20; 21 and 22:
The graphs apply to either transistor section assuming class-AB push-pull operation.
Typical values: \( V_{CE} = 25 \text{ V} \); \( I_C(ZS) = 0,1 \text{ A} \);
\( P_L = 17,5 \text{ W (P.E.P.)} \); \( T_h = 70 \text{ °C} \).
APPLICATION INFORMATION

R.F. performance in u.h.f. class-AB operation (c.w.)

<table>
<thead>
<tr>
<th>f_vision (MHz)</th>
<th>V_CE (V)</th>
<th>I_C(ZS) (A)</th>
<th>T_h (°C)</th>
<th>P_L (W)</th>
<th>I_C1 = I_C2 (A)</th>
<th>η (%)</th>
<th>G_p* (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>860</td>
<td>25</td>
<td>2 x 0,1</td>
<td>25</td>
<td>12,5</td>
<td>typ. 1,25</td>
<td>typ. 60</td>
<td>typ. 7,5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>38</td>
<td>typ. 6,5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>860</td>
<td>25</td>
<td>2 x 0,1</td>
<td>70</td>
<td>12,5</td>
<td>typ. 1,10</td>
<td>typ. 55</td>
<td>typ. 7,0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30</td>
<td>typ. 6,0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Typical values are based on 1 dB gain compression. Using a 3rd order amplitude transfer characteristic, 1 dB compression corresponds with 30% sync input/25% sync output compression in television service (negative modulation, C.C.I.R. system).

Fig. 16 Class-AB test circuit at f_vision = 860 MHz.

List of components:

- C1 = C6 = C15 = 4,7 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
- C2 = C3 = C18 = C19 = 33 pF multilayer ceramic chip capacitor (cat. no. 2222 851 13339)
- C4 = C9 = C13 = C17 = 1,2 to 3,5 pF film dielectric trimmer (cat. no. 2222 809 05001)
- C5 = C7 = C14 = C16 = 100 nF multilayer ceramic chip capacitor (cat. no. 2222 852 59104)
- C8 = C10 = C11 = C12 = 220 pF multilayer ceramic chip capacitor (cat. no. 2222 852 13221)
- C20 = C21 = 1 pF (500 V) multilayer ceramic chip capacitor (ATC▲)

C9 and C13 are placed 8,0 and 14,0 mm from transistor edge, respectively.

▲ ATC means American Technical Ceramics.
L1 = L2 = L13 = L14 = 50 Ω semi-rigid cable; outer diameter 2,2 mm; length 29,0 mm. These cables are soldered on 75 Ω striplines (1,1 mm x 28,0 mm). The centre conductors of the cables L1 and L13 are not connected.

L3 = L4 = 52 Ω stripline (2,0 mm x 16,5 mm)
L5 = L8 = 470 nH microchoke
L6 = L7 = 39 Ω stripline (3,1 mm x 8,0 mm)
L9 = L12 = 1 turn Cu wire (1,0 mm); int. dia. 5,5 mm; leads 2 x 3,5 mm
L10 = L11 = 39 Ω stripline (3,1 mm x 34,0 mm)

L3, L4, L6, L7, L10 and L11 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (\(\varepsilon_r = 2,74\)); thickness 1/32".

R1 = 10 Ω carbon resistor

Fig. 17 Component layout and printed-circuit board for 860 MHz class-AB test circuit.

The circuit and the components are on one side of the PTFE fibre-glass board, the other side is unetched copper to serve as a ground-plane. Earth connections are made by means of bolts. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.
The BLV57 is capable of withstanding a load mismatch (VSWR ≤ 2 through all phases) up to 30 W (r.m.s. value) or (VSWR ≤ 50 through all phases) up to 19 W under the following conditions:

\[ V_{CE} = 25 \text{ V}; \quad T_h = 70 \text{ °C}; \quad f = 860 \text{ MHz}; \quad R_{th \text{ mb-h}} = 0.25 \text{ K/W}. \]
Fig. 13 Input impedance (series components).

Fig. 14 Load impedance (series components).

Conditions for Figs 13, 14 and 15:
The graphs apply to either transistor section assuming class-A push-pull operation.
Typical values; $V_{CE} = 25$ V; $I_C = 0.85$ A; $T_h = 70$ °C.
U.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor in SOT-171 envelope primarily intended for use as linear amplifier in u.h.f. television transmitters.

Features:
- internal input matching to achieve an optimum wideband capability and high power gain
- emitter-ballasting resistors for lower junction temperatures.
- titanium-platinum-gold ensures long life and excellent reliability.

The transistor has a 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25\,^\circ\text{C}$ in common emitter class-AB circuit.

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_p$ dB</th>
<th>$\eta_C$ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>class AB; c.w.</td>
<td>25</td>
<td>860</td>
<td>30</td>
<td>min. 7,0</td>
<td>min. 50</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

SOT-171 (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

Dimensions in mm
MECHANICAL DATA

Fig. 1 SOT-171.

Torque on screw:
  - min. 0,6 Nm (6 kg.cm)
  - max. 0,75 Nm (7,5 kg.cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.
U.H.F. power transistor

BLV59

RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)  
Collector-emitter voltage (open base)  
Emitter-base voltage (open collector)  
Collector current  
  d.c. or average  
  (peak value); f > 1 MHz  
Total power dissipation  
at T_{mb} = 25 ^\circ C; f > 1 MHz  
Storage temperature  
Operating junction temperature

\begin{align*}
  V_{CBO} & \quad \text{max.} & 50 \text{ V} \\
  V_{CEO} & \quad \text{max.} & 27 \text{ V} \\
  V_{EBO} & \quad \text{max.} & 3.5 \text{ V} \\
  I_{C} & \quad \text{max.} & 3 \text{ A} \\
  I_{CM} & \quad \text{max.} & 9 \text{ A} \\
  P_{tot} & \quad \text{max.} & 70 \text{ W} \\
  T_{stg} & \quad & -65 \text{ to } +150 \text{ } ^\circ \text{C} \\
  T_{j} & \quad \text{max.} & 200 \text{ } ^\circ \text{C}
\end{align*}

Fig. 2  D.C. SOAR; R_{th \ mb-h} = 0.4 \text{ K/W}.

MAXIMUM THERMAL RESISTANCE
Dissipation = 50 W; T_{amb} = 25 \text{ } ^\circ \text{C}
From junction to mounting base  
From mounting base to heatsink

\begin{align*}
  R_{th \ j-mb} & \quad \text{max.} & 2.3 \text{ K/W} \\
  R_{th \ mb-h} & \quad \text{max.} & 0.4 \text{ K/W}
\end{align*}

Fig. 3  Power/temperature derating curves versus heatsink temperature.
I  Continuous operation (f > 1 MHz)  
II  Short-time operation during mismatch (f > 1 MHz)
CHARACTERISTICS

$T_j = 25 \, ^\circ C$ unless otherwise specified

Collector-base breakdown voltage
open emitter; $I_C = 50 \, mA$

Collector-emitter breakdown voltage
open base; $I_C = 100 \, mA$

Emitter-base breakdown voltage
open collector; $I_E = 10 \, mA$

Collector leakage current
$V_{BE} = 0; \, V_{CE} = 27 \, V$

Second breakdown energy
$L = 25 \, mH; \, f = 50 \, Hz; \, R_{BE} = 10 \, \Omega$

D.C. current gain
$V_{CE} = 20 \, V; \, I_C = 2 \, A$

Collector capacitance at $f = 1 \, MHz$
$I_E = i_e = 0; \, V_{CB} = 25 \, V$

Feedback capacitance at $f = 1 \, MHz$
$I_C = 0; \, V_{CE} = 25 \, V$

Collector-flange capacitance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{(BR)CBO}$</td>
<td>min. 50 V</td>
</tr>
<tr>
<td>$V_{(BR)CEO}$</td>
<td>min. 27 V</td>
</tr>
<tr>
<td>$V_{(BR)EBO}$</td>
<td>min. 3.5 V</td>
</tr>
<tr>
<td>$I_{CES}$</td>
<td>max. 10 mA</td>
</tr>
<tr>
<td>$E_{SBR}$</td>
<td>min. 4 mJ</td>
</tr>
<tr>
<td>$h_{FE}$</td>
<td>min. 15</td>
</tr>
<tr>
<td>$C_C$</td>
<td>typ. 44 pF</td>
</tr>
<tr>
<td>$C_{re}$</td>
<td>typ. 30 pF</td>
</tr>
<tr>
<td>$C_{cf}$</td>
<td>typ. 2 pF</td>
</tr>
</tbody>
</table>

Fig. 4 D.C. current gain versus collector current; $T_j = 25 \, ^\circ C$.

Fig. 5 Output capacitance versus $V_{CB}$; $I_E = i_e = 0; \, f = 1 \, MHz$. 
APPLICATION INFORMATION

R.F. performance up to $T_h = 25 \, ^\circ\text{C}$ in common emitter class-AB circuit (c.w.); $R_{th \, mb-h} = 0.4 \, \text{K/W}$

<table>
<thead>
<tr>
<th>$f$ (MHz)</th>
<th>$V_{CE}$ (V)</th>
<th>$I_{C(ZS)}$ (mA)</th>
<th>$G_p$ (dB)</th>
<th>$P_L$ (W)</th>
<th>$\eta$ (%)</th>
<th>$\Delta G_p$ (dB)$^\Delta$</th>
</tr>
</thead>
<tbody>
<tr>
<td>880</td>
<td>25</td>
<td>60</td>
<td>min. 7,0</td>
<td>30</td>
<td>min. 50</td>
<td>max. 1,0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>typ. 8,5</td>
<td></td>
<td>typ. 55</td>
<td>typ. 0,2</td>
</tr>
</tbody>
</table>

$^\Delta$ Assuming a 3rd-order amplitude transfer characteristic, 1 dB gain compression corresponds with 30% sync input/25% sync output compression in television service (negative modulation, C.C.I.R. system).

Fig. 6 Class-AB test circuit at $f = 860$ MHz.

List of components:

- $C_1 = C_{18} = 33 \, \text{pF}$ multilayer ceramic chip capacitor*$^*$
- $C_2 = C_{14} = C_{16} = 3,6 \, \text{pF}$ multilayer ceramic chip capacitor*$^*$
- $C_3 = C_4 = C_{15} = C_{17} = 1,4 \, - \, 5,5 \, \text{pF}$ film dielectric trimmer (cat. no. 2222 809 09001)
- $C_5 = C_6 = 1,8 \, \text{pF}$ multilayer ceramic chip capacitor*$^*$
- $C_7 = C_8 = 6,2 \, \text{pF}$ multilayer ceramic chip capacitor*$^*$
- $C_9 = C_{21} = 330 \, \text{pF}$ multilayer ceramic chip capacitor*$^*$
- $C_{10} = C_{11} = 5,6 \, \text{pF}$ multilayer ceramic chip capacitor*$^*$
- $C_{12} = 5,6 \, \text{pF}$ multilayer ceramic chip capacitor*$^*$
- $C_{13} = 6,2 \, \text{pF}$ multilayer ceramic chip capacitor*$^*$
- $C_{19} = 10 \, \text{pF}$ multilayer ceramic chip capacitor*$^*$
- $C_{20} = 6,8 \, \mu\text{F}$ (63 V) electrolytic capacitor
- $L_1 = L_{11} = 50 \, \Omega$ stripline (26 mm x 2,4 mm)
- $L_2 = L_3 = 50 \, \Omega$ stripline (9,5 mm x 2,4 mm)
- $L_4 = 42,6 \, \Omega$ stripline (6,0 mm x 3,0 mm)
- $L_5 = 60 \, \text{nH}; 4$ turns closely wound enamelled Cu-wire (0,4 mm) int. dia. 3 mm; leads 2 x 5 mm
- $L_6 = 42,6 \, \Omega$ stripline (4,0 mm x 3,0 mm)
- $L_7 = 45 \, \text{nH}; 4$ closely wound enamelled Cu-wire (1 mm); int. dia. 4 mm; leads 2 x 5 mm
- $L_8 = \text{Ferroxcube h.f. choke, grade 3B (cat. no.} \, 4312 \, 020 \, 36642)$
- $L_9 = 50 \, \Omega$ stripline (9,0 mm x 2,4 mm)
- $L_{10} = 50 \, \Omega$ stripline (13,5 mm x 2,4 mm)
- $R_1 = 10 \, \Omega \pm 5\%$, 1 W metal film resistor

* Assuming a 3rd-order amplitude transfer characteristic, 1 dB gain compression corresponds with 30% sync input/25% sync output compression in television service (negative modulation, C.C.I.R. system).
The striplines are on a double Cu-clad printed circuit board with a P.T.F.E. fibre-glass dielectric ($\varepsilon_r = 2.2$); thickness 1/32 inch.

* American Technical Ceramics type 100B or capacitor of the same quality.
** American Technical Ceramics type 100A or capacitor of the same quality.
Fig. 7 Printed circuit board and component layout for 860 MHz class-AB test circuit.

The circuit and the components are on one side of the PTFE fibre-glass board; the other side is unetched copper serving as a ground plane. Earth connections are made by fixing screws, hollow rivets and copper straps around the board and under the bases to provide a direct contact between the copper on the component side and the ground plane.
RUGGEDNESS
The BLV59 is capable of withstanding load mismatch (VSWR = 10 through all phases) at rated load power under the following conditions: $V_{CE} = 25$ V; $f = 860$ MHz; $I_{C(ZS)} = 60$ mA; $T_h = 25$ °C; $R_{th mb-h} = 0.4$ K/W; class·AB operation.
Fig. 10 Input impedance (series components).

Fig. 11 Load impedance (series components).

Conditions for Figs 10, 11 and 12
Typical values; \( V_{CE} = 25 \text{ V;} \) \( P_L = 30 \text{ W;} \) \( f = 470 \text{ to } 860 \text{ MHz;} \) \( T_h = 25 \text{ °C;} \)
\( R_{th \ mb-h} = 0.4 \text{ K/W;} \) \( I_{C(ZS)} = 60 \text{ mA; class-AB operation.} \)

Fig. 12 Power gain versus frequency.
V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in mobile radio transmitters in the 175 MHz communications band.

Features
- multi-base structure and emitter-ballasting resistors for an optimum temperature profile
- gold metallization ensures excellent reliability
- internal matching to achieve an optimum wideband capability and high power gain

The transistor has a 6-lead flange envelope with a ceramic cap (SOT-119). All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25 \degree C$ in a common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_p$ dB</th>
<th>$\eta_C$ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12,5</td>
<td>175</td>
<td>75</td>
<td>&gt; 6,5</td>
<td>&gt; 55</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-119 (see Fig. 1)

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
MECHANICAL DATA

Fig. 1 SOT-119.

Torque on screw:  
min. 0.6 Nm (6 kg.cm)  
max. 0.75 Nm (7.5 kg.cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)
peak value

Collector-emitter voltage (open base)

Emitter-base voltage (open collector)

Collector current
d.c. or average
peak value; \( f > 1 \text{ MHz} \)

Total power dissipation
at \( T_{mb} = 25 \degree \text{C}; f > 1 \text{ MHz} \)

Storage temperature

Operating junction temperature

---

**Fig. 2** D.C. soar.
\[ R_{th \text{ mb-h}} = 0.2 \text{ K/W}. \]

---

**Fig. 3** Power/temperature derating curves; \( R_{th \text{ mb-h}} = 0.2 \text{ K/W}. \)
I Continuous operation \( (f > 1 \text{ MHz}) \)
II Short-time operation during mismatch; \( (f > 1 \text{ MHz}) \).

---

THERMAL RESISTANCE

Dissipation = 96 W; \( T_{mb} = 25 \degree \text{C} \)

From junction to mounting base
(r.f. operation)

From mounting base to heatsink

\[
R_{th \text{ j-mb}} = 1.05 \text{ K/W}
\]

\[
R_{th \text{ mb-h}} = 0.2 \text{ K/W}
\]

---
CHARACTERISTICS

$T_j = 25 \, ^\circ\text{C}$ unless otherwise specified

Collector-base breakdown voltage
open emitter; $I_C = 100 \, \text{mA}$

Collector-emitter breakdown voltage
open base; $I_C = 200 \, \text{mA}$

Emitter-base breakdown voltage
open collector; $I_E = 20 \, \text{mA}$

Collector cut-off current
$V_{BE} = 0; \quad V_{CE} = 16 \, \text{V}$

Second breakdown energy
$L = 25 \, \text{mH}; \quad f = 50 \, \text{Hz}; \quad R_{BE} = 10 \, \Omega$

D.C. current gain
$V_{CE} = 10 \, \text{V}; \quad I_C = 10 \, \text{A}$

Collector capacitance at $f = 1 \, \text{MHz}$
$I_E = I_e = 0; \quad V_{CB} = 12.5 \, \text{V}$

Feedback capacitance at $f = 1 \, \text{MHz}$
$I_C = 0; \quad V_{CE} = 12.5 \, \text{V}$

Collector-flange capacitance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V(BR)_{CBO}$</td>
<td></td>
<td>min. 36 V</td>
</tr>
<tr>
<td>$V(BR)_{CEO}$</td>
<td></td>
<td>min. 16.5 V</td>
</tr>
<tr>
<td>$V(BR)_{EBO}$</td>
<td></td>
<td>min. 4 V</td>
</tr>
<tr>
<td>$I_{CES}$</td>
<td></td>
<td>max. 44 mA</td>
</tr>
<tr>
<td>$E_{SBR}$</td>
<td></td>
<td>min. 20 mJ</td>
</tr>
<tr>
<td>$h_{FE}$</td>
<td></td>
<td>min. 15 typ. 55</td>
</tr>
<tr>
<td>$C_c$</td>
<td></td>
<td>typ. 240 pF</td>
</tr>
<tr>
<td>$C_{re}$</td>
<td></td>
<td>typ. 150 pF</td>
</tr>
<tr>
<td>$C_{cf}$</td>
<td></td>
<td>typ. 3 pF</td>
</tr>
</tbody>
</table>

Fig. 4 D.C. current gain versus collector current; $T_j = 25 \, ^\circ\text{C}$.

Fig. 5 Output capacitance versus $V_{CB}$; $I_E = I_e = 0; \quad f = 1 \, \text{MHz}; \quad T_j = 25 \, ^\circ\text{C}$. 
APPLICATION

R.F. performance in c.w. operation (common-emitter circuit; class-B)
f = 175 MHz; T_H = 25 °C; R_{th mb-h} = 0.2 K/W

| mode of operation | V_{CE} (V) | P_L (W) | G_P (dB) | \( \eta_C \) (%)
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12.5</td>
<td>75</td>
<td>&gt; 6.5</td>
<td>&gt; 55</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>typ. 7.5</td>
<td>typ. 63</td>
</tr>
</tbody>
</table>

Fig. 6 Class-B test circuit at f = 175 MHz.

List of components:

- C1 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
- C2 = 10 pF multilayer ceramic chip capacitor*
- C3 = C16 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
- C4 = C5 = 75 pF multilayer ceramic chip capacitor
- C6 = C7 = 100 pF multilayer ceramic chip capacitor*
- C8 = C9 = 2 x 75 pF multilayer ceramic chip capacitors* in parallel
- C10 = C13 = 39 pF multilayer ceramic chip capacitor*
- C11 = 2.5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
- C12 = 2 x 820 pF multilayer ceramic chip capacitors in parallel*
- C14 = 100 nF polyester capacitor
- C15 = C17 = 12 pF multilayer ceramic chip capacitor*
- C18 = C19 = 470 pF multilayer ceramic chip capacitor*
- C20 = 820 pF multilayer ceramic chip capacitor*

* American Technical Ceramics capacitor type 100B or capacitor of the same quality.
L1 = 1 turn silver-plated Cu-wire (2,0 mm); int. dia. 10 mm; leads 2 x 4 mm
L2 = 1 turn silver-plated Cu-wire (2,0 mm); int. dia. 1 mm; leads 2 x 6 mm
L3 = strip (14 mm x 6 mm)
L4 = strip (8 mm x 6 mm)
L5 = 100 nH, 7 turns closely wound enamelled Cu-wire (0,5 mm); int. dia. 3 mm; leads 2 x 7 mm
L6 = Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36640)
L7 = strip (12 mm x 6 mm)
L8 = silver-plated copper U-shaped inductance (7 + 15 + 7) mm x 4 mm x 0,5 mm
L9 = silver-plated copper U-shaped inductance (8 + 8,5 + 6) mm x 4 mm x 0,5 mm
L10 = modified Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36640) with
  3 parallel connected Cu wires (0,8 mm)
L11 = 2 turns silver-plated Cu-wire (2,0 mm); int. dia. 9 mm; length 7,5 mm; leads 2 x 3,5 mm
L3, L4 and L7 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass
  dielectric, ($e_r = 4,5$) thickness 1/16 inch).
R1 = 10 $\Omega \pm 10\%$, carbon resistor
R2 = 4,7 $\Omega \pm 10\%$, carbon resistor
Fig. 7 Printed circuit board and component lay-out for 175 MHz class-B test circuit.

The circuit and components are on one side of the epoxy fibre-glass board. The other side, except for the area indicated by the dotted line, is unetched copper serving as a ground plane. If the p.c.b. is in direct contact with the heatsink, the heatsink area within the dotted line has to be raised at least 0.5 mm to minimize the dielectric losses. Earth connections are made by hollow rivets and additionally by fixing screws and copper straps under the emitters to provide a direct contact between the copper of the component side and the ground plane.
Fig. 8 Load power versus source power.

Fig. 9 Power gain and efficiency versus load power.

Condition for Figs 8 and 9:
Typical values; $V_{CE} = 12.5\, V$; $f = 175\, MHz$; $T_h = 25\, ^\circ C$; $R_{th\, mb-h} = 0.2\, K/W$.

Ruggedness in class-B operation
The BLV75/12 is capable of withstanding a load mismatch ($VSWR = 20$ through all phases) at rated load power up to a supply voltage of $12.5\, V$; $T_h = 25\, ^\circ C$; $R_{th\, mb-h} = 0.2\, K/W$.

Power slump
If $T_h$ is increased from $25\, ^\circ C$ to $70\, ^\circ C$ the output power slump for constant $P_S$ amounts to typ. 7\% ($V_{CE} = 12.5; f = 175\, MHz; R_{th \, mb-h} = 0.2\, K/W$).
V.H.F. power transistor

Fig. 10 Input impedance (series components).

Fig. 11 Load impedance (series components).

Conditions for Figs 10, 11 and 12:
Typical values: $V_{CE} = 12.5 \text{ V}; P_L = 75 \text{ W}; f = 50 \text{ to } 200 \text{ MHz}; \text{class-B operation}; R_{th mb-h} = 0.2 \text{ K/W}.$

Fig. 12 Power gain versus frequency.
V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in base stations in the v.h.f. mobile radio band.

Features:
- multi-base structure and diffused emitter ballasting resistors for an optimum temperature profile;
- gold metallization ensures excellent reliability.

The transistor has a 1/2 in. 4-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance at $T_h = 25\, ^\circ C$ in a common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$P_S$ W</th>
<th>$G_p$ dB</th>
<th>$\eta$ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>28</td>
<td>175</td>
<td>80</td>
<td>&lt; 17.9</td>
<td>&gt; 6.5</td>
<td>&gt; 70</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

SOT-121 (see Fig. 1)

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
MECHANICAL DATA
Fig. 1 SOT-121.

Torque on screw: min. 0.60 Nm (6.0 kg cm)
max. 0.75 Nm (7.5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.
V.H.F. power transistor

BLV80/28

RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (peak-value);
\[ V_{BE} = 0 \]
open base

Emitter-base voltage (open collector)

Collector current
d.c. or average
(peak value); \( f > 1 \) MHz

Total power dissipation at \( T_{mb} = 25 \, ^\circ C \)

R.F. power dissipation
\( f > 1 \) MHz; \( T_{mb} = 25 \, ^\circ C \)
\( f > 1 \) MHz; \( T_h = 70 \, ^\circ C \)

Storage temperature

Operating junction temperature

---

\[ V_{CESM} \] max. 65 V
\[ V_{CEO} \] max. 33 V
\[ V_{EBO} \] max. 4 V

\[ I_C; I_C(AV) \] max. 8,5 A
\[ I_{CM} \] max. 17,5 A

\[ P_{tot} \] max. 116 W
\[ P_{rf} \] max. 144 W
\[ P_{rf} \] max. 80 W

\[ T_{stg} \] \(-65 \) to \(+150 \, ^\circ C \)

\[ T_j \] max. 200 \, ^\circ C

---

Fig. 2 D.C. SOAR.

---

(1) Second breakdown limit.

---

THERMAL RESISTANCE (dissipation = 90 W; \( T_{mb} = 60 \, ^\circ C \), i.e. \( T_h = 33 \, ^\circ C \))

From junction to mounting base
(d.c. dissipation)

From junction to mounting base
(r.f. dissipation)

From mounting base to heatsink

\[ R_{th \, j-mb\,(dc)} = 1,50 \, K/W \]

\[ R_{th \, j-mb\,(rf)} = 1,30 \, K/W \]

\[ R_{th \, mb-h} = 0,3 \, K/W \]

---

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### CHARACTERISTICS

**T<sub>j</sub> = 25 °C**

#### Collector-emitter breakdown voltage

- Open base: \( V_{BE} = 0 \); \( I_C = 25 \) mA
- \( V_{BR}CES > 65 \) V

#### Emitter-base breakdown voltage

- Open collector: \( I_E = 10 \) mA
- \( V_{BR}CEO > 33 \) V

#### Collector cut-off current

- Open base: \( V_{BE} = 0 \); \( V_{CE} = 33 \) V
- \( I_{CES} < 10 \) mA

#### Second breakdown energy

- \( R_{BE} = 10 \) Ω
- \( L = 25 \) mH; \( f = 50 \) Hz
- \( E_{SO} > 10 \) mJ
- \( E_{SBR} > 10 \) mJ

#### D.C. current gain

- \( I_C = 3,5 \) A; \( V_{CE} = 25 \) V
- \( h_{FE} \) typ. 45
- 15 to 100

#### Collector-emitter saturation voltage

- \( I_C = 10 \) A; \( I_B = 2 \) A
- \( V_{CEsat} \) typ. 1,6 V

#### Transition frequency at \( f = 100 \) MHz

- \( I_E = 3,5 \) A; \( V_{CB} = 25 \) V
- \( f_T \) typ. 575 MHz
- \( I_E = 10 \) A; \( V_{CB} = 25 \) V
- \( f_T \) typ. 600 MHz

#### Collector capacitance at \( f = 1 \) MHz

- \( I_E = I_e = 0 \); \( V_{CB} = 25 \) V
- \( C_C \) typ. 155 pF

#### Feedback capacitance at \( f = 1 \) MHz

- \( I_C = 50 \) mA; \( V_{CE} = 25 \) V
- \( C_{re} \) typ. 88 pF
- \( C_{cf} \) typ. 4,5 pF

---

* Measured under pulse conditions: \( t_p > 300 \) µs; \( \delta < 0,02 \).
Fig. 4  $V_{CE} = 25$ V; $T_j = 25$ °C.

Fig. 5  $V_{CB} = 25$ V; $f = 100$ MHz; $T_j = 25$ °C.

Fig. 6  $I_E = I_e = 0$; $f = 1$ MHz; $T_j = 25$ °C.
APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter class-B circuit)

f = 175 MHz; T_h = 25 °C

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>( V_{CE} ) V</th>
<th>( P_L ) W</th>
<th>( P_S ) W</th>
<th>( G_p ) dB</th>
<th>( I_C ) A</th>
<th>( \eta ) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>28</td>
<td>80</td>
<td>&lt; 17,9</td>
<td>&gt; 6,5</td>
<td>&lt; 4,1</td>
<td>&gt; 70</td>
</tr>
<tr>
<td></td>
<td>typ. 16,0</td>
<td>typ. 7,0</td>
<td>typ. 3,8</td>
<td>typ. 75</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 7 Class-B test circuit at f = 175 MHz.

List of components:

- \( C_1 = C_{12} = C_{14} = \) 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
- \( C_2 = 30 \) pF (500 V) multilayer ceramic chip capacitor*
- \( C_3 = 5 \) to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
- \( C_4 = C_5 = 56 \) pF (500 V) multilayer ceramic chip capacitor*
- \( C_6 = 100 \) nF (50 V) multilayer ceramic chip capacitor
- \( C_7 = C_8 = 220 \) pF (50 V) multilayer ceramic chip capacitor
- \( C_9 = C_{10} = 10 \) pF (500 V) multilayer ceramic chip capacitor*
- \( C_{11} = 24 \) pF (500 V) multilayer ceramic chip capacitor*
- \( C_{13} = 13 \) pF (500 V) multilayer ceramic chip capacitor*
- \( L_1 = \) Cu wire (1,8 mm); length 15 mm
- \( L_2 = 100 \) nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 7 mm
- \( L_3 = \) strip (15 mm x 8 mm); taps for \( C_4 \) and \( C_5 \) at 7 mm from transistor edge
- \( L_4 = L_7 = \) Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- \( L_5 = 1 \) turn Cu wire (1,8 mm); int. dia. 9 mm; leads 2 x 10 mm
- \( L_6 = 1/2 \) turn Cu wire (1,8 mm); int. dia. 13 mm; leads 2 x 5 mm
- \( L_3 \) is a strip on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16 in.
- \( R_1 = R_2 = 10 \) Ω (± 10%) carbon resistor (0,25 W)

* American Technical Ceramics capacitors or capacitors of same quality.
Fig. 8 Component layout and printed-circuit board for 175 MHz.

The circuit and the components are on one side of the epoxy fibre-glass board, the other side is unetched copper to serve as ground-plane. Earth connections are made by hollow rivets and additionally by fixing screws and copper straps at the input and output to provide direct contact between the copper on the component side and the ground-plane.

To minimize the dielectric losses, the ground-plane under the interconnections of L6, C9, C10, C11 and C12 has been removed.
Fig. 9 Load power as a function of source power.

Fig. 10 Power gain and efficiency as a function of load power.

Conditions for Figs 9 and 10:
Test circuit tuned for each power level; typical values; $V_{CE} = 28$ V; $f = 175$ MHz; $T_h = 25$ °C; class-B operation.

Fig. 11 R.F. SOAR at $V_{CE} = 28$ V.

- $f > 1$ MHz (continuous);
- short time operation during mismatch ($f > 1$ MHz).
Fig. 12 Input impedance (series components).

Fig. 13 Load impedance (series components).

Fig. 14 Power gain as a function of frequency.

Conditions for Figs 12, 13 and 14:
Typical values; $V_{CE} = 28\, V; P_L = 80\, W; T_H = 25\, ^\circ C; \text{class-B operation.}$

OPERATING NOTE for Figs 12, 13 and 14:
Below 50 MHz a base-emitter resistor of 4,7 $\Omega$ is recommended to avoid oscillation. This resistor must be effective for r.f. only.
N-P-N silicon planar epitaxial transistor designed for use in mobile radio transmitters in the 900 MHz band.

Features:
- diffused emitter-ballasting resistors for an optimum temperature profile
- gold metallization ensures excellent reliability.

The transistor has a 4-lead stud envelope with a ceramic cap (SOT-172). All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance at $T_h = 25$ °C in a common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$</th>
<th>$f$</th>
<th>$P_L$</th>
<th>$G_P$</th>
<th>$\eta/C$</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12,5</td>
<td>900</td>
<td>1</td>
<td>&gt; 7,5</td>
<td>&gt; 50</td>
</tr>
<tr>
<td></td>
<td>9,6</td>
<td>900</td>
<td>0,75</td>
<td>typ. 7,9</td>
<td>typ. 61</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Dimensions in mm

Torque on nut: min. 0,75 Nm
(7,5 kg.cm)
max. 0,85 Nm
(8,5 kg.cm)

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current
d.c. or average (peak value); f > 1 MHz
D.C. power dissipation
at Tmb = 115 °C
R.F. power dissipation
f > 1 MHz; Tmb = 105 °C
Storage temperature
Operating junction temperature

\[
\begin{align*}
V_{CBO} & \quad \text{max.} \quad 36 \, \text{V} \\
V_{CEO} & \quad \text{max.} \quad 16 \, \text{V} \\
V_{EBO} & \quad \text{max.} \quad 3 \, \text{V} \\
I_C; I_C(AV) & \quad \text{max.} \quad 0,2 \, \text{A} \\
I_{CM} & \quad \text{max.} \quad 0,6 \, \text{A} \\
P_{\text{tot}(dc)} & \quad \text{max.} \quad 2,25 \, \text{W} \\
P_{\text{tot}(rf)} & \quad \text{max.} \quad 3,5 \, \text{W} \\
T_{stg} & \quad -65 \, \text{to} \, +150 \, \text{°C} \\
T_j & \quad \text{max.} \quad 200 \, \text{°C} \\
\end{align*}
\]

THERMAL RESISTANCE
Dissipation = 2,25 W; Tmb = 25 °C.
From junction to mounting base
(d.c. dissipation)
(r.f. dissipation)
From mounting base to heatsink

\[
\begin{align*}
R_{th \, j-mb(\text{d.c.})} & \quad \text{max.} \quad 25 \, \text{K/} \text{W} \\
R_{th \, j-mb(\text{r.f.})} & \quad \text{max.} \quad 19 \, \text{K/} \text{W} \\
R_{th \, mb-h} & \quad \text{max.} \quad 0,8 \, \text{K/} \text{W} \\
\end{align*}
\]

Fig. 2 D.C. SOAR.

Fig. 3 Power/temperature derating curves.
I Continuous d.c. operation
II Continuous r.f. operation (f > 1 MHz)
III Short-time r.f. operation during mismatch (f > 1 MHz)
CHARACTERISTICS

$T_j = 25 \, ^\circ C$ unless otherwise specified

Collector-base breakdown voltage, open emitter; $I_C = 2,5 \, mA$

Collector-emitter breakdown voltage, open base; $I_C = 10 \, mA$

Emitter-base breakdown voltage, open collector; $I_E = 0,5 \, mA$

Collector cut-off current, $V_{BE} = 0; V_{CE} = 16 \, V$

Second breakdown energy, $L = 25 \, mH; f = 50 \, Hz; R_{BE} = 10 \, \Omega$

D.C. current gain, $I_C = 0,15 \, A; V_{CE} = 10 \, V$

Transition frequency at $f = 500 \, MHz^*; -I_E = 0,15 \, A; V_{CB} = 12,5 \, V$

$-I_E = 0,5 \, A; V_{CB} = 12,5 \, V$

Collector capacitance at $f = 1 \, MHz, I_E = i_e = 0; V_{CB} = 12,5 \, V$

Feedback capacitance at $f = 1 \, MHz, I_C = 0; V_{CE} = 12,5 \, V$

Collector-stud capacitance

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{(BR)CBO}$</td>
<td>$&gt; 36 , V$</td>
</tr>
<tr>
<td>$V_{(BR)CEO}$</td>
<td>$&gt; 16 , V$</td>
</tr>
<tr>
<td>$V_{(BR)EBO}$</td>
<td>$&gt; 3 , V$</td>
</tr>
<tr>
<td>$I_{CES}$</td>
<td>$&lt; 1 , mA$</td>
</tr>
<tr>
<td>$E_{SBR}$</td>
<td>$&gt; 0,3 , mJ$</td>
</tr>
<tr>
<td>$h_{FE}$</td>
<td>$&gt; 25$</td>
</tr>
<tr>
<td>$f_T$</td>
<td>typ. 4,8 GHz</td>
</tr>
<tr>
<td>$f_T$</td>
<td>typ. 1,4 GHz</td>
</tr>
<tr>
<td>$C_c$</td>
<td>typ. 1,8 pF</td>
</tr>
<tr>
<td>$C_{re}$</td>
<td>typ. 1,0 pF</td>
</tr>
<tr>
<td>$C_{cs}$</td>
<td>typ. 0,5 pF</td>
</tr>
</tbody>
</table>

* Measured under pulse conditions: $t_p = 50 \, \mu s; \delta < 1\%$. 

Fig. 4 $T_j = 25 \, ^\circ C$; typical values.

Fig. 5 $V_{CB} = 12,5 \, V; f = 500 \, MHz; T_j = 25 \, ^\circ C$; typical values.

Fig. 6 $I_E = i_e = 0; f = 1 \, MHz$; typical values.
APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter circuit; class-B): f = 900 MHz; T_h = 25 °C.

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>V_CE V</th>
<th>P_L W</th>
<th>P_S W</th>
<th>G_P dB</th>
<th>I_C A</th>
<th>η_C %</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12.5</td>
<td>1</td>
<td>0.75</td>
<td>&lt; 0.178</td>
<td>&gt; 7.5</td>
<td>&lt; 0.160</td>
</tr>
</tbody>
</table>

Fig. 7 Class-B test circuit at f = 900 MHz.

List of components:

C1 = C11 = 33 pF multilayer ceramic chip capacitor
C2 = C10 = 1.4 to 5.5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = C9 = 1.2 to 3.5 pF film dielectric trimmer (cat. no. 2222 809 05001)
C4 = 5.6 pF multilayer ceramic chip capacitor*
C5 = 10 pF ceramic feed-through capacitor
C6 = 330 pF ceramic feed-through capacitor
C7 = 2.2 µF (35 V) tantalum electrolytic capacitor
C8 = 3.9 pF multilayer ceramic chip capacitor*

L1 = L7 = 50 Ω stripline (28.2 mm x 4.0 mm)
L2 = 60 nH; 4 turns closely wound enamelled Cu wire (0.4 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = 38 Ω stripline (14.6 mm x 6.0 mm)
L4 = 38 Ω stripline (10.0 mm x 6.0 mm)
L5 = 280 nH; 15 turns closely wound enamelled Cu wire (0.4 mm); int. dia. 3 mm; leads 2 x 5 mm
L6 = 50 Ω stripline (37.7 mm x 4.0 mm)
L8 = L9 = Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36642)
R1 = R2 = 10 Ω ± 10%; 0.25 W metal film resistor

L1, L3, L4, L6 and L7 are striplines on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric (ε_r = 2.74); thickness 1/16 inch.

* American Technical Ceramics capacitor type 100A or capacitor of same quality.
Fig. 8 Printed circuit board and component lay-out for 900 MHz class-B test circuit.

**Note**

The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper serving as ground plane. Earth connections are made by hollow rivets and also by fixing-screws and copper straps around the board and under the emitters to provide a direct contact between the copper on the component side and the ground plane.
Fig. 9 Load power vs. source power.

Fig. 10 Power gain and efficiency vs. load power.

Conditions for Figs 9 and 10:
$V_{CE} = 9.6\, \text{V}; f = 900\, \text{MHz}; T_h = 25\, ^\circ\text{C};$ class-B operation; typical values.

Fig. 11 Input impedance (series components).

Fig. 12 Load impedance (series components).

Conditions for Figs 11 and 12:
$V_{CE} = 12.5\, \text{V}; P_L = 1\, \text{W}; f = 900\, \text{MHz}; T_h = 25\, ^\circ\text{C};$ class-B operation; typical values.
RUGGEDNESS

The device is capable to withstand a full load mismatch (VSWR = 50; all phases) at rated load power up to a supply voltage of 15.5 V at \( T_h = 25 \, ^{\circ}\text{C} \).

Fig. 13 Input impedance (series components).

Fig. 14 Load impedance (series components).

Conditions for Figs 13 and 14:

\( V_{CE} = 12.5 \, \text{V}; \, P_L = 1 \, \text{W}; \, f = 800-960 \, \text{MHz}; \, T_h = 25 \, ^{\circ}\text{C}; \) class-B operation; typical values.

Fig. 15 Power gain vs. frequency.

\( V_{CE} = 12.5 \, \text{V}; \, P_L = 1 \, \text{W}; \, f = 800-960 \, \text{MHz}; \, T_h = 25 \, ^{\circ}\text{C}; \) class-B operation; typical values.
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor designed for use in mobile radio transmitters in the 900 MHz band.

Features:
- diffused emitter-ballasting resistors for an optimum temperature profile.
- gold metallization ensures excellent reliability.
- the device can be applied at rated output power without an external heatsink when it is mounted on a printed circuit board (see Fig. 6).

The transistor has a 4-lead envelope with a ceramic cap (SOT-172D). All leads are isolated from the mounting base.

QUICK REFERENCE DATA

R.F. performance at $T_a = 25 \degree C$ in a common-emitter class-B circuit.*

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_p$ dB</th>
<th>$\eta_C$ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narrow band; c.w.</td>
<td>12,5</td>
<td>900</td>
<td>1</td>
<td>&gt; 7,5</td>
<td>&gt; 50</td>
</tr>
<tr>
<td></td>
<td>9,6</td>
<td>900</td>
<td>1</td>
<td>typ. 7,0</td>
<td>typ. 57</td>
</tr>
</tbody>
</table>

* Device mounted on a printed circuit board (see Fig. 6).

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-172D.

PRODUCT SAFETY  This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter) \( V_{CBO} \) max. 36 V
Collector-emitter voltage (open base) \( V_{CEO} \) max. 16 V
Emitter-base voltage (open collector) \( V_{EBO} \) max. 3 V

Collector current
- d.c. or average
- (peak value); \( f > 1 \) MHz

Collector current \( I_C \); \( I_{CM} \) max. 0.2 A

Total power dissipation
- \( f > 1 \) MHz; \( T_m b < 105 \) °C

Total power dissipation \( P_{t_{ot(rf)}} \) max. 3.5 W

Storage temperature
- \( T_{stg} \) -65 to +150 °C

Operating junction temperature
- \( T_{j} \) max. 200 °C

Fig. 2 Power/temperature curve

I  Continuous r.f. operation (\( f > 1 \) MHz)
II Short-time r.f. operation during mismatch (\( f > 1 \) MHz)

THERMAL RESISTANCE

Dissipation = 2.25 W

From junction to ambient* (\( f > 1 \) MHz)
\( T_a = 25 \) °C

From junction to mounting base
\( T_m b = 25 \) °C (\( f > 1 \) MHz)

\( R_{th \ j-a \ (r.f.)} \) max. 60 K/W

\( R_{th \ j-mb \ (r.f.)} \) max. 19 K/W

* Device mounted on a printed circuit board (see Fig. 6).
CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage
open emitter; I_C = 2,5 mA

Collector-emitter breakdown voltage
open base; I_C = 10 mA

Emitter-base breakdown voltage
open collector; I_E = 0,5 mA

Collector cut-off current
V_BE = 0; V_CE = 16 V

Second breakdown energy
L = 25 mH; f = 50 Hz; R_BE = 10 Ω

D.C. current gain
I_C = 0,15 A; V_CE = 10 V

Collector capacitance at f = 1 MHz
I_E = i_E = 0; V_CB = 12,5 V

Feedback capacitance at f = 1 MHz
I_C = 0; V_CE = 12,5 V

Collector-mounting base capacitance

![Graph](7292309)

![Graph](7292311)

Fig. 3 T_j = 25 °C; typical values.

Fig. 4 I_E = i_E = 0; f = 1 MHz; typical values.
APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter circuit; class-B): \( f = 900 \text{ MHz} \); \( T_a = 25 \text{ °C} \)

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>( V_{CE} ) V</th>
<th>( P_L ) W</th>
<th>( G_P ) dB</th>
<th>( \eta_C ) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12,5</td>
<td>1</td>
<td>( &gt; 7,5 )</td>
<td>( &gt; 50 )</td>
</tr>
<tr>
<td></td>
<td>9,6</td>
<td>1</td>
<td>( \text{typ.} 9,0 )</td>
<td>( \text{typ.} 60 )</td>
</tr>
</tbody>
</table>

List of components:

- \( C_1 = C_{10} = 33 \text{ pF multilayer ceramic chip capacitor} \)
- \( C_2 = C_9 = 1 \text{ to 5,5 pF film dielectric trimmer (cat. no. 2222 B09 09001)} \)
- \( C_3 = 2 \text{ to 9 pF film dielectric trimmer (cat. no. 2222 B09 09002)} \)
- \( C_4 = 5,6 \text{ pF multilayer ceramic chip capacitor}^* \)
- \( C_5 = 10 \text{ pF multilayer ceramic chip capacitor} \)
- \( C_6 = 330 \text{ pF multilayer ceramic chip capacitor} \)
- \( C_7 = 3,9 \text{ pF multilayer ceramic chip capacitor}^* \)
- \( C_8 = 1,2 \text{ to 3,5 pF film dielectric trimmer (cat. no. 2222 B09 05001)} \)
- \( L_1 = L_7 = 50 \Omega \text{ stripline (30,8 mm x 2,4 mm)} \)
- \( L_2 = 60 \text{ nH; 4 turns closely wound enamelled Cu wire (0,4 mm); int. dia. 3 mm; leads 2 x 5 mm} \)
- \( L_3 = 38 \Omega \text{ stripline (16,0 mm x 3,5 mm)} \)
- \( L_4 = 38 \Omega \text{ stripline (11,0 mm x 3,5 mm)} \)
- \( L_5 = 280 \text{ nH; 15 turns closely wound enamelled Cu wire (0,4 mm); int. dia. 3 mm; leads 2 x 5 mm} \)
- \( L_6 = 50 \Omega \text{ stripline (41,2 mm x 2,4 mm)} \)
- \( L_8 = \text{Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36642)} \)
- \( R_1 = R_2 = 10 \Omega \pm 5\%; 0,25 \text{ W metal film resistor} \)
- \( \text{L1, L3, L4, L6 and L7 are striplines on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric (}\epsilon_r = 2,2); \text{ thickness 1/32 inch; thickness of copper-sheet 2 x 35 \mu m.} \)

\footnote{American Technical Ceramics capacitor type 100A or capacitor of same quality.}

\footnote{Device mounted on a printed circuit board (see Fig. 6).}
Fig. 6 P.c. board and component lay-out for 900 MHz class-B test circuit.

Note
The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper serving as groundplane. Earth connections are made by hollow rivets and also by fixing-screws and copper straps around the board and under the emitters to provide a direct contact between the copper on the component side and the groundplane.
Fig. 7 Load power versus source power.

Fig. 8 Power gain and efficiency versus load power.

Conditions for Figs 7 and 8:

f = 900 MHz; class-B operation; typical values.

(—— Tmb = 25 °C; VCE = 12,5 V; —— T_a = 25 °C; VCE = 12,5 V; ——— T_a = 25 °C; VCE = 9,6 V)

RUGGEDNESS

The device is capable to withstand a full load mismatch (VSWR = 50; all phases) at rated load power up to a supply voltage of 15,5 V at T_a = 25 °C. Device mounted on a printed circuit board (see Fig. 6).

Fig. 9 Input impedance (series components).

Fig. 10 Load impedance (series components).

Conditions for Figs 9 and 10:

VCE = 12,5 V; P_L = 1 W; f = 800 - 960 MHz; Tmb = 25 °C; class-B operation; typical values.
Fig. 11 Power gain versus frequency.

V_{CE} = 12.5\ V; P_L = 1\ W; f = 800 - 960\ MHz; T_{mb} = 25\ ^{\circ}\C;\ class-B\ operation;\ typical\ values.
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor designed for use in mobile radio transmitters in the 900 MHz band.

Features:
- multi-base structure and diffused emitter-ballasting resistors for an optimum temperature profile
- gold metallization ensures excellent reliability.

The transistor has a 4-lead stud envelope with a ceramic cap (SOT-172). All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance at $T_h = 25 \degree C$ in a common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ (V)</th>
<th>$f$ (MHz)</th>
<th>$P_L$ (W)</th>
<th>$G_p$ (dB)</th>
<th>$\eta_C$ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12.5</td>
<td>900</td>
<td>2</td>
<td>&gt; 6.5</td>
<td>&gt; 50</td>
</tr>
<tr>
<td></td>
<td>9.6</td>
<td>900</td>
<td>1.5</td>
<td>typ. 6.6</td>
<td>typ. 60</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-172A1.

Dimensions in mm

Torque on nut: min. 0.75 Nm
(7.5 kg.cm)
max. 0.85 Nm
(8.5 kg.cm)

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current
d.c. or average
(peak value); f > 1 MHz
D.C. power dissipation
at $T_{mb} = 90^\circ C$
R.F. power dissipation
f > 1 MHz; $T_{mb} = 90^\circ C$
Storage temperature
Operating junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CBO}$</td>
<td>max. 36 V</td>
</tr>
<tr>
<td>$V_{CEO}$</td>
<td>max. 16 V</td>
</tr>
<tr>
<td>$V_{EBO}$</td>
<td>max. 3 V</td>
</tr>
<tr>
<td>$I_C$/ $I_{C(AV)}$</td>
<td>max. 0,4 A</td>
</tr>
<tr>
<td>$I_{CM}$</td>
<td>max. 1,2 A</td>
</tr>
<tr>
<td>$P_{tot(dc)}$</td>
<td>max. 4,5 W</td>
</tr>
<tr>
<td>$P_{tot(rf)}$</td>
<td>max. 6 W</td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>−65 to + 150 °C</td>
</tr>
<tr>
<td>$T_j$</td>
<td>max. 200 °C</td>
</tr>
</tbody>
</table>

---

THERMAL RESISTANCE

Dissipation = 4,5 W; $T_{mb} = 25^\circ C$
From junction to mounting base
(d.c. dissipation)
(r.f. dissipation)
From mounting base to heatsink

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{th j-mb(d.c.)}$</td>
<td>max. 20 K/W</td>
</tr>
<tr>
<td>$R_{th j-mb(d.c.)}$</td>
<td>max. 15 K/W</td>
</tr>
<tr>
<td>$R_{th mb-h}$</td>
<td>max. 0,8 K/W</td>
</tr>
</tbody>
</table>

---

Fig. 2 D.C. SOAR.

Fig. 3 Power/temperature derating curves
I Continuous d.c. operation
II Continuous r.f. operation (f > 1 MHz)
III Short-time r.f. operation during mismatch (f > 1 MHz)
CHARACTERISTICS

T<sub>j</sub> = 25 °C unless otherwise specified

Collector-base breakdown voltage, open emitter; I<sub>C</sub> = 5 mA
Collector-emitter breakdown voltage, open base; I<sub>C</sub> = 10 mA
Emitter-base breakdown voltage, open collector; I<sub>E</sub> = 0,5 mA
Collector cut-off current, V<sub>BE</sub> = 0; V<sub>CE</sub> = 16 V
Second breakdown energy, L = 25 mH; f = 50 Hz; R<sub>BE</sub> = 10 Ω
D.C. current gain, I<sub>C</sub> = 0,3 A; V<sub>CE</sub> = 10 V
Transition frequency at f = 500 MHz<sup>*</sup>, -I<sub>E</sub> = 0,3 A; V<sub>CB</sub> = 12,5 V
-1<sub>E</sub> = 1,0 A; V<sub>CB</sub> = 12,5 V
Collector capacitance at f = 1 MHz, I<sub>E</sub> = i<sub>E</sub> = 0; V<sub>CB</sub> = 12,5 V
Feedback capacitance at f = 1 MHz, I<sub>C</sub> = 0; V<sub>CE</sub> = 12,5 V

Collector-stud capacitance

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>V&lt;sub&gt;(BR)CBO&lt;/sub&gt;</td>
<td>&gt; 36 V</td>
</tr>
<tr>
<td>V&lt;sub&gt;(BR)CEO&lt;/sub&gt;</td>
<td>&gt; 16 V</td>
</tr>
<tr>
<td>V&lt;sub&gt;(BR)EBO&lt;/sub&gt;</td>
<td>&gt; 3 V</td>
</tr>
<tr>
<td>I&lt;sub&gt;CES&lt;/sub&gt;</td>
<td>&lt; 2,5 mA</td>
</tr>
<tr>
<td>E&lt;sub&gt;SBR&lt;/sub&gt;</td>
<td>&gt; 0,55 mJ</td>
</tr>
<tr>
<td>h&lt;sub&gt;FE&lt;/sub&gt;</td>
<td>&gt; 25</td>
</tr>
<tr>
<td>f&lt;sub&gt;T&lt;/sub&gt;</td>
<td>typ. 4 GHz</td>
</tr>
<tr>
<td>f&lt;sub&gt;T&lt;/sub&gt;</td>
<td>typ. 1 GHz</td>
</tr>
<tr>
<td>C&lt;sub&gt;C&lt;/sub&gt;</td>
<td>typ. 3,5 pF</td>
</tr>
<tr>
<td>C&lt;sub&gt;re&lt;/sub&gt;</td>
<td>typ. 2,0 pF</td>
</tr>
<tr>
<td>C&lt;sub&gt;cs&lt;/sub&gt;</td>
<td>typ. 0,5 pF</td>
</tr>
</tbody>
</table>

* Measured under pulse conditions: t<sub>p</sub> = 50 µs; δ < 1%.

Fig. 4 T<sub>j</sub> = 25 °C; typical values.

Fig. 5 V<sub>CB</sub> = 12,5 V; t<sub>p</sub> = 50 µs;
T<sub>j</sub> = 25 °C; typical values.

Fig. 6 I<sub>E</sub> = i<sub>E</sub> = 0; f = 1 MHz; typical values.
APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter circuit; class-B): \( f = 900 \text{ MHz} \); \( T_h = 25 \degree C \).

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>( V_{CE} )</th>
<th>( P_L )</th>
<th>( P_S )</th>
<th>( G_P )</th>
<th>( I_C )</th>
<th>( \eta_C )</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12.5</td>
<td>2</td>
<td>&lt; 0.450</td>
<td>&gt; 6.5</td>
<td>&lt; 0.320</td>
<td>&gt; 50</td>
</tr>
<tr>
<td></td>
<td>9.6</td>
<td>1.5</td>
<td>typ. 0.332</td>
<td>typ. 7.8</td>
<td>typ. 0.267</td>
<td>typ. 60</td>
</tr>
</tbody>
</table>

Fig. 7 Class-B test circuit at \( f = 900 \text{ MHz} \).

List of components:

- \( C1 = C12 = 33 \text{ pF} \) multilayer ceramic chip capacitor
- \( C2 = C3 = C11 = 1.4 \text{ to } 5.5 \text{ pF} \) film dielectric trimmer (cat. no. 2222 809 09001)
- \( C4 = C5 = 5.6 \text{ pF} \) multilayer ceramic chip capacitor*
- \( C6 = 10 \text{ pF} \) ceramic feed-through capacitor
- \( C7 = 330 \text{ pF} \) ceramic feed-through capacitor
- \( C8 = 2.2 \text{ µF} \) (35 V) tantalum electrolytic capacitor
- \( C9 = 3.9 \text{ pF} \) multilayer ceramic chip capacitor*
- \( C10 = 1.2 \text{ to } 3.5 \text{ pF} \) film dielectric trimmer (cat. no. 2222 809 05001)
- \( L1 = L8 = \text{ Ferroxcube wideband h.f. choke, grade 3B} \) (cat. no. 4312 020 36642)
- \( L2 = 60 \text{ nH}; 4 \text{ turns closely wound enamelled Cu wire (0.4 mm); int. dia. 3 mm; leads 2 x 5 mm} \)
- \( L3 = 50 \Omega \text{ stripline (23.3 mm x 1.85 mm)} \)
- \( L4 = 50 \Omega \text{ stripline (4.0 mm x 1.85 mm)} \)
- \( L5 = L6 = 29 \Omega \text{ stripline (14.0 mm x 4.0 mm)} \)
- \( L7 = 280 \text{ nH}; 15 \text{ turns closely wound enamelled Cu wire (0.4 mm); int. dia. 3 mm; leads 2 x 5 mm} \)
- \( L9 = 50 \Omega \text{ stripline (22.7 mm x 1.85 mm)} \)
- \( L10 = 50 \Omega \text{ stripline (28.0 mm x 1.85 mm)} \)
- \( R1 = R2 = 10 \Omega \pm 10\%; 0.25 \text{ W metal film resistor} \)
- \( L3, L4, L5, L6, L9 \text{ and } L10 \text{ are striplines on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric (} \varepsilon_r = 2.74 \text{); thickness 1/32 inch.} \)

* American Technical Ceramics capacitor type 100A or capacitor of same quality.
Fig. 8 Printed circuit board and component lay-out for 900 MHz class-B test circuit.

Note
The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper serving as ground plane. Earth connections are made by hollow rivets and also by fixing-screws and copper straps around the board and under the emitters to provide a direct contact between the copper on the component side and the ground plane.
Fig. 9 Load power vs. source power.

Fig. 10 Power gain and efficiency vs. load power.

Conditions for Figs 9 and 10:
$V_{CE} = 9.6 \text{ V}$; $f = 900 \text{ MHz}$; $T_h = 25 ^\circ C$; class-B operation; typical values.

Fig. 11 Input impedance (series components).

Fig. 12 Load impedance (series components).

Conditions for Figs 11 and 12:
$V_{CE} = 12.5 \text{ V}$; $P_L = 2 \text{ W}$; $f = 900 \text{ MHz}$; $T_h = 25 ^\circ C$; class-B operation; typical values.
RUGGEDNESS
The device is capable to withstand a full load mismatch (VSWR = 50; all phases) at rated load power up to a supply voltage of 15,5 V at $T_h = 25 \, ^\circ\text{C}$.

Conditions for Figs 13 and 14:
$V_{CE} = 12.5 \, \text{V}; P_L = 2 \, \text{W}; f = 800–960 \, \text{MHz}; T_h = 25 \, ^\circ\text{C}; \text{class-B operation; typical values.}$

Fig. 13 Input impedance (series components).
Fig. 14 Load impedance (series components).

Fig. 15 Power gain vs. frequency.
$V_{CE} = 12.5 \, \text{V}; P_L = 2 \, \text{W}; f = 800–960 \, \text{MHz}; T_h = 25 \, ^\circ\text{C}; \text{class-B operation; typical values.}$
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor designed for use in mobile radio transmitters in the 900 MHz band.

Features:
- diffused emitter-ballasting resistors for an optimum temperature profile.
- gold metallization ensures excellent reliability.
- the device can be applied at rated load power, without an external heatsink, when it is mounted on a printed circuit board (see Fig. 6).

The transistor has a 4-lead envelope with a ceramic cap (SOT-172D). All leads are isolated from the mounting base.

QUICK REFERENCE DATA

R.F. performance in a common-emitter class-B circuit.

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$T_{\text{oC}}$</th>
<th>$V_{\text{CE}}$</th>
<th>$f$</th>
<th>$P_L$</th>
<th>$G_p$</th>
<th>$\eta_C$</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>$T_{mb} = 25$</td>
<td>12,5</td>
<td>900</td>
<td>2</td>
<td>&gt; 6,5</td>
<td>&gt; 50</td>
</tr>
<tr>
<td></td>
<td>$T_a = 25^*$</td>
<td>12,5</td>
<td>900</td>
<td>1,5</td>
<td>&gt; 6,5</td>
<td>&gt; 50</td>
</tr>
<tr>
<td></td>
<td>$T_a = 25^*$</td>
<td>9,6</td>
<td>900</td>
<td>1,5</td>
<td>typ. 6,6</td>
<td>typ. 60</td>
</tr>
</tbody>
</table>

* Device mounted on a printed circuit board (see Fig. 6).

MECHANICAL DATA

Fig. 1 SOT-172D.

Dimensions in mm

PRODUCT SAFETY  This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter) $V_{CBO}$ max. 36 V
Collector-emitter voltage (open base) $V_{CEO}$ max. 16 V
Emitter-base voltage (open collector) $V_{EBO}$ max. 3 V

Collector current
- d.c. or average (peak value); $f > 1$ MHz
- $I_C; I_{C(AV)}$ max. 0.4 A
- $I_{CM}$ max. 1.2 A

Total power dissipation
- $P_{tot(rf)}$ max. 6 W
- $P_{tot(rf)}$ max. 6 W

Storage temperature
- $T_{stg}$ –65 to +150 °C

Operating junction temperature $T_j$ max. 200 °C

Fig. 2 Power/temperature curve.
- I Continuous r.f. operation ($f > 1$ MHz)
- II Short-time r.f. operation during mismatch ($f > 1$ MHz)

THERMAL RESISTANCE

Dissipation = 4.5 W

From junction to ambient* ($f > 1$ MHz)
- $T_a = 25$ °C
- $R_{th j-a (r.f.)}$ max. 55 K/W

From junction to mounting base
- $T_{mb} = 25$ °C ($f > 1$ MHz)
- $R_{th j-mb (r.f.)}$ max. 15 K/W

* Device mounted on a printed circuit board (see Fig. 6).
CHARACTERISTICS

$T_j = 25 \, ^\circ\text{C}$ unless otherwise specified

Collector-base breakdown voltage
open emitter; $I_C = 5 \, \text{mA}$

Collector-emitter breakdown voltage
open base; $I_C = 10 \, \text{mA}$

Emitter-base breakdown voltage
open collector; $I_E = 0.5 \, \text{mA}$

Collector cut-off current
$V_{BE} = 0; V_{CE} = 16 \, \text{V}$

Second breakdown energy
$L = 25 \, \text{mH}; f = 50 \, \text{Hz}; R_{BE} = 10 \, \Omega$

D.C. current gain
$I_C = 0.3 \, \text{A}; V_{CE} = 10 \, \text{V}$

Collector capacitance at $f = 1 \, \text{MHz}$
$I_E = i_E = 0; V_{CB} = 12.5 \, \text{V}$

Feedback capacitance at $f = 1 \, \text{MHz}$
$I_C = 0; V_{CE} = 12.5 \, \text{V}$

Collector-mounting base capacitance

\begin{align*}
V_{(BR)CBO} &> 36 \, \text{V} \\
V_{(BR)CEO} &> 16 \, \text{V} \\
V_{(BR)EBO} &> 3 \, \text{V} \\
I_{CES} &< 2.5 \, \text{mA} \\
E_{SBR} &> 0.55 \, \text{mJ} \\
h_{FE} &> 25 \\
C_c &\text{ typ.} \ 3.5 \, \text{pF} \\
C_{re} &\text{ typ.} \ 2.0 \, \text{pF} \\
C_{c-mb} &\text{ typ.} \ 0.5 \, \text{pF}
\end{align*}

Fig. 3 $T_j = 25 \, ^\circ\text{C}$; typical values.

Fig. 4 $I_E = i_E = 0; f = 1 \, \text{MHz}$; typical values.
APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter circuit; class-B): \( f = 900 \) MHz

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>( V_{CE} ) V</th>
<th>( P_L ) W</th>
<th>( G_p ) dB</th>
<th>( \eta_C ) %</th>
<th>( T ) °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12.5</td>
<td>2</td>
<td>&gt; 6.5</td>
<td>&gt; 50</td>
<td>( T_{mb} = 25 )</td>
</tr>
<tr>
<td></td>
<td>12.5</td>
<td>2</td>
<td>typ. 7.8</td>
<td>typ. 60</td>
<td>( T_{mb} = 25 )</td>
</tr>
<tr>
<td></td>
<td>12.5</td>
<td>1.5</td>
<td>&gt; 6.5</td>
<td>&gt; 50</td>
<td>( T_a = 25^{**} )</td>
</tr>
<tr>
<td></td>
<td>9.6</td>
<td>1.5</td>
<td>typ. 6.6</td>
<td>typ. 60</td>
<td>( T_a = 25^{**} )</td>
</tr>
</tbody>
</table>

Fig. 5 Class-B test circuit at \( f = 900 \) MHz.

List of components:

- \( C_1 = C_{11} = 33 \) pF multilayer ceramic chip capacitor
- \( C_2 = C_3 = C_{10} = 1.4 \) to \( 5.5 \) pF film dielectric trimmer (cat. no. 2222 809 09001)
- \( C_4 = C_5 = 5.6 \) pF multilayer ceramic chip capacitor*
- \( C_6 = 10 \) pF multilayer ceramic chip capacitor
- \( C_7 = 330 \) pF multilayer ceramic chip capacitor
- \( C_8 = 3.9 \) pF multilayer ceramic chip capacitor*
- \( C_9 = 1.2 \) to \( 3.5 \) pF film dielectric trimmer (cat. no. 2222 809 05001)
- \( L_1 = L_8 = \) Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36642)
- \( L_2 = 60 \) nH; 4 turns closely wound enameled Cu wire (0.4 mm); int. dia. 3 mm; leads 2 x 5 mm
- \( L_3 = 50 \) Ω stripline (25.4 mm x 2.4 mm)
- \( L_4 = 50 \) Ω stripline (4.4 mm x 2.4 mm)
- \( L_5 = L_6 = 34 \) Ω stripline (14.0 mm x 4.0 mm)
- \( L_7 = 280 \) nH; 15 turns closely wound enameled Cu wire (0.4 mm); int. dia. 3 mm; leads 2 x 5 mm
- \( L_9 = 50 \) Ω stripline (24.8 mm x 2.4 mm)
- \( L_{10} = 50 \) Ω stripline (30.5 mm x 2.4 mm)
- \( R_1 = R_2 = 10 \) Ω ± 5%; 0.25 W metal film resistor
- \( L_3, L_4, L_5, L_6, L_9 \) and \( L_{10} \) are striplines on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric (\( \varepsilon_r = 2.2 \)); thickness 1/32 inch; thickness of copper-sheet 2 x 35 µm.

* American Technical Ceramics capacitor type 100A or capacitor of same quality.

** Device mounted on a printed circuit board (see Fig. 6).
Fig. 6 P.c. board and component lay-out for 900 MHz class-B test circuit.

Note
The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper serving as groundplane. Earth connections are made by hollow rivets and also by fixing-screws and copper straps around the board and under the emitters to provide a direct contact between the copper on the component side and the groundplane.
Fig. 7 Load power versus source power.

Fig. 8 Power gain and efficiency versus load power.

Conditions for Figs 7 and 8:
f = 900 MHz; class-B operation; typical values.

(— Tmb = 25 °C; VCE = 12.5 V; — — Ta = 25 °C; VCE = 12.5 V; ——— Ta = 25 °C; VCE = 9.6 V)

RUGGEDNESS

The device is capable to withstand a full load mismatch (VSWR = 50; all phases) at PL = 1.5 W up to a supply voltage of 15.5 V at Ta = 25 °C. Device mounted on a printed circuit board (see Fig. 6).

Fig. 9 Input impedance (series components).

Fig. 10 Load impedance (series components).

Conditions for Figs 9 and 10:
VCE = 12.5 V; PL = 2 W; f = 800 - 960 MHz; Tmb = 25 °C; class-B operation; typical values.
Fig. 11 Power gain versus frequency.

$V_{CE} = 12.5 \text{ V}; P_L = 2 \text{ W}; f = 800 - 960 \text{ MHz}; T_{mb} = 25^\circ \text{C}; \text{class-B operation}; \text{typical values.}$
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in mobile radio transmitters in the 900 MHz communications band.

Features:
- multi-base structure and emitter-ballasting resistors for an optimum temperature profile
- internal input matching to achieve an optimum wideband capability and high power gain
- gold metallization ensures excellent reliability.

The transistor has a 6-lead flange envelope with a ceramic cap (SOT-171). All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance at $T_h = 25 \degree C$ in a common-emitter class-B test circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_p$ dB</th>
<th>$\eta_C$ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12,5</td>
<td>900</td>
<td>4</td>
<td>$&gt; 7,5$</td>
<td>$&gt; 50$</td>
</tr>
<tr>
<td></td>
<td>9,6</td>
<td>900</td>
<td>3</td>
<td>typ. 7,3</td>
<td>typ. 56</td>
</tr>
</tbody>
</table>

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
MECHANICAL DATA

Fig. 1 SOT-171.

Dimensions in mm

Torque on screw: min. 0.6 Nm (6 kg.cm)
max. 0.75 Nm (7.5 kg.cm)
Recommended screw: cheese-head 4-40 UNC/2A.
Heatsink compound must be applied sparingly and evenly distributed.
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)
  peak value

Collector-emitter voltage (open base)

Emitter-base voltage (open collector)

Collector current
  d.c. or average
  (peak value); f > 1 MHz

Total power dissipation
  at $T_{mb} = 94 \, ^\circ C$
  at $T_{mb} = 94 \, ^\circ C$; f > 1 MHz

Storage temperature

Operating junction temperature

\[ V_{CBOM} \text{ max.} \quad 36 \, V \]
\[ V_{CEO} \text{ max.} \quad 16 \, V \]
\[ V_{EBO} \text{ max.} \quad 3 \, V \]
\[ I_C \text{ max.} \quad 0,8 \, A \]
\[ I_{CM} \text{ max.} \quad 2,4 \, A \]
\[ P_{\text{tot}(dc)} \text{ max.} \quad 9 \, W \]
\[ P_{\text{tot}(rf)} \text{ max.} \quad 12 \, W \]
\[ T_{\text{stg}} \quad -65 \text{ to } 150 \, ^\circ C \]
\[ T_j \text{ max.} \quad 200 \, ^\circ C \]

Fig. 2 D.C. SOAR.
$R_{th \, mb-h} = 0,4 \, K/W$.

Fig. 3 Power/temperature derating curves.
I  Continuous operation
II Continuous operation (f > 1 MHz)
III Short-time operation during mismatch; (f > 1 MHz)

<table>
<thead>
<tr>
<th>$R_{th , j-mb(dc)}$</th>
<th>max.</th>
<th>12 K/W</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{th , j-mb(rf)}$</td>
<td>max.</td>
<td>9 K/W</td>
</tr>
<tr>
<td>$R_{th , mb-h}$</td>
<td>max.</td>
<td>0,4 K/W</td>
</tr>
</tbody>
</table>

THERMAL RESISTANCE

Dissipation = 6 W; $T_{mb} = 128 \, ^\circ C$

From junction to mounting base
  (d.c. dissipation)
  (r.f. dissipation)

From mounting base to heatsink
CHARACTERISTICS

$T_J = 25 \, ^\circ C$ unless otherwise specified

Collector-base breakdown voltage, open emitter; $I_C = 10 \, mA$

Collector-emitter breakdown voltage, open base; $I_C = 20 \, mA$

Emitter-base breakdown voltage, open collector; $I_E = 1 \, mA$

Collector cut-off current, $V_{BE} = 0; V_{CE} = 16 \, V$

Second breakdown energy, $L = 25 \, mH; f = 50 \, Hz; R_{BE} = 10 \, \Omega$

D.C. current gain, $I_C = 0.6 \, A; V_{CE} = 10 \, V$

Transition frequency at $f = 500 \, MHz^*$, $I_E = 0.6 \, A; V_{CE} = 12.5 \, V$

Collector capacitance at $f = 1 \, MHz, I_E = 0; V_{CB} = 12.5 \, V$

Feed-back capacitance at $f = 1 \, MHz, I_C = 0; V_{CE} = 12.5 \, V$

Collector-flange capacitance

$V_{(BR)CBO} > 36 \, V$

$V_{(BR)CEO} > 16 \, V$

$V_{(BR)EBO} > 3 \, V$

$I_{CES} < 5 \, mA$

$E_{SBR} > 1 \, mJ$

$h_{FE} > 25$

$f_T \text{ typ. } 4 \, GHz$

$C_C \text{ typ. } 8 \, pF$

$C_{re} \text{ typ. } 5 \, pF$

$C_{cf} \text{ typ. } 2 \, pF$

* Measured under pulse conditions: $t_p = 50 \, \mu s; \delta < 1\%$. 

Fig. 4 $T_J = 25 \, ^\circ C$; typical values.

Fig. 5 $V_{CB} = 12.5 \, V; f = 500 \, MHz; T_J = 25 \, ^\circ C$; typical values.

Fig. 6 $I_E = I_e = 0; f = 1 \, MHz$; typical values.
### APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter circuit; class-B): \( f = 900 \text{ MHz} \); \( T_h = 25 ^\circ\text{C} \).

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>( V_{CE} ) V</th>
<th>( P_L ) W</th>
<th>( P_S ) W</th>
<th>( G_p ) dB</th>
<th>( I_C ) A</th>
<th>( \eta_C ) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12.5</td>
<td>4</td>
<td>&lt; 0.71</td>
<td>&gt; 7.5</td>
<td>&lt; 0.64</td>
<td>&gt; 50</td>
</tr>
<tr>
<td></td>
<td>9.6</td>
<td>3</td>
<td>typ. 0.57</td>
<td>typ. 8.5</td>
<td>typ. 0.56</td>
<td>typ. 57</td>
</tr>
</tbody>
</table>

![Class-B test circuit at \( f = 900 \text{ MHz} \).](image)

List of components:

- \( C_1 = C_{12} = 33 \text{ pF multilayer ceramic chip capacitor} \)
- \( C_2 = C_3 = C_{10} = C_{11} = 1.4 \text{ to 5.5 pF film dielectric trimmer} \)
  (cat. no. 2222 809 09001)
- \( C_4 = C_5 = 3.9 \text{ pF multilayer ceramic chip capacitor*} \)
- \( C_6 = C_7 = C_8 = C_9 = 6.2 \text{ pF multilayer ceramic chip capacitor*} \)
- \( C_{13} = 10 \text{ pF ceramic feed-through capacitor} \)
- \( C_{14} = 6.8 \mu \text{F} \text{ (63 V) electrolytic capacitor} \)
- \( C_{15} = 330 \text{ pF ceramic feed-through capacitor} \)
- \( L_1 = 50 \Omega \text{ stripline (29.5 mm x 2.4 mm)} \)
- \( L_2 = 50 \Omega \text{ stripline (5.5 mm x 2.4 mm)} \)
- \( L_3 = 42.7 \Omega \text{ stripline (16.8 mm x 3.0 mm)} \)
- \( L_4 = 42.7 \Omega \text{ stripline (7.5 mm x 3.0 mm)} \)
- \( L_5 = 42.7 \Omega \text{ stripline (2.0 mm x 3.0 mm)} \)
- \( L_6 = 50 \Omega \text{ stripline (8.5 mm x 2.4 mm)} \)
- \( L_7 = 50 \Omega \text{ stripline (28.0 mm x 2.4 mm)} \)
- \( L_8 = 60 \text{ nH; 4 turns closely wound enamelled Cu-wire (0.4 mm); int. dia. 3 mm; leads 2 x 5 mm} \)
- \( L_9 = 45 \text{ nH; 4 turns enamelled Cu-wire (1.0 mm); length 6 mm; int. dia. 4 mm; leads 2 x 5 mm} \)
- \( L_{10} = L_{11} = \text{Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36642)} \)
- \( R_1 = R_2 = 10 \Omega \pm 10\%; 0.25 \text{ W, metal film resistor} \)

\( L_1 \) to \( L_7 \) are striplines on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric \((\epsilon_r = 2.2)\); thickness 1/32 inch.

* American Technical Ceramics capacitors type 100A or capacitor of same quality.
Fig. 8 Printed circuit board and component lay-out for 900 MHz class-B test circuit.

Note
The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side is un-etched copper serving as ground plane. Earth connections are made by fixing screws and copper straps around the board and under the emitters to provide a direct contact between the copper on the component side and the ground plane.
Fig. 9 Load power vs. source power.

Fig. 10 Power gain and efficiency vs. load power.

Conditions for Figs 9 and 10:
V_C_E = 9.6 V; f = 900 MHz; T_H = 25 °C; class-B operation; typical values.

Fig. 11 Load power vs. source power.

Fig. 12 Power gain and efficiency vs. load power.

Conditions for Figs 11 and 12:
V_C_E = 12.5 V; f = 900 MHz; T_H = 25 °C; class-B operation; typical values.
RUGGEDNESS

The device is capable of withstanding a full load mismatch (VSWR = 50; all phases) at rated load power up to a supply voltage of 15.5 V and at $T_h = 25^\circ C$.

Fig. 13 Input impedance (series components).

Fig. 14 Load impedance (series components).

Conditions for Figs 13 and 14:
$V_{CE} = 12.5$ V; $P_L = 4$ W; $f = 800–960$ MHz; $T_h = 25^\circ C$; class-B operation; typical values.

Fig. 15 Power gain vs. frequency.

$V_{CE} = 12.5$ V; $P_L = 4$ W; $f = 800–960$ MHz; $T_h = 25^\circ C$; class-B operation; typical values.
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in mobile radio transmitters in the 900 MHz communications band.

Features:
• multi-base structure and emitter-ballasting resistors for an optimum temperature profile
• internal input matching to achieve an optimum wideband capability and high power gain
• gold metallization ensures excellent reliability.

The transistor has a 6-lead flange envelope with a ceramic cap (SOT-171). All leads are isolated from the flange.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_p$ dB</th>
<th>$\eta_C$ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12,5</td>
<td>900</td>
<td>8</td>
<td>&gt; 6,5</td>
<td>&gt; 50</td>
</tr>
<tr>
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<td>9,6</td>
<td>900</td>
<td>6</td>
<td>typ. 6,0</td>
<td>typ. 59</td>
</tr>
</tbody>
</table>

PRODUCT SAFETY  This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
MECHANICAL DATA

Fig. 1 SOT-171.

Dimensions in mm

Torque on screw: min. 0.6 Nm (6 kg.cm)
max. 0.75 Nm (7.5 kg.cm)
Recommended screw: cheese-head 4-40 UNC/2A
Heatsink compound must be applied sparingly and evenly distributed.
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)
  peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current
  d.c. or average
  (peak value); f > 1 MHz
Total power dissipation
  at T_{mb} = 67 °C
  at T_{mb} = 67 °C; f > 1 MHz
Storage temperature
Operating junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Max.</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_CBOM</td>
<td></td>
<td>36 V</td>
</tr>
<tr>
<td>V_CEO</td>
<td></td>
<td>16 V</td>
</tr>
<tr>
<td>V_EBO</td>
<td></td>
<td>3 V</td>
</tr>
<tr>
<td>I_C; I_CAV</td>
<td></td>
<td>1.6 A</td>
</tr>
<tr>
<td>I_CM</td>
<td></td>
<td>4.8 A</td>
</tr>
<tr>
<td>P_{tot}(dc)</td>
<td></td>
<td>18 W</td>
</tr>
<tr>
<td>P_{tot}(rf)</td>
<td></td>
<td>24 W</td>
</tr>
<tr>
<td>T_{stg}</td>
<td></td>
<td>-65 to +150 °C</td>
</tr>
<tr>
<td>T_j</td>
<td></td>
<td>200 °C</td>
</tr>
</tbody>
</table>

![Fig. 2 D.C.-SOAR.](image)

R_{th mb-h} = 0.4 K/W

Thermal Resistance

Dissipation = 12 W; T_{mb} = 112 °C
From junction to mounting base
  (d.c. dissipation)
  (r.f. dissipation)
From mounting base to heatsink

<table>
<thead>
<tr>
<th>Resistance</th>
<th>Max.</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>R_{th j-mb (dc)}</td>
<td></td>
<td>7.0 K/W</td>
</tr>
<tr>
<td>R_{th j-mb (rf)}</td>
<td></td>
<td>5.2 K/W</td>
</tr>
<tr>
<td>R_{th mb-h}</td>
<td></td>
<td>0.4 K/W</td>
</tr>
</tbody>
</table>

![Fig. 3 Power/temperature derating curves.](image)

I Continuous operation
II Continuous operation (f > 1 MHz)
III Short-time operation during mismatch; (f > 1 MHz)
CHARACTERISTICS

$T_j = 25 \, ^\circ\text{C}$ unless otherwise specified

Collector-base breakdown voltage
open emitter; $I_C = 20 \, \text{mA}$

Collector-emitter breakdown voltage
open base; $I_C = 40 \, \text{mA}$

Emitter-base breakdown voltage
open collector; $I_E = 2 \, \text{mA}$

Collector cut-off current
$V_{BE} = 0; V_{CE} = 16 \, \text{V}$

Second breakdown energy
$L = 25 \, \text{mH}; f = 50 \, \text{Hz}; R_{BE} = 10 \, \Omega$

D.C. current gain
$I_C = 1.2 \, \text{A}; V_{CE} = 10 \, \text{V}$

Transition frequency at $f = 500 \, \text{MHz}$*
$-I_E = 1.2 \, \text{A}; V_{CE} = 12.5 \, \text{V}$

Collector capacitance at $f = 1 \, \text{MHz}$
$I_C = I_E = 0; V_{CB} = 12.5 \, \text{V}$

Feedback capacitance at $f = 1 \, \text{MHz}$
$I_C = 0; V_{CE} = 12.5 \, \text{V}$

Collector-flange capacitance

\[ h'_{FE} = \text{typ.} \quad 25 \]

\[ f_T \quad \text{typ.} \quad 4 \, \text{GHz} \]

\[ C_c \quad \text{typ.} \quad 15 \, \text{pF} \]

\[ C_{re} \quad \text{typ.} \quad 9 \, \text{pF} \]

\[ C_{cf} \quad \text{typ.} \quad 2 \, \text{pF} \]

\[ V_{(BR)CBO} > 36 \, \text{V} \]

\[ V_{(BR)CEO} > 16 \, \text{V} \]

\[ V_{(BR)EBO} > 3 \, \text{V} \]

\[ I_{CES} < 10 \, \text{mA} \]

\[ E_{SBR} > 2 \, \text{mJ} \]

\[ V_{(BR)CBO} > 36 \, \text{V} \]

\[ V_{(BR)CEO} > 16 \, \text{V} \]

\[ V_{(BR)EBO} > 3 \, \text{V} \]

\[ I_{CES} < 10 \, \text{mA} \]

\[ E_{SBR} > 2 \, \text{mJ} \]

* Measured under pulse conditions: $t_p = 50 \, \mu\text{s}; \delta < 1\%$.
APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter circuit; class-B): f = 900 MHz; T_h = 25 °C.

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>V_CE (V)</th>
<th>P_L (W)</th>
<th>P_S (W)</th>
<th>G_P (dB)</th>
<th>I_C (A)</th>
<th>η_C (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12,5</td>
<td>8</td>
<td>&lt; 1,8</td>
<td>&gt; 6,5</td>
<td>&lt; 1,28</td>
<td>&gt; 50</td>
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<tr>
<td></td>
<td>9,6</td>
<td>6</td>
<td>typ. 1,5</td>
<td>typ. 7,3</td>
<td>typ. 1,1</td>
<td>typ. 58</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>typ. 1,5</td>
<td>typ. 6,0</td>
<td>typ. 1,05</td>
<td>typ. 59</td>
</tr>
</tbody>
</table>
Fig. 7 Class-B test circuit at $f = 900$ MHz.

List of components:

- $C_1 = C_{12} = 33$ pF multilayer ceramic chip capacitor
- $C_2 = C_3 = C_{10} = C_{11} = 1.4$ to $5.5$ pF film dielectric trimmer (cat. no. 2222 809 09001)
- $C_4 = C_5 = 4.7$ pF multilayer ceramic chip capacitor*
- $C_6 = C_7 = 5.6$ pF multilayer ceramic chip capacitor*
- $C_8 = C_9 = 3.3$ pF multilayer ceramic chip capacitor*
- $C_{13} = 10$ pF ceramic feed-through capacitor
- $C_{14} = 6.8 \mu F (63$ V$)$ electrolytic capacitor
- $C_{15} = 330$ pF ceramic feed-through capacitor
- $L_1 = L_7 = 50$ $\Omega$ stripline ($29.0 \times 2.4$ mm$)$
- $L_2 = 50$ $\Omega$ stripline ($6.0$ mm $\times 2.4$ mm$)$
- $L_3 = 42.7$ $\Omega$ stripline ($13.1$ mm $\times 3.0$ mm$)$
- $L_4 = 42.7$ $\Omega$ stripline ($4.4$ mm $\times 3.0$ mm$)$
- $L_5 = 42.7$ $\Omega$ stripline ($4.6$ mm $\times 3.0$ mm$)$
- $L_6 = 50$ $\Omega$ stripline ($11.0 \times 2.4$ mm$)$
- $L_8 = 60$ nH; 4 turns closely wound enamelled Cu-wire (0.4 mm$)$; int. dia. 3 mm; leads 2 x 5 mm
- $L_9 = 45$ nH; 4 turns enamelled Cu-wire (1.0 mm$)$; length 6 mm; int. dia 4 mm; leads 2 x 5 mm
- $L_{10} = L_{11} =$ Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36642)
- $R_1 = R_2 = 10 \Omega \pm 10\%; 0.25$ W, metal film resistor

$L_1$ to $L_7$ are striplines on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric ($\varepsilon_r = 2.2$); thickness 1/32 inch.

* American Technical Ceramics capacitor type 100A or capacitor of same quality.
Fig. 8 Printed circuit board and component lay-out for 900 MHz class-B test circuit.

Note
The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side is un-etched copper serving as ground plane. Earth connections are made by fixing screws and copper straps around the board and under the emitters to provide a direct contact between the copper on the component side and the ground plane.
Fig. 9 Load power vs. source power.

Conditions for Figs 9 and 10:
$V_{CE} = 9.6 \text{ V}; f = 900 \text{ MHz}; T_h = 25 \degree \text{C}; \text{class-B operation}; \text{typical values.}$

Fig. 10 Power gain and efficiency vs. load power.

Fig. 11 Load power vs. source power.

Conditions for Figs 11 and 12:
$V_{CE} = 12.5 \text{ V}; f = 900 \text{ MHz}; T_h = 25 \degree \text{C}; \text{class-B operation}; \text{typical values.}$

Fig. 12 Power gain and efficiency vs. load power.
RUGGEDNESS
The device is capable of withstanding a full load mismatch (VSWR = 50; all phases) at rated load power up to a supply voltage of 15.5 V and at $T_h = 25 \degree C$.

Fig. 13 Input impedance (series components).

Fig. 14 Load impedance (series components).

Conditions for Figs 13 and 14:
\[ V_{CE} = 12.5 \, \text{V}; \, P_L = 8 \, \text{W}; \, f = 800-960 \, \text{MHz}; \, T_h = 25 \degree \text{C}; \, \text{class-B operation; typical values}. \]

Fig. 15 Power gain vs. frequency.

\[ V_{CE} = 12.5 \, \text{V}; \, P_L = 8 \, \text{W}; \, f = 800-960 \, \text{MHz}; \, T_h = 25 \degree \text{C}; \, \text{class-B operation; typical values}. \]
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for common base, class-B operation in mobile radio transmitters for the 900 MHz communication band.

Features:
- emitter-ballasting resistors for an optimum temperature profile
- gold metallization ensures excellent reliability
- internal input matching to achieve an optimum wideband capability and stable operation

The transistor has a 6-lead flange envelope with a ceramic cap (SOT-171). All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25 \, ^\circ\text{C}$ in a common-base class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CB}$ (V)</th>
<th>$f$ (MHz)</th>
<th>$P_L$ (W)</th>
<th>$G_p$ (dB)</th>
<th>$\eta_C$ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12.5</td>
<td>900</td>
<td>15</td>
<td>&gt;6</td>
<td>&gt;50</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

SOT-171 (see Fig. 1).

PRODUCT SAFETY  This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
MECHANICAL DATA

Fig. 1 SOT-171.

Dimensions in mm

Torque on screw:  
min. 0,6 Nm (6 kg.cm)
max. 0,75 Nm (7,5 kg.cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter) \( V_{CBO} \) max. 36 V

Collector-emitter voltage (open base) \( V_{CEO} \) max. 16 V

Emitter-base voltage (open collector) \( V_{EBO} \) max. 3,5 V

Collector current
- d.c. or average \( I_C \) max. 3 A
- peak value; \( f > 1 \text{ MHz} \) \( I_{CM} \) max. 9 A

Total power dissipation
at \( T_{mb} = 25 \text{ °C}; f > 1 \text{ MHz} \) \( P_{tot} \) max. 45 W

Storage temperature
- \( T_{stg} \) \(-65 \text{ to } +150 \text{ °C} \)

Operating junction temperature \( T_j \) max. 200 °C

**Fig. 2** Power/temperature derating curves;
I Continuous operation \( (f > 1 \text{ MHz}) \)
II Short-time operation during mismatch;
\( (f > 1 \text{ MHz}) \)

THermal RESISTANCE

From junction to mounting base
(r.f. operation) \( R_{th \ j-mb} \) max. 4 K/W

From mounting base to heatsink \( R_{th \ mb-h} \) max. 0,4 K/W
CHARACTERISTICS

$T_j = 25 \, ^\circ C$ unless otherwise specified

Collector-base breakdown voltage
open emitter; $I_C = 25 \, mA$

Collector-emitter breakdown voltage
open base; $I_C = 50 \, mA$

Emitter-base breakdown voltage
open collector; $I_E = 5 \, mA$

Collector cut-off current
$V_{BE} = 0; V_{CE} = 16 \, V$

Second breakdown energy
$L = 25 \, mH; f = 50 \, Hz; R_{BE} = 10 \, \Omega$

D.C. current gain
$V_{CE} = 10 \, V; I_C = 2 \, A$

Collector capacitance at $f = 1 \, MHz$
$|I_E| = |i_e| = 0; V_{CB} = 12,5 \, V$

Feedback capacitance at $f = 1 \, MHz$
$|I_E| = 0; V_{CB} = 12,5 \, V$

$\rightarrow$ Collector-flange capacitance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Typ.</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{(BR)CBO}$</td>
<td></td>
<td>36 V</td>
<td></td>
</tr>
<tr>
<td>$V_{(BR)CEO}$</td>
<td></td>
<td>16 V</td>
<td></td>
</tr>
<tr>
<td>$V_{(BR)EBO}$</td>
<td></td>
<td>3,5 V</td>
<td></td>
</tr>
<tr>
<td>$I_{CES}$</td>
<td></td>
<td>10 mA</td>
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<tr>
<td>$E_{SBR}$</td>
<td></td>
<td>4,5 mJ</td>
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<tr>
<td>$h_{FE}$</td>
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<td>15</td>
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<td>$C_C$</td>
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</tr>
<tr>
<td>$C_{rb}$</td>
<td></td>
<td>9 pF</td>
<td></td>
</tr>
<tr>
<td>$C_{cf}$</td>
<td></td>
<td>2 pF</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 3 D.C. current gain versus collector current; $T_j = 25 \, ^\circ C$. Typical values.

Fig. 4 Output capacitance versus $V_{CB}$; $|I_E| = |i_e| = 0; f = 1 \, MHz$. Typical values.
### APPLICATION INFORMATION

R.F. performance in c.w. operation (common-base circuit; class-B)

$f = 900\,\text{MHz};\ T_h = 25\,\text{°C}$

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CB}$ V</th>
<th>$P_L$ W</th>
<th>$G_p$ dB</th>
<th>$\eta$ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>12,5</td>
<td>15</td>
<td>$&gt;6,0$</td>
<td>$&gt;50$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>typ. 7,0</td>
<td>typ. 61</td>
</tr>
</tbody>
</table>

![Class-B test circuit at $f = 900\,\text{MHz}$](image)

**Fig. 5** Class-B test circuit at $f = 900\,\text{MHz}$.

### List of components:

- $C_1 = C_{18} = 330\,\text{pF}$ multilayer ceramic chip capacitor *
- $C_2 = C_4 = C_{16} = 5,6\,\text{pF}$ multilayer ceramic chip capacitor *
- $C_3 = C_5 = C_{15} = C_{17} = 1,4$ to $5,5\,\text{pF}$ film dielectric trimmer (cat. no. 2222 809 09001)
- $C_6 = C_7 = 4,3\,\text{pF}$ multilayer ceramic chip capacitor *
- $C_8 = 330\,\text{pF}$ multilayer ceramic chip capacitor
- $C_9 = C_{10} = 5,6\,\text{pF}$ multilayer ceramic chip capacitors **
- $C_{11} = C_{12} = 6,2\,\text{pF}$ multilayer ceramic chip capacitor *
C₁₃ = 6,8 μF (63 V) electrolytic capacitor
C₁₄ = 2,2 pF multilayer ceramic chip capacitor
L₁ = L₁₂ = 50 Ω stripline (24 mm x 2,4 mm)
L₂ = L₁₁ = 50 Ω stripline (10 mm x 2,4 mm)
L₃ = 50 Ω stripline (8 mm x 2,4 mm)
L₄ = L₇ = 41 Ω (3 mm x 3,2 mm)
L₅ = L₈ = 4 turns Cu-wire (1,0 mm); int. dia. 4 mm; length 5 mm;
leads 2 x 7 mm
L₆ = L₉ = Ferroxcube wideband h.f. choke; grade 3B (cat. no 4312 020 36642)
L₁₀ = 50 Ω stripline (7 mm x 2,4 mm)

R₁ = R₂ = 10 Ω ± 10 %; 0,25 W, metal film resistor
The striplines are on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric
(εᵣ = 2,2); thickness 1/32 inch.

* American Technical Ceramics capacitor type 100B or capacitor of the same quality.
** Idem type 100A.
The circuit and components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper serving as a ground plane.

Earth connections are made by fixing screws, hollow rivets and copper straps around the board and under the bases to provide a direct contact between the copper of the component side and the ground plane.
Fig. 7 Load power versus source power.

Fig. 8 Power gain and efficiency versus load power.

Conditions for Figs 7 and 8:
VCB = 12.5 V; f = 900 MHz; T_h = 25 °C; class-B operation;
R_{th\,mb-h} = 0.4 K/W; typical values.

RUGGEDNESS
The BLV94 is capable of withstanding a load mismatch (VSWR = 50 through all phases) at rated load power up to a supply voltage of 15.5 V at T_h = 25 °C and R_{th\,mb-h} = 0.4 K/W.
Conditions for Figs 9, 10 and 11:

Typical values; \( V_{CE} = 12.5 \text{ V} \); \( P_L = 15 \text{ W} \); \( f = 800 \text{ to } 960 \text{ MHz} \);
\( R_{th \, mb-h} = 0.4 \text{ K/W} \); \( T_h = 25^\circ \text{C} \).
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor in SOT-171 envelope and intended for use in class-B operated mobile radio transmitters in the 900 MHz communications band.

Features:
- internal input matching to achieve an optimum wideband capability and stable operation;
- emitter-ballasting resistors for an optimum temperature profile;
- gold metallization ensures excellent reliability.

The transistor has a 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

| R.F. performance at $T_h = 25\, ^\circ C$ in a common-base class-B circuit |
|-----------------------------|---|---|---|---|---|
| mode of operation           | $V_{CB}$ | $f$ | $P_L$ | $G_p$ | $\eta_C$ |
| narrow band; c.w.           | 12,5   | 900 | 22   | $> 5,5$ | $> 50$ |

MECHANICAL DATA

Fig. 1 SOT-171.

Dimensions in mm

Torque on screw:
- min. $0,6\, \text{Nm (6 kg.cm)}$
- max. $0,75\, \text{Nm (7,5 kg.cm)}$

Recommended screw:
cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

DEVELOPMENT DATA
This data sheet contains advance information and specifications are subject to change without notice.

August 1986
BLV95

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter) \( V_{CBO} \) max. 36 V
Collector-emitter voltage (open base) \( V_{CEO} \) max. 16 V
Emitter-base voltage (open collector) \( V_{EBO} \) max. 3,5 V
Collector current; d.c. \( I_C \) max. 5 A
Total power dissipation at \( T_{mb} = 25 \, ^\circ C \); \( f > 1 \, MHz \) \( P_{tot} \) max. 70 W
Storage temperature \( T_{stg} \) -65 to + 150 \, ^\circ C
Operating junction temperature \( T_j \) max. 200 \, ^\circ C

CHARACTERISTICS

\( T_j = 25 \, ^\circ C \) unless otherwise specified

Collector-base breakdown voltage
   open emitter; \( I_C = 50 \, mA \)
Collector-emitter breakdown voltage
   open base; \( I_C = 100 \, mA \)
Emitter-base breakdown voltage
   open collector; \( I_E = 10 \, mA \)
D.C. current gain
   \( V_{CE} = 10 \, V \); \( I_C = 3,5 \, A \)
Collector capacitance at \( f = 1 \, MHz \)
   \( I_E = I_e = 0 \); \( V_{CB} = 12,5 \, V \)
   \( C_C \) typ. 62 pF
   \( C_{cf} \) typ. 2 pF

RUGGEDNESS

The device is capable of withstanding a load mismatch (VSWR = 10; all phases) at rated load power up to a supply voltage of 15,5 V and \( T_h = 25 \, ^\circ C \).
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor in SOT-171 envelope intended for use in class-B operated base station transmitters in the 900 MHz communications band.

Features

• internal matching to achieve an optimum wideband capability and stable operation.
• emitter-ballasting resistors for an optimum temperature profile.
• gold metallization ensures excellent reliability.

The transistor has a 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25^\circ C$ in common-base class-B circuit.

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CB}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_p$ dB</th>
<th>$\eta_C$ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>24</td>
<td>900</td>
<td>30</td>
<td>&gt; 7.0</td>
<td>&gt; 55</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-171.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
MECHANICAL DATA

Fig. 1 SOT-171.

Dimensions in mm

Torque on screw: min. 0.6 Nm (6 kg.cm)
max. 0.75 Nm (7.5 kg.cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)  \( V_{CBO} \)  max.  50 V
Collector-emitter voltage (open base)  \( V_{CEO} \)  max.  27 V
Emitter-base voltage (open collector)  \( V_{EBO} \)  max.  3.5 V

Collector current
  d.c. or average  \( I_C \)  max.  3 A
  peak value; \( f > 1 \) MHz  \( I_{CM} \)  max.  9 A

Total power dissipation
  at \( T_{mb} = 25 \) °C; \( f > 1 \) MHz  \( P_{tot} \)  max.  60 W

Storage temperature
  \( -65 \) to \( +150 \) °C

Operating junction temperature
  200 °C

Fig. 2 Power/temperature derating curves.
I  Continuous operation \( (f > 1 \) MHz\)
II  Short-time operating during mismatch \( (f > 1 \) MHz\)

THERMAL RESISTANCE
Dissipation = 60 W; \( T_{amb} = 25 \) °C.

From junction to mounting base
  (r.f. operation) \( R_{th j-mb} \)  max.  2.9 K/W
From mounting base to heatsink \( R_{th mb-h} \)  max.  0.4 K/W
CHARACTERISTICS

$T_J = 25 \, ^\circ\mathrm{C}$ unless otherwise specified.

Collector-base breakdown voltage
- open emitter; $I_C = 50 \, \text{mA}$

Collector-emitter breakdown voltage
- open base; $I_C = 100 \, \text{mA}$

Emitter-base breakdown voltage
- open collector; $I_E = 10 \, \text{mA}$

Collector-emitter leakage current
- $V_{\text{BE}} = 0; V_{\text{CE}} = 27 \, \text{V}$

Second breakdown energy
- $L = 25 \, \text{mH}; f = 50 \, \text{Hz}; R_{\text{BE}} = 10 \, \Omega$

D.C. current gain
- $V_{\text{CE}} = 20 \, \text{V}; I_C = 2 \, \text{A}$

Collector capacitance at $f = 1 \, \text{MHz}$
- $I_E = I_E = 0; V_{\text{CS}} = 24 \, \text{V}$

Feedback capacitance at $f = 1 \, \text{MHz}$
- $I_E = 0; V_{\text{CB}} = 24 \, \text{V}$

Collector-flange capacitance

- $V_{\text{BR}CBO} = \text{min.} 50 \, \text{V}$
- $V_{\text{BR}CEO} = \text{min.} 27 \, \text{V}$
- $V_{\text{BR}EBO} = \text{min.} 3.5 \, \text{V}$
- $I_{\text{CES}} = \text{max.} 10 \, \text{mA}$
- $E_{\text{SBR}} = \text{min.} 4 \, \text{mJ}$
- $h_{\text{FE}} = \text{min.} 15$
- $C_C = \text{typ.} 44 \, \text{pF}$
- $C_{rb} = \text{typ.} 14 \, \text{pF}$
- $C_{cf} = \text{typ.} 2 \, \text{pF}$

---

**Fig. 3** D.C. current gain versus collector current; $T_J = 25 \, ^\circ\mathrm{C}$.

**Fig. 4** Collector capacitance versus $V_{\text{CB}}$; $I_E = I_E = 0; f = 1 \, \text{MHz}$.
APPLICATION INFORMATION

R.F. performance at $T_h = 25 \, ^\circ\text{C}$ in common-base class-B circuit.

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CB}$ (V)</th>
<th>$f$ (MHz)</th>
<th>$P_L$ (W)</th>
<th>$G_p$ (dB)</th>
<th>$\eta_C$ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>24</td>
<td>900</td>
<td>30</td>
<td>&gt; 7,0 typ. 8,0</td>
<td>&gt; 55 typ. 63</td>
</tr>
</tbody>
</table>

List of components:

- $C_1 = C_{10} = C_{19} = 330 \, \text{pF}$ multilayer ceramic chip capacitor
- $C_2 = C_4 = C_{13} = C_{14} = C_{15} = C_{17} = 6,2 \, \text{pF}$ multilayer ceramic chip capacitor
- $C_3 = C_5 = C_{16} = C_{18} = 1,4$ to $5,5 \, \text{pF}$ dielectric trimmer (cat. no. 2222 809 09001)
- $C_6 = 6,2 \, \text{pF}$ multilayer ceramic chip capacitor
- $C_7 = C_8 = C_9 = 6,8 \, \text{pF}$ multilayer ceramic chip capacitor
- $C_{11} = 2,2 \, \mu\text{F}$ (63 V) electrolytic capacitor
- $C_{12} = 3 \times 100 \, \text{nF}$ multilayer ceramic chip capacitor in parallel
- $L_1 = L_{13} = 50 \, \Omega$ stripline (9,0 mm x 2,4 mm)
- $L_2 = 50 \, \Omega$ stripline (24,0 mm x 2,4 mm)
- $L_3 = 50 \, \Omega$ stripline (13,0 mm x 2,4 mm)
- $L_4 = 250 \, \text{nH}$; 9 turns closely wound enamelled Cu-wire (1,0 mm) int. dia. 4 mm; leads 2 x 7 mm
- $L_5 = L_9 = \text{Ferroxcube wide-band h.f. choke, grade 3B}$ (cat. no. 4312 020 26642)
- $L_6 = 43 \, \Omega$ stripline (5,5 mm x 3,0 mm)
- $L_7 = 43 \, \Omega$ stripline (3,0 mm x 3,0 mm)
- $L_8 = 65 \, \text{nH}$; 5 turns closely wound enamelled Cu-wire (1,0 mm) int. dia. 4 mm; leads 2 x 7 mm
- $L_{10} = 43 \, \Omega$ stripline (7,5 mm x 3,0 mm)
- $L_{11} = 50 \, \Omega$ stripline (8,0 mm x 2,4 mm)
- $L_{12} = 50 \, \Omega$ stripline (24,0 mm x 2,4 mm)
- $R_1 = 1 \, \Omega \pm 5\%$ (0,25 W) metal film resistor
- $R_2 = 10 \, \Omega \pm 5\%$ (0,25 W) metal film resistor

The striplines are on a double Cu-clad printed circuit board with PTFE fibre-glass dielectric ($\varepsilon_r = 2,2$); thickness 1/32 inch.

* Americal Technical Ceramics capacitor type 100B or capacitor of the same quality.
** Idem type 100A.
Fig. 6 Printed circuit board and component layout for 900 MHz class-B test circuit.

The circuit and the components are on one side of the PTFE fibre-glass board; the other side is unetched copper serving as a ground plane. Earth connections are made by fixing screws, hollow rivets and copper straps around the board and under the bases to provide a direct contact between the copper on the component side and the ground plane.
Fig. 7 Load power versus source power.

Fig. 8 Power gain and efficiency versus load power.

Conditions for Figs 7 and 8:
Typical values; \( V_{CB} = 24 \text{ V}; f = 900 \text{ MHz}; T_h = 25 \degree \text{C}; \) class-B operation; \( R_{th \text{ mb-h}} = 0.4 \text{ K/W}. \)

RUGGEDNESS
The BLV97 is capable of withstanding a full load mismatch (VSWR = 50 through all phases) at rated load power and supply voltage; when \( T_h = 25 \degree \text{C} \) and \( R_{th \text{ mb-h}} = 0.4 \text{ K/W}. \)

INPUT AND LOAD IMPEDANCES
\( \bar{Z}_i = 1.6 + j 4.4 \, \Omega \) and \( \bar{Z}_L = 1.20 + j 3.0 \, \Omega \) (series components).
Conditions: \( V_{CB} = 24 \text{ V}; P_L = 30 \text{ W}; f = 900 \text{ MHz}, T_h = 25 \degree \text{C}; \) class-B operation; \( R_{th \text{ mb-h}} = 0.4 \text{ K/W}; \) typical values.
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor in SOT-171 envelope intended for use in class-B operated base station transmitters in the 900 MHz communications band.

Features
- Internal matching to achieve an optimum wideband capability and stable operation.
- Emitter ballasting resistors for an optimum temperature profile.
- Gold metallization ensures excellent reliability.

The transistor has a 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25 \, ^\circ\text{C}$ in common-base class-B circuit.

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CB}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_p$ dB</th>
<th>$\eta_C$ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>24</td>
<td>900</td>
<td>14</td>
<td>$&gt;8.5$</td>
<td>$&gt;55$</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-171.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

Dimensions in mm

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MECHANICAL DATA
Fig. 1 SOT-171.

Dimensions in mm

Torque on screw: min. 0,6 Nm (6 kg.cm)
max. 0,75 Nm (7,5 kg.cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.
U.H.F. power transistor

RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter) \( V_{CBO} \) max. 50 V
Collector-emitter voltage (open base) \( V_{CEO} \) max. 27 V
Emitter-base voltage (open collector) \( V_{EBO} \) max. 3,5 V

Collector current
- d.c. or average \( I_C \) max. 1,5 A
- peak value; \( f > 1 \text{ MHz} \) \( I_{CM} \) max. 4,5 A

Total power dissipation
at \( T_{mb} = 25 \text{ °C} \); \( f > 1 \text{ MHz} \) \( P_{tot} \) max. 40 W

Storage temperature
\( T_{stg} \) -65 to +150 °C
Operating junction temperature
\( T_j \) max. 200 °C

Fig. 2 Power/temperature derating curves.
- I Continuous operation \( (f > 1 \text{ MHz}) \)
- II Short-time operation during mismatch \( (f > 1 \text{ MHz}) \)

THERMAL RESISTANCE
Dissipation = 40 W; \( T_{amb} = 25 \text{ °C} \)
From junction to mounting base
(r.f. operation) \( R_{th j-mb} \) max. 4,4 K/W
From mounting base to heatsink
\( R_{th mb-h} \) max. 0,4 K/W
CHARACTERISTICS

\( T_j = 25 \, ^\circ C \) unless otherwise specified

Collector-base breakdown voltage
- open emitter; \( I_C = 25 \, mA \)

Collector-emitter breakdown voltage
- open base; \( I_C = 50 \, mA \)

Emitter-base breakdown voltage
- open collector; \( I_E = 5 \, mA \)

Collector-emitter leakage current
\( V_{BE} = 0; V_{CE} = 27 \, V \)

Second breakdown energy
\( L = 25 \, mH; f = 50 \, Hz; R_{BE} = 10 \, \Omega \)

D.C. current gain
\( V_{CE} = 20 \, V; I_C = 1 \, A \)

Collector capacitance at \( f = 1 \, MHz \)
\( I_E = I_C = 0; V_{CB} = 24 \, V \)

Feedback capacitance at \( f = 1 \, MHz \)
\( I_E = 0; V_{CB} = 24 \, V \)

Collector-flange capacitance

\[ \begin{align*}
V_{(BR)CBO} & \quad \text{min.} & 50 \, V \\
V_{(BR)CEO} & \quad \text{min.} & 27 \, V \\
V_{(BR)EBO} & \quad \text{min.} & 3.5 \, V \\
I_{CES} & \quad \text{max.} & 5 \, mA \\
E_{SBR} & \quad \text{min.} & 2 \, mJ \\
h_{FE} & \quad \text{min.} & 15 \\
C_c & \quad \text{typ.} & 23 \, pF \\
C_{rb} & \quad \text{typ.} & 7 \, pF \\
C_{cf} & \quad \text{typ.} & 2 \, pF
\end{align*} \]

Fig. 3 D.C. current gain versus collector current; \( T_j = 25 \, ^\circ C \).

Fig. 4 Output capacitance versus \( V_{CB}; I_E = I_C = 0; f = 1 \, MHz \).
APPLICATION INFORMATION

R.F. performance at $T_H = 25 \, ^\circ C$ in common-base class-B circuit.

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CB}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_P$ dB</th>
<th>$\eta_C$ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>24</td>
<td>900</td>
<td>14</td>
<td>&gt; 8,5 typ. 10,0</td>
<td>&gt; 55 typ. 65</td>
</tr>
</tbody>
</table>

List of components:
- $C_1 = C_{10} = C_{17} = 330 \, \text{pF}$ multilayer ceramic chip capacitor
- $C_2 = C_{13} = 3,3 \, \text{pF}$ multilayer ceramic chip capacitor*
- $C_3 = C_5 = C_{14} = C_{16} = 1,4$ to $5,5 \, \text{pF}$ film dielectric trimmer (cat. no. 2222 809 09001)
- $C_4 = C_8 = C_9 = C_{15} = 6,2 \, \text{pF}$ multilayer ceramic chip capacitor*
- $C_6 = C_7 = 6,2 \, \text{pF}$ multilayer ceramic chip capacitor**
- $C_{11} = 2,2 \, \mu \text{F}$ (63 V) electrolytic capacitor
- $C_{12} = 3 \times 100 \, \text{nF}$ multilayer ceramic chip capacitors in parallel
- $L_1 = L_{12} = 50 \, \Omega$ stripline (9,0 mm $\times$ 2,4 mm)
- $L_2 = L_{11} = 50 \, \Omega$ stripline (24,0 mm $\times$ 2,4 mm)
- $L_3 = 50 \, \Omega$ stripline (16,0 mm $\times$ 2,4 mm)
- $L_4 = 43 \, \Omega$ stripline (3,0 mm $\times$ 3,0 mm)
- $L_5 = 88 \, \text{nH}; 9$ turns closely wound enamelled Cu-wire (0,8 mm); int. dia. 3 mm length 12 mm; leads 2 x 5 mm
- $L_6 = L_9 = \text{Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36642)}$
- $L_7 = 43 \, \Omega$ stripline (14,5 mm $\times$ 3,0 mm)
- $L_8 = 53 \, \text{nH}; 4$ turns enamelled Cu-wire (1,0 mm); int. dia. 4 mm; length 5 mm; leads 2 x 5 mm
- $L_{10} = 50 \, \Omega$ stripline (4,5 mm $\times$ 2,4 mm)
- $R_1 = 1 \, \Omega \pm 5\%$ (0,25 W) metal film resistor
- $R_2 = 10 \, \Omega \pm 5\%$ (0,25 W) metal film resistor

The striplines are on a double Cu-clad printed circuit board with PTFE fibre-glass dielectric ($e_r = 2,2$); thickness 1/32 inch.

* Americal Technical Ceramics capacitor type 100B or capacitor of the same quality.
** Idem type 100A.
Fig. 6 Printed circuit board and component layout for 900 MHz class-B test circuit.

The circuit and the components are on one side of the PTFE fibre-glass board; the other side is unetched copper serving as a ground plane. Earth connections are made by fixing screws, hollow rivets and copper straps around the board and under the bases to provide a direct contact between the copper on the component side and the ground plane.
Fig. 7 Load power versus source power.

Fig. 8 Power gain and efficiency versus load power.

Conditions for Figs 7 and 8:
Typical values; $V_{CB} = 24$ V; $f = 900$ MHz; $T_h = 25$ °C; class-B operation; $R_{th mb-h} = 0.4$ K/W.

RUGGEDNESS
The BLV98 is capable of withstanding a full load mismatch (VSWR = 50 through all phases) at rated load power and supply voltage; when $T_h = 25$ °C and $R_{th mb-h} = 0.4$ K/W.

INPUT AND LOAD IMPEDANCES
$\bar{Z}_i = 5.1 + j 4.5$ Ω and $\bar{Z}_L = 2.2 + j 3.0$ Ω (series components).
Conditions: $V_{CB} = 24$ V; $P_L = 14$ W; $f = 900$ MHz; $T_h = 25$ °C; class-B operation; $R_{th mb-h} = 0.4$ K/W; typical values.
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use as a driver-stage in base stations in the 900 MHz communications band.

Features:
- emitter-ballasting resistors for an optimum temperature profile
- gold metallization ensures excellent reliability

The transistor has a 4-lead stud envelope with a ceramic cap (SOT-172). All leads are isolated from the stud.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>R.F. performance at $T_h = 25 , ^\circ C$ in a common-emitter class-B circuit</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_P$ dB</th>
<th>$\eta_C$ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>24</td>
<td>900</td>
<td>2</td>
<td>&gt;8,0</td>
<td>&gt;55</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Dimensions in mm

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>0,14</th>
<th>5,25</th>
<th>5,35</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,9</td>
<td>8-32 UNC</td>
<td>3,3</td>
<td>6,9 min</td>
</tr>
<tr>
<td>1,52</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3,5</td>
<td></td>
<td>8,5</td>
<td></td>
</tr>
<tr>
<td>0,9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0,6 (2x)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27 24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3,35</td>
<td></td>
<td>3,00 (2x)</td>
<td></td>
</tr>
</tbody>
</table>

Torque on nut: min. 0,75 Nm (7,5 kg.cm) max. 0,85 Nm (8,5 kg.cm)

When locking is required an adhesive is preferred instead of a lock washer.

Diameter of clearance hole in heatsink: max. 4,2 mm.

Mounting hole to have no burrs at either end.

Deburring must leave surface flat; donot chamfer or countersink either end of hole.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

July 1986
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter) \( V_{CBO} \) max. 50 V
Collector-emitter voltage (open base) \( V_{CEO} \) max. 27 V
Emitter-base voltage (open collector) \( V_{EBO} \) max. 3,5 V
Collector current; d.c. \( I_C \) max. 0,2 A
Collector current (peak value) \( I_{CM} \) max. 0,6 A
Total power dissipation at \( T_{mb} = 50 \, ^{\circ}C \); \( f > 1 \, MHz \) \( P_{tot} \) max. 6 W
Storage temperature \( T_{stg} \) –65 to + 150 \, ^{\circ}C
Operating junction temperature \( T_j \) max. 200 \, ^{\circ}C

Fig. 2 Power/temperature derating curves.
I continuous r.f. operation (\( f > 1 \, MHz \))
II short-time r.f. operation during mismatch (\( f > 1 \, MHz \))

THERMAL RESISTANCE
\( P = 4,5 \, W; \, T_{mb} = 25 \, ^{\circ}C \)
From junction to mounting base (\( f > 1 \, MHz \)) \( R_{thj-mb} \) max. 20 K/W
From mounting base to heatsink \( R_{th \, mb-h} \) max. 0,8 K/W
CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage
open emitter; I_C = 5 mA

Collector-emitter breakdown voltage
open base; I_C = 10 mA

Emitter-base breakdown voltage
open collector; I_E = 0,5 mA

Collector-emitter leakage current
V_BE = 0; V_CE = 27 V

Second breakdown energy at f = 50 Hz
L = 25 mH; R_BE = 10 Ω

D.C. current gain
I_C = 150 mA; V_CE = 20 V

Collector capacitance at f = 1 MHz
I_E = I_E = 0; V_CB = 24 V

Feedback capacitance at f = 1 MHz
I_C = 0; V_CE = 24 V

Collector-stud capacitance

---

Fig. 3  V_CE = 20 V; T_j = 25 °C;
typical values.

---

Fig. 4  I_E = I_E = 0; f = 1 MHz;
typical values.
APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter circuit; class-B)

\[ f = 900 \text{ MHz}; \quad T_H = 25 \text{ °C}; \quad R_{th \ mb-h} = 0.8 \text{ K/W} \]

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>( V_{CE} ) (V)</th>
<th>( f ) (MHz)</th>
<th>( P_L ) (W)</th>
<th>( G_p ) (dB)</th>
<th>( \eta_C ) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow band; c.w.</td>
<td>24</td>
<td>900</td>
<td>2</td>
<td>min. 8.0</td>
<td>min. 55</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>typ. 9.3</td>
<td>typ. 63</td>
</tr>
</tbody>
</table>

Fig. 5 class-B test circuit at \( f = 900 \text{ MHz} \).

List of components

- **C1 = C3 = C8 = C9**: 1.4 – 5.5 pF film dielectric trimmer (cat. no. 2222 809 09001)
- **C2**: 4.7 pF multilayer ceramic chip capacitor*
- **C4 = C6 = C10**: 220 pF multilayer ceramic chip capacitor
- **C5**: 1 µF (63 V) electrolytic capacitor
- **C7**: 2.2 pF multilayer ceramic chip capacitor*
- **L1**: 50 Ω stripline (48 mm x 2.4 mm)
- **L2**: 60 nH; 7 turns closely wound enamelled Cu-wire (0.4 mm); int. dia. 2 mm; leads 2 x 5 mm
- **L3 = L7**: Ferroxcube wide-band h.f. choke; grade 3B; (cat. no. 4312 020 36642)
- **L4 = L5**: 35 Ω stripline (14 mm x 4.0 mm)
- **L6**: 120 nH; 6 turns Cu-wire (1.0 mm); int. dia. 6 mm; length 10 mm; leads 2 x 5 mm
- **L8**: 50 Ω stripline (31 mm x 2.4 mm)
- **L9**: 50 Ω stripline (29 mm x 2.4 mm)
- **R1 = R2**: 10 Ω ± 5% (0.4 W) metal film resistor

The striplines are on a Cu-clad printed-circuit board with a PTFE fibre-glass dielectric \((e_r = 2.2)\); thickness 1/32 inch.

* American Technical Ceramics capacitor type 100A or capacitor of the same quality.
Fig. 6 Printed-circuit board and component layout for 900 MHz class-B test circuit.

Note:
The circuit and the components are on one side of the PTFE fibre-glass board; the other side is unetched copper serving as a ground plane. Earth connections are made by hollow rivets and also by fixing screws and copper straps under the emitters to provide a direct contact between the copper on the component side and the ground plane.
Fig. 7 Load power versus source power.

Fig. 8 Power gain and efficiency versus load power.

Conditions for Figs 7 and 8:

\( V_{CE} = 24 \, \text{V}; \quad f = 900 \, \text{MHz}; \quad T_h = 25^\circ \text{C}; \quad R_{th \, mb-h} = 0.8 \, \text{k}\Omega/\text{W}; \) class-B operation; typical values.

RUGGEDNESS

The device is capable of withstanding a full load mismatch (VSWR = 50) through all phases, at rated load power and supply voltage (\( T_h = 25^\circ \text{C}; \quad R_{th \, mb-h} = 0.8 \, \text{k}\Omega/\text{W} \)).
Fig. 9 Input impedance (series components).  
Fig. 10 Load impedance (series components).  

Fig. 11 Power gain versus frequency.  

Conditions for Figs 9, 10 and 11:

\( V_{CE} = 24 \, V; \quad P_L = 2 \, W; \quad f = 800 \, 960 \, MHz; \quad R_{th \, mb-h} = 0.8 \, K/W; \quad T_h = 25 \, ^{\circ}C; \) class-B operation; typical values.
V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B or C operated mobile transmitters with a nominal supply voltage of 13.5 V. Because of the high gain and excellent power handling capability, the transistor is especially suited for design of wide-band and semi-wide-band v.h.f. amplifiers. Together with a BFQ42 driver stage, the chain can deliver 15 W with a maximum drive power of 120 mW at 175 MHz. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16.5 V.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_P$ dB</th>
<th>$\eta$ %</th>
<th>$\bar{z}_I$ (\Omega)</th>
<th>$V_L$ mS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w. class-B</td>
<td>13.5</td>
<td>175</td>
<td>15</td>
<td>&gt; 10</td>
<td>&gt; 60</td>
<td>1.3 + j0.68</td>
<td>180 – j54</td>
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<td>c.w. class-B</td>
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<td>15</td>
<td>typ. 10.5</td>
<td>typ. 67</td>
<td>–</td>
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</tr>
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</table>

MECHANICAL DATA

Fig. 1 SOT-120.

Dimensions in mm

Torque on nut: min. 0.75 Nm (7.5 kg cm)
max. 0.85 Nm (8.5 kg cm)

Diameter of clearance hole in heatsink: max. 4.2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage \((V_{BE} = 0)\)
- peak value

Collector-emitter voltage (open base)

Emitter-base voltage (open collector)

Collector current (average)

Collector current (peak value); \(f > 1\) MHz

R.F. power dissipation \((f > 1\) MHz\); \(T_{mb} = 25\) °C

Storage temperature

Operating junction temperature

---

Fig. 2 D.C. SOAR.

Fig. 3 R.F. power dissipation; \(V_{CE} \leq 16.5\) V; \(f \geq 1\) MHz.

THERMAL RESISTANCE (dissipation = 15 W; \(T_{mb} = 77\) °C, i.e. \(T_h = 70\) °C)

From junction to mounting base (d.c. dissipation)

From junction to mounting base (r.f. dissipation)

From mounting base to heatsink

\[
\begin{align*}
V_{CESM} & \quad \text{max.} \quad 36\ \text{V} \\
V_{CEO} & \quad \text{max.} \quad 18\ \text{V} \\
V_{EBO} & \quad \text{max.} \quad 4\ \text{V} \\
I_{C(AV)} & \quad \text{max.} \quad 2.75\ \text{A} \\
I_{CM} & \quad \text{max.} \quad 8\ \text{A} \\
P_{rf} & \quad \text{max.} \quad 53\ \text{W} \\
T_{stg} & \quad -65\ \text{to} +150\ \text{°C} \\
T_j & \quad \text{max.} \quad 200\ \text{°C}
\end{align*}
\]

\[
\begin{align*}
R_{th\ j-mb}(dc) & = 3.7\ \text{K/W} \\
R_{th\ j-mb}(rf) & = 3.05\ \text{K/W} \\
R_{th\ mb-h} & = 0.45\ \text{K/W}
\end{align*}
\]
V.H.F. power transistor

CHARACTERISTICS

Tj = 25 °C

Collector-emitter breakdown voltage
VBE = 0; IC = 15 mA

Collector-emitter breakdown voltage
open base; IC = 100 mA

Emitter-base breakdown voltage
open collector; IE = 5 mA

Collector cut-off current
VBE = 0; VCE = 18 V

Second breakdown energy; L = 25 mH; f = 50 Hz
RBE = 10 Ω

D.C. current gain*
IC = 1,75 A; VCE = 5 V

Collector-emitter saturation voltage*
IC = 5 A; IB = 1 A

Transition frequency at f = 100 MHz*
-Ie = 1,75 A; VCB = 13,5 V
-Ie = 5 A; VCB = 13,5 V

Collector capacitance at f = 1 MHz
IE = Ie = 0; V CB = 13,5 V

Feedback capacitance at f = 1 MHz
IC = 100 mA; VCE = 13,5 V

Collector-stud capacitance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tr>
<td>V(BR)CES</td>
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<tr>
<td>V(BR)CEO</td>
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</tr>
<tr>
<td>V(BR)EBO</td>
<td>&gt; 4 V</td>
</tr>
<tr>
<td>IE</td>
<td>&lt; 5 mA</td>
</tr>
<tr>
<td>VBE</td>
<td>&gt; 18 V</td>
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<tr>
<td>VCE</td>
<td>&gt; 4 mJ</td>
</tr>
<tr>
<td>RBE</td>
<td>&gt; 4 mJ</td>
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<tr>
<td>ICES</td>
<td>&lt; 5 mA</td>
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<td>hFE</td>
<td>typ. 40</td>
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<td>10 to 80</td>
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<tr>
<td>fT</td>
<td>typ. 900 MHz</td>
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<tr>
<td>fT</td>
<td>typ. 825 MHz</td>
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<tr>
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<td>typ. 43 pF</td>
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<tr>
<td>Cre</td>
<td>typ. 27 pF</td>
</tr>
<tr>
<td>Ccs</td>
<td>typ. 2 pF</td>
</tr>
</tbody>
</table>

* Measured under pulse conditions: tp ≤ 200 µs; δ ≤ 0,02.
Fig. 4 Typical values; $T_j = 25 \, ^\circ\text{C}$.

Fig. 5 $I_E = I_e = 0; f = 1 \, \text{MHz}; T_j = 25 \, ^\circ\text{C}$.

Fig. 6 $V_{CB} = 13.5 \, \text{V}; f = 100 \, \text{MHz}; T_j = 25 \, ^\circ\text{C}$.
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

\[ T_h = 25 \, ^\circ\text{C} \]

<table>
<thead>
<tr>
<th>( f ) (MHz)</th>
<th>( V_{CE} ) (V)</th>
<th>( P_L ) (W)</th>
<th>( P_S ) (W)</th>
<th>( Gp ) (dB)</th>
<th>( I_C ) (A)</th>
<th>( \eta ) (%)</th>
<th>( \bar{\beta} ) (( \Omega ))</th>
<th>( \bar{Y}_L ) (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>13,5</td>
<td>15</td>
<td>&lt; 1,5</td>
<td>&gt; 10</td>
<td>&lt; 1,85</td>
<td>&gt; 60</td>
<td>1,3 + j0,68</td>
<td>180 – j54</td>
</tr>
<tr>
<td>175</td>
<td>12,5</td>
<td>15</td>
<td>typ. 1,34</td>
<td>typ. 10,5</td>
<td>typ. 1,8</td>
<td>typ. 67</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Fig. 7 Test circuit; c.w. class-B.

List of components:

- \( C_1 = 2,5 \) to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
- \( C_2 = C_6 = C_7 = 4 \) to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
- \( C_{3a} = C_{3b} = 47 \) pF ceramic capacitor (500 V)
- \( C_4 = 1 \) nF ceramic capacitor
- \( C_5 = 100 \) nF polyester capacitor
- \( L_1 = \frac{1}{2} \) turn Cu wire (1,6 mm); int. dia. 6,0 mm; leads 2 x 5 mm
- \( L_2 = L_6 = \) Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- \( L_3 = L_4 = \) strip (12 mm x 6 mm); taps for \( C_{3a} \) and \( C_{3b} \) at 5 mm from transistor
- \( L_5 = 4\frac{1}{2} \) turns closely wound enamelled Cu wire (1,6 mm); int. dia. 6,0 mm; leads 2 x 5 mm
- \( L_7 = 2 \) turns closely wound enamelled Cu wire (1,6 mm); int. dia. 6,0 mm; leads 2 x 5 mm

\( L_3 \) and \( L_4 \) are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16”.

\( R_1 = R_2 = 10 \) \( \Omega \) carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.
Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive \( \frac{P_S}{P_{\text{Snom}}} \) increases linearly with supply over-voltage ratio.
OPERATING NOTE  Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

---

Fig. 12.

 figura 12

Fig. 13.

 figura 13

Fig. 14.

 figura 14

Conditions for Figs 12, 13 and 14:
Typical values; $V_{CE} = 13.5$ V; $P_L = 15$ W; $T_h = 25$ °C.
V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B or C operated mobile transmitters with a nominal supply voltage of 13.5 V. Because of the high gain and excellent power handling capability, the transistor is especially suited for design of wide-band and semi-wide-band v.h.f. amplifiers. Together with a BFQ43 driver stage, the chain can deliver 28 W with a maximum drive power of 250 mW at 175 MHz. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16.5 V.

It has a 3/8” capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>R.F. performance up to $T_h = 25^\circ$C</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_P$ dB</th>
<th>$\eta$ %</th>
<th>$\bar{Z_i}$ $\Omega$</th>
<th>$\gamma_L$ mS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w. class-B</td>
<td>13.5</td>
<td>175</td>
<td>28</td>
<td>$&gt; 9$</td>
<td>$&gt; 60$</td>
<td>0.9 + j0.9</td>
<td>380 + j40</td>
</tr>
<tr>
<td>c.w. class-B</td>
<td>12.5</td>
<td>175</td>
<td>28</td>
<td>typ. 9.5</td>
<td>typ. 70</td>
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</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-120.

Dimensions in mm

Torque on nut: min. 0.75 Nm (7.5 kg cm) max. 0.85 Nm (8.5 kg cm)

Diameter of clearance hole in heatsink: max. 4.2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$)
  peak value

Collector-emitter voltage (open base)

Emitter-base voltage (open collector)

Collector current (average)

Collector current (peak value); $f > 1$ MHz

R.F. power dissipation ($f > 1$ MHz); $T_{mb} = 25 ^\circ C$

Storage temperature

Operating junction temperature

- $V_{CESM}$ max. 36 V
- $V_{CEO}$ max. 18 V
- $V_{EBO}$ max. 4 V
- $I_{C(AV)}$ max. 6 A
- $I_{CM}$ max. 15 A
- $P_{rf}$ max. 96 W
- $T_{stg}$ -65 to + 150 $^\circ$ C
- $T_J$ max. 200 $^\circ$ C

THERMAL RESISTANCE (dissipation = 25 W; $T_{mb} = 81$ $^\circ$ C, i.e. $T_J = 70$ $^\circ$ C)

From junction to mounting base (d.c. dissipation)

From junction to mounting base (r.f. dissipation)

From mounting base to heatsink

$R_{th j-mb (dc)} = 2,4$ K/W

$R_{th j-mb (rf)} = 1,85$ K/W

$R_{th mb-h} = 0,45$ K/W
CHARACTERISTICS

$T_j = 25 \, ^\circ C$

Collector-emitter breakdown voltage

$V_{BE} = 0; \, I_C = 25 \, mA$

Collector-emitter breakdown voltage
open base; $I_C = 100 \, mA$

Emitter-base breakdown voltage
open collector; $I_E = 10 \, mA$

Collector cut-off current

$V_{BE} = 0; \, V_{CE} = 18 \, V$

Second breakdown energy; $L = 25 \, mH; \, f = 50 \, Hz$
open base

$R_{BE} = 10 \, \Omega$

D.C. current gain*

$I_C = 3,5 \, A; \, V_{CE} = 5 \, V$

Collector-emitter saturation voltage*

$I_C = 10 \, A; \, I_B = 2 \, A$

Transition frequency at $f = 100 \, MHz$

$-I_E = 3,5 \, A; \, V_{CB} = 13,5 \, V$

$-I_E = 10 \, A; \, V_{CB} = 13,5 \, V$

Collector capacitance at $f = 1 \, MHz$

$I_E = I_E = 0; \, V_{CB} = 13,5 \, V$

Feedback capacitance at $f = 1 \, MHz$

$I_C = 100 \, mA; \, V_{CE} = 13,5 \, V$

Collector-stud capacitance

$V_{(BR)CES} > 36 \, V$

$V_{(BR)CEO} > 18 \, V$

$V_{(BR)EBO} > 4 \, V$

$I_{CES} < 10 \, mA$

$E_{SBO} > 8 \, mJ$

$E_{SBR} > 8 \, mJ$

$h_{FE} \, \text{typ.} \, 40$

$f_T \, \text{typ.} \, 850 \, MHz$

$f_T \, \text{typ.} \, 700 \, MHz$

$V_{CESat} \, \text{typ.} \, 1,8 \, V$

$C_c \, \text{typ.} \, 92 \, pF$

$C_{re} \, \text{typ.} \, 58 \, pF$

$C_{cs} \, \text{typ.} \, 2 \, pF$

* Measured under pulse conditions: $t_p < 200 \, \mu s; \, \delta < 0,02$.

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Fig. 4  Typical values; $T_J = 25 \, ^\circ C$.

Fig. 5  $I_E = I_e = 0$; $f = 1 \, MHz$; $T_J = 25 \, ^\circ C$.

Fig. 6  $V_{CB} = 13.5 \, V$; $f = 100 \, MHz$; $T_J = 25 \, ^\circ C$. 
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

$T_h = 25 \degree C$

<table>
<thead>
<tr>
<th>$f$ (MHz)</th>
<th>$V_{CE}$ (V)</th>
<th>$P_L$ (W)</th>
<th>$P_S$ (W)</th>
<th>$G_P$ (dB)</th>
<th>$I_C$ (A)</th>
<th>$\eta$ (%)</th>
<th>$Z_i$ (Ω)</th>
<th>$\bar{Y}_L$ (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>13.5</td>
<td>28</td>
<td>&lt; 3.5</td>
<td>&gt; 9</td>
<td>&lt; 3.45</td>
<td>&gt; 60</td>
<td>0.9 + j0.9</td>
<td>380 + j40</td>
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<tr>
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<td>typ. 3.2</td>
<td>typ. 70</td>
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<td></td>
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</tbody>
</table>

Fig. 7 Test circuit; c.w. class-B.

List of components:

C1 = 2.5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C7 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C6 = 7 to 100 pF film dielectric trimmer (cat. no. 2222 809 07015)
L1 = ½ turn Cu wire (1.6 mm); int. dia. 6.0 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0.5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L7 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); teps for C3a and C3b at 5 mm from transistor
L6 = 3½ turns closely wound enamelled Cu wire (1.6 mm) int. dia. 6.0 mm; leads 2 x 5 mm
L8 = 1 turn Cu wire (1.6 mm) int. dia. 6.0 mm; leads 2 x 5 mm
L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".
R1 = R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.
Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.
OPERATING NOTE  Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

Fig. 12.

Fig. 13.

Fig. 14.

Conditions for Figs 12, 13 and 14:
Typical values; $V_{CE} = 13.5$ V; $P_L = 28$ W; $T_h = 25$ °C.
U.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in linear u.h.f. amplifiers for television transmitters and transposers. The excellent d.c. dissipation properties for class-A operation are obtained by means of diffused emitter ballasting resistors and a multi-base structure, providing an optimum temperature profile on the crystal area. The combination of optimum thermal design and the application of gold sandwich metallization realizes excellent reliability properties.

The transistor has a 1/4” capstan envelope with ceramic cap.

QUICK REFERENCE DATA

<table>
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<tr>
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<th>V_{CE}</th>
<th>I_{c}</th>
<th>T_{h}</th>
<th>d_{im}</th>
<th>P_{o sync}</th>
<th>G_{p}</th>
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<tbody>
<tr>
<td>mode of operation</td>
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<td>V</td>
<td>mA</td>
<td>°C</td>
<td>dB</td>
<td>W</td>
<td>dB</td>
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* Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

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<thead>
<tr>
<th>Dimensions in mm</th>
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<tr>
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<td>3,3 max</td>
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<td>2,8 max</td>
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<td>5,6 max</td>
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<tr>
<td>12,0 max</td>
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<tr>
<td>11,0 max</td>
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</table>

Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

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RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage
(peak value); $V_{BE} = 0$
open base

Emitter-base voltage (open collector)

Collector current
d.c. or average
(peak value); $f > 1$ MHz

Total power dissipation up to $T_{mb} = 25\,^\circ C$

Storage temperature

Operating junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Maximum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CESM}$</td>
<td>50 V</td>
</tr>
<tr>
<td>$V_{CEO}$</td>
<td>30 V</td>
</tr>
<tr>
<td>$V_{EBO}$</td>
<td>4 V</td>
</tr>
<tr>
<td>$I_C$</td>
<td>650 mA</td>
</tr>
<tr>
<td>$I_{CM}$</td>
<td>1000 mA</td>
</tr>
<tr>
<td>$P_{tot}$</td>
<td>10.8 W</td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>-65 to +150 °C</td>
</tr>
<tr>
<td>$T_j$</td>
<td>200 °C</td>
</tr>
</tbody>
</table>

![Graph 1](image1.png)

(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

![Graph 2](image2.png)

Fig. 3 Power derating curve vs. temperature.

THERMAL RESISTANCE (see Fig. 4)

From junction to mounting base
(dissipation = 3.75 W; $T_{mb} = 72.3\,^\circ C$; i.e. $T_h = 70\,^\circ C$)

From mounting base to heatsink

$$ R_{th\,j-mb} = 15.0 \, K/W $$

$$ R_{th\,mb-h} = 0.6 \, K/W $$

520 September 1979
Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\,mb-h} = 0.6 \, K/W$.)

Example
Nominal class-A operation: $V_{CE} = 25 \, V$; $I_C = 150 \, mA$; $T_h = 70 \, ^{\circ}C$.
Fig. 4 shows: $R_{th\,j-h}$ max. 15.6 K/W $T_j$ max. 130 °C
Typical device: $R_{th\,j-h}$ typ. 13.5 K/W $T_j$ typ. 120 °C
**CHARACTERISTICS**

$T_j = 25 \, ^\circ C$ unless otherwise specified

**Collector-emitter breakdown voltage**

<table>
<thead>
<tr>
<th>Condition</th>
<th>$V_{BR}(CES)$</th>
<th>$V_{BR}(CEO)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_C = 2 , mA$</td>
<td>$&gt; 50 , V$</td>
<td>$&gt; 30 , V$</td>
</tr>
<tr>
<td>$I_C = 15 , mA$</td>
<td>$&gt; 4 , V$</td>
<td></td>
</tr>
</tbody>
</table>

**Emitter-base breakdown voltage**

<table>
<thead>
<tr>
<th>Condition</th>
<th>$I_E = 1 , mA$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{BR}(EBO)$</td>
<td>$&lt; 0.5 , mA$</td>
</tr>
<tr>
<td>$V_{BR}(EBO)$</td>
<td>$&lt; 1.2 , mA$</td>
</tr>
</tbody>
</table>

**Collector cut-off current**

<table>
<thead>
<tr>
<th>Condition</th>
<th>$I_C$</th>
<th>$V_{CE}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_C = 150 , mA$</td>
<td>$V_{CE} = 25 , V$</td>
<td>$&gt; 0.5 , mA$</td>
</tr>
<tr>
<td>$I_C = 300 , mA$</td>
<td>$V_{CE} = 25 , V$</td>
<td>$&gt; 1.2 , mA$</td>
</tr>
</tbody>
</table>

**D.C. current gain**

<table>
<thead>
<tr>
<th>Condition</th>
<th>$h_{FE}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_C = 150 , mA$</td>
<td>$V_{CE} = 25 , V$</td>
</tr>
<tr>
<td>$I_C = 150 , mA$</td>
<td>$V_{CE} = 25 , V$</td>
</tr>
</tbody>
</table>

**Collector-emitter saturation voltage**

<table>
<thead>
<tr>
<th>Condition</th>
<th>$V_{CEsat}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_C = 300 , mA$</td>
<td>$I_B = 30 , mA$</td>
</tr>
</tbody>
</table>

**Transition frequency at $f = 500 \, MHz$**

<table>
<thead>
<tr>
<th>Condition</th>
<th>$f_T$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_E = 150 , mA$</td>
<td>$V_{CB} = 25 , V$</td>
</tr>
<tr>
<td>$I_E = 300 , mA$</td>
<td>$V_{CB} = 25 , V$</td>
</tr>
</tbody>
</table>

**Collector capacitance at $f = 1 \, MHz$**

<table>
<thead>
<tr>
<th>Condition</th>
<th>$C_C$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_E = I_C = 0$</td>
<td>$V_{CB} = 25 , V$</td>
</tr>
</tbody>
</table>

**Feedback capacitance at $f = 1 \, MHz$**

<table>
<thead>
<tr>
<th>Condition</th>
<th>$C_{RE}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_C = 10 , mA$</td>
<td>$V_{CE} = 25 , V$</td>
</tr>
</tbody>
</table>

**Collector-stud capacitance**

<table>
<thead>
<tr>
<th>Condition</th>
<th>$C_{CS}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_C = 10 , mA$</td>
<td>$V_{CE} = 25 , V$</td>
</tr>
</tbody>
</table>

* Measured under pulse conditions: $t_p \leq 300 \, \mu s$; $\delta \leq 0.02$.

** Measured under pulse conditions: $t_p \leq 50 \, \mu s$; $\delta \leq 0.01$. 

522 August 1986
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Fig. 5 Typical values; $T_j = 25\, ^\circ C$.

Fig. 6 $I_E = I_e = 0$; $f = 1\, \text{MHz}$; $T_j = 25\, ^\circ C$.

Fig. 7 $V_{CB} = 25\, \text{V}$; $f = 500\, \text{MHz}$; $T_j = 25\, ^\circ C$. 
 List of components:

C1 = C7 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 05003)
C2 = C6 = C8 = 1 to 3,5 pF film dielectric trimmer (cat. no. 2222 809 05001) placed 24 mm, 17 mm and 45 mm respectively from transistor edge
C3 = 1,8 to 10 pF film dielectric trimmer (cat. no. 2222 809 05002)
C4 = C5 = 3 pF multilayer chip capacitor (ATC 100A-3RO-C-PX-50)
C9 = C12 = 1 nF chip capacitor
C10 = 100 nF polyester capacitor
C11 = C13 = 470 nF polyester capacitor
C14 = 10 nF polyester capacitor
C15 = 3,3 µF/40 V solid aluminium electrolytic capacitor
L1 = stripline (5,0 mm x 4,5 mm)
L2 = stripline (13,2 mm x 4,5 mm)
L3 = stripline (15,0 mm x 4,5 mm)
L4 = micro choke 0.47 µH (cat. no. 4322 057 04770)
L5 = 4 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 5,5 mm; leads 2 x 4 mm
L6 = stripline (37,0 mm x 4,5 mm)
L7 = stripline (13,5 mm x 4,5 mm)
L1; L2; L3; L6 and L7 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric ($\varepsilon_r = 2.74$); thickness 1/16".

Component layout and printed-circuit board for 860 MHz test circuit are shown in Fig. 9. For bias circuit see Fig. 10.
Fig. 9 Component layout and printed-circuit board for 860 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.
List of components:
C1 = 100 pF ceramic capacitor
C2 = C3 = 100 nF polyester capacitor
C4 = 10 µF/25 V solid aluminium electrolytic capacitor
R1 = 150 Ω carbon resistor (0,25 W)
R2 = 100 Ω preset potentiometer (0,1 W)
R3 = 82 Ω carbon resistor (0,25 W)
R4 = R5 = 2,2 kΩ carbon resistor (0,25 W)
R6 = 12 Ω carbon resistor (0,5 W)
R7 = R8 = 820 Ω carbon resistor (0,25 W)
R9 = 33 Ω carbon resistor (0,25 W)
D1 = BZY88-C3V3
D2 = BY206
TR1 = BD136

Fig. 10 Bias circuit for class-A amplifier at f_\text{vision} = 860 MHz.

Fig. 11 Intermodulation distortion (d_{im})* and cross-modulation distortion (d_{cm})** as a function of output power. Typical values; V_{CE} = 25 V; I_{C} = 150 mA; f_{\text{vision}} = 860 MHz; ----- T_{H} = 25 °C; ------- T_{H} = 70 °C.

Information for wideband application from 470 to 860 MHz available on request.

* Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -16 dB), zero dB corresponds to peak sync level.

** Two-tone test method (vision carrier 0 dB, sound carrier -7 dB), zero dB corresponds to peak sync level.

Cross-modulation distortion (d_{cm}) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to -20 dB.
U.H.F. linear power transistor

**Fig. 12** Input impedance (series components).

**Fig. 13** Load impedance (series components).

**Fig. 14.**

Conditions for Figs 12, 13 and 14:
Typical values; \( V_{CE} = 25 \) V; \( I_C = 150 \) mA; \( T_h = 70 \) °C.

**Ruggedness**
The BLW32 is capable of withstanding a load mismatch (VSWR = 50 through all phases) under the following conditions:
\( f = 860 \) MHz; \( V_{CE} = 25 \) V; \( I_C = 150 \) mA; \( T_h = 70 \) °C and \( P_L = 1 \) W.
U.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in linear u.h.f. amplifiers for television transmitters and transposers. The excellent d.c. dissipation properties for class-A operation are obtained by means of diffused emitter ballasting resistors and a multi-base structure, providing an optimum temperature profile on the crystal area. The combination of optimum thermal design and the application of gold sandwich metallization realizes excellent reliability properties.

The transistor has a ¼" capstan envelope with ceramic cap.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Mode of Operation</th>
<th>f_{vision} MHz</th>
<th>V_{CE} V</th>
<th>I_C mA</th>
<th>T_H °C</th>
<th>d_{im} dB</th>
<th>P_0 sync W</th>
<th>G_p dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>class-A; linear amplifier</td>
<td>860</td>
<td>25</td>
<td>300</td>
<td>70</td>
<td>-60</td>
<td>&gt; 1,0</td>
<td>&gt; 10,0</td>
</tr>
<tr>
<td>860</td>
<td>25</td>
<td>300</td>
<td>25</td>
<td>-60</td>
<td>typ. 1,15</td>
<td>typ. 10,5</td>
<td></td>
</tr>
</tbody>
</table>

* Three-tone test method (vision carrier —8 dB, sound carrier —7 dB, sideband signal —16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Torque on nut: min. 0,75 Nm (7,5 kg cm) 
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm. 
Mounting hole to have no burrs at either end. 
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage
(peak value); $V_{BE} = 0$

Emitter-base voltage (open collector)

Collector current
d.c. or average
(peak value); $f > 1$ MHz

Total power dissipation up to $T_{mb} = 25\, ^\circ C$

Storage temperature

Operating junction temperature

---

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CESM}$ max.</td>
<td>50 V</td>
</tr>
<tr>
<td>$V_{CEO}$ max.</td>
<td>30 V</td>
</tr>
<tr>
<td>$V_{EBO}$ max.</td>
<td>4 V</td>
</tr>
<tr>
<td>$I_C$ max.</td>
<td>1,25 A</td>
</tr>
<tr>
<td>$I_{CM}$ max.</td>
<td>1,9 A</td>
</tr>
<tr>
<td>$P_{tot}$ max.</td>
<td>19,3 W</td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>-65 to +150 $^\circ C$</td>
</tr>
<tr>
<td>$T_J$ max.</td>
<td>200 $^\circ C$</td>
</tr>
</tbody>
</table>

---

Fig. 2D.C. SOAR.

THERMAL RESISTANCE (see Fig. 4)

From junction to mounting base
(dissipation = 7,5 W; $T_{mb} = 74,5\, ^\circ C$; i.e. $T_{h} = 70\, ^\circ C$)

From mounting base to heatsink

$$R_{th\, j-mb} = 10,1\, \text{K/W}$$

$$R_{th\, mb-h} = 0,6\, \text{K/W}$$

---

Fig. 3 Power derating curve vs. temperature.
Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\, mb-h} = 0,6\, K/W$.)

Example

Nominal class-A operation: $V_{CE} = 25\, V; I_C = 300\, mA; T_H = 70\, ^\circ C$.

Fig. 4 shows: $R_{th\, j-h}$ max. $10,7\, K/W$

$T_J$ max. $150\, ^\circ C$

Typical device: $R_{th\, j-h}$ typ. $8,25\, K/W$

$T_J$ typ. $132\, ^\circ C$
**CHARACTERISTICS**

*Tj = 25 °C unless otherwise specified*

**Collector-emitter breakdown voltage**
- \( V_{BE} = 0; I_C = 4 \text{ mA} \)
  - open base; \( I_C = 30 \text{ mA} \)
- \( V_{BE} = 0; V_{CE} = 30 \text{ V} \)

**Emitter-base breakdown voltage**
- open collector; \( I_E = 2 \text{ mA} \)
- \( I_E = 30 \text{ mA} \)

**Collector cut-off current**
- \( V_{BE} = 0; V_{CE} = 30 \text{ V} \)
  - \( V_{BE} = 0; V_{CE} = 30 \text{ V}; T_j = 175 \text{ °C} \)

**D.C. current gain**
- \( I_C = 300 \text{ mA}; V_{CE} = 25 \text{ V} \)
  - \( I_C = 300 \text{ mA}; V_{CE} = 25 \text{ V}; T_j = 175 \text{ °C} \)

**Collector-emitter saturation voltage**
- \( I_C = 600 \text{ mA}; I_B = 60 \text{ mA} \)

**Transition frequency at \( f = 500 \text{ MHz} \)**
- \( I_E = 300 \text{ mA}; V_{CB} = 25 \text{ V} \)
  - \( I_E = 600 \text{ mA}; V_{CB} = 25 \text{ V} \)

**Collector capacitance at \( f = 1 \text{ MHz} \)**
- \( I_E = I_E = 0; V_{CB} = 25 \text{ V} \)

**Feedback capacitance at \( f = 1 \text{ MHz} \)**
- \( I_C = 20 \text{ mA}; V_{CE} = 25 \text{ V} \)

**Collector-stud capacitance**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-emitter breakdown voltage</td>
<td>( V_{(BR)CES} )</td>
<td>&gt; 50 V</td>
</tr>
<tr>
<td>Collector-emitter breakdown voltage</td>
<td>( V_{(BR)CEO} )</td>
<td>&gt; 30 V</td>
</tr>
<tr>
<td>Collector-emitter breakdown voltage</td>
<td>( V_{(BR)EBO} )</td>
<td>&gt; 4 V</td>
</tr>
<tr>
<td>Emitter-base breakdown voltage</td>
<td>( I_{CES} )</td>
<td>&lt; 1,0 mA</td>
</tr>
<tr>
<td>Emitter-base breakdown voltage</td>
<td>( I_{CES} )</td>
<td>&lt; 2,5 mA</td>
</tr>
<tr>
<td>D.C. current gain</td>
<td>( h_{FE} )</td>
<td>&gt; 20</td>
</tr>
<tr>
<td>D.C. current gain</td>
<td>( h_{FE} )</td>
<td>&lt; 120</td>
</tr>
<tr>
<td>Collector-emitter saturation voltage</td>
<td>( V_{CEsat} )</td>
<td>typ. 450 mV</td>
</tr>
<tr>
<td>Transition frequency at ( f = 500 \text{ MHz} )</td>
<td>( f_T )</td>
<td>typ. 3,4 GHz</td>
</tr>
<tr>
<td>Transition frequency at ( f = 500 \text{ MHz} )</td>
<td>( f_T )</td>
<td>typ. 3,1 GHz</td>
</tr>
<tr>
<td>Collector capacitance at ( f = 1 \text{ MHz} )</td>
<td>( C_c )</td>
<td>typ. 6,6 pF</td>
</tr>
<tr>
<td>Feedback capacitance at ( f = 1 \text{ MHz} )</td>
<td>( C_{re} )</td>
<td>typ. 3,5 pF</td>
</tr>
<tr>
<td>Collector-stud capacitance</td>
<td>( C_{cs} )</td>
<td>typ. 1,2 pF</td>
</tr>
</tbody>
</table>

* Measured under pulse conditions: \( t_p \leq 300 \mu s; \delta \leq 0,02 \).
** Measured under pulse conditions: \( t_p \leq 50 \mu s; \delta \leq 0,01 \).
U.H.F. linear power transistor

Fig. 5 Typical values; $T_j = 25 \, ^\circ C$.

Fig. 6 $I_E = I_e = 0$; $f = 1 \, MHz$; $T_j = 25 \, ^\circ C$.

Fig. 7 $V_{CB} = 25 \, V$; $f = 500 \, MHz$; $T_j = 25 \, ^\circ C$. 

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**APPLICATION INFORMATION**

<table>
<thead>
<tr>
<th>$f_{\text{vision}}$ (MHz)</th>
<th>$V_{CE}$ (V)</th>
<th>$I_C$ (mA)</th>
<th>$T_h$ (°C)</th>
<th>$d_{\text{lim}}$ (dB)</th>
<th>$P_{\text{osync}}$ (W)</th>
<th>$G_p$ (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>860</td>
<td>25</td>
<td>300</td>
<td>70</td>
<td>-60</td>
<td>&gt; 1,0</td>
<td>&gt; 10</td>
</tr>
<tr>
<td>860</td>
<td>25</td>
<td>300</td>
<td>70</td>
<td>-60</td>
<td>typ. 1,07</td>
<td>typ. 10,5</td>
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<tr>
<td>860</td>
<td>25</td>
<td>300</td>
<td>25</td>
<td>-60</td>
<td>typ. 1,15</td>
<td>typ. 10,5</td>
</tr>
</tbody>
</table>

* Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -16 dB), zero dB corresponds to peak sync level.

![Test circuit at $f_{\text{vision}} = 860$ MHz.](image)

List of components:

- **C1 = C3 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 05003)**
- **C2 = C6 = C8 = 1 to 3,5 pF film dielectric trimmer (cat. no. 2222 809 05001) placed 24 mm, 8 mm and 46 mm respectively from transistor edge**
- **C4 = C5 = 4,3 pF multilayer chip capacitor (ATC 100A-4R3-C-PX-50)**
- **C7 = 1,8 to 10 pF film dielectric trimmer (cat. no. 2222 809 05002)**
- **C9 = C12 = 1 nF chip capacitor**
- **C10 = 100 nF polyester capacitor**
- **C11 = C13 = 470 nF polyester capacitor**
- **C14 = 10 nF polyester capacitor**
- **C15 = 3,3 µF/40 F solid aluminium electrolytic capacitor**

- **L1 = stripline (5,2 mm x 4,5 mm)**
- **L2 = stripline (13,2 mm x 4,5 mm)**
- **L3 = stripline (15,0 mm x 4,5 mm)**
- **L4 = micro choke 0,47 µH (cat. no. 4322 057 04770)**
- **L5 = stripline (see Fig. 9 printed-circuit board layout)**
- **L6 = 4 turns closely wound enamed Cu wire (1,0 mm); int. dia. 5,5 mm; leads 2 x 4 mm**
- **L7 = stripline (37,0 mm x 4,5 mm)**
- **L8 = stripline (13,5 mm x 4,5 mm)**

$L1; L2; L3; L5$ and $L7$ and $L8$ are striplines on a double Cu-clad printed-circuit board with PTFE fibreglass dielectric ($\varepsilon_r = 2,74$); thickness $1/16\"$.
The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.
List of components:
C1 = 100 pF ceramic capacitor
C2 = C3 = 100 nF polyester capacitor
C4 = 10 µF/25 V solid aluminium electrolytic capacitor
R1 = 150 Ω carbon resistor (0.25 W)
R2 = 100 Ω preset potentiometer (0.1 W)
R3 = 82 Ω carbon resistor (0.25 W)
R4 = R5 = 2.2 kΩ carbon resistor (0.25 W)
R6 = 6 Ω; parallel connection of 2 x 12 Ω carbon resistors (0.5 W each)
R7 = R8 = 820 Ω carbon resistor (0.25 W)
R9 = 33 Ω carbon resistor (0.25 W)
D1 = BZY88-C3V3
D2 = BY206
TR1 = BD136

Fig. 10 Bias circuit for class-A linear amplifier at f_{vision} = 860 MHz.

Fig. 11 Intermodulation distortion (d_{im})* and cross-modulation distortion (d_{cm})** as a function of output power. Typical values;
V_{CE} = 25 V; I\text{C} = 300 mA; f_{vision} = 860 MHz; --- \text{T}_\text{h} = 25 \degree \text{C};
--- \text{T}_\text{h} = 70 \degree \text{C}.

Information for wideband application from 470 to 860 MHz available on request.
* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
Intermodulation distortion of input signal \leq −75 dB.
** Two-tone test method (vision carrier 0 dB, sound carrier −7 dB), zero dB corresponds to peak sync level.
Cross-modulation distortion (d_{cm}) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to −20 dB.
Fig. 12 Input impedance (series components).

Fig. 13 Load impedance (series components).

Conditions for Figs 12, 13 and 14:
Typical values; $V_{CE} = 25 \text{ V}$; $I_C = 300 \text{ mA}$; $T_h = 70 \text{ °C}$.

Ruggedness
The BLW33 is capable of withstanding a load mismatch ($\text{VSWR} = 50$ through all phases) under the following conditions:
$f = 860 \text{ MHz}$; $V_{CE} = 25 \text{ V}$; $I_C = 300 \text{ mA}$; $T_h = 70 \text{ °C}$ and $P_L = 2 \text{ W}$. 
U.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in linear u.h.f. amplifiers for television transmitters and transposers. The excellent d.c. dissipation properties for class-A operation are obtained by means of diffused emitter ballasting resistors and a multi-base structure, providing an optimum temperature profile on the crystal area. The combination of optimum thermal design and the application of gold sandwich metallization realizes excellent reliability properties.

The transistor has a ¼” capstan envelope with ceramic cap.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>R.F. performance mode of operation</th>
<th>f_{vision} MHz</th>
<th>V_{CE} V</th>
<th>I_{C} mA</th>
<th>T_{H} °C</th>
<th>d_{im} dB</th>
<th>P_{o sync} W</th>
<th>G_{p} dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>class-A; linear amplifier</td>
<td>860</td>
<td>25</td>
<td>600</td>
<td>70</td>
<td>-60</td>
<td>&gt; 1,8</td>
<td>&gt; 9</td>
</tr>
<tr>
<td></td>
<td>860</td>
<td>25</td>
<td>600</td>
<td>25</td>
<td>-60</td>
<td>typ. 2,15</td>
<td>typ. 10,2</td>
</tr>
</tbody>
</table>

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage
(peak value); $V_{BE} = 0$
open base

Emitter-base voltage (open collector)

Collector current
d.c. or average
(peak value); $f > 1$ MHz

Total power dissipation at $T_{mb} = 25^\circ C$

Storage temperature

Operating junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CESM}$</td>
<td>max. 50 V</td>
</tr>
<tr>
<td>$V_{CEO}$</td>
<td>max. 30 V</td>
</tr>
<tr>
<td>$V_{EBO}$</td>
<td>max. 4 V</td>
</tr>
<tr>
<td>$I_C$</td>
<td>max. 2.25 A</td>
</tr>
<tr>
<td>$I_{CM}$</td>
<td>max. 3.5 A</td>
</tr>
<tr>
<td>$P_{tot}$</td>
<td>max. 31 W</td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>$-65$ to $+150$ °C</td>
</tr>
<tr>
<td>$T_j$</td>
<td>max. 200 °C</td>
</tr>
</tbody>
</table>

Fig. 2 D.C. SOAR.

THERMAL RESISTANCE (see Fig. 4)

From junction to mounting base
(dissipation = 15 W; $T_{mb} = 79$ °C; i.e. $T_h = 70$ °C)

From mounting base to heatsink

$R_{th \ j\ -\ mb} = 6.2$ K/W

$R_{th \ mb\ -\ h} = 0.6$ K/W

Fig. 3 Power derating curve vs. temperature.
Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{\text{th mb-h}} = 0.6 \text{ K/W}$.)

Example
Nominal class-A operation: $V_{CE} = 25 \text{ V}; \ I_C = 600 \text{ mA}; \ T_h = 70 \text{ °C}$.

Fig. 4 shows:
- $R_{\text{th j-h}}$ max. $6.75 \text{ K/W}$
- $T_j$ max. $170 \text{ °C}$

Typical device:
- $R_{\text{th j-h}}$ typ. $5.45 \text{ K/W}$
- $T_j$ typ. $152 \text{ °C}$
CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage

\[ V_{BE} = 0; \ I_C = 8 \, mA \]
open base; \( I_C = 60 \, mA \)

Emitter-base breakdown voltage
open collector; \( I_E = 4 \, mA \)

Collector cut-off current

\[ V_{BE} = 0; V_{CE} = 30 \, V \]
\[ V_{BE} = 0; V_{CE} = 30 \, V; T_j = 175 \, ^\circ C \]

D.C. current gain

\[ I_C = 600 \, mA; V_{CE} = 25 \, V \]
\[ I_C = 600 \, mA; V_{CE} = 25 \, V; T_j = 175 \, ^\circ C \]

Collector-emitter saturation voltage *

\[ I_C = 1,2 \, A; I_B = 0,12 \, A \]

Transition frequency at \( f = 500 \, MHz \) **

\[ -I_E = 0,6 \, A; V_{CB} = 25 \, V \]
\[ -I_E = 1,2 \, A; V_{CB} = 25 \, V \]

Collector capacitance at \( f = 1 \, MHz \)

\[ I_E = I_e = 0; V_{CB} = 25 \, V \]

Feedback capacitance at \( f = 1 \, MHz \)

\[ I_C = 40 \, mA; V_{CE} = 25 \, V \]

Collector-stud capacitance

\[ V_{(BR)CES} > 50 \, V \]
\[ V_{(BR)CEO} > 30 \, V \]
\[ V_{(BR)EBO} > 4 \, V \]

\[ I_{CES} < 2,0 \, mA \]
\[ I_{CES} < 5,0 \, mA \]

\[ h_{FE} \quad \text{typ.} \quad 20 \]
\[ h_{FE} < 120 \]

\[ V_{CEsat} \quad \text{typ.} \quad 450 \, mV \]

\[ f_T \quad \text{typ.} \quad 3,3 \, GHz \]
\[ f_T \quad \text{typ.} \quad 3,0 \, GHz \]

\[ C_c \quad \text{typ.} \quad 13,5 \, pF \]

\[ C_{re} \quad \text{typ.} \quad 8,4 \, pF \]

\[ C_{cs} \quad \text{typ.} \quad 1,2 \, pF \]

* Measured under pulse conditions: \( t_p \leq 300 \, \mu s; \delta \leq 0,02 \).

** Measured under pulse conditions: \( t_p \leq 50 \, \mu s; \delta \leq 0,01 \).
U.H.F. linear power transistor

Fig. 5 Typical values; $T_j = 25 \, ^\circ\text{C}$.

Fig. 6 $I_E = I_c = 0; f = 1 \, \text{MHz}; T_j = 25 \, ^\circ\text{C}$.

Fig. 7 $V_{CB} = 25 \, \text{V}; f = 500 \, \text{MHz}; T_j = 25 \, ^\circ\text{C}$.
APPLICATION INFORMATION

<table>
<thead>
<tr>
<th>$f_{\text{vision}}$ (MHz)</th>
<th>$V_{CE}$ (V)</th>
<th>$I_C$ (mA)</th>
<th>$T_h$ ($^\circ$C)</th>
<th>$d_{im}$ (dB)</th>
<th>$P_{o \text{sync}}$ (W)</th>
<th>$G_p$ (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>860</td>
<td>25</td>
<td>600</td>
<td>70</td>
<td>-60</td>
<td>&gt; 1.8</td>
<td>&gt; 9</td>
</tr>
<tr>
<td>860</td>
<td>25</td>
<td>600</td>
<td>70</td>
<td>-60</td>
<td>typ. 1.9</td>
<td>typ. 10.2</td>
</tr>
<tr>
<td>860</td>
<td>25</td>
<td>600</td>
<td>25</td>
<td>-60</td>
<td>typ. 2.15</td>
<td>typ. 10.2</td>
</tr>
</tbody>
</table>

* Three-tone test method (vision carrier $-8$ dB, sound carrier $-7$ dB, sideband signal $-16$ dB), zero dB corresponds to peak sync level.

Fig. 8 Test circuit at $f_{\text{vision}} = 860$ MHz.

List of components:

- $C1 = C5 = 1.8$ to $10$ pF film dielectric trimmer (cat. no. 2222 809 05002)
- $C2 = C6 = 1$ to $3.5$ pF film dielectric trimmer (cat. no. 2222 809 05001) placed $13.5$ mm and $46$ mm respectively from transistor edge
- $C3 = C4 = 2$ pF multilayer chip capacitor (ATC 100A-2RO-C-PX-50)
- $C7 = C10 = 1$ nF chip capacitor
- $C8 = 100$ nF polyester capacitor
- $C9 = C12 = 470$ nF polyester capacitor
- $C11 = 10$ nF polyester capacitor
- $C13 = 3.3$ $\mu$F/40 V solid aluminium electrolytic capacitor
- $L1 = \text{stripline} (9.2$ mm x $7.0$ mm)
- $L2 = \text{stripline} (14.2$ mm x $7.0$ mm)
- $L3 = \text{micro choke} 0.47 \mu$H (cat. no. 4322 057 04770)
- $L4 = \text{stripline} (\text{see Fig. 9 printed-circuit board layout})$
- $L5 = 34$ mm straight Cu wire (1.0 mm); height above print $3.3$ mm
- $L6 = \text{stripline} (41.0$ mm x $7.0$ mm)
- $L7 = \text{stripline} (8.7$ mm x $7.0$ mm)

$L1$; $L2$; $L4$; $L6$ and $L7$ are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric ($\varepsilon_r = 2.74$); thickness $1/16"$.

Component layout and printed-circuit board for $860$ MHz test circuit are shown in Fig. 9. For bias circuit see Fig. 10.
The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.
List of components:

- **C1** = 100 pF ceramic capacitor
- **C2 = C3** = 100 nF polyester capacitor
- **C4** = 10 µF/25 V solid aluminium electrolytic capacitor
- **R1** = 150 Ω carbon resistor (0.25 W)
- **R2** = 100 Ω preset potentiometer (0.1 W)
- **R3** = 82 Ω carbon resistor (0.25 W)
- **R4 = R5** = 2,2 kΩ carbon resistor (0.25 W)
- **R6 = 2,8 Ω**; parallel connection of 2 x 5,6 Ω carbon resistors (0.5 W each)
- **R7 = RB** = 820 Ω carbon resistor (0.25 W)
- **R9** = 33 Ω carbon resistor (0.25 W)
- **D1** = BZY88-C3V3
- **D2** = BY206
- **TR1** = BD136

**Fig. 10** Bias circuit for class-A linear amplifier at $f_{\text{vision}} = 860$ MHz.

**Fig. 11** Intermodulation distortion ($d_{\text{im}}$)* and cross-modulation distortion ($d_{\text{cm}}$)** as a function of output power. Typical values; $V_{\text{CE}} = 25$ V; $I_C = 600$ mA; $f_{\text{vision}} = 860$ MHz; —— $T_H = 25^\circ$C; —— $T_H = 70^\circ$C.

Information for wideband application from 470 to 860 MHz available on request.

* Three-tone test method (vision carrier $-8$ dB, sound carrier $-7$ dB, sideband signal $-16$ dB), zero dB corresponds to peak sync level.
  Intermodulation distortion of input signal $\leq -75$ dB.

** Two-tone test method (vision carrier 0 dB, sound carrier $-7$ dB), zero dB corresponds to peak sync level.
  Cross-modulation distortion ($d_{\text{cm}}$) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to $-20$ dB.
Fig. 12 Input impedance (series components).

Fig. 13 Load impedance (series components).

Conditions for Figs 12, 13 and 14:
Typical values; V_{CE} = 25 V; I_C = 600 mA; T_{h} = 70 °C.

Ruggedness
The BLW34 is capable of withstanding a load mismatch (VSWR = 50 through all phases) under the following conditions:
f = 860 MHz; V_{CE} = 25 V; I_C = 600 mA; T_{h} = 70 °C and P_L = 4 W.
H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in class-A, AB and B operated, industrial and military transmitters in the h.f. and v.h.f. band. Resistance stabilization provides protection against device damage at severe load mismatch conditions. Matched $h_{FE}$ groups are available on request.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_p$ dB</th>
<th>$\eta_{dt}$</th>
<th>$I_C$ A</th>
<th>$I_C(ZS)$ mA</th>
<th>$d_3$ dB</th>
<th>$T_h$ °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>s.s.b. (class-A)</td>
<td>45</td>
<td>1,6 - 28</td>
<td>0 - 16 (P.E.P.)</td>
<td>$&gt;19,5$</td>
<td>$-$</td>
<td>1,2</td>
<td>$-$</td>
<td>$&lt;40$</td>
<td>70</td>
</tr>
<tr>
<td>s.s.b. (class-AB)</td>
<td>50</td>
<td>1,6 - 28</td>
<td>10 - 65 (P.E.P.)</td>
<td>typ. 18</td>
<td>typ. 45*</td>
<td>1,45</td>
<td>50</td>
<td>typ. $-30$</td>
<td>25</td>
</tr>
</tbody>
</table>

* At 65W P.E.P.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0)
  peak value

Collector-emitter voltage (open base)

Emitter-base voltage (open collector)

Collector current (average)

Collector current (peak value); f > 1 MHz

D.C. and r.f. (f > 1 MHz) power dissipation; T_{mb} = 25 °C

Storage temperature

Operating junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Max. Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_{CESM}</td>
<td>110 V</td>
</tr>
<tr>
<td>V_{CEO}</td>
<td>55 V</td>
</tr>
<tr>
<td>V_{EBO}</td>
<td>4 V</td>
</tr>
<tr>
<td>I_{C(AV)}</td>
<td>2.5 A</td>
</tr>
<tr>
<td>I_{CM}</td>
<td>7.5 A</td>
</tr>
<tr>
<td>P_{tot}; P_{rf}</td>
<td>94 W</td>
</tr>
<tr>
<td>T_{stg}</td>
<td>-65 to +150 °C</td>
</tr>
<tr>
<td>T_{j}</td>
<td>200 °C</td>
</tr>
</tbody>
</table>

**THERMAL RESISTANCE** (dissipation = 54 W; T_{mb} = 86 °C, i.e. T_{h} = 70 °C)

From junction to mounting base
  (d.c. and r.f. dissipation)

From mounting base to heatsink

\[ R_{th \; j-mb} = 2.1 \; \text{K/W} \]

\[ R_{th \; mb-h} = 0.3 \; \text{K/W} \]
### CHARACTERISTICS

\( T_j = 25 \, ^\circ \text{C} \)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-emitter breakdown voltage</td>
<td>( V_{BE} = 0; , I_C = 25 , \text{mA} )</td>
</tr>
<tr>
<td>Collector-emitter breakdown voltage open base</td>
<td>( I_C = 100 , \text{mA} )</td>
</tr>
<tr>
<td>Emitter-base breakdown voltage open collector</td>
<td>( I_E = 10 , \text{mA} )</td>
</tr>
<tr>
<td>Collector cut-off current ( V_{BE} = 0; , V_{CE} = 55 , \text{V} )</td>
<td></td>
</tr>
<tr>
<td>Second breakdown energy; ( L = 25 , \text{mH}; , f = 50 , \text{Hz} ) open base</td>
<td>( R_{BE} = 10 , \Omega )</td>
</tr>
<tr>
<td>D.C. current gain*</td>
<td>( I_C = 1.2 , \text{A}; , V_{CE} = 5 , \text{V} )</td>
</tr>
<tr>
<td>D.C. current gain ratio of matched devices*</td>
<td>( I_C = 1.2 , \text{A}; , V_{CE} = 5 , \text{V} )</td>
</tr>
<tr>
<td>Collector-emitter saturation voltage*</td>
<td>( I_C = 3.0 , \text{A}; , I_B = 0.6 , \text{A} )</td>
</tr>
<tr>
<td>Transition frequency at ( f = 100 , \text{MHz} )*</td>
<td>( -I_E = 1.2 , \text{A}; , V_{CB} = 45 , \text{V} )</td>
</tr>
<tr>
<td></td>
<td>( -I_E = 4.0 , \text{A}; , V_{CB} = 45 , \text{V} )</td>
</tr>
<tr>
<td>Collector capacitance at ( f = 1 , \text{MHz} )</td>
<td>( I_E = I_C = 0; , V_{CB} = 45 , \text{V} )</td>
</tr>
<tr>
<td>Feedback capacitance at ( f = 1 , \text{MHz} )</td>
<td>( I_C = 50 , \text{mA}; , V_{CE} = 45 , \text{V} )</td>
</tr>
<tr>
<td>Collector-flange capacitance</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_{BR} )CES</td>
<td>( &gt; 110 , \text{V} )</td>
</tr>
<tr>
<td>( V_{BR} )CEO</td>
<td>( &gt; 55 , \text{V} )</td>
</tr>
<tr>
<td>( V_{BR} )EBO</td>
<td>( &gt; 4 , \text{V} )</td>
</tr>
<tr>
<td>( I_{CES} )</td>
<td>(&lt; 10 , \text{mA} )</td>
</tr>
<tr>
<td>( E_{SBO} )</td>
<td>( &gt; 8 , \text{mJ} )</td>
</tr>
<tr>
<td>( E_{SBR} )</td>
<td>( &gt; 8 , \text{mJ} )</td>
</tr>
<tr>
<td>( h_{FE} ) typ.</td>
<td>( 25 )</td>
</tr>
<tr>
<td></td>
<td>( 15 , \text{to} , 100 )</td>
</tr>
<tr>
<td>( h_{FE1}/h_{FE2} )</td>
<td>(&lt; 1.2 )</td>
</tr>
<tr>
<td>( V_{CESat} ) typ.</td>
<td>( 1.2 , \text{V} )</td>
</tr>
<tr>
<td>( f_T ) typ.</td>
<td>( 490 , \text{MHz} )</td>
</tr>
<tr>
<td>( f_T ) typ.</td>
<td>( 540 , \text{MHz} )</td>
</tr>
<tr>
<td>( C_C ) typ.</td>
<td>( 53 , \text{pF} )</td>
</tr>
<tr>
<td>( C_{re} ) typ.</td>
<td>( 35 , \text{pF} )</td>
</tr>
<tr>
<td>( C_{cf} ) typ.</td>
<td>( 2 , \text{pF} )</td>
</tr>
</tbody>
</table>

* Measured under pulse conditions: \( t_p \leq 200 \, \mu\text{s}; \, \delta \leq 0.02. \)
Fig. 4  $V_{CE} = 40 \, V$; $T_{mb} = 25 \, ^{\circ}C$.

Fig. 5  Typical values; $T_j = 25 \, ^{\circ}C$.

Fig. 6  Typical values; $f = 100 \, MHz$; $T_j = 25 \, ^{\circ}C$.

Fig. 7  $I_E = I_e = 0$; $f = 1 \, MHz$; $T_j = 25 \, ^{\circ}C$. 
APPLICATION INFORMATION

R.F. performance in s.s.b. class-A operation (linear power amplifier)

\[ V_{CE} = 45 \text{ V} \]; \( f_1 = 28,000 \text{ MHz} \); \( f_2 = 28,001 \text{ MHz} \)

<table>
<thead>
<tr>
<th>output power</th>
<th>( G_p ) dB</th>
<th>( I_C ) A</th>
<th>( d_3^* ) dB</th>
<th>( d_5^* ) dB</th>
<th>( T_h ) °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 16 (P.E.P.)</td>
<td>&gt; 19.5</td>
<td>1.2</td>
<td>−40</td>
<td>&lt;−40</td>
<td>70</td>
</tr>
<tr>
<td>typ. 17 (P.E.P.)</td>
<td>typ. 20.5</td>
<td>1.2</td>
<td>−40</td>
<td>&lt;−40</td>
<td>70</td>
</tr>
</tbody>
</table>

Fig. 8 Test circuit; s.s.b. class-A.

List of components in Fig. 8:

- \( C_1 = C_2 = 10 \text{ to } 780 \text{ pF} \) film dielectric trimmer
- \( C_3 = 22 \text{ nF} \) ceramic capacitor (63 V)
- \( C_4 = 4.7 \mu F/16 \text{ V} \) electrolytic capacitor
- \( C_5 = 1 \mu F/75 \text{ V} \) solid tantalum capacitor
- \( C_6 = C_7 = 47 \text{ nF} \) polyester capacitor (100 V)
- \( C_8 = 68 \text{ pF} \) ceramic capacitor (500 V)
- \( C_9 = 3.9 \text{ nF} \) ceramic capacitor

- \( L_1 = 3 \) turns closely wound enamelled Cu wire (1,0 mm); int. dia. 9.0 mm; leads 2 x 5 mm
- \( L_2 = \) Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- \( L_3 = 1.05 \mu H; \) 15 turns enamelled Cu wire (1,0 mm); int. dia. 10.0 mm; length 17.4 mm; leads 2 x 5 mm
- \( L_4 = 162 \text{ nH}; \) 6 turns enamelled Cu wire (1,0 mm); int. dia. 7.0 mm; length 11.6 mm; leads 2 x 5 mm

- \( R_1 = 1.6 \Omega; \) parallel connection of 3 x 4.7 \( \Omega \) carbon resistors (± 5%; 0,125 W)
- \( R_2 = 47 \Omega \) carbon resistor (± 5%; 0,25 W)
- \( R_3 = 4.7 \Omega \) carbon resistor (± 5%; 0,25 W)

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.
Fig. 9 Intermodulation distortion (see note on page 5) as a function of output power. Typical values; $V_{CE} = 45 \, \text{V}; f_1 = 28,000 \, \text{MHz}; f_2 = 28,001 \, \text{MHz}; T_h = 70 \, ^\circ\text{C}$. 
R.F. performance in s.s.b. class-AB operation (linear power amplifier)

\[ V_{CE} = 50 \text{ V}; \quad f_1 = 28,000 \text{ MHz}; \quad f_2 = 28,001 \text{ MHz} \]

<table>
<thead>
<tr>
<th>output power</th>
<th>( G_p )</th>
<th>( \eta_{dt} ) (%)</th>
<th>( I_C ) (A)</th>
<th>( d_3^* )</th>
<th>( d_5^* )</th>
<th>( I_C(ZS) )</th>
<th>( T_h )</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>dB</td>
<td>at 65 W P.E.P.</td>
<td></td>
<td>dB</td>
<td>dB</td>
<td>mA</td>
<td>°C</td>
</tr>
<tr>
<td>10 to 65 (P.E.P.)</td>
<td>typ. 18</td>
<td>typ. 45</td>
<td>typ. 1,45</td>
<td>typ. -30</td>
<td>&lt;-30</td>
<td>50</td>
<td>25</td>
</tr>
</tbody>
</table>

List of components:
- \( C1 = C2 = 10 \text{ to } 780 \text{ pF film dielectric trimmer} \)
- \( C3 = C5 = C6 = 220 \text{ nF polyester capacitor} \)
- \( C4 = 120 \text{ pF ceramic capacitor (500 V)} \)
- \( C7 = 150 \text{ pF ceramic capacitor (500 V)} \)
- \( C8 = 47 \mu\text{F/63 V electrolytic capacitor} \)
- \( C9 = 3,9 \text{ nF ceramic capacitor} \)
- \( L1 = 4 \text{ turns closely wound enamelled Cu wire (1,6 mm); int. dia. 7,0 mm; leads 2 x 5 mm} \)
- \( L2 = \text{Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)} \)
- \( L3 = 9 \text{ turns enamelled Cu wire (1,0 mm); int. dia. 10 mm; length 14,5 mm; leads 2 x 5 mm} \)
- \( L4 = 6 \text{ turns enamelled Cu wire (1,0 mm); int. dia. 8,5 mm; length 11,0 mm; leads 2 x 5 mm} \)
- \( R1 = 2,4 \Omega; \text{ parallel connection of } 2 \times 4,7 \Omega \text{ carbon resistors} \)
- \( R2 = 39 \Omega \text{ carbon resistor} \)

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.
Fig. 11 Intermodulation distortion as a function of output power*.

Fig. 12 Double-tone efficiency and power gain as a function of output power.

Conditions for Figs 11 and 12:
V_{CE} = 50 V; I_{C(ZS)} = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

Ruggedness in s.s.b. operation

The BLW50F is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 45 W (P.E.P.) under the following conditions:
V_{CE} = 50 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 70 °C; R_{th mb-h} = 0.3 K/W.
H.F./V.H.F. power transistor

Fig. 13 Power gain as a function of frequency.

Fig. 14 Input impedance (series components) as a function of frequency.

Figs 13 and 14 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions for Figs 13 and 14:

\[ V_{CE} = 50 \, V; \, I_{C(ZS)} = 50 \, mA; \, P_L = 60 \, W; \, T_h = 25 \, ^\circ C; \, Z_L = 16 \, \Omega. \]
V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a nominal supply voltage of 12.5 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions with a supply over-voltage to 15 V. Matched hFE groups are available on request.

It has a plastic encapsulated stripline package. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25$ °C

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_p$ dB</th>
<th>$\eta$ %</th>
<th>$\bar{z}_i$ $\Omega$</th>
<th>$\bar{z}_L$ $\Omega$</th>
<th>$d_3$ dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w. (class-B)</td>
<td>12.5</td>
<td>175</td>
<td>45</td>
<td>&gt; 5.0</td>
<td>&gt; 75</td>
<td>1.2 + j1.4</td>
<td>2.6 - j1.2</td>
<td>-</td>
</tr>
<tr>
<td>s.s.b. (class-AB)</td>
<td>12.5</td>
<td>1.6-28</td>
<td>3-30 (P.E.P.)</td>
<td>typ. 19.5</td>
<td>typ. 35</td>
<td>-</td>
<td>-</td>
<td>typ. -33</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-56.

When locking is required an adhesive is preferred instead of a lock washer.

Torque on nut: min. 1.5 Nm
(15 kg cm)
max. 1.7 Nm
(17 kg cm)

Diameter of clearance hole in heatsink: max. 4.9 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
Ratings

Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter)
  peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current (average)
Collector current (peak value); f ≥ 1 MHz

Total power dissipation at $T_h = 70 \, ^\circ C$
  $f \geq 1 \, \text{MHz}; V_{CE} \leq 15 \, \text{V}; R_{th\, mb-h} \leq 0.3 \, \text{K/W}$
  Derate by $0.5 \, \text{W/K}$ for $50 \, ^\circ C \leq T_h \leq 100 \, ^\circ C$

$P_{tot} \text{ max.} \quad 65 \, \text{W}$

$V_{CBOM} \text{ max.} \quad 36 \, \text{V}$
$V_{CEO} \text{ max.} \quad 18 \, \text{V}$
$V_{EBO} \text{ max.} \quad 4 \, \text{V}$
$I_{C(AV)} \text{ max.} \quad 8 \, \text{A}$
$I_{CM} \text{ max.} \quad 20 \, \text{A}$

Storage temperature

$T_{stg} \quad -65 \, \text{to} \, +200 \, ^\circ C$
CHARACTERISTICS

Breakdown voltages

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_{(BR)CBO} )</td>
<td>( 36 ) V</td>
</tr>
<tr>
<td>( V_{(BR)CEO} )</td>
<td>( 18 ) V</td>
</tr>
<tr>
<td>( V_{(BR)EBO} )</td>
<td>( 4 ) V</td>
</tr>
</tbody>
</table>

Collector-base voltage
- open emitter: \( I_C = 100 \) mA

Collector-emitter voltage
- open base: \( I_C = 100 \) mA

Emitter-base voltage
- open collector: \( I_E = 25 \) mA

Transient energy

<table>
<thead>
<tr>
<th>Condition</th>
<th>( V_{BE} )</th>
<th>( R_{BE} )</th>
<th>( E_{\text{trans}} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>open base</td>
<td>( 1.5 ) V</td>
<td>( 33 ) Q</td>
<td>( 8 ) ms</td>
</tr>
</tbody>
</table>

D.C. current gain

<table>
<thead>
<tr>
<th>Condition</th>
<th>( I_C )</th>
<th>( V_{CE} )</th>
<th>( h_{FE} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.C. current gain</td>
<td>( 1 ) A</td>
<td>( 5 ) V</td>
<td>20 to 100</td>
</tr>
</tbody>
</table>

D.C. current gain ratio of matched devices

<table>
<thead>
<tr>
<th>Condition</th>
<th>( I_C )</th>
<th>( V_{CE} )</th>
<th>( h_{FE1}/h_{FE2} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.C. current gain ratio of matched devices</td>
<td>( 1 ) A</td>
<td>( 5 ) V</td>
<td>1, 2</td>
</tr>
</tbody>
</table>

Transition frequency

<table>
<thead>
<tr>
<th>Condition</th>
<th>( I_C )</th>
<th>( V_{CE} )</th>
<th>( f_T )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transition frequency</td>
<td>( 6 ) A</td>
<td>( 10 ) V</td>
<td>typ. 550 MHz</td>
</tr>
</tbody>
</table>

Collector capacitance at \( f = 1 \) MHz

<table>
<thead>
<tr>
<th>Condition</th>
<th>( I_E)</th>
<th>( I_e)</th>
<th>( V_{CB} )</th>
<th>( C_C )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector capacitance</td>
<td>( 0 ) A</td>
<td>( 0 ) A</td>
<td>( 15 ) V</td>
<td>typ. 120 pF</td>
</tr>
</tbody>
</table>

Feedback capacitance

<table>
<thead>
<tr>
<th>Condition</th>
<th>( I_C )</th>
<th>( V_{CE} )</th>
<th>( C_{re} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feedback capacitance</td>
<td>( 200 ) mA</td>
<td>( 15 ) V</td>
<td>typ. 80 pF</td>
</tr>
</tbody>
</table>

Collector-stud capacitance

<table>
<thead>
<tr>
<th>Condition</th>
<th>( I_C )</th>
<th>( V_{CE} )</th>
<th>( C_{cs} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-stud capacitance</td>
<td>( 0 ) mA</td>
<td>( 15 ) V</td>
<td>typ. 2 pF</td>
</tr>
</tbody>
</table>

\( T_j = 25 \) °C unless otherwise specified
typical values

$V_{CB} =$
- 12.5 V
- 10 V
- 7.5 V
- 5 V

$C_C$ (pF)

$I_E = I_e = 0$
$f = 1$ MHz

$V_{CB}$ (V)
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

\[ T_h = 25 \, ^\circ\text{C} \]

<table>
<thead>
<tr>
<th>( f ) (MHz)</th>
<th>( V_{CE} ) (V)</th>
<th>( P_L ) (W)</th>
<th>( P_S ) (W)</th>
<th>( G_p ) (dB)</th>
<th>( I_C ) (A)</th>
<th>( \eta ) (%)</th>
<th>( \overline{Z_i} ) ( \Omega )</th>
<th>( \overline{Z_L} ) ( \Omega )</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>12,5</td>
<td>45</td>
<td>&lt; 14,2</td>
<td>&gt; 5,0</td>
<td>&lt; 4,8</td>
<td>&gt; 75</td>
<td>1,2 + j1,4</td>
<td>2,6 − j1,2</td>
</tr>
</tbody>
</table>

Fig. 6 Test circuit; c.w. class-B.

List of components:

- \( C_1 = 2 \) to \( 20 \) pF film dielectric trimmer
- \( C_2 = 4 \) to \( 40 \) pF film dielectric trimmer
- \( C_3 = C_4 = C_5 = C_6 = 56 \) pF ceramic capacitor
- \( C_7 = 100 \) pF ceramic capacitor
- \( C_8 = 100 \) nF polyester capacitor
- \( C_9 = 4 \) to \( 80 \) pF film dielectric trimmer
- \( C_{10} = 4 \) to \( 60 \) pF film dielectric trimmer
- \( L_1 = 1\frac{1}{2} \) turns enameled Cu wire \((1,6 \, \text{mm})\); int. dia. \( 6,0 \, \text{mm} \); length \( 4 \, \text{mm} \); leads \( 2 \times 5 \, \text{mm} \)
- \( L_2 = 7 \) turns closely wound enameled Cu wire \((0,5 \, \text{mm})\); int. dia. \( 3,0 \, \text{mm} \); leads \( 2 \times 5 \, \text{mm} \)
- \( L_3 = L_4 = \) Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- \( L_5 = \) bifilar wound enameled Cu wire \((1,0 \, \text{mm})\); see figure on
- \( R_1 = 10 \, \Omega \) carbon resistor
- \( R_2 = 4,7 \, \Omega \) carbon resistor
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power \( P_{L\text{nom}} \) must be derated in accordance with the adjacent graph for safe operation at supply voltages other than nominal. The graph shows the allowable output power under nominal conditions as a function of the supply overvoltage ratio with VSWR as parameter. The graph applies to the situation in which the drive \( P_S/P_{S\text{nom}} \) increases linearly with supply overvoltage ratio \( V_{CC}/V_{CC\text{nom}} \).

At \( P_L = 45 \text{ W} \) and \( V_{CC} = 12.5 \text{ V} \), the output power at heatsink temperatures between 25 °C and 70 °C relative to that at 25 °C is diminished by 60 mW/K.
Fig. 10 Input impedance (series components).

Fig. 11 Load impedance (series components).

Conditions for Figs 10, 11 and 12:
Typical values; \( V_{CE} = 12.5 \) V; \( P_L = 45 \) W; \( T_h = 25 \) °C.
APPLICATION INFORMATION (continued)

R.F. performance in s.s.b. class-AB operation

V_{CE} = 12,5 V; T_{h} up to 25 °C; R_{th mb-h} ≤ 0,3 K/W

f_{1} = 28,000 MHz; f_{2} = 28,001 MHz

<table>
<thead>
<tr>
<th>output power</th>
<th>G_{P} dB</th>
<th>η_{d t}</th>
<th>d_{3} dB*</th>
<th>d_{5} dB*</th>
<th>I_{C(ZS)} mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 to 30 (P.E.P.)</td>
<td>typ. 19,5</td>
<td>typ. 35</td>
<td>typ. −33</td>
<td>typ. −36</td>
<td>25</td>
</tr>
</tbody>
</table>

Test circuit; s.s.b. class-AB.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.
APPLICATION INFORMATION (continued)

List of components:

Tr1 = Tr2 = BD137

C1  = 100 pF air dielectric capacitor (single insulated rotor)
C2  = 27 pF ceramic capacitor
C3  = 180 pF ceramic capacitor
C4  = 100 pF air dielectric capacitor (single non-insulated rotor)
C5  = C7  = 3,9 nF polyester capacitor (±10%)
C6  = 2 x 270 pF polystyrene capacitors in parallel
C8  = C15 = C16 = 100 nF polyester capacitor (±10%)
C9  = 2,2 µF moulded metallized polyester capacitor
C10 = 2 x 385 pF film dielectric trimmers in parallel
C11 = 68 pF ceramic capacitor
C12 = 2 x 82 pF ceramic capacitors in parallel
C13 = 47 pF ceramic capacitor
C14 = 385 pF film dielectric trimmer
L1  = 88 nH; 3 turns Cu wire (1,0 mm); internal diameter 9 mm; coil length 6,1 mm;
leads 2 x 5 mm
L2 = L5 = ferroxcube bead, grade 3B (code number 4312 020 36640)
L3  = 68 nH; 3 turns enamelled Cu wire (1,6 mm); internal diameter 8 mm;
coil length 8,3 mm; leads 2 x 5 mm
L4  = 96 nH; 3 turns enamelled Cu wire (1,6 mm); internal diameter 10 mm;
coil length 7,6 mm; leads 2 x 5 mm
R1  = 27 Ω carbon resistor (±5%)
R2  = 4,7 Ω carbon resistor (±5%)
R3  = 1,5 kΩ carbon resistor (±5%)
R4  = 10 Ω wire-wound potentiometer (3 W)
R5  = 47 Ω wire-wound resistor (5,5 W)
R6  = 150 Ω carbon resistor (±5%)
**V.H.F. power transistor**

**Intermodulation distortion versus output power**

<table>
<thead>
<tr>
<th>VCC</th>
<th>$f_1$</th>
<th>$f_2$</th>
<th>$T_h$</th>
<th>$R_{th \text{ mb- } h}$</th>
<th>$I_{C(ZS)}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.5 V</td>
<td>28,000 MHz</td>
<td>28,001 MHz</td>
<td>25°C</td>
<td>0.3 K/W</td>
<td>25 mA</td>
</tr>
</tbody>
</table>

typ. values

$\Delta V_{ee} = 12.5 V$

$\Delta f_1 = 28,000 MHz$

$\Delta f_2 = 28,001 MHz$

$\Delta T_h = 25°C$

$\Delta R_{th \text{ mb- } h} \leq 0.3 K/W$

$\Delta I_{C(ZS)} = 25 mA$

$1) \text{ Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.}$

**Double-tone efficiency versus output power**

<table>
<thead>
<tr>
<th>VCC</th>
<th>$f_1$</th>
<th>$f_2$</th>
<th>$T_h$</th>
<th>$R_{th \text{ mb- } h}$</th>
<th>$I_{C(ZS)}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.5 V</td>
<td>28,000 MHz</td>
<td>28,001 MHz</td>
<td>25°C</td>
<td>0.3 K/W</td>
<td>25 mA</td>
</tr>
</tbody>
</table>

typ. values

$\Delta V_{ee} = 13.5 V$

$\Delta f_1 = 28,000 MHz$

$\Delta f_2 = 28,001 MHz$

$\Delta T_h = 25°C$

$\Delta R_{th \text{ mb- } h} \leq 0.3 K/W$

$\Delta I_{C(ZS)} = 25 mA$
S.S.B. class AB operation

Conditions:

\[
\begin{align*}
PL &= 30 \text{ W (PEP)} \\
V_{CC} &= 12.5 \text{ V} \\
I_{C(ZS)} &= 25 \text{ mA} \\
T_h &= 25 \text{ °C} \\
R_{th \ mb-h} &\leq 0.3 \text{ K/W} \\
Z_L &= 1.9 \Omega
\end{align*}
\]

\[
\begin{align*}
PL &= 35 \text{ W (PEP)} \\
V_{CC} &= 13.5 \text{ V} \\
I_{C(ZS)} &= 25 \text{ mA} \\
T_h &= 25 \text{ °C} \\
R_{th \ mb-h} &\leq 0.3 \text{ K/W} \\
Z_L &= 1.9 \Omega
\end{align*}
\]

The curve (both conditions) holds for an unneutralized amplifier.
S.S.B. class AB operation

Conditions:

\[ P_L = 30 \text{ W (PEP)} \]
\[ V_{CC} = 12.5 \text{ V} \]
\[ I_{C(ZS)} = 25 \text{ mA} \]
\[ T_h = 25 \text{ °C} \]
\[ R_{th\ mb-h} \leq 0.3 \text{ K/W} \]
\[ Z_L = 1.9 \Omega \]

\[ P_L = 35 \text{ W (PEP)} \]
\[ V_{CC} = 13.5 \text{ V} \]
\[ I_{C(ZS)} = 25 \text{ mA} \]
\[ T_h = 25 \text{ °C} \]
\[ R_{th\ mb-h} \leq 0.3 \text{ K/W} \]
\[ Z_L = 1.9 \Omega \]

The curve (both conditions) holds for an unneutralized amplifier.
V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a nominal supply voltage of 12,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. Matched hFE groups are available on request.

It has a 3/8” capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance up to \( T_h = 25 \, ^\circ C \)

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>( V_{CC} ) (V)</th>
<th>( f ) (MHz)</th>
<th>( P_L ) (W)</th>
<th>( G_P ) (dB)</th>
<th>( \eta ) (%)</th>
<th>( Z_i ) (Ω)</th>
<th>( Z_L ) (Ω)</th>
<th>( d_3 ) (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w. (class-B)</td>
<td>12,5</td>
<td>175</td>
<td>45</td>
<td>&gt; 5,0</td>
<td>&gt; 75</td>
<td>1,2 + j1,4</td>
<td>2,6 – j1,2</td>
<td>–</td>
</tr>
<tr>
<td>s.s.b. (class-AB)</td>
<td>12,5</td>
<td>1,6–28</td>
<td>3–30 (P.E.P.)</td>
<td>typ. 19,5</td>
<td>typ. 35</td>
<td>–</td>
<td>–</td>
<td>typ. –33</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Dimensions in mm

- Torque on nut: min. 0,75 Nm (7,5 kg cm) max. 0,85 Nm (8,5 kg cm)
- Diameter of clearance hole in heatsink: max. 4,2 mm.

*PRODUCT SAFETY* This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage \( V_{BE} = 0 \)
- peak value

Collector-emitter voltage (open base)

Emitter-base voltage (open-collector)

Collector current (average)

Collector current (peak value); \( f > 1 \text{ MHz} \)

R.F. power dissipation (\( f > 1 \text{ MHz} \)); \( T_{mb} = 25 \text{ °C} \)

Storage temperature

Operating junction temperature

\[
\begin{align*}
V_{CESM} & \quad \text{max.} \quad 36 \text{ V} \\
V_{CEO} & \quad \text{max.} \quad 18 \text{ V} \\
V_{EBO} & \quad \text{max.} \quad 4 \text{ V} \\
I_{C(AV)} & \quad \text{max.} \quad 9 \text{ A} \\
I_{CM} & \quad \text{max.} \quad 22 \text{ A} \\
P_{rf} & \quad \text{max.} \quad 100 \text{ W} \\
T_{stg} & \quad -65 \text{ to } +150 \text{ °C} \\
T_j & \quad \text{max.} \quad 200 \text{ °C}
\end{align*}
\]

THERMAL RESISTANCE (dissipation = 40 W; \( T_{mb} = 88 \text{ °C} \), i.e. \( T_h = 70 \text{ °C} \))

From junction to mounting base (d.c. dissipation)

From junction to mounting base (r.f. dissipation)

From mounting base to heatsink

\[
\begin{align*}
R_{th j-mb}(dc) & = 2,8 \text{ K/W} \\
R_{th j-mb}(rf) & = 2,05 \text{ K/W} \\
R_{th mb-h} & = 0,45 \text{ K/W}
\end{align*}
\]
V.H.F. power transistor

**CHARACTERISTICS**

\( T_j = 25 \, ^\circ\text{C} \)

**Breakdown voltage**

- Collector-emitter voltage
  \( V_{BE} = 0; \, I_C = 50 \, \text{mA} \)
  \( V_{(BR)CES} > 36 \, \text{V} \)

- Collector-emitter voltage
  open base; \( I_C = 100 \, \text{mA} \)
  \( V_{(BR)CEO} > 18 \, \text{V} \)

- Emitter-base voltage
  open collector; \( I_E = 25 \, \text{mA} \)
  \( V_{(BR)EBO} > 4 \, \text{V} \)

**Collector cut-off current**

\( V_{BE} = 0; \, V_{CE} = 15 \, \text{V} \)

\( I_{CES} < 25 \, \text{mA} \)

**Transient energy**

- \( L = 25 \, \text{mH}; \, f = 50 \, \text{Hz} \)
  
  - open base
    - \( V_{BE} = 1.5 \, \text{V}; \, R_{BE} = 33 \, \Omega \)
    - \( E > 8 \, \text{ms} \)
    - \( E > 8 \, \text{ms} \)

**D.C. current gain** *

\( I_C = 4 \, \text{A}; \, V_{CE} = 5 \, \text{V} \)

\( h_{FE} \, \text{typ} \, 10 \, \text{to} \, 80 \)

**D.C. current gain ratio of matched devices** *

\( I_C = 4 \, \text{A}; \, V_{CE} = 5 \, \text{V} \)

\( h_{FE1}/h_{FE2} < 1.2 \)

**Collector-emitter saturation voltage** *

\( I_C = 12.5 \, \text{A}; \, I_B = 2.5 \, \text{A} \)

\( V_{CEsat} \, \text{typ} \, 1.5 \, \text{V} \)

**Transition frequency at \( f = 100 \, \text{MHz}** *

\( I_C = 4 \, \text{A}; \, V_{CE} = 12.5 \, \text{V} \)

\( f_T \, \text{typ} \, 650 \, \text{MHz} \)

\( I_C = 12.5 \, \text{A}; \, V_{CE} = 12.5 \, \text{V} \)

\( f_T \, \text{typ} \, 600 \, \text{MHz} \)

**Collector capacitance at \( f = 1 \, \text{MHz}**

\( I_E = I_e = 0; \, V_{CB} = 15 \, \text{V} \)

\( C_c \, \text{typ} \, 120 \, \text{pF} \)

\( C_c < 160 \, \text{pF} \)

**Feedback capacitance at \( f = 1 \, \text{MHz}**

\( I_C = 200 \, \text{mA}; \, V_{CE} = 15 \, \text{V} \)

\( C_{re} \, \text{typ} \, 80 \, \text{pF} \)

**Collector-stud capacitance**

\( C_{cs} \, \text{typ} \, 2 \, \text{pF} \)

---

* Measured under pulse conditions: \( t_p \leq 200 \, \mu\text{s}; \delta \leq 0.02. \)
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

\[ T_h = 25 \, ^\circ C \]

<table>
<thead>
<tr>
<th>f (MHz)</th>
<th>( V_{CC} ) (V)</th>
<th>( P_L ) (W)</th>
<th>( P_S ) (W)</th>
<th>( G_p ) (dB)</th>
<th>( I_C ) (A)</th>
<th>( \eta ) (%)</th>
<th>( Z_L ) (Ω)</th>
<th>( Z_I ) (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>12.5</td>
<td>45</td>
<td>&lt; 14.2</td>
<td>&gt; 5.0</td>
<td>&lt; 4.8</td>
<td>&gt; 75</td>
<td>1.2 + j1.4</td>
<td>2.6 − j1.2</td>
</tr>
<tr>
<td>175</td>
<td>13.5</td>
<td>45</td>
<td>−</td>
<td>typ. 6.0</td>
<td>−</td>
<td>typ. 75</td>
<td>−</td>
<td>−</td>
</tr>
</tbody>
</table>

Test circuit for 175 MHz

![Fig. 7 Class-B test circuit at f = 175 MHz.](image)

List of components:
- C1 = 2.5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
- C2 = C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
- C3a = C3b = 47 pF ceramic capacitor (500 V)
- C4 = 120 pF ceramic capacitor
- C5 = 100 nF polyester capacitor
- C6a = C6b = 8.2 pF ceramic capacitor (500 V)
- C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
- L1 = 1 turn Cu wire (1.6 mm); int. dia. 9.0 mm; leads 2 x 5 mm
- L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0.5 mm); int. dia. 3 mm; leads 2 x 5 mm
- L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
- L6 = 2 turns enamelled Cu wire (1.6 mm); int. dia. 5.0 mm; length 6.0 mm; leads 2 x 5 mm
- L7 = 2 turns enamelled Cu wire (1.6 mm); int. dia. 4.5 mm; length 6.0 mm; leads 2 x 5 mm
- L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".
- R1 = 10 Ω (±10%) carbon resistor
- R2 = 4.7 Ω (±5%) carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit on November 1981

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The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive \( P_S/P_{S\text{nom}} \) increases linearly with supply over-voltage ratio.
Fig. 12 Input impedance (series components).

Fig. 13 Load impedance (series components).

Conditions for Figs 12, 13 and 14:
Typical values; $V_{CE} = 12.5 \text{ V}$; $P_L = 45 \text{ W}$; class-B operation; $T_h = 25 \text{ °C}$.
R.F. performance in s.s.b. class-AB operation

\[ V_{CE} = 12.5 \text{ V}; \; T_h \text{ up to } 25 \degree \text{C}; \; R_{th \; mb-h} \leq 0.45 \; \text{K/W} \]

\[ f_1 = 28,000 \; \text{MHz}; \; f_2 = 28,001 \; \text{MHz} \]

Output power

<table>
<thead>
<tr>
<th>W</th>
<th>( G_p )</th>
<th>( \eta_{dt} )</th>
<th>( d_3 )</th>
<th>( d_5 )</th>
<th>( I_{C(ZS)} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 to 30 (P.E.P.)</td>
<td>typ 19.5</td>
<td>typ 35</td>
<td>typ -33</td>
<td>typ -36</td>
<td>25 mA</td>
</tr>
</tbody>
</table>

Test circuit

S.S.B. class-AB

List of components:

- \( TR1 = TR2 = BD137 \)
- \( C1 = 100 \; \text{pF} \) air dielectric trimmer (single insulated rotor type)
- \( C2 = 27 \; \text{pF} \) ceramic capacitor
- \( C3 = 180 \; \text{pF} \) ceramic capacitor
- \( C4 = 100 \; \text{pF} \) air dielectric trimmer (single non-insulated rotor type)
- \( C5 = C7 = 3.9 \; \text{nF} \) polyester capacitor
- \( C6 = 2 \times 270 \; \text{pF} \) polystyrene capacitors in parallel
- \( C8 = C15 = C16 = 100 \; \text{nF} \) polyester capacitor
- \( C9 = 2.2 \; \mu\text{F} \) moulded metallized polyester capacitor
- \( C10 = 2 \times 385 \; \text{pF} \) film dielectric trimmer
- \( C11 = 68 \; \text{pF} \) ceramic capacitor

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.
APPLICATION INFORMATION (continued)

List of components (continued)

C12 = 2 x 82 pF ceramic capacitors in parallel
C13 = 47 pF ceramic capacitor
C14 = 385 pF film dielectric trimmer
L1 = 88 nH; 3 turns Cu wire (1,0 mm); int. dia. 9 mm; length 6,1 mm; leads 2 x 5 mm
L2 = L5 = Ferroxcube choke coil (cat. no. 4312 020 36640)
L3 = 68 nH; 3 turns enamelled Cu wire (1,6 mm); int. dia. 8 mm; length 8,3 mm; leads 2 x 5 mm
L4 = 96 nH; 3 turns enamelled Cu wire (1,6 mm); int. dia. 10 mm; length 7,6 mm; leads 2 x 5 mm
R1 = 27 Ω (±5%) carbon resistor
R2 = 4,7 Ω (±5%) carbon resistor
R3 = 1,5 kΩ (±5%) carbon resistor
R4 = 10 Ω wirewound potentiometer (3 W)
R5 = 47 Ω wirewound resistor (5,5 W)
R6 = 150 Ω (±5%) carbon resistor

Measuring conditions for the upper graphs on page 11

V_{CC} = 12,5 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
R_{th mb-h} ≤ 0,45 °K/W
I_{C(ZS)} = 25 mA

Measuring conditions for the lower graphs on page 11

V_{CC} = 13,5 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
R_{th mb-h} ≤ 0,45 °K/W
I_{C(ZS)} = 25 mA
* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.
S.S.B. class-AB operation

Conditions for the graphs above:

\[ V_{CC} = 12.5 \text{ V} \]
\[ P_L = 30 \text{ W (P.E.P.)} \]
\[ T_h = 25 \text{ °C} \]
\[ R_{th \ mb-h} \leq 0.45 \text{ K/W} \]
\[ I_C(ZS) = 25 \text{ mA} \]
\[ Z_L = 1.9 \Omega \]

\[ V_{CC} = 13.5 \text{ V} \]
\[ P_L = 35 \text{ W (P.E.P.)} \]
\[ T_h = 25 \text{ °C} \]
\[ R_{th \ mb-h} \leq 0.45 \text{ K/W} \]
\[ I_C(ZS) = 25 \text{ mA} \]
\[ Z_L = 1.9 \Omega \]

The typical curves (both conditions) hold for an unneutralized amplifier.
H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-AB or class-B operated high power transmitters in the h.f. and v.h.f. bands. The transistor presents excellent performance as a linear amplifier in the h.f. band. It is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Transistors are delivered in matched $h_{FE}$ groups.

The transistor has a ½˝ flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25^\circ C$

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$I_C(ZS)$ A</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_p$ dB</th>
<th>$\eta$ %</th>
<th>$d_3$ dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>s.s.b. (class-AB)</td>
<td>28</td>
<td>0,05</td>
<td>1,6–28</td>
<td>8–80 (P.E.P.)</td>
<td>&gt; 13</td>
<td>&gt; 35*</td>
<td>&lt;–30</td>
</tr>
<tr>
<td>c.w. (class-B)</td>
<td>28</td>
<td>–</td>
<td>108</td>
<td>80</td>
<td>typ. 7,9</td>
<td>typ. 70</td>
<td>–</td>
</tr>
</tbody>
</table>

* At 80 W P.E.P.

MECHANICAL DATA
SOT-121 (see Fig.1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
MECHANICAL DATA

Fig. 1 SOT-121.

Dimensions in mm

Torque on screw: min. 0.6 Nm (6 kg cm)
max. 0.75 Nm (7.5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$)
  peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current (average)
Collector current (peak value); $f > 1 \text{ MHz}$
R.F. power dissipation ($f > 1 \text{ MHz}$); $T_{mb} = 25^\circ C$
Storage temperature
Operating junction temperature

![Graph of D.C. SOAR](image1)

**Fig. 2 D.C. SOAR.**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CESM}$</td>
<td>max. 70 V</td>
</tr>
<tr>
<td>$V_{CEO}$</td>
<td>max. 35 V</td>
</tr>
<tr>
<td>$V_{EBO}$</td>
<td>max. 4 V</td>
</tr>
<tr>
<td>$I_{C(AV)}$</td>
<td>max. 8 A</td>
</tr>
<tr>
<td>$I_{CM}$</td>
<td>max. 20 A</td>
</tr>
<tr>
<td>$P_{rf}$</td>
<td>max. 140 W</td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>-65 to +150 $^\circ C$</td>
</tr>
<tr>
<td>$T_j$</td>
<td>max. 200 $^\circ C$</td>
</tr>
</tbody>
</table>

![Graph of R.F. power dissipation](image2)

**Fig. 3 R.F. power dissipation; $V_{CE} \leq 28 \text{ V}$; $f > 1 \text{ MHz}$.**

I  Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

**THERMAL RESISTANCE** (dissipation = 60 W; $T_{mb} = 82^\circ C$, i.e. $T_h = 70^\circ C$)

From junction to mounting base (d.c. dissipation)
From junction to mounting base (r.f. dissipation)
From mounting base to heatsink

<table>
<thead>
<tr>
<th>Resistance</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{th\ j-mb(d)}$</td>
<td>1.92 K/W</td>
</tr>
<tr>
<td>$R_{th\ j-mb(rf)}$</td>
<td>1.33 K/W</td>
</tr>
<tr>
<td>$R_{th\ mb-h}$</td>
<td>0.2 K/W</td>
</tr>
</tbody>
</table>
CHARACTERISTICS

T<sub>j</sub> = 25 °C unless otherwise specified

Collector-emitter breakdown voltage

\[ V_{BE} = 0; \ I_C = 50 \text{ mA} \]

Collector-emitter breakdown voltage
open base; \( I_C = 50 \text{ mA} \)

Emitter-base breakdown voltage
open collector; \( I_E = 10 \text{ mA} \)

Collector cut-off current

\[ V_{BE} = 0; \ V_{CE} = 35 \text{ V} \]

D.C. current gain*

\[ I_C = 4 \text{ A}; \ V_{CE} = 5 \text{ V} \]

D.C. current gain ratio of matched devices*

\[ I_C = 4 \text{ A}; \ V_{CE} = 5 \text{ V} \]

Collector-emitter saturation voltage*

\[ I_C = 12.5 \text{ A}; \ I_B = 2.5 \text{ A} \]

Transition frequency at \( f = 100 \text{ MHz} \)**

\[ -I_E = 4 \text{ A}; \ V_{CB} = 28 \text{ V} \]

\[ -I_E = 12.5 \text{ A}; \ V_{CB} = 28 \text{ V} \]

Collector capacitance at \( f = 1 \text{ MHz} \)

\[ I_E = I_B = 0; \ V_{CB} = 28 \text{ V} \]

Feedback capacitance at \( f = 1 \text{ MHz} \)

\[ I_C = 50 \text{ mA}; \ V_{CE} = 28 \text{ V} \]

Collector-flange capacitance

![Graph](image)

Fig. 4 Typical values; \( V_{CE} = 20 \text{ V} \).

* Measured under pulse conditions: \( t_p \leq 300 \mu\text{s}; \ \delta \leq 0.02 \).

** Measured under pulse conditions: \( t_p \leq 50 \mu\text{s}; \ \delta \leq 0.01 \).

- \( V(BR)CES \geq 70 \text{ V} \)
- \( V(BR)CEO \geq 35 \text{ V} \)
- \( V(BR)EBO \geq 4 \text{ V} \)
- \( I_{CES} \leq 10 \text{ mA} \)
- \( h_{FE} \geq 15 \text{ to } 80 \)
- \( h_{FE1}/h_{FE2} \leq 1.2 \)
- \( V_{CEsat} \text{ typ. } 2.5 \text{ V} \)
- \( f_T \text{ typ. } 315 \text{ MHz} \)
- \( f_T \text{ typ. } 305 \text{ MHz} \)
- \( C_{ce} \text{ typ. } 125 \text{ pF} \)
- \( C_{re} \text{ typ. } 85 \text{ pF} \)
- \( C_{cf} \text{ typ. } 3 \text{ pF} \)
Fig. 5 Typical values; $T_j = 25 \, ^\circ C$.

Fig. 6 $I_E = I_e = 0; f = 1 \, MHz; T_j = 25 \, ^\circ C$.

Fig. 7 $V_{CB} = 28 \, V; f = 100 \, MHz; T_j = 25 \, ^\circ C$. 
APPLICATION INFORMATION

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

\[ V_{CE} = 28 \text{ V} ; \quad T_{h} = 25 ^\circ \text{C} ; \quad f_1 = 28,000 \text{ MHz} ; \quad f_2 = 28,001 \text{ MHz} \]

<table>
<thead>
<tr>
<th>output power</th>
<th>( G_p ) dB</th>
<th>( \eta_{dt} ) (%)</th>
<th>( I_C(A) )</th>
<th>( d_3 ) dB</th>
<th>( d_5 ) dB</th>
<th>( I_C(ZS) ) A</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 to 80 (P.E.P.)</td>
<td>&gt;13</td>
<td>&gt;35</td>
<td>&lt;4,1</td>
<td>&lt;−30</td>
<td>&lt;−30</td>
<td>0,05</td>
</tr>
</tbody>
</table>

Fig. 8 Test circuit; s.s.b. class-AB.

List of components:

- \( C_1 = 27 \text{ pF ceramic capacitor (500 V)} \)
- \( C_2 = 100 \text{ pF air dielectric trimmer (single insulated rotor type)} \)
- \( C_3 = 100 \text{ pF polystyrene capacitor} \)
- \( C_4 = C_6 = C_9 = 100 \text{ nF polyester capacitor} \)
- \( C_5 = 280 \text{ pF air dielectric trimmer (single non-insulated rotor type)} \)
- \( C_7 = C_8 = 3,9 \text{ nF ceramic capacitor} \)
- \( C_{10} = 2,2 \text{ \mu F moulded metallized polyester capacitor} \)
- \( C_{11} = 180 \text{ pF polystyrene capacitor} \)
- \( C_{12} = 2 \times 68 \text{ pF ceramic capacitors in parallel (500 V)} \)
- \( C_{13} = 120 \text{ pF polystyrene capacitor} \)
H.F./V.H.F. power transistor

BLW76

C14 = C15 = 280 pF air dielectric trimmer (single insulated rotor type)
C16 = 56 pF ceramic capacitor (500 V)
L1 = 108 nH; 4 turns Cu wire (1,6 mm); int. dia. 8,7 mm; length 11,2 mm; leads 2 x 7 mm
L2 = L4 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 88 nH; 3 turns Cu wire (1,6 mm); int. dia. 8,0 mm; length 8,0 mm; leads 2 x 7 mm
L5 = 120 nH; 4 turns Cu wire (1,6 mm); int. dia. 9,3 mm; length 11,2 mm; leads 2 x 7 mm
R1 = 1,5 kΩ (± 5%) carbon resistor (0,5 W)
R2 = 10 Ω wirewound potentiometer (3 W)
R3 = 0,9 Ω; parallel connection of 2 x 1,8 Ω carbon resistors (± 5%; 0,5 W each)
R4 = 60 Ω; parallel connection of 2 x 120 Ω wirewound resistors (5,5 W each)
R5 = 56 Ω (± 5%) carbon resistor (0,5 W)
R6 = 33 Ω (± 5%) carbon resistor (0,5 W)
R7 = 4,7 Ω (± 5%) carbon resistor (0,5 W)

Fig. 9 Intermodulation distortion as a function of output power.*

Conditions for Figs 9 and 10:

\[ V_{CE} = 28 \, V; \, I_{C(ZS)} = 50 \, mA; \, f_1 = 28,000 \, MHz; \, f_2 = 28,001 \, MHz; \, T_h = 25 \, ^\circ C; \, \text{typical values.} \]

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

Fig. 10 Double-tone efficiency and power gain as a function of output power.
APPLICATION INFORMATION (continued)

Fig. 11 Power gain as a function of frequency.

Fig. 12 Input impedance (series components) as a function of frequency.

Figs 11 and 12 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:

$V_{CE} = 28 \text{ V}$; $I_{C(ZS)} = 50 \text{ mA}$; $P_L = 80 \text{ W}$; $T_h = 25 \degree C$; $Z_L = 3.9 \Omega$. 
Fig. 13 Power gain as a function of frequency.

Fig. 14 Input impedance (series components) as a function of frequency.

Figs 13 and 14 are typical curves and hold for a push-pull amplifier with cross-neutralization in s.s.b. class-AB operation.

Conditions:
\[ V_{CE} = 28 \text{ V}; \, I_{C(ZS)} = 50 \text{ mA}; \, P_L = 80 \text{ W}; \, T_h = 25 \text{ °C}; \, Z_L = 3.9 \Omega; \, \text{neutralizing capacitor: 68 pF}. \]
Fig. 15  R.F. SOAR; s.s.b. class-AB operation; 
\( f_1 = 28,000 \text{ MHz}; \ f_2 = 28,001 \text{ MHz}; \ V_{CE} = 28 \text{ V}; \)
\( R_{th \ mb-h} = 0.2 \text{ K/W}. \)

The graph shows the permissible output power under nominal conditions (VSWR = 1) 
as a function of the expected VSWR during short-time mismatch conditions with heatsink 
temperatures as parameter.
H.F./V.H.F. power transistor

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

<table>
<thead>
<tr>
<th>$f$ (MHz)</th>
<th>$V_{CE}$ (V)</th>
<th>$P_L$ (W)</th>
<th>$P_S$ (W)</th>
<th>$G_P$ (dB)</th>
<th>$I_C$ (A)</th>
<th>$\eta$ (%)</th>
<th>$\bar{z}_n$ (Ω)</th>
<th>$\bar{Y}_L$ (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>108</td>
<td>28</td>
<td>80</td>
<td>typ. 13</td>
<td>typ. 7,9</td>
<td>typ. 4,1</td>
<td>typ. 70</td>
<td>0,85 + j1,0</td>
<td>174 – j40</td>
</tr>
</tbody>
</table>

Fig. 16 Test circuit; c.w. class-B.

List of components:

- **C1** = **C9** = **C10** = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
- **C2** = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
- **C3** = 22 pF ceramic capacitor (500 V)
- **C4ab** = 2 x 82 pF ceramic capacitors in parallel (500 V)
- **C5** = 270 pF polystyrene capacitor
- **C6** = 100 nF polyester capacitor
- **C7a** = 8,2 pF ceramic capacitor (500 V)
- **C7b** = 10 pF ceramic capacitor (500 V)
- **C8** = 5,6 pF ceramic capacitor (500 V)
- **C11** = 10 pF ceramic capacitor (500 V)
- **L1** = 21 nH; 2 turns Cu wire (1,0 mm); int. dia. 4,0 mm; length 3,5 mm; leads 2 x 5 mm
- **L2** = **L5** = 2,4 nH; strip (12 mm x 6 mm); tap for **L4** at 6 mm from transistor
- **L3** = **L7** = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- **L4** = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
- **L6** = 49 nH; 2 turns Cu wire (1,6 mm); int. dia. 9,0 mm; length 4,7 mm; leads 2 x 5 mm
- **L8** = 56 nH; 2 turns Cu wire (1,6 mm); int. dia. 10,0 mm; length 4,5 mm; leads 2 x 5 mm
- **L2** and **L5** are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric.

R1 = R2 = 10 Ω (± 10%) carbon resistor

Component layout and printed-circuit board for 108 MHz test circuit are shown in Fig. 17.
Fig. 17 Component layout and printed-circuit board for 108 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.
Fig. 18 \( V_{CE} = 28 \, \text{V}; f = 108 \, \text{MHz}; T_h = 25 \, ^\circ\text{C} \).

Fig. 19 \( V_{CE} = 28 \, \text{V}; f = 108 \, \text{MHz}; T_h = 25 \, ^\circ\text{C} \); typical values.

Fig. 20 R.F. SOAR; c.w. class-B operation; \( f = 108 \, \text{MHz}; V_{CE} = 28 \, \text{V}; R_{th \, mb-h} = 0.2 \, \text{K/W} \).

The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.
APPLICATION INFORMATION (continued)

Fig. 21 \( V_{CE} = 28 \text{ V}; P_L = 80 \text{ W}; T_h = 25 ^\circ \text{C} \)

typical values.

Fig. 22 \( V_{CE} = 28 \text{ V}; P_L = 80 \text{ W}; T_h = 25 ^\circ \text{C} \)

typical values.

Fig. 23 \( V_{CE} = 28 \text{ V}; P_L = 80 \text{ W}; T_h = 25 ^\circ \text{C} \).

\[ 7Z77455 \]

\[ 7Z77456 \]

\[ 7Z77457 \]
H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-AB or class-B operated high power transmitters in the h.f. and v.h.f. bands. The transistor presents excellent performance as a linear amplifier in the h.f. band. It is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Transistors are delivered in matched $h_{FE}$ groups.

The transistor has a $\frac{3}{4}''$ flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25^\circ C$

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$I_{C(ZS)}$ A</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_p$ dB</th>
<th>$\eta$ %</th>
<th>$d_3$ dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>s.s.b. (class-AB)</td>
<td>28</td>
<td>0,1</td>
<td>1,6–28</td>
<td>15–130</td>
<td>&gt; 12</td>
<td>&gt; 37,5*</td>
<td>&lt; −30</td>
</tr>
<tr>
<td>c.w. (class-B)</td>
<td>28</td>
<td>–</td>
<td>87,5</td>
<td>130</td>
<td>typ. 7,5</td>
<td>typ. 75</td>
<td>–</td>
</tr>
</tbody>
</table>

* At 130 W P.E.P.

MECHANICAL DATA

SOT-121 (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
MECHANICAL DATA

Fig. 1 SOT-121.

Torque on screw: min. 0.6 Nm (6 kg cm)
max. 0.75 Nm (7.5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.
H.F./V.H.F. power transistor

BLW77

RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0)
  peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current (average)
Collector current (peak value); f > 1 MHz
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 ºC
Storage temperature
Operating junction temperature

![D.C. SOAR](image1.png)

Fig. 2 D.C. SOAR.

![R.F. power dissipation](image2.png)

Fig. 3 R.F. power dissipation; V_{CE} ≤ 28 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 100 W; T_{mb} = 90 ºC, i.e. T_{Th} = 70 ºC)
From junction to mounting base (d.c. dissipation)
From junction to mounting base (r.f. dissipation)
From mounting base to heatsink

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_{CESM} max.</td>
<td>70 V</td>
</tr>
<tr>
<td>V_{CEO} max.</td>
<td>35 V</td>
</tr>
<tr>
<td>V_{EBO} max.</td>
<td>4 V</td>
</tr>
<tr>
<td>I_{C(AV)} max.</td>
<td>12 A</td>
</tr>
<tr>
<td>I_{CM} max.</td>
<td>30 A</td>
</tr>
<tr>
<td>P_{rf} max.</td>
<td>245 W</td>
</tr>
<tr>
<td>T_{stg}</td>
<td>-65 to +150 ºC</td>
</tr>
<tr>
<td>T_{j} max.</td>
<td>200 ºC</td>
</tr>
<tr>
<td>R_{th j-mb(dc)}</td>
<td>1.03 K/W</td>
</tr>
<tr>
<td>R_{th j-mb(rf)}</td>
<td>0.71 K/W</td>
</tr>
<tr>
<td>R_{th mb-h}</td>
<td>0.2 K/W</td>
</tr>
</tbody>
</table>
CHARACTERISTICS

$T_j = 25 \degree C$ unless otherwise specified

Collector-emitter breakdown voltage

$V_{BE} = 0; I_C = 50 mA$

Collector-emitter breakdown voltage
open base; $I_C = 100 mA$

Emitter-base breakdown voltage
open collector; $I_E = 20 mA$

Collector cut-off current

$V_{BE} = 0; V_{CE} = 35 V$

D.C. current gain*

$I_C = 7 A; V_{CE} = 5 V$

D.C. current gain ratio of matched devices*

$I_C = 7 A; V_{CE} = 5 V$

Collector-emitter saturation voltage*

$I_C = 20 A; I_B = 4 A$

Transition frequency at $f = 100 MHz$**

$-I_E = 7 A; V_{CB} = 28 V$

$-I_E = 20 A; V_{CB} = 28 V$

Collector capacitance at $f = 1 MHz$

$I_E = I_e = 0; V_{CE} = 28 V$

Feedback capacitance at $f = 1 MHz$

$I_C = 100 mA; V_{CE} = 28 V$

Collector-flange capacitance

$V_{(BR)CES} > 70 V$

$V_{(BR)CEO} > 35 V$

$V_{(BR)EBO} > 4 V$

$I_{CES} < 20 mA$

$h_{FE} \quad 15$ to $80$

$h_{FE1}/h_{FE2} < 1.2$

$V_{CEsat}$ typ. $2 V$

$f_T$ typ. $320 MHz$

$f_T$ typ. $300 MHz$

$C_c$ typ. $255 pF$

$C_{re}$ typ. $175 pF$

$C_{cf}$ typ. $3 pF$

* Measured under pulse conditions: $t_p \leq 300 \mu s; \delta \leq 0.02.$

** Measured under pulse conditions: $t_p \leq 50 \mu s; \delta \leq 0.01.$

Fig. 4 Typical values; $V_{CE} = 20 V.$
Fig. 5 Typical values; $T_j = 25\, ^\circ\text{C}$.

Fig. 6 $I_E = I_e = 0$; $f = 1\, \text{MHz}$; $T_j = 25\, ^\circ\text{C}$.

Fig. 7 $V_{CB} = 28\, \text{V}$; $f = 100\, \text{MHz}$; $T_j = 25\, ^\circ\text{C}$.
APPLICATION INFORMATION

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

\[ V_{CE} = 28 \, V; \quad T_H = 25 \, ^\circ C; \quad f_1 = 28,000 \, MHz; \quad f_2 = 28,001 \, MHz \]

<table>
<thead>
<tr>
<th>output power W</th>
<th>( G_p ) dB</th>
<th>( \eta_{dt} ) (%)</th>
<th>( I_C(A) )</th>
<th>( d_3 ) dB</th>
<th>( d_5 ) dB</th>
<th>( I_C(ZS) ) A</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 to 130 (P.E.P.)</td>
<td>&gt; 12</td>
<td>&gt; 37,5</td>
<td>&lt; 6,2</td>
<td>&lt; -30</td>
<td>&lt; -30</td>
<td>0,1</td>
</tr>
</tbody>
</table>

List of components:
- \( C_1 = 27 \, pF \) ceramic capacitor (500 V)
- \( C_2 = 100 \, pF \) air dielectric trimmer (single insulated rotor type)
- \( C_3 = 180 \, pF \) polystyrene capacitor
- \( C_4 = C_6 = C_9 = 100 \, nF \) polyester capacitor
- \( C_5 = 100 \, pF \) air dielectric trimmer (single non-insulated rotor type)
- \( C_7 = C_8 = 3,9 \, nF \) ceramic capacitor
- \( C_{10} = 2,2 \, \mu F \) moulded metallized polyester capacitor
- \( C_{11} = 2 \times 180 \, pF \) polystyrene capacitors in parallel
- \( C_{12} = 3 \times 56 \, pF \) and \( 33 \, pF \) ceramic capacitors in parallel (500 V)
- \( C_{13} = 4 \times 56 \, pF \) and \( 68 \, pF \) ceramic capacitors in parallel (500 V)
C14 = 360 pF air dielectric trimmer (single insulated rotor type)
C15 = 360 pF air dielectric trimmer (single non-insulated rotor type)
L1 = 88 nH; 3 turns Cu wire (1.0 mm); int. dia. 9.0 mm; length 6.1 mm; leads 2 x 7 mm
L2 = L4 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = L5 = 80 nH; 2.5 turns closely wound enamelled Cu wire (1.6 mm); int. dia. 10.0 mm; 
leads 2 x 7 mm
R1 = 470 Ω wirewound resistor (5.5 W)
R2 = 4.7 Ω wirewound potentiometer (3 W)
R3 = 0.55 Ω; parallel connection of 4 x 2.2 Ω carbon resistors (± 5%; 0.5 W each)
R4 = 45 Ω; parallel connection of 4 x 180 Ω wirewound resistors (5.5 W each)
R5 = 56 Ω (± 5%) carbon resistor (0.5 W)
R6 = 27 Ω (± 5%) carbon resistor (0.5 W)
R7 = 4.7 Ω (± 5%) carbon resistor (0.5 W)

Fig. 9 Intermodulation distortion as a function of output power.*

Conditions for Figs 9 and 10:
V_{CE} = 28 V; I_{C(ZS)} = 100 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.
Fig. 11 Power gain as a function of frequency.

Fig. 12 Input impedance (series components) as a function of frequency.

Figs 11 and 12 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:
\( V_{CE} = 28 \, V \); \( I_{C(ZS)} = 100 \, mA \); \( P_L = 130 \, W \); \( T_h = 25 \, ^\circ C \); \( Z_L = 2.5 \, \Omega \).
Fig. 13 Power gain as a function of frequency.

Fig. 14 Input impedance (series components) as a function of frequency.

Figs 13 and 14 are typical curves and hold for a push-pull amplifier with cross-neutralization in s.s.b class-AB operation.

Conditions:
- $V_{CE} = 28 \, \text{V}$;
- $I_{C(ZS)} = 100 \, \text{mA}$;
- $P_L = 130 \, \text{W}$;
- $T_h = 25 \, ^\circ\text{C}$;
- $Z_L = 2.5 \, \Omega$;
- Neutralizing capacitor: 150 pF.
Fig. 15  R.F. SOAR; s.s.b. class-AB operation; 
f₁ = 28,000 MHz; f₂ = 28,001 MHz; V_C = 28 V; 
R_{th mb-h} = 0,2 \, K/W. 
The graph shows the permissible output power 
under nominal conditions (VSWR = 1) as a 
function of the expected VSWR during short-
time mismatch conditions with heatsink temper­
atures as parameter.
H.F./V.H.F. power transistor

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)
$T_h = 25 \, ^oC$

<table>
<thead>
<tr>
<th>$f$ (MHz)</th>
<th>$V_{CE}$ (V)</th>
<th>$P_L$ (W)</th>
<th>$P_S$ (W)</th>
<th>$G_p$ (dB)</th>
<th>$I_C$ (A)</th>
<th>$\eta$ (%)</th>
<th>$z_i$ (Ω)</th>
<th>$Y_L$ (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>87.5</td>
<td>28</td>
<td>130</td>
<td>typ. 23.2</td>
<td>typ. 7.5</td>
<td>typ. 6.2</td>
<td>typ. 75</td>
<td>0.62 + j0.73</td>
<td>273 - j42</td>
</tr>
</tbody>
</table>

Fig. 16 Test circuit; c.w. class-B.

List of components:
- $C1 = 4$ to $40 \, \text{pF}$ film dielectric trimmer (cat. no. 2222 809 07008)
- $C2 = C9 = C10 = 7$ to $100 \, \text{pF}$ film dielectric trimmer (cat. no. 2222 809 07015)
- $C3 = C8 = 22 \, \text{pF}$ ceramic capacitor (500 V)
- $C4 = 4 \times 82 \, \text{pF}$ ceramic capacitors in parallel (500 V)
- $C5 = 390 \, \text{pF}$ polystyrene capacitor
- $C6 = 220 \, \text{nF}$ polyester capacitor
- $C7a = 2 \times 10 \, \text{pF}$ ceramic capacitors in parallel (500 V)
- $C7b = 2 \times 8.2 \, \text{pF}$ ceramic capacitors in parallel (500 V)
- $L1 = 25 \, \text{nH}$; 2 turns Cu wire (1.6 mm); int. dia. 5.0 mm; length 4.6 mm; leads 2 x 5 mm
- $L2 = L5 = 2.4 \, \text{nH}$; strip (12 mm x 6 mm); tap for $L4$ and $L6$ at 5 mm from transistor
- $L3 = L7 = \text{Ferroxcube wide-band h.f. choke, grade 3B}$ (cat. no. 4312 020 36640)
- $L4 = 100 \, \text{nH}$; 7 turns closely wound enamelled Cu wire (0.5 mm); int. dia. 3 mm; leads 2 x 5 mm
- $L6 = 46 \, \text{nH}$; 2 turns Cu wire (2.0 mm); int. dia. 9.0 mm; length 6.0 mm; leads 2 x 5 mm
- $L8 = 44 \, \text{nH}$; 2 turns Cu wire (2.0 mm); int. dia. 9.0 mm; length 6.7 mm; leads 2 x 5 mm
- $L2$ and $L5$ are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric.
- $R1 = 10 \, \Omega \, (\pm 10\%)$ carbon resistor
- $R2 = 4.7 \, \Omega \, (\pm 10\%)$ carbon resistor

Component layout and printed-circuit board for 87.5 MHz test circuit are shown in Fig. 17.
Fig. 17 Component layout and printed-circuit board for 87.5 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.
Fig. 18 V_{CE} = 28 V; f = 87.5 MHz; T_h = 25 °C.

Fig. 19 V_{CE} = 28 V; f = 87.5 MHz; T_h = 25 °C; typical values.

Fig. 20 R.F. SOAR; c.w. class-B operation; f = 87.5 MHz; V_{CE} = 28 V; R_{th mb-h} = 0.2 K/W.

The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.
Fig. 21 $V_{CE} = 28 \text{ V}; P_L = 130 \text{ W}; T_h = 25 \text{ °C}$; typical values.

Fig. 22 $V_{CE} = 28 \text{ V}; P_L = 130 \text{ W}; T_h = 25 \text{ °C}$; typical values.

Fig. 23 $V_{CE} = 28 \text{ V}; P_L = 130 \text{ W}; T_h = 25 \text{ °C}$.  

612 November 1981
H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, AB or B operated mobile, industrial and military transmitters in the h.f. and v.h.f. bands. It is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a ½" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25 \degree C$

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$I_C^{(ZS)}$ A</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_D$ dB</th>
<th>$\eta$ %</th>
<th>$d_3^*$ dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w. (class-B)</td>
<td>28</td>
<td>-</td>
<td>150</td>
<td>100</td>
<td>&gt; 6</td>
<td>&gt; 70</td>
<td>-</td>
</tr>
<tr>
<td>s.s.b. (class-A)</td>
<td>26</td>
<td>3</td>
<td>28</td>
<td>35 (P.E.P.)</td>
<td>typ. 19,5</td>
<td>-</td>
<td>typ. -40</td>
</tr>
<tr>
<td>s.s.b. (class-AB)</td>
<td>28</td>
<td>0,05</td>
<td>28</td>
<td>100 (P.E.P.)</td>
<td>typ. 19,0</td>
<td>typ. 42</td>
<td>typ. -30</td>
</tr>
</tbody>
</table>

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

MECHANICAL DATA

SOT-121 (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
MECHANICAL DATA

Fig. 1 SOT-121.

Torque on screw: min. 0.6 Nm (6 kg cm)
max. 0.75 Nm (7.5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-emitter voltage (V_{BE} = 0) peak value</td>
<td>V_{CESM} \text{ max.}</td>
<td>70 V</td>
<td></td>
</tr>
<tr>
<td>Collector-emitter voltage (open base)</td>
<td>V_{CEO} \text{ max.}</td>
<td>35 V</td>
<td></td>
</tr>
<tr>
<td>Emitter-base voltage (open collector)</td>
<td>V_{EBO} \text{ max.}</td>
<td>4 V</td>
<td></td>
</tr>
<tr>
<td>Collector current (average)</td>
<td>I_{C(AV)} \text{ max.}</td>
<td>10 A</td>
<td></td>
</tr>
<tr>
<td>Collector current (peak value); f &gt; 1 MHz</td>
<td>I_{CM} \text{ max.}</td>
<td>25 A</td>
<td></td>
</tr>
<tr>
<td>R.F. power dissipation (f &gt; 1 MHz); T_{mb} = 25 °C</td>
<td>P_{rf} \text{ max.}</td>
<td>160 W</td>
<td></td>
</tr>
<tr>
<td>Storage temperature</td>
<td>T_{stg}</td>
<td>-65 to +150 °C</td>
<td></td>
</tr>
<tr>
<td>Operating junction temperature</td>
<td>T_{j} \text{ max.}</td>
<td>200 °C</td>
<td></td>
</tr>
</tbody>
</table>

THERMAL RESISTANCE (dissipation = 80 W; T_{mb} = 86 °C; i.e. T_{j} = 70 °C)

<table>
<thead>
<tr>
<th>From</th>
<th>R_{th}</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>junction to mounting base (d.c. dissipation)</td>
<td>j-mb(dc)</td>
<td>1,45 K/W</td>
</tr>
<tr>
<td>junction to mounting base (r.f. dissipation)</td>
<td>j-mb(rf)</td>
<td>1,06 K/W</td>
</tr>
<tr>
<td>mounting base to heatsink</td>
<td>mb-h</td>
<td>0,2 K/W</td>
</tr>
</tbody>
</table>

Fig. 2 D.C. SOAR.

Fig. 3 R.F. power dissipation; V_{CE} \leq 28 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch
CHARACTERISTICS

\( T_j = 25 \, ^\circ \text{C} \)

Collector-emitter breakdown voltage
\( V_{BE} = 0; \, I_C = 50 \, \text{mA} \)

Collector-emitter breakdown voltage
open base; \( I_C = 100 \, \text{mA} \)

Emitter-base breakdown voltage
open collector; \( I_E = 5 \, \text{mA} \)

Collector cut-off current
\( V_{BE} = 0; \, V_{CE} = 35 \, \text{V} \)

D.C. current gain*
\( I_C = 5 \, \text{A}; \, V_{CE} = 5 \, \text{V} \)

Collector-emitter saturation voltage
\( I_C = 15 \, \text{A}; \, I_B = 3 \, \text{A} \)

Transition frequency at \( f = 100 \, \text{MHz}^{**} \)
\(-I_E = 5 \, \text{A}; \, V_{CB} = 28 \, \text{V} \)
\(-I_E = 15 \, \text{A}; \, V_{CB} = 28 \, \text{V} \)

Collector capacitance at \( f = 1 \, \text{MHz} \)
\( I_E = I_E = 0; \, V_{CB} = 28 \, \text{V} \)

Feedback capacitance at \( f = 1 \, \text{MHz} \)
\( I_C = 100 \, \text{mA}; \, V_{CE} = 28 \, \text{V} \)

Collector-flange capacitance

\( V_{(BR)CES} > 70 \, \text{V} \)

\( V_{(BR)CEO} > 35 \, \text{V} \)

\( V_{(BR)EBO} > 4 \, \text{V} \)

\( I_{CES} < 5 \, \text{mA} \)

\( h_{FE} = 20 \text{ to } 85 \)

\( V_{CEsat} \text{ typ. } 2 \, \text{V} \)

\( f_T \text{ typ. } 370 \, \text{MHz} \)

\( f_T \text{ typ. } 350 \, \text{MHz} \)

\( C_C \text{ typ. } 155 \, \text{pF} \)

\( C_{re} \text{ typ. } 102 \, \text{pF} \)

\( C_{cf} \text{ typ. } 3 \, \text{pF} \)

* Measured under pulse conditions: \( t_p \leq 300 \, \mu\text{s}; \, \delta \leq 0.02. \)

** Measured under pulse conditions: \( t_p \leq 50 \, \mu\text{s}; \, \delta \leq 0.01. \)
Fig. 4 Typical values; $T_j = 25^\circ C$.

![Graph](image)

Fig. 5 $I_E = I_e = 0$; $f = 1$ MHz; $T_j = 25^\circ C$.

![Graph](image)

Fig. 6 Typical values; $f = 100$ MHz; $T_j = 25^\circ C$.

![Graph](image)
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit); \( T_h = 25 \, ^\circ\text{C} \)

<table>
<thead>
<tr>
<th>( f ) (MHz)</th>
<th>( V_{CE} ) (V)</th>
<th>( P_L ) (W)</th>
<th>( P_D ) (W)</th>
<th>( \eta ) (%)</th>
<th>( \bar{Z}_i ) (( \Omega ))</th>
<th>( Z_L ) (( \Omega ))</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>28</td>
<td>100</td>
<td>(&lt;25)</td>
<td>( &gt;70)</td>
<td>0.74 + j1.35</td>
<td>4.30 + j0.60</td>
</tr>
</tbody>
</table>

Fig. 7 Test circuit; c.w. class-B; \( f = 150 \, \text{MHz} \).

List of components:
- \( C_1 = C_2 = C_7 = C_8 = 5 \) to 100 pF film dielectric trimmer
- \( C_3 = 203 \) pF; \( 2 \times 82 \) pF and \( 39 \) pF multilayer ceramic chip capacitors (500 V, ATC*) in parallel
- \( C_4 = 39 \) pF multilayer ceramic chip capacitor (500 V, ATC*)
- \( C_5 = 1 \) nF feed-through capacitor
- \( C_6 = 100 \) nF polyester capacitor
- \( L_1 = \) strip (30 mm x 8 mm); bent to form inverted 'U' shape with top 15 mm above heatsink, and bottom 5 mm above heatsink
- \( L_2 = 1 \) µH r.f. choke
- \( L_3 = \) strip; shape as shown in Fig. 8; 5 mm above heatsink
- \( L_4 = \) strip (40 mm x 8 mm); bent in form \( _{-}\), 25 mm at 15 mm above heatsink, 5 mm at 5 mm above heatsink
- \( L_5 = \) strip (75 mm long; width 8 mm); 5 mm above base

\( L_1, L_3, L_4, \) and \( L_5 \) are copper strips with a thickness of 0.6 mm.

Heatsink: aluminium; 0.9 K/W

At \( P_L = 100 \) W and \( V_{CE} = 28 \) V, the output power at heatsink temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 0.12 W/K.

Component layout on an aluminium heatsink for 150 MHz test circuit is shown in Fig. 8.

* ATC means American Technical Ceramics.
Fig. 8 Component layout on an aluminium heatsink for 150 MHz test circuit. ©Earthing bolts.
 APPLICATION INFORMATION (continued)

Fig. 9 V_{CE} = 28 V; f = 150 MHz; T_h = 25 °C.

Fig. 10 V_{CE} = 28 V; f = 150 MHz; T_h = 25 °C; typical values.

Fig. 11 R.F. SOAR; c.w. class-B operation; f = 150 MHz; V_{CE} = 28 V; R_{th mb-h} = 0.2 K/W. The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.
OPERATING NOTE  Below 50 MHz a base-emitter resistor of 4.7 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

Fig. 12 Input impedance (series components).

Fig. 13 Load impedance (series components).

Conditions for Figs 12, 13 and 14:
$V_{CE} = 28 \, \text{V}$; $P_L = 100 \, \text{W}$; $T_H = 25 \, ^\circ \text{C}$; typical values; class-B operation.
APPLICATION INFORMATION (continued)

R.F. performance in s.s.b. class-A operation

\[ V_{CE} = 26 \text{ V}; T_h = 40 \, ^\circ\text{C}; f_1 = 28,000 \, \text{MHz}; f_2 = 28,001 \, \text{MHz} \]

<table>
<thead>
<tr>
<th>output power</th>
<th>( G_p ) dB</th>
<th>( I_C ) A</th>
<th>( d_3 ) dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>35 (P.E.P.)</td>
<td>typ. 19,5</td>
<td>3</td>
<td>typ. -40</td>
</tr>
</tbody>
</table>

List of components:

- \( C_1 = 33 \, \text{pF} \) ceramic capacitor (500 V)
- \( C_2 = 100 \, \text{pF} \) air dielectric trimmer (single insulated rotor type)
- \( C_3 = 280 \, \text{pF} \) air dielectric trimmer (single non-insulated rotor type)
- \( C_4 = 180 \, \text{pF} \) polystyrene capacitor
- \( C_5 = C_6 = C_7 = 3,9 \, \text{nF} \) ceramic capacitor
- \( C_8 = 2 \times 33 \, \text{pF} \) ceramic capacitors in parallel (500 V)
- \( C_9 = 330 \, \text{nF} \) polyester capacitor
- \( C_{10} = 82 \, \text{pF} \) ceramic capacitor (500 V)
- \( C_{11} = 100 \, \text{pF} \) air dielectric trimmer (single insulated rotor type)
- \( C_{12} = 180 \, \text{pF} \) air dielectric trimmer (single non-insulated rotor type)
- \( C_{13} = 150 \, \text{pF} \) polystyrene capacitor
- \( C_{14} = 390 \, \text{nF} \) polyester capacitor

Fig. 15 Test circuit; s.s.b. class-A; \( f = 28 \, \text{MHz} \).
List of components in Fig. 15 (continued):

L1 = 72 nH; 3 turns Cu wire (1,0 mm); int. dia. 7 mm; length 4,8 mm; leads 2 x 5 mm
L2 = Cu strip (28 mm x 5 mm x 0,2 mm); 18 mm at 3 mm above printed-circuit board
L3 = Ferroxcube choke coil (cat. no. 4312 020 36640)
L4 = 300 nH; 6 turns Cu wire (1,5 mm); int. dia. 12 mm; length 16 mm; leads 2 x 5 mm
L5 = 330 nH; 7 turns Cu wire (1,5 mm); int. dia. 12 mm; length 20,8 mm; leads 2 x 5 mm

R1 = 1,5 kΩ (± 5%) carbon resistor (0,5 W)
R2 = 100 Ω (± 5%) carbon resistor (0,5 W)
R3 = 68 Ω (± 5%) carbon resistor (0,5 W)
R4 = 100 Ω wirewound potentiometer
R5 = 33 Ω (± 5%) carbon resistor (0,5 W)
R6 = 0,68 Ω (± 10%) wirewound resistor (7 W)
R7 = 120 Ω wirewound resistor (8 W)
R8 = 10 Ω (± 10%) carbon resistor (0,5 W)

Fig. 16 Intermodulation distortion as a function of output power; V_{CE} = 26 V; I_C = 3 A;
f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 40 °C.
APPLICATION INFORMATION (continued)

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

\[ V_{CE} = 28 \, \text{V}; \, T_h = 25 \, ^\circ \text{C}; \, f_1 = 28,000 \, \text{MHz}; \, f_2 = 28,001 \, \text{MHz} \]

<table>
<thead>
<tr>
<th>output power</th>
<th>( G_p ) dB</th>
<th>( \eta_{dt} ) %</th>
<th>( I_C ) A</th>
<th>( d_3^* ) dB</th>
<th>( d_5^* ) dB</th>
<th>( I_C(ZS) ) mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 (P.E.P.)</td>
<td>typ. 19</td>
<td>typ. 42</td>
<td>typ. 4,3</td>
<td>typ. -30</td>
<td>typ. -37</td>
<td>50</td>
</tr>
</tbody>
</table>

Fig. 17 Test circuit; s.s.b. class-AB; \( f = 28 \, \text{MHz} \).

List of components:

- \( C_1 = C_{11} = 150 \, \text{pF} \) air dielectric trimmer (single insulated rotor type)
- \( C_2 = 27 \, \text{pF} \) ceramic capacitor (500 V)
- \( C_3 = C_{12} = 150 \, \text{pF} \) air dielectric trimmer (single non-insulated rotor type)
- \( C_4 = 180 \, \text{pF} \) ceramic capacitor (500 V)
- \( C_5 = C_8 = 3,9 \, \text{nF} \) ceramic capacitor
- \( C_6 = 150 \, \mu\text{F} / 6 \, \text{V} \) solid tantalum capacitor
- \( C_7 = 150 \, \text{pF} \) ceramic capacitor (500 V)
- \( C_9 = 100 \, \text{nF} \) polyester capacitor
- \( C_{10} = 750 \, \text{pF} \) mica dielectric trimmer (single insulated rotor type)
- \( C_{13} = 750 \, \text{pF} \) mica dielectric trimmer (single non-insulated rotor type)
- \( L_1 = 3 \) turns enamelled Cu wire (1,0 mm); int. dia. 12 mm; length 12 mm
- \( L_2 = \) Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- \( L_3 = 3 \) turns enamelled Cu wire (2,0 mm); int. dia. 12 mm; length 12 mm
- \( L_4 = 2 \) turns enamelled Cu wire (2,0 mm); int. dia. 12 mm; length 8 mm
- \( R_1 = 27 \, \Omega \, (\pm 10\%) \) carbon resistor (0,5 W)
- \( R_2 = 4,7 \, \Omega \, (\pm 10\%) \) carbon resistor (0,5 W)

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.
Fig. 18 Intermodulation distortion* as a function of output power.
Typical values; $V_{CE} = 28 \, V$; $I_{C(ZS)} = 50 \, mA$; $f_1 = 28,000 \, MHz$; $f_2 = 28,001 \, MHz$; $T_h = 25 \, ^oC$. 

*Intermodulation distortion
Fig. 19 Power gain as a function of frequency.

Fig. 20 Input impedance (series components).

Figs 19 and 20 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:

\[ V_{CE} = 28 \, V; \, I_{C(ZS)} = 50 \, mA; \, P_L = 100 \, W \, (P.E.P.); \, T_h = 25 \, ^\circ C; \, Z_L = 2.7 \, \Omega . \]
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C in the u.h.f. and v.h.f. range for nominal supply voltages up to 13.5 V. The resistance stabilization of the transistor provides protection against device damage at severe load mismatch conditions. The transistor is housed in a ¼” capstan envelope with a ceramic cap.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25 \, ^\circ C$ in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CC}$ (V)</th>
<th>$f$ (MHz)</th>
<th>$P_L$ (W)</th>
<th>$G_D$ (dB)</th>
<th>$\eta$ (%)</th>
<th>$\bar{z}_i$ (Ω)</th>
<th>$\bar{Y}_L$ (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>12.5</td>
<td>470</td>
<td>2</td>
<td>$&gt; 9.0$</td>
<td>$&gt; 60$</td>
<td>3.5 + j0.4</td>
<td>28 – j38</td>
</tr>
<tr>
<td>c.w.</td>
<td>12.5</td>
<td>175</td>
<td>2</td>
<td>typ. 13.5</td>
<td>typ. 60</td>
<td>4.2 – j3.4</td>
<td>25 – j24</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.

Torque on nut: min. 0.75 Nm (7.5 kg cm)
max. 0.85 Nm (8.5 kg cm)

Diameter of clearance hole in heatsink: max. 4.2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-emitter voltage (VBE = 0)
- peak value

Collector-emitter voltage (open base)

Emitter-base voltage (open collector)

Collector current (d.c.)

Collector current (peak value); f > 1 MHz

Total power dissipation (d.c. and r.f.) up to Th = 70 °C

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCESM max</td>
<td>36 V</td>
</tr>
<tr>
<td>VCEO max</td>
<td>17 V</td>
</tr>
<tr>
<td>VEO max</td>
<td>4 V</td>
</tr>
<tr>
<td>IC max</td>
<td>0,5 A</td>
</tr>
<tr>
<td>ICM max</td>
<td>1,5 A</td>
</tr>
<tr>
<td>Ptot max</td>
<td>8,5 W</td>
</tr>
</tbody>
</table>

Storage temperature

Operating junction temperature

THERMAL RESISTANCE

From junction to mounting base

From mounting base to heatsink

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tstg</td>
<td>-65 to +150 °C</td>
</tr>
<tr>
<td>Tj max</td>
<td>200 °C</td>
</tr>
<tr>
<td>Rth j-mb</td>
<td>14,5 K/W</td>
</tr>
<tr>
<td>Rth mb-h</td>
<td>0,6 K/W</td>
</tr>
</tbody>
</table>
U.H.F. power transistor

BLW79

CHARACTERISTICS

$T_j = 25 \, ^\circ C$

Breakdown voltages

<table>
<thead>
<tr>
<th>Voltage Type</th>
<th>Voltage (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-emitter voltage</td>
<td>$V_{BR}CES &gt; 36$</td>
</tr>
<tr>
<td>Collector-emitter voltage open base</td>
<td>$V_{BR}CEO &gt; 17$</td>
</tr>
<tr>
<td>Emitter-base voltage open collector</td>
<td>$V_{BR}EBO &gt; 4$</td>
</tr>
</tbody>
</table>

Collector cut-off current

<table>
<thead>
<tr>
<th>Current Type</th>
<th>Current (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_{CES}$</td>
<td>$&lt; 2$</td>
</tr>
</tbody>
</table>

D.C. current gain *

<table>
<thead>
<tr>
<th>Current Type</th>
<th>Current (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_C = 250$ mA; $V_{CE} = 5$ V</td>
<td>$h_{FE} &gt; 10$</td>
</tr>
</tbody>
</table>

Collector-emitter saturation voltage *

<table>
<thead>
<tr>
<th>Current Type</th>
<th>Voltage (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_C = 750$ mA; $I_B = 150$ mA</td>
<td>$V_{CEsat} typ 0,6$</td>
</tr>
</tbody>
</table>

Transition frequency at $f = 500$ MHz *

<table>
<thead>
<tr>
<th>Current Type</th>
<th>Frequency (GHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_C = 250$ mA; $V_{CE} = 12,5$ V</td>
<td>$f_T typ 1,5$</td>
</tr>
<tr>
<td>$I_C = 750$ mA; $V_{CE} = 12,5$ V</td>
<td>$f_T typ 1,0$</td>
</tr>
</tbody>
</table>

Collector capacitance at $f = 1$ MHz

<table>
<thead>
<tr>
<th>Current Type</th>
<th>Capacitance (pF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_E = I_e = 0$; $V_{CE} = 12,5$ V</td>
<td>$C_c typ 8$</td>
</tr>
</tbody>
</table>

Feedback capacitance at $f = 1$ MHz

<table>
<thead>
<tr>
<th>Current Type</th>
<th>Capacitance (pF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_C = 20$ mA; $V_{CE} = 12,5$ V</td>
<td>$C_{re} typ 3,6$</td>
</tr>
</tbody>
</table>

Collector-stud capacitance

<table>
<thead>
<tr>
<th>Capacitance (pF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_{cs} typ 1,2$</td>
</tr>
</tbody>
</table>

* Measured under pulse conditions: $t_p \leq 200 \, \mu s; \delta \leq 0,02.$
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

\[ T_h = 25 \, ^\circ C \]

<table>
<thead>
<tr>
<th>f (MHz)</th>
<th>( V_{CE} ) (V)</th>
<th>( P_L ) (W)</th>
<th>( P_S ) (W)</th>
<th>( G_P ) (dB)</th>
<th>( I_C ) (A)</th>
<th>( \eta ) (%)</th>
<th>( \bar{Z}_i ) (( \Omega ))</th>
<th>( \bar{Y}_L ) (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>470</td>
<td>12,5</td>
<td>2</td>
<td>&lt; 0,25</td>
<td>&gt; 9,0</td>
<td>&lt; 0,27</td>
<td>&gt; 60</td>
<td>3,5 + j0,4</td>
<td>28 – j38</td>
</tr>
<tr>
<td>470</td>
<td>13,5</td>
<td>2</td>
<td>–</td>
<td>typ 10,5</td>
<td>–</td>
<td>typ 70</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>175</td>
<td>12,5</td>
<td>2</td>
<td>–</td>
<td>typ 13,5</td>
<td>–</td>
<td>typ 60</td>
<td>4,2 – j3,4</td>
<td>25 – j24</td>
</tr>
</tbody>
</table>

Test circuit for 470 MHz

![Diagram](BLW79)

List of components:

- \( C_1 = 2,2 \, \text{pF} \) (± 0,25 pF) ceramic capacitor
- \( C_2 = C_4 = C_7 = 1,4 \) to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
- \( C_3 = 3,3 \, \text{pF} \) (± 0,25 pF) ceramic capacitor
- \( C_5 = 100 \, \text{pF} \) ceramic feed-through capacitor
- \( C_6 = 100 \, \text{nF} \) polyester capacitor
- \( C_8 = 2 \) to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
- \( L_1 = \) stripline (35,6 mm x 6,0 mm)
- \( L_2 = L_3 = \) Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- \( L_4 = 178 \, \text{nH} \); 4 turns Cu wire (1 mm); int. dia. 6 mm; length 7 mm; leads 2 x 5 mm
- \( L_5 = \) stripline (10,0 mm x 6,0 mm)
- \( L_6 = 28 \, \text{nH} \); ½ turn Cu wire (1 mm); int. dia. 10 mm
- \( L_7 = \) striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (\( \varepsilon_r = 2,74 \)); thickness 1/16”.
- \( R_1 = 100 \, \Omega \) (± 5%) carbon resistor
- \( R_2 = 10 \, \Omega \) (± 5%) carbon resistor

Component layout and printed-circuit board for 470 MHz test circuit see page 6.
APPLICATION INFORMATION (continued)
Component layout and printed-circuit board for 470 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.
Conditions for R.F. SOAR

- f = 470 MHz
- \( T_h = 70 \, ^\circ\text{C} \)
- \( R_{th\, mb\cdot h} = 0.6 \, \text{K/W} \)
- \( V_{CC\text{nom}} = 12.5 \, \text{V or 13.5 V} \)
- \( P_s = P_{Snom} \) at \( V_{CC\text{nom}} \) and VSWR = 1

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio, with VSWR as parameter.

The graph applies to the situation in which the drive \( (P_s/P_{Snom}) \) increases linearly with supply over-voltage ratio.
**OPERATING NOTE** Below 300 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

---

**Measuring conditions for the graphs on this page**

\[ V_{CC} = 12.5 \text{ V} \]
\[ P_L = 2 \text{ W} \]
\[ T_h = 25 \text{ °C} \]

*typical values*
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C in the u.h.f. and v.h.f. range for nominal supply voltages up to 13,5 V.

The resistance stabilization of the transistor provides protection against device damage at severe load mismatch conditions.

The transistor is housed in a ¼” capstan envelope with a ceramic cap.

QUICK REFERENCE DATA

<p>| R.F. performance up to $T_h = 25 , ^\circ C$ in an unneutralized common-emitter class-B circuit |</p>
<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CC}$</th>
<th>$f$</th>
<th>$P_L$</th>
<th>$G_D$</th>
<th>$\eta$</th>
<th>$\overline{z}_1$</th>
<th>$\overline{Y}_L$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V</td>
<td>MHz</td>
<td>W</td>
<td>dB</td>
<td>%</td>
<td>$\Omega$</td>
<td>mS</td>
</tr>
<tr>
<td>c.w.</td>
<td>12,5</td>
<td>470</td>
<td>4</td>
<td>$&gt;8,0$</td>
<td>$&gt;60$</td>
<td>$2,1+ j2,3$</td>
<td>$57 - j56$</td>
</tr>
<tr>
<td>c.w.</td>
<td>12,5</td>
<td>175</td>
<td>4</td>
<td>typ. 15,0</td>
<td>typ. 60</td>
<td>$2,0 - j2,2$</td>
<td>$51 - j48$</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-122.

Dimensions in mm

Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-emitter voltage (\(V_{BE} = 0\))
- Peak value

Collector-emitter voltage (open base)

Emitter-base voltage (open collector)

Collector current (d.c.)

Collector current (peak value); \(f > 1\) MHz

Total power dissipation (d.c. and r.f.) up to \(T_{mb} = 25\) °C

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-emitter voltage (peak value)</td>
<td>(V_{CESM})</td>
<td>(V)</td>
<td>max 36</td>
</tr>
<tr>
<td>Collector-emitter voltage (open base)</td>
<td>(V_{CEO})</td>
<td>(V)</td>
<td>max 17</td>
</tr>
<tr>
<td>Emitter-base voltage (open collector)</td>
<td>(V_{EBO})</td>
<td>(V)</td>
<td>max 4</td>
</tr>
<tr>
<td>Collector current (d.c.)</td>
<td>(I_C)</td>
<td>A</td>
<td>max 1</td>
</tr>
<tr>
<td>Collector current (peak value); (f &gt; 1) MHz</td>
<td>(I_{CM})</td>
<td>A</td>
<td>max 3</td>
</tr>
<tr>
<td>Total power dissipation (d.c. and r.f.) up to (T_{mb} = 25) °C</td>
<td>(P_{tot})</td>
<td>W</td>
<td>max 17</td>
</tr>
</tbody>
</table>

Storage temperature

Operating junction temperature

THERMAL RESISTANCE

From junction to mounting base

From mounting base to heatsink

\(R_{th\ j-mb} = 10.3\ °C/W\)

\(R_{th\ mb-h} = 0.6\ °C/W\)
CHARACTERISTICS

T<sub>j</sub> = 25 °C

Breakdown voltages

Collector-emitter voltage

\[ V_{BE} = 0; I_C = 10 \text{ mA} \]

Collector-emitter voltage

open base; \( I_C = 50 \text{ mA} \)

Emitter-base voltage

open collector; \( I_E = 4 \text{ mA} \)

Collector cut-off current

\[ V_{BE} = 0; V_{CE} = 17 \text{ V} \]

D.C. current gain *

\[ I_C = 0.5 \text{ A}; V_{CE} = 5 \text{ V} \]

Collector-emitter saturation voltage *

\[ I_C = 1.5 \text{ A}; I_B = 0.3 \text{ A} \]

Transition frequency at \( f = 500 \text{ MHz} \)*

\[ I_C = 0.5 \text{ A}; V_{CE} = 12.5 \text{ V} \]
\[ I_C = 1.5 \text{ A}; V_{CE} = 12.5 \text{ V} \]

Collector capacitance at \( f = 1 \text{ MHz} \)

\[ I_E = I_e = 0; V_{CB} = 12.5 \text{ V} \]

Feedback capacitance at \( f = 1 \text{ MHz} \)

\[ I_C = 40 \text{ mA}; V_{CE} = 12.5 \text{ V} \]

Collector-stud capacitance

** Measured under pulse conditions: \( t_p \leq 200 \mu s; \delta \leq 0.02 \)
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

\[ T_h = 25\,^\circ C \]

<table>
<thead>
<tr>
<th>( f ) (MHz)</th>
<th>( V_{CE} ) (V)</th>
<th>( P_L ) (W)</th>
<th>( P_S ) (W)</th>
<th>( G_p ) (dB)</th>
<th>( I_C ) (A)</th>
<th>( \eta ) (%)</th>
<th>( z_j ) (( \Omega ))</th>
<th>( \overline{V_L} ) (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>470</td>
<td>12,5</td>
<td>4</td>
<td>(&lt; 0,63)</td>
<td>( &gt; 8,0)</td>
<td>(&lt; 0,53)</td>
<td>( &gt; 60)</td>
<td>2,1 + j2,3</td>
<td>57 – j56</td>
</tr>
<tr>
<td>470</td>
<td>13,5</td>
<td>4</td>
<td>—</td>
<td>typ 9,5</td>
<td>—</td>
<td>typ 65</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>175</td>
<td>12,5</td>
<td>4</td>
<td>—</td>
<td>typ 15,0</td>
<td>—</td>
<td>typ 60</td>
<td>2,0 – j2,2</td>
<td>51 – j48</td>
</tr>
</tbody>
</table>

Test circuit for 470 MHz

List of components:

C1 = 2,2 pF (± 0,25 pF) ceramic capacitor
C2 = C7 = C8 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = 5,6 pF (± 0,25 pF) ceramic capacitor
C4 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C5 = 100 pF ceramic feed-through capacitor
C6 = 100 nF polyester capacitor
L1 = stripline (22,5 mm x 6,0 mm)
L2 = 13 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4 mm; leads 2 x 5 mm
L3 = L4 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L5 = 51 nH; 3,5 turns Cu wire (1 mm); int. dia. 6 mm; coil length 7 mm; leads 2 x 5 mm
L6 = stripline (10,0 mm x 6,0 mm)
L7 = 15 nH; 1 turn Cu wire (1 mm); int. dia. 5 mm; leads 2 x 5 mm
L1 and L6 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric \( (\varepsilon_r = 2,74) \); thickness 1/16”.
R1 = R2 = 10 \( \Omega \) (± 5%) carbon resistor

Component layout and printed-circuit board for 470 MHz test circuit see page 6.
The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.
U.H.F. power transistor

Conditions for R.F. SOAR

- f = 470 MHz
- \( T_h = 70 \, ^\circ C \)
- \( R_{th \, mb-h} = 0.6 \, K/W \)
- \( V_{CCnom} = 12.5 \, V \) or \( 13.5 \, V \)
- \( P_S = P_{Snom} \) at \( V_{CCnom} \) and \( VSWR = 1 \)

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio, with VSWR as parameter.

The graph applies to the situation in which the drive \((P_S/P_{Snom})\) increases linearly with supply over-voltage ratio.
OPERATING NOTE Below 300 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

Measuring conditions for the graphs on this page

\[ V_{CC} = 12.5 \text{ V} \]
\[ P_L = 4 \text{ W} \]
\[ T_h = 25 \text{ °C} \]

Typical values
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C in the u.h.f. and v.h.f. range for nominal supply voltages up to 13.5 V.
The resistance stabilization of the transistor provides protection against device damage at severe load mismatch conditions.
The transistor is housed in a ⅛" capstan envelope with a ceramic cap.

QUICK REFERENCE DATA

| R.F. performance up to $T_h = 25\, ^\circ C$ in an unneutralized common-emitter class-B circuit |
|---|---|---|---|---|---|---|
| mode of operation | $V_{CC}$ | $f$ | $P_L$ | $G_p$ | $\eta$ | $\bar{z}_L$ | $\bar{V}_L$ |
| c.w. | 12,5 | 470 | 10 | $>6,0$ | $>60$ | $1,3 + j2,5$ | $150 - j66$ |
| c.w. | 12,5 | 175 | 10 | typ. 13,5 | typ. 60 | $1,2 - j0,6$ | $140 - j80$ |

MECHANICAL DATA

Fig. 1 SOT-122.

Dimensions in mm

- Torque on nut: min. 0.75 Nm (7.5 kg cm)
- max. 0.85 Nm (8.5 kg cm)

Diameter of clearance hole in heatsink: max. 4.2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC134)
Collector-emitter voltage ($V_{BE} = 0$)
  peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current (d.c. or average)
Collector current (peak value); $f > 1$ MHz
R.F. power dissipation ($f > 1$ MHz); $T_{mb} = 25$ °C

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CESM}$</td>
<td>max 36 V</td>
</tr>
<tr>
<td>$V_{CEO}$</td>
<td>max 17 V</td>
</tr>
<tr>
<td>$V_{EBO}$</td>
<td>max 4 V</td>
</tr>
<tr>
<td>$I_{C}$</td>
<td>max 2,5 A</td>
</tr>
<tr>
<td>$I_{CM}$</td>
<td>max 7,5 A</td>
</tr>
<tr>
<td>$P_{tot}$</td>
<td>max 40 W</td>
</tr>
</tbody>
</table>

Storage temperature
Operating junction temperature

THERMAL RESISTANCE
From junction to mounting base
From mounting base to heatsink

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{th j-mb}$</td>
<td>4,3 K/W</td>
</tr>
<tr>
<td>$R_{th mb-h}$</td>
<td>0,6 K/W</td>
</tr>
</tbody>
</table>

$mT_{mb} = 25$ °C
$mT_{h} = 70$ °C

$mT_{mb} = 25$ °C
$mT_{h} = 70$ °C

$V_{CE} < 16,5$ V
$f > 1$ MHz

$T_{stg}$ -65 to +150 °C
$T_{j}$ max 200 °C
### CHARACTERISTICS

**$T_j = 25 \, ^\circ\text{C}$**

**Breakdown voltages**

- **Collector-emitter voltage**
  - $V_{BE} = 0; I_C = 25 \, \text{mA}$
  - $V(BR)_{CES} > 36 \, \text{V}$

- **Collector-emitter voltage**
  - open base; $I_C = 100 \, \text{mA}$
  - $V(BR)_{CEO} > 17 \, \text{V}$

- **Emitter-base voltage**
  - open collector; $I_E = 10 \, \text{mA}$
  - $V(BR)_{EBO} > 4 \, \text{V}$

**Collector cut-off current**

- $V_{BE} = 0; V_{CE} = 17 \, \text{V}$
  - $I_{CES} < 10 \, \text{mA}$

**D.C. current gain** *

- $I_C = 1,25 \, \text{A}; V_{CE} = 5 \, \text{V}$
  - $h_{FE} > 10$
  - typ 35

**Collector-emitter saturation voltage** *

- $I_C = 3,75 \, \text{A}; I_B = 0,75 \, \text{A}$
  - $V_{CEsat} \, \text{typ} \, 0,75 \, \text{V}$

**Transition frequency at $f = 500 \, \text{MHz}$** *

- $I_C = 1,25 \, \text{A}; V_{CE} = 12,5 \, \text{V}$
  - $f_T \, \text{typ} \, 1,3 \, \text{GHz}$

- $I_C = 3,75 \, \text{A}; V_{CE} = 12,5 \, \text{V}$
  - $f_T \, \text{typ} \, 0,9 \, \text{GHz}$

**Collector capacitance at $f = 1 \, \text{MHz}$**

- $I_E = I_B = 0; V_{CB} = 12,5 \, \text{V}$
  - $C_c \, \text{typ} \, 34 \, \text{pF}$

**Feedback capacitance at $f = 1 \, \text{MHz}$**

- $I_C = 100 \, \text{mA}; V_{CE} = 12,5 \, \text{V}$
  - $C_{re} \, \text{typ} \, 18 \, \text{pF}$

**Collector-stud capacitance**

* Measured under pulse conditions: $t_p \leq 200 \, \mu\text{s}; \delta \leq 0,02$. 

---

*August 1986 645*
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

$T_h = 25 \, ^\circ C$

<table>
<thead>
<tr>
<th>$f$ (MHz)</th>
<th>$V_{CE}$ (V)</th>
<th>$P_L$ (W)</th>
<th>$P_S$ (W)</th>
<th>$G_D$ (dB)</th>
<th>$I_C$ (A)</th>
<th>$\eta$ (%)</th>
<th>$\bar{z}_i$ (Ω)</th>
<th>$\bar{Y}_L$ (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>470</td>
<td>12,5</td>
<td>10</td>
<td>&lt; 2,5</td>
<td>&gt; 6,0</td>
<td>&lt; 1,33</td>
<td>&gt; 60</td>
<td>1,3 + j2,5</td>
<td>150 – j66</td>
</tr>
<tr>
<td>470</td>
<td>13,5</td>
<td>10</td>
<td>typ 1,9</td>
<td>typ 7,2</td>
<td>–</td>
<td>typ 75</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>175</td>
<td>12,5</td>
<td>10</td>
<td>typ 0,45</td>
<td>typ 13,5</td>
<td>–</td>
<td>typ 60</td>
<td>1,2 – j0,6</td>
<td>140 – j80</td>
</tr>
</tbody>
</table>

Test circuit for 470 MHz

List of components:

- $C1 = 2,2 \, \mu F \, (\pm \, 0,25 \, \mu F)$ ceramic capacitor
- $C2 = C9 = C10 = 2$ to $18 \, \mu F$ film dielectric trimmer (cat. no. 2222 809 09003)
- $C3 = 3,9 \, \mu F \, (\pm \, 0,25 \, \mu F)$ ceramic capacitor
- $C4 = 1,4$ to $5,5 \, \mu F$ film dielectric trimmer (cat. no. 2222 809 09001)
- $C5 = C6 = 15 \, \mu F$ ceramic chip capacitor (cat. no. 2222 851 13159)
- $C7 = 100 \, \mu F$ ceramic feed-through capacitor
- $C8 = 100 \, nF$ polyester capacitor
- $L1 = \text{stripline (27,9 mm} \times 6,0 \, \text{mm})$
- $L2 = 13 \, \text{turns closely wound enamelled Cu wire (0,5 mm); int. dia. = 4 mm; leads 2 x 5 mm}$
- $L3 = 17 \, \text{nH; 1½ turns enamelled Cu wire (1 mm); spacing 1 mm; int. dia. = 6 mm; leads 2 x 5 mm}$
- $L4 = \text{Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)}$
- $L5 = \text{stripline (45,8 mm} \times 6,0 \, \text{mm})$

$L1$ and $L5$ are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric ($\varepsilon_r = 2,74$); thickness 1/16".

- $R1 = 1 \, \Omega \, (\pm \, 5\%)$ carbon resistor
- $R2 = 10 \, \Omega \, (\pm \, 5\%)$ carbon resistor

Component layout and printed-circuit board for 470 MHz test circuit see page 6.
APPLICATION INFORMATION (continued)
Component layout and printed-circuit board for 470 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio, with VSWR as parameter.

The graph applies to the situation in which the drive (Ps/Psnom) increases linearly with supply over-voltage ratio.
OPERATING NOTE: Below 200 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

Measuring conditions for the graphs on this page:

- $V_{CC} = 12.5$ V
- $P_L = 10$ W
- $T_H = 25^\circ$C

Typical values
H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in transmitting amplifiers operating in the h.f. and v.h.f. bands, with a nominal supply voltage of 28 V. The transistor is specified for s.s.b. applications as linear amplifier in class-A and AB. The device is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

Matched hFE groups are available on request.

It has a 3/8” flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_D$ dB</th>
<th>$\eta_{dt}$ %</th>
<th>$I_C$ A</th>
<th>$d_3$ dB</th>
<th>$T_h$ °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>s.s.b. (class-A)</td>
<td>26</td>
<td>1,6 - 28</td>
<td>0 - 10 (P.E.P.)</td>
<td>$&gt; 20$</td>
<td>-</td>
<td>1,35</td>
<td>$&lt; -40$</td>
<td>70</td>
</tr>
<tr>
<td>s.s.b. (class-AB)</td>
<td>28</td>
<td>1,6 - 28</td>
<td>3 - 30 (P.E.P.)</td>
<td>typ. 21</td>
<td>typ. 40</td>
<td>typ. 1,34</td>
<td>typ. -30</td>
<td>25</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-123.

Dimensions in mm

Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head
4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage \( V_{BE} = 0 \)
peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open-collector)
Collector current (average)
Collector current (peak value); \( f > 1 \) MHz
R.F. power dissipation \( (f > 1 \) MHz\); \( T_{mb} = 25 \) °C
Storage temperature
Operating junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_{CESM} ) max.</td>
<td>65 V</td>
</tr>
<tr>
<td>( V_{CEO} ) max.</td>
<td>36 V</td>
</tr>
<tr>
<td>( V_{EBO} ) max.</td>
<td>4 V</td>
</tr>
<tr>
<td>( I_{CAV} ) max.</td>
<td>3 A</td>
</tr>
<tr>
<td>( I_{CM} ) max.</td>
<td>9 A</td>
</tr>
<tr>
<td>( P_{rf} ) max.</td>
<td>76 W</td>
</tr>
<tr>
<td>( T_{stg} ) max.</td>
<td>-65 to +150 °C</td>
</tr>
<tr>
<td>( T_{j} ) max.</td>
<td>200 °C</td>
</tr>
</tbody>
</table>

Fig. 2 D.C. SOAR.
Fig. 3 R.F. power dissipation; \( V_{CE} \leq 28 \) V; \( f \geq 1 \) MHz.

THERMAL RESISTANCE (dissipation = 35 W; \( T_{mb} = 80 \) °C, i.e. \( T_{h} = 70 \) °C)
From junction to mounting base (d.c. dissipation)
From junction to mounting base (r.f. dissipation)
From mounting base to heatsink

\[
\begin{align*}
R_{th \, j-mb (dc)} &= 3,15 \, K/W \\
R_{th \, j-mb (rf)} &= 2,35 \, K/W \\
R_{th \, mb-h} &= 0,3 \, K/W 
\end{align*}
\]
CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage
V_{BE} = 0; |I_C| = 10 mA

Collector-emitter breakdown voltage
open base; |I_C| = 50 mA

Emitter-base breakdown voltage
open collector; |I_E| = 10 mA

Collector cut-off current
V_{BE} = 0; V_{CE} = 36 V

Second breakdown energy; L = 25 mH; f = 50 Hz
open base
R_{BE} = 10 Ω

D.C. current gain*
I_C = 1.25 A; V_{CE} = 5 V

D.C. current gain ratio of matched devices*
I_C = 1.25 A; V_{CE} = 5 V

Collector-emitter saturation voltage*
I_C = 3.75 A; |I_B| = 0.75 A

Transition frequency at f = 100 MHz*
-I_E = 1.25 A; V_{CB} = 28 V
-I_E = 3.75 A; V_{CB} = 28 V

Collector capacitance at f = 1 MHz
I_E = I_B = 0; V_{CB} = 28 V

Feedback capacitance at f = 1 MHz
I_C = 100 mA; V_{CE} = 28 V

Collector-flange capacitance

\[ I_C \quad (A) \]

\[ V_{BE} \quad (V) \]

Fig. 4 Typical values; V_{CE} = 28 V.

* Measured under pulse conditions: \( t_p \leq 200 \mu s; \delta \leq 0.02. \)
Fig. 5 Typical values; $T_j = 25 \, ^\circ\mathrm{C}$.

Fig. 6 $I_E = I_e = 0$; $f = 1 \, \text{MHz}$; $T_j = 25 \, ^\circ\mathrm{C}$.

Fig. 7 Typical values; $f = 100 \, \text{MHz}$; $T_j = 25 \, ^\circ\mathrm{C}$. 
APPLICATION INFORMATION
R.F. performance in s.s.b. class-A operation (linear power amplifier)

\[ V_{CE} = 26 \text{ V}; f_1 = 28,000 \text{ MHz}; f_2 = 28,001 \text{ MHz} \]

<table>
<thead>
<tr>
<th>Output Power W</th>
<th>( G_p ) dB</th>
<th>( I_C ) A</th>
<th>( d_3 ) dB*</th>
<th>( d_5 ) dB*</th>
<th>( T_h ) °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 10 (P.E.P.)</td>
<td>&gt; 20</td>
<td>1.35</td>
<td>-40</td>
<td>-40</td>
<td>70</td>
</tr>
<tr>
<td>typ. 11 (P.E.P.)</td>
<td>typ. 24</td>
<td>1.35</td>
<td>-40</td>
<td>-40</td>
<td>25</td>
</tr>
</tbody>
</table>

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

Fig. 8 Test circuit; s.s.b. class-A.
List of components in Fig. 8:

C1 = C2 = 10 to 780 pF film dielectric trimmer  
C3 = 22 nF ceramic capacitor (63 V)  
C4 = 47 µF/10 V electrolytic capacitor  
C5 = 56 pF ceramic capacitor (500 V)  
C6 = 47 µF/35 V electrolytic capacitor  
C7 = C8 = 220 nF polyester capacitor  
C9 = 10 µF/35 V electrolytic capacitor  
C10 = C11 = 7 to 100 pF film dielectric trimmer  
C12 = 82 pF ceramic capacitor (500 V)  

L1 = 3 turns closely wound enamelled Cu wire (1.6 mm); int. dia. 9.0 mm; leads to 2 x 5 mm  
L2 = L3 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)  
L4 = 11 turns closely wound enamelled Cu wire (1.6 mm); int. dia. 11.0 mm  
L5 = 14 turns closely wound enamelled Cu wire (1.6 mm); int. dia. 11.0 mm  

R1 = 600 Ω; parallel connection of 2 x 1,2 kΩ carbon resistors (±5%; 0.5 W each)  
R2 = 15 Ω carbon resistor (±5%; 0.25 W)  
R3 = 1,2 Ω; parallel connection of 4 x 4,7 Ω carbon resistors (±5%; 0.125 W each)  
R4 = 33 Ω carbon resistor (±5%; 0.25 W)  
R5 = 18 Ω carbon resistor (±5%; 0.25 W)  
R6 = 120 Ω wirewound resistor (±5%; 5.5 W)  
R7 = 1 Ω carbon resistor (±5%; 0.125 W)  
R8 = 47 Ω wirewound potentiometer (3 W)  
R9 = 1,57 Ω; parallel connection of 3 x 4,7 Ω wirewound resistors (±5%; 5.5 W each)  

Fig. 9 Intermodulation distortion as a function of output power.  
Typical values; \( V_{CE} = 26 \) V; \( T_h = 70 \) °C; \( T_h = 25 \) °C.
H.F./V.H.F. power transistor

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

\[ V_{CE} = 28 \text{ V} ; \ f_1 = 28,000 \ \text{MHz} ; \ f_2 = 28,001 \ \text{MHz} \]

<table>
<thead>
<tr>
<th>output power W</th>
<th>( G_p ) dB</th>
<th>( \eta_{dt} ) (%) at 30 W P.E.P.</th>
<th>( I_C ) (A) typ. 30 W P.E.P.</th>
<th>( d_3 ) dB*</th>
<th>( d_5 ) dB*</th>
<th>( I_C(ZS) ) mA</th>
<th>( T_h ) °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 to 30 (P.E.P.)</td>
<td>typ. 21</td>
<td>typ. 40</td>
<td>typ. 1.34</td>
<td>typ. –30</td>
<td>&lt; –30</td>
<td>25</td>
<td>70</td>
</tr>
<tr>
<td>3 to 25 (P.E.P.)</td>
<td>typ. 21</td>
<td>–</td>
<td>–</td>
<td>typ. –30</td>
<td>&lt; –30</td>
<td>25</td>
<td>70</td>
</tr>
</tbody>
</table>

*Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

List of components:

- \( C_1 = C_2 = 10 \) to 780 pF film dielectric trimmer
- \( C_3 = C_5 = C_6 = 220 \) nF polyester capacitor
- \( C_4 = 56 \) pF ceramic capacitor (500 V)
- \( C_7 = C_8 = 15 \) to 575 pF film dielectric trimmer

- \( L_1 = 4 \) turns closely wound enamelled Cu wire (1,6 mm); int. dia. 7,0 mm; leads 2 x 5 mm
- \( L_2 = \) Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- \( L_3 = 4 \) turns enamelled Cu wire (1,6 mm); int. dia. 10 mm; length 9,4 mm; leads 2 x 5 mm
- \( L_4 = 7 \) turns enamelled Cu wire (1,6 mm); int. dia. 12 mm; length 17,2 mm; leads 2 x 5 mm

- \( R_1 = 1,2 \) Ω; parallel connection of 4 x 4,7 Ω carbon resistors
- \( R_2 = 39 \) Ω carbon resistor
Fig. 11 Intermodulation distortion as a function of output power.*

Conditions for Fig. 11:
V_{CE} = 28 V; I_{C(ZS)} = 25 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; typical values.

Fig. 12 Double-tone efficiency and power gain as a function of output power.

Conditions for Fig. 12:
V_{CE} = 28 V; I_{C(ZS)} = 25 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

* See note on previous page.
Fig. 13 Power gain as a function of frequency.

Fig. 14 Input impedance (series components) as a function of frequency.

Figs 13 and 14 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:
$V_{CE} = 28 \text{ V}; I_C(ZS) = 25 \text{ mA}; P_L = 30 \text{ W}; T_h = 25 \text{ °C}; Z_L = 9.5 \Omega.$

**Ruggedness in s.s.b. operation**

The BLW83 is capable of withstanding a load mismatch ($VSWR = 50$) under the following conditions:
$f_1 = 28,000 \text{ MHz}; f_2 = 28,001 \text{ MHz}; V_{CE} = 28 \text{ V}; T_h = 70 \text{ °C}$ and $P_{Lnom} = 35 \text{ W (P.E.P.)}.$
V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25 \, ^\circ C$ in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f_{PL}$ MHz</th>
<th>$P_L$ W</th>
<th>$G_p$ dB</th>
<th>$\eta$ %</th>
<th>$\bar{z}_L$ $\Omega$</th>
<th>$\bar{Y}_L$ mS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>28</td>
<td>175</td>
<td>25</td>
<td>&gt; 9</td>
<td>&gt; 60</td>
<td>1,0 + j1,2</td>
<td>59 – j54</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-123.

Dimensions in mm

Torque on screw: min. 0,6 Nm (6 kg cm) max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current (average)
Collector current (peak value); f > 1 MHz
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C
Storage temperature
Operating junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_{CESM}</td>
<td>max. 65 V</td>
</tr>
<tr>
<td>V_{CEO}</td>
<td>max. 36 V</td>
</tr>
<tr>
<td>V_{EBO}</td>
<td>max. 4 V</td>
</tr>
<tr>
<td>I_{C(AV)}</td>
<td>max. 3 A</td>
</tr>
<tr>
<td>I_{CM}</td>
<td>max. 9 A</td>
</tr>
<tr>
<td>P_{rf}</td>
<td>max. 76 W</td>
</tr>
<tr>
<td>T_{stg}</td>
<td>-65 to +150 °C</td>
</tr>
<tr>
<td>T_j</td>
<td>max. 200 °C</td>
</tr>
</tbody>
</table>

**Fig. 2** D.C. SOAR.

**Fig. 3** R.F. power dissipation; V_{CE} ≤ 28 V; f > 1 MHz.

THERMAL RESISTANCE (dissipation = 20 W; T_{mb} = 76 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation) \( R_{th j-mb (dc)} = 3.0 \text{ K/W} \)
From junction to mounting base (r.f. dissipation) \( R_{th j-mb (rf)} = 2.25 \text{ K/W} \)
From mounting base to heatsink \( R_{th mb-h} = 0.3 \text{ K/W} \)
**CHARACTERISTICS**

**Tj = 25 °C**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-emitter breakdown voltage</td>
<td>$V_{BE} = 0; I_C = 10 \text{ mA}$</td>
</tr>
<tr>
<td>Collector-emitter breakdown voltage open base; $I_C = 50 \text{ mA}$</td>
<td></td>
</tr>
<tr>
<td>Emitter-base breakdown voltage open collector; $I_E = 10 \text{ mA}$</td>
<td></td>
</tr>
<tr>
<td>Collector cut-off current $V_{BE} = 0; V_{CE} = 36 \text{ V}$</td>
<td></td>
</tr>
<tr>
<td>Second breakdown energy; $L = 25 \text{ mH}; f = 50 \text{ Hz}$ open base $R_{BE} = 10 \Omega$</td>
<td></td>
</tr>
<tr>
<td>D.C. current gain * $I_C = 1,25 \text{ A}; V_{CE} = 5 \text{ V}$</td>
<td></td>
</tr>
<tr>
<td>Collector-emitter saturation voltage * $I_C = 3,75 \text{ A}; I_B = 0,75 \text{ A}$</td>
<td></td>
</tr>
<tr>
<td>Transition frequency at $f = 100 \text{ MHz}$ * $I_E = 1,25 \text{ A}; V_{CB} = 28 \text{ V}$</td>
<td></td>
</tr>
<tr>
<td>$I_E = 3,75 \text{ A}; V_{CB} = 28 \text{ V}$</td>
<td></td>
</tr>
<tr>
<td>Collector capacitance at $f = 1 \text{ MHz}$ $I_E = I_E = 0; V_{CE} = 28 \text{ V}$</td>
<td></td>
</tr>
<tr>
<td>Feedback capacitance at $f = 1 \text{ MHz}$ $I_C = 100 \text{ mA}; V_{CE} = 28 \text{ V}$</td>
<td></td>
</tr>
<tr>
<td>Collector-flange capacitance</td>
<td></td>
</tr>
</tbody>
</table>

| $V_{(BR)CES}$ | $> 65 \text{ V}$ |
| $V_{(BR)CEO}$ | $> 36 \text{ V}$ |
| $V_{(BR)EBO}$ | $> 4 \text{ V}$  |
| $I_{CES}$     | $< 4 \text{ mA}$ |
| $E_{SBO}$     | $> 8 \text{ mJ}$ |
| $E_{SBR}$     | $> 8 \text{ mJ}$ |
| $h_{FE}$      | typ. $45$ |
|               | 10 to 100         |
| $V_{CEsat}$   | typ. $1,5 \text{ V}$ |
| $f_T$         | typ. $650 \text{ MHz}$ |
| $C_C$         | typ. $45 \text{ pF}$ |
| $C_{re}$      | typ. $28 \text{ pF}$ |
| $C_{cf}$      | typ. $2 \text{ pF}$ |

* Measured under pulse conditions: $t_p \leq 200 \mu s; \delta \leq 0,02$. 
Fig. 4 Typical values; $T_j = 25 \, ^\circ\text{C}$.

Fig. 5 $I_E = I_e = 0$; $f = 1 \, \text{MHz}$; $T_j = 25 \, ^\circ\text{C}$.

Fig. 6 Typical values; $f = 100 \, \text{MHz}$; $T_j = 25 \, ^\circ\text{C}$.
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

\[ T_h = 25 \, ^\circ C \]

<table>
<thead>
<tr>
<th>( f ) (MHz)</th>
<th>( V_{CE} ) (V)</th>
<th>( P_L ) (W)</th>
<th>( P_S ) (W)</th>
<th>( G_p ) (dB)</th>
<th>( I_C ) (A)</th>
<th>( \eta ) (%)</th>
<th>( \overline{Z_i} ) (( \Omega ))</th>
<th>( Y_L ) (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>28</td>
<td>25</td>
<td>(&lt; 3.15)</td>
<td>(&lt; 9)</td>
<td>(&lt; 1.49)</td>
<td>&gt;60</td>
<td>(1.0 + j1.2)</td>
<td>(59 - j54)</td>
</tr>
</tbody>
</table>

![Test circuit diagram](7277104)

**Fig. 7 Test circuit; c.w. class-B.**

**List of components**

- \( C_1 = C_7 = 2.5 \) to \( 20 \) pF film dielectric trimmer (cat. no. 2222 809 07004)
- \( C_2 = 5 \) to \( 60 \) pF film dielectric trimmer (cat. no. 2222 809 07011)
- \( C_3a = C_3b = 47 \) pF ceramic capacitor (500 V)
- \( C_4 = 120 \) pF ceramic capacitor (500 V)
- \( C_5 = 100 \) nF (± 10%) polyester capacitor
- \( C_6a = 2.2 \) pF ceramic capacitor (500 V)
- \( C_6b = 1.8 \) pF ceramic capacitor (500 V)
- \( C_8 = 4 \) to \( 40 \) pF film dielectric trimmer (cat. no. 2222 809 07008)
- \( L_1 = 14 \) nH; 1 turn enamelled Cu wire (1.6 mm); int. dia. 7.7 mm; leads 2 x 5 mm
- \( L_2 = 100 \) nH; 7 turns closely wound enamelled Cu wire (0.5 mm); int. dia. 3 mm; leads 2 x 5 mm
- \( L_3 = L_8 = \) Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- \( L_4 = L_5 = \) strip (12 mm x 6 mm); taps for \( C_3a \) and \( C_3b \) at 5 mm from transistor
- \( L_6 = 80 \) nH; 3 turns enamelled Cu wire (1.6 mm); int. dia. 9.0 mm; length 8.0 mm; leads 2 x 5 mm
- \( L_7 = 82 \) nH; 3 turns enamelled Cu wire (1.6 mm); int. dia. 7.5 mm; length 8.1 mm; leads 2 x 5 mm
- \( L_4 \) and \( L_5 \) are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16”.
- \( R_1 = R_2 = 10 \, \Omega \) (± 10%) carbon resistor (0.25 W)

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

To minimize the dielectric losses, the ground plane under the interconnection of L7 and C7 has been removed.

Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.
V.H.F. power transistor

Fig. 9 $V_{CE} = 28 \text{ V}; f = 175 \text{ MHz}$; typical values.

$P_L (\text{W})$ vs $P_S (\text{W})$

$T_h = 25 ^\circ \text{C}$

$P_L (\text{W})$

$T_h = 70 ^\circ \text{C}$

Fig. 10 $V_{CE} = 28 \text{ V}; f = 175 \text{ MHz}$; typical values;

$\eta$ (\%) vs $P_L (\text{W})$

$\eta$

$T_h = 25 ^\circ \text{C}$

$T_h = 70 ^\circ \text{C}$

Fig. 11 R.F. SOAR; c.w. class-B operation;

$f = 175 \text{ MHz}; V_{CE} = 28 \text{ V}; R_{th \text{ mb-h}} = 0.3 \text{ K/W}$

The graph shows the permissible output power under nominal conditions ($\text{VSWR} = 1$) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.
OPERATING NOTE Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

Conditions for Figs 12, 13 and 14:
Typical values; $V_{CE} = 28$ V; $P_L = 25$ W; $T_h = 25 \degree C$. 

Fig. 12.

Fig. 13.

Fig. 14.
H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile h.f. and v.h.f. transmitters with a nominal supply voltage of 12,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. Matched $h_{FE}$ groups are available on request.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25^\circ C$

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_p$ dB</th>
<th>$\eta$ %</th>
<th>$\overline{Z_i}$ $\Omega$</th>
<th>$\overline{Z_L}$ $\Omega$</th>
<th>$d_3$ dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w. (class-B)</td>
<td>12,5</td>
<td>175</td>
<td>45</td>
<td>&gt; 4,5</td>
<td>&gt; 75</td>
<td>1,4 + j1,5</td>
<td>2,7 – j1,3</td>
<td>–</td>
</tr>
<tr>
<td>s.s.b. (class-AB)</td>
<td>12,5</td>
<td>1,6–28</td>
<td>3–30 (P.E.P.)</td>
<td>typ. 19,5</td>
<td>typ. 35</td>
<td>–</td>
<td>–</td>
<td>typ.–33</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-123.

Dimensions in mm

Torque on screw: min. 0,6 Nm (6 kg cm) max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$)
  peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open-collector)
Collector current (average)
Collector current (peak value); $f > 1$ MHz
R.F. power dissipation ($f > 1$ MHz); $T_{mb} = 25$ °C
Storage temperature
Operating junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Max. Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CESM}$</td>
<td>36 V</td>
</tr>
<tr>
<td>$V_{CEO}$</td>
<td>18 V</td>
</tr>
<tr>
<td>$V_{EBO}$</td>
<td>4 V</td>
</tr>
<tr>
<td>$I_{C(AV)}$</td>
<td>9 A</td>
</tr>
<tr>
<td>$I_{CM}$</td>
<td>22 A</td>
</tr>
<tr>
<td>$P_{rf}$</td>
<td>105 W</td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>-65 to +150 °C</td>
</tr>
<tr>
<td>$T_{j}$</td>
<td>200 °C</td>
</tr>
</tbody>
</table>

Fig. 2 D.C. SOAR.

Fig. 3 R.F. power dissipation; $V_{CE} \leq 16,5$ V; $f \geq 1$ MHz.

THERMAL RESISTANCE (dissipation = 30 W; $T_{mb} = 79$ °C, i.e. $T_{h} = 70$ °C)
From junction to mounting base (d.c. dissipation)
From junction to mounting base (r.f. dissipation)
From mounting base to heatsink

$R_{th \ j-mb (dc)} = 2,5$ K/W
$R_{th \ j-mb (rf)} = 1,8$ K/W
$R_{th \ mb-h} = 0,3$ K/W
CHARACTERISTICS

$T_j = 25 \, ^\circ C$

Collector-emitter breakdown voltage

\[ V_{BE} = 0; \quad I_C = 50 \, mA \]

Collector-emitter breakdown voltage
open base; \[ I_C = 100 \, mA \]

Emitter-base breakdown voltage
open collector; \[ I_E = 25 \, mA \]

Collector cut-off current

\[ V_{BE} = 0; \quad V_{CE} = 18 \, V \]

Second breakdown energy; \( L = 25 \, mH; \quad f = 50 \, Hz \)
open base
\[ R_{BE} = 10 \, \Omega \]

D.C. current gain*

\[ I_C = 4 \, A; \quad V_{CE} = 5 \, V \]

D.C. current gain ratio of matched devices*

\[ I_C = 4 \, A; \quad V_{CE} = 5 \, V \]

Collector-emitter saturation voltage*

\[ I_C = 12.5 \, A; \quad I_B = 2.5 \, A \]

Transition frequency at $f = 100 \, MHz$*

\[ -I_E = 4 \, A; \quad V_{CB} = 12.5 \, V \]
\[ -I_E = 12.5 \, A; \quad V_{CB} = 12.5 \, V \]

Collector capacitance at $f = 1 \, MHz$

\[ I_E = I_E = 0; \quad V_{CB} = 15 \, V \]

Feedback capacitance at $f = 1 \, MHz$

\[ I_C = 200 \, mA; \quad V_{CE} = 15 \, V \]

Collector-flange capacitance

\[ V_{(BR)CES} > 36 \, V \]
\[ V_{(BR)CEO} > 18 \, V \]
\[ V_{(BR)EBO} > 4 \, V \]
\[ I_{CES} < 25 \, mA \]
\[ E_{SO} > 8 \, mJ \]
\[ E_{SR} > 8 \, mJ \]
\[ h_{FE} \quad \text{typ.} \quad 50 \]
\[ 10 \, \text{to} \, 80 \]
\[ h_{FE1/hFE2} < 1,2 \]
\[ V_{CEsat} \quad \text{typ.} \quad 1.5 \, V \]
\[ f_T \quad \text{typ.} \quad 650 \, MHz \]
\[ f_T \quad \text{typ.} \quad 600 \, MHz \]
\[ C_c \quad \text{typ.} \quad 120 \, pF \]
\[ C_{re} \quad \text{typ.} \quad 82 \, pF \]
\[ C_{cf} \quad \text{typ.} \quad 2 \, pF \]

* Measured under pulse conditions: $t_p \leq 200 \, \mu s; \quad \delta \leq 0.02.$
Fig. 4. Typical values
$T_j = 25 \, ^\circ\text{C}$

$V_{CE} = 12.5 \, \text{V}$

$5 \, \text{V}$

Fig. 5. $T_j = 25 \, ^\circ\text{C}$

$C_C (\text{pF})$

$V_{CB} (\text{V})$

Typical values

$f = 1 \, \text{MHz}$

$I_E = \eta = 0$

Fig. 6. Typical values

$f = 100 \, \text{MHz}$

$T_j = 25 \, ^\circ\text{C}$

$V_{CB} = 12.5 \, \text{V}$

$10 \, \text{V}$

$5 \, \text{V}$
## APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

\( T_h = 25 \, ^\circ\mathrm{C} \)

<table>
<thead>
<tr>
<th>( f ) (MHz)</th>
<th>( V_{CE} ) (V)</th>
<th>( P_L ) (W)</th>
<th>( P_S ) (W)</th>
<th>( G_p ) (dB)</th>
<th>( I_C ) (A)</th>
<th>( \eta ) (%)</th>
<th>( \bar{z}_i ) (( \Omega ))</th>
<th>( Z_L ) (( \Omega ))</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>12.5</td>
<td>45</td>
<td>&lt;16</td>
<td>&gt;4.5</td>
<td>&lt;4.8</td>
<td>&gt;75</td>
<td>1.4 + j1.5</td>
<td>2.7 - j1.3</td>
</tr>
<tr>
<td>175</td>
<td>13.5</td>
<td>45</td>
<td>typ. 6.0</td>
<td>typ. 75</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

![Test circuit; c.w. class-B.](image)

**Fig. 7** Test circuit; c.w. class-B.

List of components:

- \( C_1 = 2.5 \) to \( 20 \) pF film dielectric trimmer (cat. no. 2222 809 07004)
- \( C_2 = 8 \) to \( 40 \) pF film dielectric trimmer (cat. no. 2222 809 07008)
- \( C_{3a} = C_{3b} = 47 \) pF ceramic capacitor (500 V)
- \( C_4 = 120 \) pF ceramic capacitor (500 V)
- \( C_5 = 100 \) nF polyester capacitor
- \( C_{6a} = C_{6b} = 8.2 \) pF ceramic capacitor (500 V)
- \( C_7 = 5 \) to \( 60 \) pF film dielectric trimmer (cat. no. 2222 809 07011)
- \( L_1 = 1 \) turn Cu wire (1.6 mm); int. dia. 9.0 mm; leads 2 x 5 mm
- \( L_2 = 100 \) nH; 7 turns closely wound enamelled Cu wire (0.5 mm); int. dia. 3 mm; leads 2 x 5 mm
- \( L_3 = L_8 = \) Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- \( L_4 = L_5 = \) strip (12 mm x 6 mm); taps for \( C_{3a} \) and \( C_{3b} \) at 5 mm from transistor
- \( L_6 = 2 \) turns enamelled Cu wire (1.6 mm); int. dia. 5.0 mm; length 6.0 mm; leads 2 x 5 mm
- \( L_7 = 2 \) turns enamelled Cu wire (1.6 mm); int. dia. 4.5 mm; length 6.0 mm; leads 2 x 5 mm
- \( L_4 \) and \( L_5 \) are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".
- \( R_1 = 10 \, \Omega \) (±10%) carbon resistor (0.25 W)
- \( R_2 = 4.7 \, \Omega \) (±5%) carbon resistor (0.25 W)

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

To minimize the dielectric losses, the ground plane under the interconnection of L7 and C7 has been removed.
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (PS/PNom) increases linearly with supply over-voltage ratio.
Fig. 12 Input impedance (series components).

Fig. 13 Load impedance (series components).

Fig. 14.

Conditions for Figs 12, 13 and 14:
Typical values; $V_{CE} = 12.5 \, V$; $P_L = 45 \, W$; class-B operation; $T_h = 25 \, ^\circ C$. 
R.F. performance in s.s.b. class-AB operation

$V_{CE} = 12,5\,\text{V}; T_h \uparrow \text{up to } 25^\circ\text{C}; R_{th, mb-h} \leq 0,3\,\text{K/W}$

$f_1 = 28,000\,\text{MHz}; f_2 = 28,001\,\text{MHz}$

<table>
<thead>
<tr>
<th>output power</th>
<th>$G_p$ dB</th>
<th>$\eta_{dt}$ %</th>
<th>$d_3$ dB*</th>
<th>$d_5$ dB*</th>
<th>$I_{C(ZS)}$ mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 to 30 (P.E.P.)</td>
<td>typ. 19,5</td>
<td>typ. 35</td>
<td>typ. $-33$</td>
<td>typ. $-36$</td>
<td>25</td>
</tr>
</tbody>
</table>

List of components:

- TR1 = TR2 = BD137
- C1 = 100 pF air dielectric trimmer (single insulated rotor type)
- C2 = 27 pF ceramic capacitor (500 V)
- C3 = 180 pF polystyrene capacitor
- C4 = 100 pF air dielectric trimmer (single non-insulated rotor type)
- C5 = C7 = 3,9 nF polyester capacitor
- C6 = 2 x 270 pF polystyrene capacitors in parallel
- C8 = C15 = C16 = 100 nF polyester capacitor
- C9 = 2,2 µF moulded metallized polyester capacitor
- C10 = 2 x 385 pF (sections in parallel) film dielectric trimmer
- C11 = 68 pF ceramic capacitor (500 V)

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.
APPLICATION INFORMATION (continued)

List of components (continued)

C12 = 2 x 82 pF ceramic capacitors in parallel (500 V)
C13 = 47 pF ceramic capacitor (500 V)
C14 = 385 pF film dielectric trimmer

L1 = 88 nH; 3 turns Cu wire (1,0 mm); int. dia. 9 mm; length 6,1 mm; leads 2 x 5 mm
L2 = L5 = Ferroxcube choke coil (cat. no. 4312 020 36640)
L3 = 68 nH; 3 turns enamelled Cu wire (1,6 mm); int. dia. 8 mm; length 8,3 mm; leads 2 x 5 mm
L4 = 96 nH; 3 turns enamelled Cu wire (1,6 mm); int. dia. 10 mm; length 7,6 mm; leads 2 x 5 mm

R1 = 27 Ω (±5%) carbon resistor (0,5 W)
R2 = 4,7 Ω (±5%) carbon resistor (0,25 W)
R3 = 1,5 kΩ (±5%) carbon resistor (0,5 W)
R4 = 10 Ω wirewound potentiometer (3 W)
R5 = 47 Ω wirewound resistor (5,5 W)
R6 = 150 Ω (±5%) carbon resistor (0,25 W)

* See next page.

Conditions for Figs 16 and 17:

V CE = 12,5 V; f1 = 28,000 MHz; f2 = 28,001 MHz; T h = 25 °C; R th mb-h ≤ 0,3 °C/W; I C(ZS) = 25 mA; typical values.
H.F./V.H.F. power transistor

Fig. 18.
Intermodulation distortion versus output power *

Fig. 19.
Double-tone efficiency versus output power

Conditions for Figs 18 and 19:
\( V_{CE} = 13.5 \) V; \( f_1 = 28,000 \) MHz; \( f_2 = 28,001 \) MHz; \( T_h = 25 \) °C; \( R_{th \ mb-h} < 0.3 \) K/W; \( I_{C(ZS)} = 25 \) mA; typical values.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.
APPLICATION INFORMATION (continued)

Fig. 20 Power gain as a function of frequency.

Fig. 21 Input impedance (series components) as a function of frequency.

Fig. 20 and 21 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:

\[
\begin{align*}
V_{CE} &= 12.5 \text{ V} \\
P_L &= 30 \text{ W (P.E.P.)} \\
T_h &= 25 \text{ °C} \\
R_{th \ mb-h} &\leq 0.3 \text{ K/W} \\
I_C(ZS) &= 25 \text{ mA} \\
Z_L &= 1.8 \text{ Ω}
\end{align*}
\]

\[
\begin{align*}
V_{CE} &= 13.5 \text{ V} \\
P_L &= 35 \text{ W (P.E.P.)} \\
T_h &= 25 \text{ °C} \\
R_{th \ mb-h} &\leq 0.3 \text{ K/W} \\
I_C(ZS) &= 25 \text{ mA} \\
Z_L &= 1.8 \text{ Ω}
\end{align*}
\]
H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, AB and B operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Matched hFE groups are available on request.

It has a 3/8” flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25 \, ^\circ\text{C}$

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_D$ dB</th>
<th>$\eta$</th>
<th>$\bar{z}_L$ $\Omega$</th>
<th>$\bar{Y}_L$ $\text{mS}$</th>
<th>$d_3$ dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w. (class-B)</td>
<td>28</td>
<td>175</td>
<td>45</td>
<td>$&gt;7,5$</td>
<td>$&gt;70$</td>
<td>$0,7 + j1,3$</td>
<td>110 – j62</td>
<td>–</td>
</tr>
<tr>
<td>s.s.b. (class-AB)</td>
<td>28</td>
<td>1,6 – 28</td>
<td>5–47,5(P.E.P.)</td>
<td>typ. 19</td>
<td>typ. 45</td>
<td>–</td>
<td>–</td>
<td>typ. –30</td>
</tr>
<tr>
<td>s.s.b. (class-A)</td>
<td>26</td>
<td>1,6 – 28</td>
<td>17(P.E.P.)</td>
<td>typ. 22</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>typ. –42</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-123.

Dimensions in mm

Torque on screw: min. 0,6 Nm (6 kg cm) max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-emitter voltage ($V_{BE} = 0$)
- peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open-collector)
Collector current (average)
Collector current (peak value); $f > 1$ MHz
R.F. power dissipation ($f > 1$ MHz); $T_{mb} = 25^\circ C$
Storage temperature
Operating junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CESM}$ max.</td>
<td>65 V</td>
</tr>
<tr>
<td>$V_{CEO}$ max.</td>
<td>36 V</td>
</tr>
<tr>
<td>$V_{EBO}$ max.</td>
<td>4 V</td>
</tr>
<tr>
<td>$I_{C(AV)}$ max.</td>
<td>4 A</td>
</tr>
<tr>
<td>$I_{CM}$ max.</td>
<td>12 A</td>
</tr>
<tr>
<td>$P_{rf}$ max.</td>
<td>105 W</td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>-65 to +150 $^\circ C$</td>
</tr>
<tr>
<td>$T_{j}$ max.</td>
<td>200 $^\circ C$</td>
</tr>
</tbody>
</table>

Fig. 2 D.C. SOAR.

Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; $f > 1$ MHz.

- I Continuous d.c. operation
- II Continuous r.f. operation
- III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 45 W; $T_{mb} = 83.5^\circ C$, i.e. $T_h = 70^\circ C$)

<table>
<thead>
<tr>
<th>Resistance Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{th j-mb(dc)}$</td>
<td>2.65 K/W</td>
</tr>
<tr>
<td>$R_{th j-mb(rf)}$</td>
<td>1.95 K/W</td>
</tr>
<tr>
<td>$R_{th mb-h}$</td>
<td>0.3 K/W</td>
</tr>
</tbody>
</table>
CHARACTERISTICS

Tj = 25 °C unless otherwise specified

Collector-emitter breakdown voltage
VBE = 0; IC = 25 mA

Collector-emitter breakdown voltage
open base; IC = 100 mA

Emitter-base breakdown voltage
open collector; IE = 10 mA

Collector cut-off current
VBE = 0; VCE = 36 V

Second breakdown energy; L = 25 mH; f = 50 Hz
open base
RS = 10 Ω

D.C. current gain*
IC = 2.5 A; VCE = 5 V

D.C. current gain ratio of matched devices*
IC = 2.5 A; VCE = 5 V

Collector-emitter saturation voltage*
IC = 7.5 A; IB = 1.5 A

Transition frequency at f = 100 MHz*
-IE = 2.5 A; VCB = 28 V
-IE = 7.5 A; VCB = 28 V

Collector capacitance at f = 1 MHz
IE = Ie = 0; VCB = 28 V

Feedback capacitance at f = 1 MHz
IC = 100 mA; VCE = 28 V

Collector-flange capacitance

---

* Measured under pulse conditions: tp ≤ 200 µs; δ ≤ 0,02.

---

Fig. 4 Typical values; VCE = 28 V.
Fig. 5  Typical values; $T_j = 25 \, ^\circ\text{C}$.

Fig. 6  $I_e = I_e = 0; f = 1 \, \text{MHz}; T_j = 25 \, ^\circ\text{C}$.

Fig. 7  Typical values; $f = 100 \, \text{MHz}; T_j = 25 \, ^\circ\text{C}$.
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

\[ T_h = 25 \, ^\circ \text{C} \]

<table>
<thead>
<tr>
<th>( f ) (MHz)</th>
<th>( V_{CE} ) (V)</th>
<th>( P_L ) (W)</th>
<th>( P_S ) (W)</th>
<th>( G_p ) (dB)</th>
<th>( I_c ) (A)</th>
<th>( \eta ) (%)</th>
<th>( \bar{z}_i ) (( \Omega ))</th>
<th>( \bar{Y}_L ) (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>28</td>
<td>45</td>
<td>&lt; 8</td>
<td>&gt; 7,5</td>
<td>&lt; 2,47</td>
<td>&gt; 70</td>
<td>0,7 + j1,3</td>
<td>110 – j62</td>
</tr>
</tbody>
</table>

List of components:

- \( C_1 = C_7 = 2,5 \) to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
- \( C_2 = 5 \) to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
- \( C_{3a} = C_{3b} = 47 \) pF ceramic capacitor (500 V)
- \( C_4 = 120 \) pF ceramic capacitor
- \( C_5 = 100 \) nF polyester capacitor
- \( C_{6a} = 2,2 \) pF ceramic capacitor (500 V)
- \( C_{6b} = 1,8 \) pF ceramic capacitor (500 V)
- \( C_8 = 4 \) to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)

- \( L_1 = 14 \) nH; 1 turn Cu wire (1,6 mm); int. dia. 7,7 mm; leads 2 x 5 mm
- \( L_2 = 100 \) nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
- \( L_3 = L_8 = \) Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- \( L_4 = L_5 = \) strip (12 mm x 6 mm); taps for \( C_{3a} \) and \( C_{3b} \) at 5 mm from transistor
- \( L_6 = 80 \) nH; 3 turns Cu wire (1,6 mm); int. dia. 9,0 mm; length 8,0 mm; leads 2 x 5 mm
- \( L_7 = 62 \) nH; 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 8,1 mm; leads 2 x 5 mm

\( L_4 \) and \( L_5 \) are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

- \( R_1 = R_2 = 10 \) \( \Omega \) carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 9.
Fig. 9 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

To minimize the dielectric losses, the ground plane under the interconnection of L7 and C7 has been removed.
H.F./V.H.F. power transistor

Fig. 10  Typical values; $V_{CE} = 28 \, V$; $f = 175 \, MHz$.  
Fig. 11  Typical values; $V_{CE} = 28 \, V$; $f = 175 \, MHz$;  
--- $T_h = 25 \, ^{\circ}C$;  --- $T_h = 70 \, ^{\circ}C$.  

Fig. 12  R.F. SOAR; c.w. class-B operation;  
$f = 175 \, MHz$; $V_{CE} = 28 \, V$; $R_{th\, mb-h} = 0.3 \, K/W$  
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.
Fig. 13 Input impedance (series components).

Fig. 14 Load impedance (parallel components).

OPERATING NOTE

Below 75 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

Conditions for Figs 13; 14 and 15.
Typical values; $V_{CE} = 28$ V; $P_L = 45$ W; $T_h = 25 ^\circ$C.

Fig. 15 Power gain versus frequency.
R.F. performance in s.s.b. class-AB operation (linear power amplifier)

\[ V_{CE} = 28 \text{ V}; f_1 = 28,000 \text{ MHz}; f_2 = 28,001 \text{ MHz} \]

| output power || \[ P \text{ dB} \] | \[ \eta_{dt} \text{ (%)} \] at \[ 47.5 \text{ W (P.E.P.)} \] | \[ I_C \text{ (A)} \] | \[ d_3 \text{ dB*} \] | \[ d_5 \text{ dB*} \] | \[ I_C(ZS) \text{ mA} \] | \[ T_h \text{ °C} \] |
|----------------|----------|-----------------|----------|----------|----------|----------------|----------|
| 5 to 47.5 (P.E.P.) | typ. 19 | typ. 45 | typ. 1.9 | typ. -30 | < -30 | 50 | 25 |
| 5 to 42.5 (P.E.P.) | typ. 19 | - | - | typ. -30 | < -30 | 50 | 70 |

List of components:

- \( C_1 = C_2 = 10 \text{ to } 780 \text{ pF film dielectric trimmer} \)
- \( C_3 = C_5 = C_6 = 220 \text{ nF polyester capacitor} \)
- \( C_4 = 56 \text{ pF ceramic capacitor (500 V)} \)
- \( C_7 = C_8 = 15 \text{ to } 575 \text{ pF film dielectric trimmer} \)

\( L_1 = 4 \text{ turns closely wound enamelled Cu wire (1.6 mm); int. dia. 7.0 mm; leads 2 x 5 mm} \)

\( L_2 = \text{Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)} \)

\( L_3 = 4 \text{ turns enamelled Cu wire (1.6 mm); int. dia. 10 mm; length 9.4 mm; leads 2 x 5 mm} \)

\( L_4 = 7 \text{ turns enamelled Cu wire (1.6 mm); int. dia. 12 mm; length 17.2 mm; leads 2 x 5 mm} \)

- \( R_1 = 1.2 \Omega; \text{ parallel connection of 4 x 4.7 \Omega carbon resistors} \)
- \( R_2 = 39 \Omega \text{ carbon resistor} \)

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.
Fig. 17 Intermodulation distortion as a function of output power. *

Conditions for Fig. 17:
$V_{CE} = 28 \text{ V}; I_{C(ZS)} = 50 \text{ mA}; f_1 = 28,000 \text{ MHz}; f_2 = 28,001 \text{ MHz};$ typical values.

Conditions for Fig. 18:
$V_{CE} = 28 \text{ V}; I_{C(ZS)} = 50 \text{ mA}; f_1 = 28,000 \text{ MHz}; f_2 = 28,001 \text{ MHz}; T_h = 25 \text{ °C};$ typical values.

* See note on previous page.
Fig. 19 Power gain as a function of frequency.

Fig. 20 Input impedance (series components) as a function of frequency.

Figs 19 and 20 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:
\[ V_{CE} = 28 \text{ V}; \ i_c(ZS) = 50 \text{ mA}; \ P_L = 47.5 \text{ W}; \ T_h = 25 \text{ °C}; \ Z_L = 6.4 \Omega. \]

Ruggedness in s.s.b. operation

The BLW86 is capable of withstanding a load mismatch (VSWR = 50) under the following conditions: class-AB operation; \( f_1 = 28,000 \text{ MHz}; \ f_2 = 28,001 \text{ MHz}; \ V_{CE} = 28 \text{ V}; \ T_h = 70 \text{ °C} \) and \( P_{L_{nom}} = 50 \text{ W} \) P.E.P.
R.F. performance in s.s.b. class-A operation (linear power amplifier)

\[ V_{CE} = 26 \text{ V}; f_1 = 28,000 \text{ MHz}; f_2 = 28,001 \text{ MHz} \]

<table>
<thead>
<tr>
<th>output power ( W )</th>
<th>( G_0 ) dB</th>
<th>( I_C ) A</th>
<th>( d_3 ) dB*</th>
<th>( d_B ) dB*</th>
<th>( T_h ) °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>17 (P.E.P.)</td>
<td>typ. 22</td>
<td>1.7</td>
<td>typ. -40</td>
<td>&lt; -40</td>
<td>70</td>
</tr>
<tr>
<td>17 (P.E.P.)</td>
<td>typ. 22</td>
<td>1.7</td>
<td>typ. -42</td>
<td>&lt; -40</td>
<td>25</td>
</tr>
</tbody>
</table>

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

Fig. 21 Test circuit; s.s.b. class-A.
List of components in Fig. 21:

- C1 = C2 = 10 to 780 pF film dielectric trimmer
- C3 = 22 nF ceramic capacitor (63 V)
- C4 = 47 µF/10 V electrolytic capacitor
- C5 = 56 pF ceramic capacitor (500 V)
- C6 = 47 µF/35 V electrolytic capacitor
- C7 = C8 = 220 nF polyester capacitor
- C9 = 10 µF/35 V electrolytic capacitor
- C10 = 10 to 210 pF film dielectric trimmer
- C11 = 15 to 575 pF film dielectric trimmer

- L1 = 3 turns closely wound enameled Cu wire (1.6 mm); int. dia. 9.0 mm; leads 2 x 5 mm
- L2 = L3 = Ferroxcube wide-band h.f. choke, grade 38 (cat. no. 4312 020 36640)
- L4 = 11 turns closely wound enameled Cu wire (1.6 mm); int. dia. 11.0 mm
- L5 = 14 turns closely wound enameled Cu wire (1.6 mm); int. dia. 11.0 mm

- R1 = 600 Ω; parallel connection of 2 x 1,2 kΩ carbon resistors (±5%; 0.5 W each)
- R2 = 15 Ω carbon resistor (±5%; 0.25 W)
- R3 = 1,2 Ω; parallel connection of 4 x 4,7 Ω carbon resistors (±5%; 0.125 W each)
- R4 = 33 Ω carbon resistor (±5%; 0.25 W)
- R5 = 18 Ω carbon resistor (±5%; 0.25 W)
- R6 = 120 Ω wirewound resistor (±5%; 5.5 W)
- R7 = 1 Ω carbon resistor (±5%; 0.125 W)
- R8 = 47 Ω wirewound potentiometer (3 W)
- R9 = 1.57 Ω; parallel connection of 3 x 4.7 Ω wirewound resistors (±5%; 5.5 W each)

---

Fig. 22 Intermodulation distortion as a function of output power. Typical values; \( V_{CE} = 26 \text{ V} \); \( T_H = 70 \text{ °C} \); \( f_1 = 28,000 \text{ MHz} \); \( f_2 = 28,001 \text{ MHz} \).
V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile h.f. and v.h.f. transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25 \, ^\circ C$ in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_D$ dB</th>
<th>$\eta$ %</th>
<th>$\bar{Z}_i$ $\Omega$</th>
<th>$\bar{Y}_L$ mS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>13,5</td>
<td>175</td>
<td>25</td>
<td>&gt; 6</td>
<td>&gt; 70</td>
<td>1,6 + j1,4</td>
<td>210 + j5,5</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (VBE = 0)
  peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current (average)
Collector current (peak value); f > 1 MHz
R.F. power dissipation (f > 1 MHz); Tmb = 25 °C

Storage temperature
Operating junction temperature

---

**Fig. 2 D.C. SOAR.**

---

**Fig. 3** R.F. power dissipation; VCE < 16.5 V; f > 1 MHz.

---

**THERMAL RESISTANCE** (dissipation = 20 W; Tmb = 76 °C; i.e. Th = 70 °C)

From junction to mounting base (d.c. dissipation)
From junction to mounting base (r.f. dissipation)
From mounting base to heatsink

\[
\begin{align*}
R_{th\ j-mb (dc)} &= 3.0 \text{ K/W} \\
R_{th\ j-mb (rf)} &= 2.25 \text{ K/W} \\
R_{th\ mb-h} &= 0.3 \text{ K/W}
\end{align*}
\]
### CHARACTERISTICS

$T_j = 25 \, ^\circ\!C$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-emitter breakdown voltage</td>
<td>$V_{BE} = 0; I_C = 25 , mA$</td>
<td>$V_{(BR)CES} &gt; 36 , V$</td>
</tr>
<tr>
<td>Collector-emitter breakdown voltage</td>
<td>open base; $I_C = 50 , mA$</td>
<td>$V_{(BR)CEO} &gt; 18 , V$</td>
</tr>
<tr>
<td>Emitter-base breakdown voltage</td>
<td>open collector; $I_E = 10 , mA$</td>
<td>$V_{(BR)EBO} &gt; 4 , V$</td>
</tr>
<tr>
<td>Collector cut-off current</td>
<td>$V_{BE} = 0; V_{CE} = 18 , V$</td>
<td>$I_{CES} &lt; 10 , mA$</td>
</tr>
<tr>
<td>Second breakdown energy; $L = 25 , mH; f = 50 , Hz$</td>
<td>open base</td>
<td>$E_{SBBO} &gt; 8 , mJ$</td>
</tr>
<tr>
<td></td>
<td>$R_{BE} = 10 , \Omega$</td>
<td>$E_{SBR} &gt; 8 , mJ$</td>
</tr>
<tr>
<td>D.C. current gain*</td>
<td>$I_C = 2,5 , A; V_{CE} = 5 , V$</td>
<td>$h_{FE}$ typ. 50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 to 80</td>
</tr>
<tr>
<td>Collector-emitter saturation voltage*</td>
<td>$I_C = 7,5 , A; I_B = 1,5 , A$</td>
<td>$V_{CEsat}$ typ. 1,7 V</td>
</tr>
<tr>
<td>Transition frequency at $f = 100 , MHz$*</td>
<td>$-I_E = 2,5 , A; V_{CB} = 13,5 , V$</td>
<td>$f_T$ typ. 800 MHz</td>
</tr>
<tr>
<td></td>
<td>$-I_E = 7,5 , A; V_{CB} = 13,5 , V$</td>
<td>$f_T$ typ. 750 MHz</td>
</tr>
<tr>
<td>Collector capacitance at $f = 1 , MHz$</td>
<td>$I_E = I_B = 0; V_{CB} = 15 , V$</td>
<td>$C_C$ typ. 65 pF</td>
</tr>
<tr>
<td>Feedback capacitance at $f = 1 , MHz$</td>
<td>$I_C = 100 , mA; V_{CE} = 15 , V$</td>
<td>$C_{re}$ typ. 41 pF</td>
</tr>
<tr>
<td>Collector-flange capacitance</td>
<td></td>
<td>$C_{cf}$ typ. 2 pF</td>
</tr>
</tbody>
</table>

* Measured under pulse conditions: $t_p \leq 200 \, \mu s; \delta \leq 0.02$.  

---

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Fig. 4.

Typ values

$T_j = 25 \, ^\circ\mathrm{C}$

$V_{CE} = 13.5 \, \text{V}$

$V_{CE} = 5 \, \text{V}$

Fig. 5 $T_j = 25 \, ^\circ\mathrm{C}$.

$V_{CE} = 13.5 \, \text{V}$

$f = 100 \, \text{MHz}$

$T_j = 25 \, ^\circ\mathrm{C}$

Fig. 6.

$V_{CB} = 13.5 \, \text{V}$

$f = 100 \, \text{MHz}$

$T_j = 25 \, ^\circ\mathrm{C}$

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APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

\[ T_h = 25 \degree C \]

<table>
<thead>
<tr>
<th>( f ) (MHz)</th>
<th>( V_{CE} ) (V)</th>
<th>( P_L ) (W)</th>
<th>( P_S ) (W)</th>
<th>( G_p ) (dB)</th>
<th>( I_C ) (A)</th>
<th>( \eta ) (%)</th>
<th>( z_1 ) (Ω)</th>
<th>( Y_L ) (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>13,5</td>
<td>25</td>
<td>(&lt; 6,25)</td>
<td>&gt; 6</td>
<td>(&lt; 2,64)</td>
<td>&gt; 70</td>
<td>1,6 + j1,4</td>
<td>210 + j5,5</td>
</tr>
<tr>
<td>175</td>
<td>12,5</td>
<td>25</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Figure 7 Test circuit; c.w. class-B.

List of components:

- \( C_1 = 2,5 \) to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
- \( C_2 = C_8 = 4 \) to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
- \( C_{3a} = C_{3b} = 47 \) pF ceramic capacitor (500 V)
- \( C_4 = 120 \) pF ceramic capacitor (500 V)
- \( C_5 = 100 \) nF polyester capacitor
- \( C_{6a} = C_{6b} = 8,2 \) pF ceramic capacitor (500 V)
- \( C_7 = 5 \) to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

- \( L_1 = 1 \) turn Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
- \( L_2 = 100 \) nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
- \( L_3 = L_8 = \) Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- \( L_4 = L_5 = \) strip (12 mm x 6 mm); taps for \( C_{3a} \) and \( C_{3b} \) at 5 mm from transistor
- \( L_6 = 2 \) turns Cu wire (1,6 mm); int. dia. 5,0 mm; length 6,0 mm; leads 2 x 5 mm
- \( L_7 = 2 \) turns Cu wire (1,6 mm); int. dia. 4,5 mm; length 6,0 mm; leads 2 x 5 mm

- \( L_4 \) and \( L_5 \) are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

- \( R_1 = 10 \) Ω (± 10%) carbon resistor (0,25 W)
- \( R_2 = 4,7 \) Ω (± 5%) carbon resistor (0,25 W)

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.
Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive \( \frac{P_S}{P_{S\text{nom}}} \) increases linearly with supply over-voltage ratio.
OPERATING NOTE  Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

Fig. 12.  Input impedance (series components) versus frequency (class-B operation)

Fig. 13.  Load impedance (parallel components) versus frequency (class-B operation)

Fig. 14.  Power gain versus frequency (class-B operation)

Conditions for Figs 12, 13 and 14:
Typical values; \( V_{CE} = 13.5 \) V; \( P_L = 25 \) W; \( T_h = 25 \) °C.
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor suitable for transmitting applications in class-A, B or C in the u.h.f. and v.h.f. range for a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand infinite VSWR at rated output power. High reliability is ensured by a gold sandwich metallization.

The transistor is housed in a ¼" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25 \, ^\circ\text{C}$ in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ (V)</th>
<th>$f$ (MHz)</th>
<th>$P_L$ (W)</th>
<th>$G_p$ (dB)</th>
<th>$\eta$ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>28</td>
<td>470</td>
<td>2</td>
<td>&gt; 12</td>
<td>&gt; 50</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-122.

Dimensions in mm

Torque on nut: min. 0,75 Nm (7,5 kg cm)  
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.  
Mounting hole to have no burrs at either end.  
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-emitter voltage (peak value); $V_{BE} = 0$</td>
<td></td>
</tr>
<tr>
<td>open base</td>
<td></td>
</tr>
<tr>
<td>Emitter-base voltage (open collector)</td>
<td></td>
</tr>
<tr>
<td>Collector current</td>
<td></td>
</tr>
<tr>
<td>d.c. or average</td>
<td></td>
</tr>
<tr>
<td>(peak value); $f &gt; 1$ MHz</td>
<td></td>
</tr>
<tr>
<td>Total power dissipation (d.c. and r.f.) up to $T_{mb} = 50$ °C</td>
<td></td>
</tr>
<tr>
<td>Storage temperature</td>
<td></td>
</tr>
<tr>
<td>Operating junction temperature</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CESM}$ max.</td>
<td>60 V</td>
</tr>
<tr>
<td>$V_{CEO}$ max.</td>
<td>30 V</td>
</tr>
<tr>
<td>$V_{EBO}$ max.</td>
<td>4 V</td>
</tr>
<tr>
<td>$I_C; I_C(AV)$ max.</td>
<td>0,32 A</td>
</tr>
<tr>
<td>$I_{CM}$ max.</td>
<td>1,0 A</td>
</tr>
<tr>
<td>$P_{tot}$ max.</td>
<td>9,6 W</td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>-65 to + 150 °C</td>
</tr>
<tr>
<td>$T_j$ max.</td>
<td>200 °C</td>
</tr>
</tbody>
</table>

![Graph of D.C. SOAR](image1)

**Fig. 2** D.C. SOAR.

![Graph of Power derating curve vs. temperature](image2)

**Fig. 3** Power derating curve vs. temperature.

THERMAL RESISTANCE (dissipation = 3,5 W; $T_{mb} = 72$ °C, i.e. $T_h = 70$ °C)

From junction to mounting base
(d.c. and r.f. dissipation)

$$R_{th j-mb} = 13,0 \text{ K/W}$$

From mounting base to heatsink

$$R_{th mb-h} = 0,6 \text{ K/W}$$
**U.H.F. power transistor**

**BLW89**

**CHARACTERISTICS**

$T_j = 25 \, ^\circ C$

Collector-emitter breakdown voltage

- $V_{BE} = 0; \, I_C = 2 \, mA$
- $V_{BR} = 60 \, V$

Collector-emitter breakdown voltage

- open base; $I_C = 10 \, mA$
- $V_{BR} = 30 \, V$

Emitter-base breakdown voltage

- open collector; $I_E = 1 \, mA$
- $V_{BR} = 4 \, V$

Collector cut-off current

- $V_{BE} = 0; \, V_{CE} = 30 \, V$
- $I_{CES} < 1 \, mA$

Second breakdown energy; $L = 25 \, mH; \, f = 50 \, Hz$

- open base
- $R_{BE} = 10 \, \Omega$
- $E_{BO} > 0.5 \, mJ$
- $R_{ES} > 0.5 \, mJ$

D.C. current gain *

- $I_C = 0.15 \, A; \, V_{CE} = 5 \, V$
- $h_{FE} \, \text{typ.} \, 40$
- $10 \, \text{to} \, 100$

Collector-emitter saturation voltage *

- $I_C = 0.5 \, A; \, I_B = 0.1 \, A$
- $V_{CE_{\text{sat}}} \, \text{typ.} \, 0.9 \, V$

Transition frequency at $f = 500 \, MHz$

- $I_E = 0.15 \, A; \, V_{CB} = 28 \, V$
- $f_T \, \text{typ.} \, 1.20 \, GHz$
- $I_E = 0.50 \, A; \, V_{CB} = 28 \, V$
- $f_T \, \text{typ.} \, 0.85 \, GHz$

Collector capacitance at $f = 1 \, MHz$

- $I_E = I_E = 0; \, V_{CB} = 28 \, V$
- $C_C \, \text{typ.} \, 5.5 \, pF$

Feedback capacitance at $f = 1 \, MHz$

- $I_C = 10 \, mA; \, V_{CE} = 28 \, V$
- $C_{re} \, \text{typ.} \, 2 \, pF$
- $C_{cs} \, \text{typ.} \, 1.2 \, pF$

* Measured under pulse conditions: $t_p \leq 200 \, \mu s; \, \delta \leq 0.02$. 

**August 1986**
Fig. 4 Typical values; $T_j = 25 \, ^\circ\text{C}$.

Fig. 5 $I_E = I_e = 0$; $f = 1 \, \text{MHz}$; $T_j = 25 \, ^\circ\text{C}$.

Fig. 6 $V_{CB} = 28 \, \text{V}$; $f = 500 \, \text{MHz}$; $T_j = 25 \, ^\circ\text{C}$. 

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

<table>
<thead>
<tr>
<th>f (MHz)</th>
<th>VCE (V)</th>
<th>P_L (W)</th>
<th>P_S (W)</th>
<th>G_P (dB)</th>
<th>I_C (A)</th>
<th>η (%)</th>
<th>\bar{z}_1 (Ω)</th>
<th>\bar{Z}_L (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>470</td>
<td>28</td>
<td>2</td>
<td>&lt; 0.13</td>
<td>&gt; 12</td>
<td>&lt; 0.145</td>
<td>&gt; 50</td>
<td>3.0 − j0.4</td>
<td>12 + j45</td>
</tr>
<tr>
<td>470</td>
<td>28</td>
<td>2</td>
<td>typ. 0.09</td>
<td>typ. 13.5</td>
<td>typ. 0.135</td>
<td>typ. 53</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 7 Test circuit; c.w. class-B.

List of components:

- C1 = C5 = C6 = 1.4 to 5.5 pF film dielectric trimmer (cat. no. 2222 809 09001)
- C2 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
- C3 = 100 pF ceramic feed-through capacitor
- C4 = 100 nF polyester capacitor
- L1 = stripline (34.8 mm x 6.0 mm)
- L2 = L5 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- L3 = stripline (12.0 mm x 6.0 mm)
- L4 = 220 nH; 10 turns enamelled Cu wire (0.35 mm) closely wound around R2
- L6 = 29 nH; 3 turns closely wound enamelled Cu wire (1.0 mm); int. dia. 3.5 mm; leads 2 x 4 mm
- L1 and L3 are strip lines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ε_r = 2.74); thickness 1/16".
- R1 = 100 Ω carbon resistor
- R2 = 10 kΩ carbon resistor (style CR37)
- R3 = 10 Ω carbon resistor

Component layout and printed-circuit board for 470 MHz test circuit are shown in Fig. 8.
Fig. 8 Component layout and printed-circuit board for 470 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.
Fig. 9  $V_{CE} = 28$ V; $f = 470$ MHz; $T_h = 25$ °C.

Fig. 10 Typical values; $V_{CE} = 28$ V; $f = 470$ MHz; $T_h = 25$ °C.
Fig. 11 Input impedance (series components).

Fig. 12 Load impedance (series components).

Conditions for Figs 11, 12 and 13:
Typical values; $V_{CE} = 28$ V; $P_L = 2$ W; $T_h = 25$ °C.

Ruggedness
The BLW89 is capable of withstanding full load mismatch ($VSWR = 50$ through all phases) up to 2 W under the following conditions:
$V_{CE} = 28$ V; $f = 470$ MHz; $T_h = 70$ °C;
$R_{th mb-h} = 0.6$ K/W.
**U.H.F. POWER TRANSISTOR**

N-P-N silicon planar epitaxial transistor suitable for transmitting applications in class-A, B or C in the u.h.f. and v.h.f. range for a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand infinite VSWR at rated output power. High reliability is ensured by a gold sandwich metallization.

The transistor is housed in a ¼” capstan envelope with a ceramic cap. All leads are isolated from the stud.

**QUICK REFERENCE DATA**

R.F. performance up to \( T_h = 25 \) °C in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>( V_{CE} ) V</th>
<th>( f ) MHz</th>
<th>( P_L ) W</th>
<th>( G_p ) dB</th>
<th>( \eta ) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>28</td>
<td>470</td>
<td>4</td>
<td>&gt; 11</td>
<td>&gt; 55</td>
</tr>
</tbody>
</table>

**MECHANICAL DATA**

Fig. 1 SOT-122.

Dimensions in mm

Torque on nut: min. 0,75 Nm
\( (7,5 \text{ kg cm}) \)
max. 0,85 Nm
\( (8,5 \text{ kg cm}) \)

When locking is required an adhesive is preferred instead of a lock washer.

**PRODUCT SAFETY** This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage
(peak value); \( V_{BE} = 0 \)
open base

Emitter-base voltage (open collector)

Collector current
(d.c. or average)
(peak value); \( f > 1 \text{ MHz} \)

Total power dissipation (d.c. and r.f.) up to \( T_{mb} = 25^\circ\text{C} \)

Storage temperature
Operating junction temperature

\[
\begin{align*}
V_{CESM} & \quad \text{max.} \quad 60 \text{ V} \\
V_{CEO} & \quad \text{max.} \quad 30 \text{ V} \\
V_{EBO} & \quad \text{max.} \quad 4 \text{ V} \\
I_C; I_C(AV) & \quad \text{max.} \quad 0.62 \text{ A} \\
I_{CM} & \quad \text{max.} \quad 2.0 \text{ A} \\
P_{\text{tot}} & \quad \text{max.} \quad 18.6 \text{ W} \\
T_{\text{stg}} & \quad -65 \text{ to } +150^\circ\text{C} \\
T_j & \quad \text{max.} \quad 200^\circ\text{C} \\
\end{align*}
\]

THERMAL RESISTANCE (dissipation = 6 W; \( T_{mb} = 73.6^\circ\text{C} \), i.e. \( T_h = 70^\circ\text{C} \))

From junction to mounting base
(d.c. and r.f. dissipation)

From mounting base to heatsink

\[
\begin{align*}
R_{\text{th j-mb}} & = 9.0 \text{ K/W} \\
R_{\text{th mb-h}} & = 0.6 \text{ K/W} \\
\end{align*}
\]
U.H. F. power transistor

BLW90

CHARACTERISTICS

$T_j = 25 \, ^\circ\!C$

Collector-emitter breakdown voltage
$V_{BE} = 0; \, I_C = 4 \, mA$

Collector-emitter breakdown voltage
open base; $I_C = 20 \, mA$

Emitter-base breakdown voltage
open collector; $I_E = 2 \, mA$

Collector cut-off current
$V_{BE} = 0; \, V_{CE} = 30 \, V$

Second breakdown energy; $L = 25 \, mH; \, f = 50 \, Hz$
open base
$R_{BE} = 10 \, \Omega$

D.C. current gain *
$I_C = 0,3 \, A; \, V_{CE} = 5 \, V$

Collector-emitter saturation voltage *
$I_C = 1,0 \, A; \, I_B = 0,2 \, A$

Transition frequency at $f = 500 \, MHz$

$-I_E = 0,3 \, A; \, V_{CB} = 28 \, V$
$-I_E = 1,0 \, A; \, V_{CB} = 28 \, V$

Collector capacitance at $f = 1 \, MHz$
$I_E = I_e = 0; \, V_{CE} = 28 \, V$

Feedback capacitance at $f = 1 \, MHz$
$I_C = 20 \, mA; \, V_{CE} = 28 \, V$

Collector-stud capacitance

$V_{(BR)CES} > 60 \, V$
$V_{(BR)CEO} > 30 \, V$
$V_{(BR)EBO} > 4 \, V$
$I_{CES} < 2 \, mA$
$E_{SBO} > 1 \, mJ$
$E_{SBR} > 1 \, mJ$
$hFE \quad {\text{typ.}} \quad 40$
$10 \, \text{to} \, 100$
$V_{CEsat} \quad {\text{typ.}} \quad 0,9 \, V$
$f_T \quad {\text{typ.}} \quad 1,2 \, GHz$
$f_T \quad {\text{typ.}} \quad 0,9 \, GHz$
$C_C \quad {\text{typ.}} \quad 8,4 \, pF$
$C_{re} \quad {\text{typ.}} \quad 3,6 \, pF$
$C_{cs} \quad {\text{typ.}} \quad 1,2 \, pF$

* Measured under pulse conditions: $t_p \leq 200 \, \mu s; \, \delta \leq 0,02.$
Fig. 4 Typical values; $T_j = 25 \, ^\circ\mathrm{C}$.

Fig. 5 $I_E = I_C = 0$; $f = 1 \, \text{MHz}$; $T_j = 25 \, ^\circ\mathrm{C}$.

Fig. 6 $V_{CB} = 28 \, \text{V}$; $f = 500 \, \text{MHz}$; $T_j = 25 \, ^\circ\mathrm{C}$.
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

$T_h = 25 \, ^\circ C$

<table>
<thead>
<tr>
<th>$f$ (MHz)</th>
<th>$V_{CE}$ (V)</th>
<th>$P_L$ (W)</th>
<th>$P_S$ (W)</th>
<th>$G_p$ (dB)</th>
<th>$I_C$ (A)</th>
<th>$\eta$ (%)</th>
<th>$z_I$ (Ω)</th>
<th>$z_L$ (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>470</td>
<td>28</td>
<td>4</td>
<td>&lt; 0.32</td>
<td>&gt; 11</td>
<td>&lt; 0.26</td>
<td>&gt; 55</td>
<td>1.7 + j1.8</td>
<td>8 + j26</td>
</tr>
<tr>
<td>470</td>
<td>28</td>
<td>4</td>
<td>typ. 0.23</td>
<td>typ. 12.5</td>
<td>typ. 0.25</td>
<td>typ. 58</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 7 Test circuit; c.w. class-B.

List of components:

- $C1 = C5 = C6 = 1.4$ to $5.5 \, \mu F$ film dielectric trimmer (cat. no. 2222 809 09001)
- $C2 = 2$ to $9 \, \mu F$ film dielectric trimmer (cat. no. 2222 809 09002)
- $C3 = 100 \, \mu F$ feed-through capacitor
- $C4 = 100 \, nF$ polyester capacitor
- $L1$ = stripline ($34.8 \, \text{mm} \times 6.0 \, \text{mm}$)
- $L2 = 320 \, nH$; 13 turns closely wound enameled Cu wire (0.5 mm); int. dia. 4 mm; leads 2 x 4 mm
- $L3 = L7$ = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- $L4$ = stripline ($12.0 \, \text{mm} \times 6.0 \, \text{mm}$)
- $L5 = 265 \, nH$; 13 turns closely wound enameled Cu wire (0.35 mm); int. dia. 3.5 mm; leads 2 x 4 mm
- $L6 = 29 \, nH$; 3 turns closely wound enameled Cu wire (1 mm); int. dia. 3.5 mm; leads 2 x 4 mm
- $L1$ and $L4$ are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric ($e_r = 2.74$); thickness $1/16"$.
- $R1 = 100 \, \Omega$ carbon resistor
- $R2 = 10 \, \Omega$ carbon resistor

Component layout and printed-circuit board for 470 MHz test circuit are shown in Fig. 8.
Fig. 8 Component layout and printed-circuit board for 470 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.
Fig. 9 $V_{CE} = 28\,V; f = 470\,MHz; T_h = 25\,^\circ C$.  

Fig. 10 Typical values; $V_{CE} = 28\,V; f = 470\,MHz; T_h = 25\,^\circ C$. 
Fig. 11 Input impedance (series components).

Fig. 12 Load impedance (series components).

Conditions for Figs 11, 12 and 13:
Typical values: $V_{CE} = 28$ V; $P_L = 4$ W; $T_h = 25$ °C.

Ruggedness
The BLW90 is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 4 W under the following conditions:
$V_{CE} = 28$ V; $f = 470$ MHz; $T_h = 70$ °C;
$R_{th mb-h} = 0.6$ K/W.
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor suitable for transmitting applications in class-A, B or C in the u.h.f. and v.h.f. range for a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand infinite VSWR at rated output power. High reliability is ensured by a gold sandwich metallization.

The transistor is housed in a ¾” capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance up to \( T_h = 25 \, ^\circ\text{C} \) in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>( V_{CE} )</th>
<th>( f )</th>
<th>( P_L )</th>
<th>( G_p )</th>
<th>( \eta )</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>28</td>
<td>470</td>
<td>10</td>
<td>&gt;9</td>
<td>&gt;60</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-122.

Dimensions in mm

<table>
<thead>
<tr>
<th>Torque on nut:</th>
<th>min. 0,75 Nm (7,5 kg cm)</th>
<th>max. 0,85 Nm (8,5 kg cm)</th>
</tr>
</thead>
</table>

Diameter of clearance hole in heatsink: max. 4,2 mm. Mounting hole to have no burrs at either end. De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage
(peak value); \( V_{BE} = 0 \)
open base

Emitter-base voltage (open collector)

Collector current
d.c. or average
(peak value); \( f > 1 \text{ MHz} \)

Total power dissipation up to \( T_{mb} = 35 \text{ °C} \)

R.F. power dissipation (\( f > 1 \text{ MHz} \)); \( T_{mb} = 25 \text{ °C} \)

Storage temperature

Operating junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Max. Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_{CESM} )</td>
<td>60 V</td>
</tr>
<tr>
<td>( V_{CEO} )</td>
<td>30 V</td>
</tr>
<tr>
<td>( V_{EBO} )</td>
<td>4 V</td>
</tr>
<tr>
<td>( I_{C} )</td>
<td>1.5 A</td>
</tr>
<tr>
<td>( I_{CM} )</td>
<td>3.5 A</td>
</tr>
<tr>
<td>( P_{tot} )</td>
<td>30 W</td>
</tr>
<tr>
<td>( P_{rf} )</td>
<td>32.5 W</td>
</tr>
<tr>
<td>( T_{stg} )</td>
<td>-65 to +150 °C</td>
</tr>
<tr>
<td>( T_{j} )</td>
<td>200 °C</td>
</tr>
</tbody>
</table>

Fig. 2 D.C. SOAR.

THERMAL RESISTANCE (dissipation = 10 W; \( T_{mb} = 76 \text{ °C} \), i.e. \( T_{h} = 70 \text{ °C} \))

From junction to mounting base (d.c. and r.f. dissipation)

\[
R_{th\ j-mb} = 6.2 \text{ K/W}
\]

From mounting base to heatsink

\[
R_{th\ mb-h} = 0.6 \text{ K/W}
\]
U.H.F. power transistor

CHARACTERISTICS

$T_j = 25 \, ^\circ\text{C}$

Collector-emitter breakdown voltage
$V_{BE} = 0; \, I_C = 10 \, \text{mA}$

Collector-emitter breakdown voltage
open base; $I_C = 50 \, \text{mA}$

Emitter-base breakdown voltage
open collector; $I_E = 4 \, \text{mA}$

Collector cut-off current
$V_{BE} = 0; \, V_{CE} = 30 \, \text{V}$

Second breakdown energy; $L = 25 \, \text{mH}; \, f = 50 \, \text{Hz}$
open base
$R_{BE} = 10 \, \Omega$

D.C. current gain *
$I_C = 0,6 \, \text{A}; \, V_{CE} = 5 \, \text{V}$

Collector-emitter saturation voltage *
$I_C = 2,0 \, \text{A}; \, I_B = 0,4 \, \text{A}$

Transition frequency at $f = 500 \, \text{MHz}$ *
$-I_E = 0,6 \, \text{A}; \, V_{CB} = 28 \, \text{V}$
$-I_E = 2,0 \, \text{A}; \, V_{CB} = 28 \, \text{V}$

Collector capacitance at $f = 1 \, \text{MHz}$
$I_E = I_B = 0; \, V_{CE} = 28 \, \text{V}$

Feedback capacitance at $f = 1 \, \text{MHz}$
$I_C = 20 \, \text{mA}; \, V_{CE} = 28 \, \text{V}$

Collector-stud capacitance

$V_{(BR)CES} > 60 \, \text{V}$
$V_{(BR)CEO} > 30 \, \text{V}$
$V_{(BR)EBO} > 4 \, \text{V}$
$ICES < 4 \, \text{mA}$
$ESBO > 2 \, \text{mJ}$
$ESBR > 2 \, \text{mJ}$
$hFE \text{typ.} \quad 40$
$hFE \text{10 to 100}$
$CEsat \text{typ.} \quad 1,0 \, \text{V}$
$fT \text{typ.} \quad 1,2 \, \text{GHz}$
$fT \text{typ.} \quad 1,0 \, \text{GHz}$
$C_c \text{typ.} \quad 17 \, \text{pF}$
$C_re \text{typ.} \quad 8,5 \, \text{pF}$
$C_cs \text{typ.} \quad 1,2 \, \text{pF}$

* Measured under pulse conditions: $t_p \leq 200 \, \mu\text{s}; \, \delta \leq 0,02.$
Fig. 4 Typical values; $T_j = 25 \, ^\circ C$.

Fig. 5 $I_E = I_e = 0; \ f = 1 \, MHz; \ T_j = 25 \, ^\circ C$.

Fig. 6 $V_{CB} = 28 \, V; \ f = 500 \, MHz; \ T_j = 25 \, ^\circ C$. 
APPLICATION INFORMATION
R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

\[ T_h = 25 \, ^\circ\text{C} \]

<table>
<thead>
<tr>
<th>( f ) (MHz)</th>
<th>( V_{CE} ) (V)</th>
<th>( P_L ) (W)</th>
<th>( P_S ) (W)</th>
<th>( G_P ) (dB)</th>
<th>( I_C ) (A)</th>
<th>( \eta ) (%)</th>
<th>( Z_j ) (Ω)</th>
<th>( Z_L ) (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>470</td>
<td>28</td>
<td>10</td>
<td>&lt; 1,26</td>
<td>&gt; 9</td>
<td>&lt; 0,6</td>
<td>&gt; 60</td>
<td>1,0 + j2,1</td>
<td>4,9 + j11</td>
</tr>
<tr>
<td>470</td>
<td>28</td>
<td>10</td>
<td>typ. 0,9</td>
<td>typ. 10,5</td>
<td>typ. 0,56</td>
<td>typ. 63</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Fig. 7 Test circuit; c.w. class-B. For component layout and p.c.b. see Fig. 8.

List of components:

- \( C_1 = C_7 = C_8 = 1,4 \) to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
- \( C_2 = 2 \) to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
- \( C_3 = C_4 = 15 \) pF multilayer ceramic chip capacitor (cat. no. 2222 851 13159), middle of capacitor 3 mm from transistor edge
- \( C_5 = 100 \) pF feed-through capacitor
- \( C_6 = 100 \) nF polyester capacitor
- \( L_1 \) = stripline (30,4 mm x 6,0 mm); tap for \( L_2 \) placed 11 mm from transistor edge
- \( L_2 = 320 \) nH; 13 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4 mm; leads 2 x 4 mm
- \( L_3 = L_7 = \) Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- \( L_4 = \) stripline (12,0 mm x 6,0 mm)
- \( L_5 = 78 \) nH; 5 turns enamelled Cu wire (1,0 mm); int. dia. 5 mm; length 9,3 mm; leads 2 x 5 mm
- \( L_6 = 22 \) nH; 2 turns enamelled Cu wire (1,0 mm); int. dia. 4 mm; length 3,2 mm; leads 2 x 5 mm
- \( R_1 = R_2 = 10 \Omega \) carbon resistor
Fig. 8 Component layout and printed-circuit board for 470 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.
Fig. 9 $V_{CE} = 28$ V; $f = 470$ MHz; $T_h = 25$ °C.

Fig. 10 Typical values; $V_{CE} = 28$ V; $f = 470$ MHz; $T_h = 25$ °C.
The BLW91 is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 10 W under the following conditions:

\[
\begin{align*}
V_{\text{CE}} &= 28 \text{ V} ; \quad f = 470 \text{ MHz} ; \quad T_H = 70 \, ^\circ\text{C} ; \\
R_{\text{th mb-h}} &= 0.6 \, \Omega/\text{W} .
\end{align*}
\]

**Ruggedness**

Figures 11, 12 and 13 show the input and load impedances for a typical scenario with:

- \( V_{\text{CE}} = 28 \text{ V} \)
- \( P_L = 10 \text{ W} \)
- \( T_H = 25 \, ^\circ\text{C} \)

The conditions for Figs 11, 12 and 13:

Typical values: \( V_{\text{CE}} = 28 \text{ V} \); \( P_L = 10 \text{ W} \); \( T_H = 25 \, ^\circ\text{C} \).
H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-AB operated high power industrial and military transmitting equipment in the h.f. band. The transistor presents excellent performance as a linear amplifier in s.s.b. applications. It is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Matched $h_{FE}$ groups are available on request.

The transistor has a ½" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25$ °C

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$I_C(ZS)$ A</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_p$ dB</th>
<th>$\eta_{dt}$ %</th>
<th>$d_3$ dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>s.s.b. (class-AB)</td>
<td>50</td>
<td>0,1</td>
<td>1,6 – 28</td>
<td>20 – 160 (P.E.P.)</td>
<td>&gt; 14</td>
<td>&gt; 40*</td>
<td>&lt; -30</td>
</tr>
</tbody>
</table>

* At 160 W P.E.P.

MECHANICAL DATA

SOT-121A (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
MECHANICAL DATA
Fig. 1 SOT-121.

Torque on screw: min. 0.6 Nm (6 kg cm)
max. 0.75 Nm (7.5 kg cm)
Recommended screw: cheese-head 4-40 UNC/2A
Heatsink compound must be applied sparingly and evenly distributed.
H.F. power transistor

RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$)
peak value

Collector-emitter voltage (open base)

Emitter-base voltage (open collector)

Collector current (average)

Collector current (peak value); $f > 1$ MHz

R.F. power dissipation ($f > 1$ MHz); $T_{mb} = 25 ^\circ C$

Storage temperature

Operating junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CESM}$ max.</td>
<td>110 V</td>
</tr>
<tr>
<td>$V_{CEO}$ max.</td>
<td>53 V</td>
</tr>
<tr>
<td>$V_{EBO}$ max.</td>
<td>4 V</td>
</tr>
<tr>
<td>$I_{C}(AV)$ max.</td>
<td>8 A</td>
</tr>
<tr>
<td>$I_{CM}$ max.</td>
<td>20 A</td>
</tr>
<tr>
<td>$P_{rf}$ max.</td>
<td>245 W</td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>-65 to + 150 °C</td>
</tr>
<tr>
<td>$T_j$ max.</td>
<td>200 °C</td>
</tr>
</tbody>
</table>

Fig. 2 D.C. SOAR.

Fig. 3 R.F. power dissipation; $V_{CE} \leq 50$ V; $f > 1$ MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 100 W; $T_{mb} = 90 ^\circ C$, i.e. $T_h = 70 ^\circ C$)

<table>
<thead>
<tr>
<th>Resistance</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{th j-mb}(dc)$</td>
<td>1,0 K/W</td>
</tr>
<tr>
<td>$R_{th j-mb}(rf)$</td>
<td>0,7 K/W</td>
</tr>
<tr>
<td>$R_{th mb-h}$</td>
<td>0,2 K/W</td>
</tr>
</tbody>
</table>

November 1981
### CHARACTERISTICS

- **$T_J = 25 \, ^\circ\text{C}$**
- **Collector-emitter breakdown voltage**
  - $V_{BE} = 0; \, I_C = 25 \, \text{mA}$
  - $V_{BE} = 0; \, I_B = 100 \, \text{mA}$
- **Emitter-base breakdown voltage**
  - open collector; $I_E = 20 \, \text{mA}$
- **Collector cut-off current**
  - $V_{BE} = 0; \, V_{CE} = 53 \, \text{V}$
- **Second breakdown energy**
  - $L = 25 \, \text{mH}; \, f = 50 \, \text{Hz}$
  - open base
  - $R_{BE} = 10 \, \Omega$
- **D.C. current gain**
  - $I_C = 4 \, \text{A}; \, V_{CE} = 5 \, \text{V}$
- **D.C. current gain ratio of matched devices**
  - $I_C = 4 \, \text{A}; \, V_{CE} = 5 \, \text{V}$
- **Collector-emitter saturation voltage**
  - $I_C = 12.5 \, \text{A}; \, I_B = 2.5 \, \text{A}$
- **Transition frequency at $f = 100 \, \text{MHz}$**
  - $-I_E = 4 \, \text{A}; \, V_{CB} = 40 \, \text{V}$
  - $-I_E = 12.5 \, \text{A}; \, V_{CB} = 40 \, \text{V}$
- **Collector capacitance at $f = 1 \, \text{MHz}$**
  - $I_E = I_e = 0; \, V_{CE} = 50 \, \text{V}$
- **Feedback capacitance at $f = 1 \, \text{MHz}$**
  - $I_C = 150 \, \text{mA}; \, V_{CE} = 50 \, \text{V}$
- **Collector-flange capacitance**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{(BR)CES}$</td>
<td>$&gt; 110 , \text{V}$</td>
</tr>
<tr>
<td>$V_{(BR)CEO}$</td>
<td>$&gt; 53 , \text{V}$</td>
</tr>
<tr>
<td>$V_{(BR)EBO}$</td>
<td>$&gt; 4 , \text{V}$</td>
</tr>
<tr>
<td>$I_{CES}$</td>
<td>$&lt; 10 , \text{mA}$</td>
</tr>
<tr>
<td>$E_{SO}$</td>
<td>$&gt; 12.5 , \text{mJ}$</td>
</tr>
<tr>
<td>$E_{SR}$</td>
<td>$&gt; 12.5 , \text{mJ}$</td>
</tr>
<tr>
<td>$h_{FE}$</td>
<td>typ. 30 , 15 to 50</td>
</tr>
<tr>
<td>$h_{FE1}/h_{FE2}$</td>
<td>$\leq 1.2$</td>
</tr>
<tr>
<td>$V_{CEsat}$</td>
<td>typ. $2.2 , \text{V}$</td>
</tr>
<tr>
<td>$f_T$</td>
<td>typ. $270 , \text{MHz}$</td>
</tr>
<tr>
<td>$f_T$</td>
<td>typ. $285 , \text{MHz}$</td>
</tr>
<tr>
<td>$C_C$</td>
<td>typ. $185 , \text{pF}$</td>
</tr>
<tr>
<td>$C_{re}$</td>
<td>typ. $115 , \text{pF}$</td>
</tr>
<tr>
<td>$C_{cf}$</td>
<td>typ. $3 , \text{pF}$</td>
</tr>
</tbody>
</table>

* Measured under pulse conditions: $t_p \leq 200 \, \mu\text{s}; \, \delta \leq 0.02$.  

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**BLW95**

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**730 June 1980**
H.F. power transistor

**Fig. 4** $V_{CE} = 40\ V$; $T_h = 25\ ^\circ C$.  

**Fig. 5** Typical values; $T_j = 25\ ^\circ C$.

**Fig. 6** Typical values; $f = 100\ MHz$; $T_j = 25\ ^\circ C$.  

**Fig. 7** $I_E = I_e = 0$; $f = 1\ MHz$; $T_j = 25\ ^\circ C$.
APPLICATION INFORMATION

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

\( V_{CE} = 50 \text{ V}; T_h = 25 \, ^\circ\text{C}; f_1 = 28,000 \, \text{MHz}; f_2 = 28,001 \, \text{MHz} \)

<table>
<thead>
<tr>
<th>Output Power</th>
<th>( G_D ) dB</th>
<th>( \eta_{dt} ) (%) at 160 W (P.E.P.)</th>
<th>( I_C ) (A)</th>
<th>( d_3 ) dB *</th>
<th>( d_5 ) dB *</th>
<th>( I_C(ZS) ) A</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 to 160 (P.E.P.)</td>
<td>&gt;14</td>
<td>&gt;40</td>
<td>&lt;4,0</td>
<td>&lt;-30</td>
<td>&lt;-30</td>
<td>0,1</td>
</tr>
</tbody>
</table>

![Test circuit; s.s.b. class-AB.](image)

List of components:

- \( C_1 = C_{10} = 100 \, \text{pF} \) film dielectric trimmer
- \( C_2 = C_6 = 27 \, \text{pF} \) ceramic capacitor (500 V)
- \( C_3 = 220 \, \text{pF} \) polystyrene capacitor
- \( C_4 = C_{13} = 100 \, \text{pF} \) film dielectric trimmer
- \( C_5 = C_7 = 3,9 \, \text{nF} \) ceramic capacitor
- \( C_8 = 100 \, \text{nF} \) polyester capacitor
- \( C_9 = 2,2 \, \mu\text{F} \) moulded metallized polyester capacitor
- \( C_{11} = 68 \, \text{pF} \) ceramic capacitor (500 V)
- \( C_{12} = 220 \, \text{pF} \) polystyrene capacitor
- \( L_1 = 88 \, \text{nH} \); 3 turns Cu wire (1,0 mm); int. dia. 9,0 mm; length 6,1 mm; leads 2 x 5 mm
- \( L_2 = L_5 \) = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- \( L_3 = 180 \, \text{nH} \); 4 turns enamelled Cu wire (1,6 mm); int. dia. 12,0 mm; length 9,9 mm; leads 2 x 10 mm
- \( L_4 = 350 \, \text{nH} \); 7 turns enamelled Cu wire (1,6 mm); int. dia. 12,0 mm; length 19,1 mm; leads 2 x 10 mm
- \( R_1 = 0,66 \, \Omega \); parallel connection of 5 x 3,3 \( \Omega \) carbon resistors (± 5%; 0,5 W each)
- \( R_2 = 27 \, \Omega \) carbon resistor (± 5%; 0,5 W)
- \( R_3 = 4,7 \, \Omega \) carbon resistor (± 5%; 0,5 W)

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.
Fig. 9 Intermodulation distortion as a function of output power.*

Fig. 10 Double-tone efficiency and power gain as a function of output power.

Conditions for Figs 9 and 10:

\[ V_{CE} = 50 \text{ V; } I_{C(ZS)} = 0.1 \text{ A; } f_1 = 28,000 \text{ MHz; } f_2 = 28,001 \text{ MHz; } T_h = 25 \text{ °C; typical values.} \]

**Ruggedness**

The BLW95 is capable of withstanding full load mismatch (VSWR = 50) up to 150 W (P.E.P.) under the following conditions:

\[ V_{CE} = 45 \text{ V; } f = 28 \text{ MHz; } T_h = 70 \text{ °C; } R_{th mb-h} = 0.2 \text{ K/W.} \]

* See note on previous page.
Fig. 11 Power gain as a function of frequency.

Fig. 12 Input impedance (series components) as a function of frequency.

Figs 11 and 12 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions: 
\( V_{CE} = 50 \text{ V} \); \( I_C(ZS) = 0.1 \text{ A} \); \( P_L = 160 \text{ W (P.E.P.)} \); \( T_h = 25 \degree \text{C} \); \( Z_L = 6.25 \Omega \) in series with 7.3 nH (in parallel with -188 pF).
H.F. power transistor

Fig. 13 Power gain as a function of frequency.

Fig. 14 Input impedance (series components) as a function of frequency.

Figs 13 and 14 are typical curves and hold for one transistor of a push-pull amplifier with cross-neutralization in s.s.b. class-AB operation.

Conditions:

\[ V_{CE} = 50 \text{ V}; \quad I_{C(ZS)} = 0.1 \text{ A}; \quad P_L = 160 \text{ W (P.E.P.)}; \quad T_H = 25 \degree \text{C}; \quad Z_L = 6.25 \Omega \text{ in series with } 10.4 \text{ nH (in parallel with } -267 \text{ pF)}; \quad \text{neutralizing capacitor: } 82 \text{ pF}. \]
H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, AB and B operated high power industrial and military transmitting equipment in the h.f. and v.h.f. band. The transistor presents excellent performance as a linear amplifier in s.s.b. applications. It is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Transistors are supplied in matched hFE groups. The transistor has a ½” flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25 \degree C$

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_p$ dB</th>
<th>$\eta$ %</th>
<th>$d_3$ dB</th>
<th>$d_5$ dB</th>
<th>$I_{C(ZS)}$ A</th>
</tr>
</thead>
<tbody>
<tr>
<td>s.s.b. (class-AB)</td>
<td>50</td>
<td>1,6 - 28</td>
<td>25 - 200(P.E.P.)</td>
<td>&gt; 13,5</td>
<td>&gt; 40*</td>
<td>&lt; -30</td>
<td>&lt; -30</td>
<td>0,1</td>
</tr>
<tr>
<td>c.w. (class-B)</td>
<td>50</td>
<td>108</td>
<td>200</td>
<td>typ. 6,5</td>
<td>typ. 67</td>
<td>-</td>
<td>-</td>
<td>(6)</td>
</tr>
<tr>
<td>s.s.b. (class-A)</td>
<td>40</td>
<td>28</td>
<td>50 (P.E.P.)</td>
<td>typ. 19</td>
<td>-</td>
<td>typ. -40</td>
<td>&lt; -40</td>
<td>(4)</td>
</tr>
</tbody>
</table>

* $\eta_{dt}$ at 200 W P.E.P.

MECHANICAL DATA
SOT-121 (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
MECHANICAL DATA

Fig. 1 SOT-121.

Dimensions in mm

Torque on screw: min. 0.6 Nm (6 kg cm)
max. 0.75 Nm (7.5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.
**RATINGS**

Limiting values in accordance with the Absolute Maximum System (IEC 134)

- Collector-emitter voltage ($V_{BE} = 0$)
  - peak value: $V_{CESM_{max.}} = 110$ V
- Collector-emitter voltage (open base)
- Emitter-base voltage (open collector)
- Collector current (average)
- Collector current (peak value); $f > 1$ MHz
- R.F. power dissipation ($f > 1$ MHz); $T_{mb} = 45$ °C

Storage temperature
Operating junction temperature

---

**THERMAL RESISTANCE** (dissipation = 150 W; $T_{mb} = 100$ °C, i.e. $T_h = 70$ °C)

- From junction to mounting base (d.c. dissipation): $R_{th \_j \_mb (dc)} = 0.63$ K/W
- From junction to mounting base (r.f. dissipation): $R_{th \_j \_mb (rf)} = 0.45$ K/W
- From mounting base to heatsink: $R_{th \_mb \_h} = 0.2$ K/W
**CHARACTERISTICS**

- $T_j = 25 \degree C$
- Collector-emitter breakdown voltage
  - $V_{BE} = 0; I_C = 50 \text{ mA}$
  - $V_{BE} = 0; I_C = 200 \text{ mA}$
- Emitter-base breakdown voltage
  - $I_E = 20 \text{ mA}$
- Collector cut-off current
  - $V_{BE} = 0; V_{CE} = 55 \text{ V}$
- Second breakdown energy; $L = 25 \text{ mH}; f = 50 \text{ Hz}$
  - $R_{BE} = 10 \Omega$
- D.C. current gain*
  - $I_C = 7 \text{ A}; V_{CE} = 5 \text{ V}$
- D.C. current gain ratio of matched devices*
  - $I_C = 7 \text{ A}; V_{CE} = 5 \text{ V}$
- Collector-emitter saturation voltage*
  - $I_C = 20 \text{ A}; I_B = 4 \text{ A}$
- Transition frequency at $f = 100 \text{ MHz}$**
  - $-I_E = 7 \text{ A}; V_{CB} = 45 \text{ V}$
  - $-I_E = 20 \text{ A}; V_{CB} = 45 \text{ V}$
- Collector capacitance at $f = 1 \text{ MHz}$
  - $I_E = 0; V_{CB} = 50 \text{ V}$
- Feedback capacitance at $f = 1 \text{ MHz}$
  - $I_C = 150 \text{ mA}; V_{CE} = 50 \text{ V}$
- Collector-flange capacitance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{(BR)CES}$</td>
<td>$&gt; 110 \text{ V}$</td>
</tr>
<tr>
<td>$V_{(BR)CEO}$</td>
<td>$&gt; 55 \text{ V}$</td>
</tr>
<tr>
<td>$V_{(BR)EBO}$</td>
<td>$&gt; 4 \text{ V}$</td>
</tr>
<tr>
<td>$I_{CES}$</td>
<td>$&lt; 10 \text{ mA}$</td>
</tr>
<tr>
<td>$E_{SBO}$</td>
<td>$&gt; 20 \text{ mJ}$</td>
</tr>
<tr>
<td>$E_{SBR}$</td>
<td>$&gt; 20 \text{ mJ}$</td>
</tr>
<tr>
<td>$h_{FE}$</td>
<td>typ. $30$</td>
</tr>
<tr>
<td></td>
<td>15 to $50$</td>
</tr>
<tr>
<td>$h_{FE1}/h_{FE2}$</td>
<td>$&lt; 1.2$</td>
</tr>
<tr>
<td>$V_{CEsat}$</td>
<td>typ. $1.9 \text{ V}$</td>
</tr>
<tr>
<td>$f_T$</td>
<td>typ. $235 \text{ MHz}$</td>
</tr>
<tr>
<td>$f_T$</td>
<td>typ. $245 \text{ MHz}$</td>
</tr>
<tr>
<td>$C_c$</td>
<td>typ. $280 \text{ pF}$</td>
</tr>
<tr>
<td>$C_{fe}$</td>
<td>typ. $170 \text{ pF}$</td>
</tr>
<tr>
<td>$C_{cf}$</td>
<td>typ. $4.4 \text{ pF}$</td>
</tr>
</tbody>
</table>

* Measured under pulse conditions: $t_p \leq 300 \mu s; \delta \leq 0.02$.
** Measured under pulse conditions: $t_p \leq 50 \mu s; \delta \leq 0.01$. 

740 November 1981
H.F./V.H.F. power transistor

Fig. 4 Typical values; \( V_{CE} = 40 \, \text{V} \).

Fig. 5 Typical values; \( T_j = 25 \, \text{°C} \).

Fig. 6 Typical values; \( f = 100 \, \text{MHz}; T_j = 25 \, \text{°C} \).

Fig. 7 \( I_E = I_e = 0; f = 1 \, \text{MHz}; T_j = 25 \, \text{°C} \).
APPLICATION INFORMATION

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

\[ V_{CE} = 50 \, \text{V}; \, T_h = 25 \, ^\circ\text{C}; \, f_1 = 28,000 \, \text{MHz}; \, f_2 = 28,001 \, \text{MHz} \]

<table>
<thead>
<tr>
<th>output power W</th>
<th>( G_p ), dB</th>
<th>( \eta_{dt}(%) ) at 200 W (P.E.P.)</th>
<th>( I_C ), A</th>
<th>( d_3^* ), dB</th>
<th>( d_5^* ), dB</th>
<th>( I_{C}(ZS) ), A</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 to 200 (P.E.P.)</td>
<td>&gt; 13,5</td>
<td>&gt; 40</td>
<td>&lt; 5,0</td>
<td>&lt; -30</td>
<td>&lt; -30</td>
<td>0,1</td>
</tr>
</tbody>
</table>

Fig. 8 Test circuit; s.s.b. class-AB.

List of components:

- \( C_1 = C_4 = C_{10} = C_{14} = 100 \, \text{pF film dielectric trimmer} \)
- \( C_2 = 27 \, \text{pF ceramic capacitor (500 V)} \)
- \( C_3 = 270 \, \text{pF polystyrene capacitor (630 V)} \)
- \( C_5 = C_7 = C_B = 220 \, \text{nF multilayer ceramic chip capacitor} \)
- \( C_6 = 27 \, \text{pF multilayer ceramic chip capacitor (500 V; ATC\( \Delta \))} \)
- \( C_9 = 47 \, \mu\text{F/63 V electrolytic capacitor} \)
- \( C_{11} = 2 \times 36 \, \text{pF multilayer ceramic chip capacitors (500 V; ATC\( \Delta \)) in parallel} \)
- \( C_{12} = 2 \times 43 \, \text{pF multilayer ceramic chip capacitors (500 V; ATC\( \Delta \)) in parallel} \)
- \( C_{13} = 43 \, \text{pF multilayer ceramic chip capacitor (500 V; ATC\( \Delta \))} \)
- \( L_1 = 88 \, \text{nH; 3 turns Cu wire (1,0 mm); int. dia. 9,0 mm; length 6,1 mm; leads 2 x 5 mm} \)
- \( L_2 = \text{Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)} \)
- \( L_3 = 150 \, \text{nH; 5 turns Cu wire (2,0 mm); int. dia. 10,0 mm; length 18,7 mm; leads 2 x 5 mm} \)
- \( L_4 = 197 \, \text{nH; 5 turns Cu wire (2,0 mm); int. dia. 12,0 mm; length 18,6 mm; leads 2 x 5 mm} \)
- \( R_1 = 0,66 \, \Omega; \) parallel connection of 5 x 3,3 \( \Omega \) metal film resistors (PR37; \( \pm 5\% \); 1,6 W each)
- \( R_2 = 27 \, \Omega \) carbon resistor (\( \pm 5\%; 0,5 \, \text{W})

\* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

\( \Delta \) ATC means American Technical Ceramics.
H.F./V.H.F. power transistor

BLW96

Fig. 9 Intermodulation distortion as a function of output power.*

Fig. 10 Double-tone efficiency and power gain as a function of output power.

Conditions for Figs 9 and 10:

\[ V_{CE} = 50 \text{ V}; \quad I_{C(ZS)} = 0.1 \text{ A}; \quad f_1 = 28,000 \text{ MHz}; \quad f_2 = 28,001 \text{ MHz}; \quad T_h = 25^\circ \text{C}; \quad \text{typical values}. \]

Ruggedness

The BLW96 is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 150 W (P.E.P.) or a load mismatch (VSWR = 5 through all phases) up to 200 W (P.E.P.) under the following conditions:

\[ V_{CE} = 45 \text{ V}; \quad f = 28 \text{ MHz}; \quad T_h = 70^\circ \text{C}; \quad R_{th \text{ mb-h}} = 0.2 \text{ K/W}. \]

* See note on previous page.
Fig. 11 Power gain as a function of frequency.

Figs 11 and 12 are typical curves and hold for one transistor of a push-pull amplifier with cross-neutralization in s.s.b. class-AB operation.

Conditions:
$V_{CE} = 50 \text{ V}$; $I_{C(ZS)} = 0.1 \text{ A}$; $P_L = 200 \text{ W (P.E.P.)}$; $T_h = 25 \degree C$; $Z_L = 5 \Omega$; neutralizing capacitor: 47 pF.
**R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)**

$T_h = 25 ^\circ C$

<table>
<thead>
<tr>
<th>$f$ (MHz)</th>
<th>$V_{CE}$ (V)</th>
<th>$P_L$ (W)</th>
<th>$P_S$ (W)</th>
<th>$G_p$ (dB)</th>
<th>$I_C$ (A)</th>
<th>$\eta$ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>108</td>
<td>50</td>
<td>200</td>
<td>typ. 45</td>
<td>typ. 6,5</td>
<td>typ. 6</td>
<td>typ. 67</td>
</tr>
</tbody>
</table>

![Graph of $P_L$ vs. $P_S$](image1)

![Graph of $G_p$ vs. $P_L$](image2)

Fig. 13 $V_{CE} = 50$ V; $f = 108$ MHz; $T_h = 25 ^\circ C$.

Fig. 14 $V_{CE} = 50$ V; $f = 108$ MHz; $T_h = 25 ^\circ C$; typical values.
Fig. 15 Input impedance (series components).

Fig. 16 Load impedance (series components).

Fig. 17.

Conditions for Figs 15, 16 and 17:
Typical values; $V_{CE} = 50 \, V$; $P_L = 200 \, W$;
$T_h = 25 \, ^\circ C$; class-B operation.
**H.F./V.H.F. power transistor**

R.F. performance in s.s.b. class-A operation (linear power amplifier)

\[ V_{CE} = 40 \text{ V}; \; T_h = 25 \degree C; \; f_1 = 28,000 \text{ MHz}; \; f_2 = 28,001 \text{ MHz} \]

<table>
<thead>
<tr>
<th>Output Power (W)</th>
<th>( G_p ) (dB)</th>
<th>( I_C ) (A)</th>
<th>( d_3^* ) (dB)</th>
<th>( d_5^* ) (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>typ. 50 (P.E.P.)</td>
<td>typ. 19</td>
<td>4</td>
<td>typ. (-40)</td>
<td>(&lt; -40)</td>
</tr>
</tbody>
</table>

---

**Fig. 18 Test circuit; s.s.b. class-A.**

List of components:

- \( C_1 = C_2 = 10 \) to 780 pF film dielectric trimmer
- \( C_3 = 220 \) nF polyester capacitor (100 V)
- \( C_4 = 100 \mu F / 4 \) V electrolytic capacitor
- \( C_5 = 2 \times 330 \) nF polyester capacitors (100 V) in parallel
- \( C_6 = 47 \mu F / 63 \) V electrolytic capacitor
- \( C_7 = C_{10} = 2 \times 82 \) pF ceramic capacitors (500 V) in parallel
- \( C_8 = C_9 = 10 \) to 150 pF air dielectric trimmer
- \( L_1 = 45 \) nH; 2 turns enamelled Cu wire (1.6 mm); int. dia. 8.0 mm; length 4.0 mm; leads 2 x 3 mm
- \( L_2 = \) Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- \( L_3 = 110 \) nH; 4 turns enamelled Cu wire (2.0 mm); int. dia. 10.0 mm; length 8.0 mm; leads 2 x 2 mm
- \( L_4 = 210 \) nH; 5 turns enamelled Cu wire (2.0 mm); int. dia. 12.0 mm; length 10.0 mm; leads 2 x 2 mm
- \( R_1 = 27 \) Ω carbon resistor (± 5%; 0.5 W)

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.
Fig. 19 Third order intermodulation distortion as a function of output power.*
Typical values; $V_{CE} = 40$ V; $T_h = 25$ °C; $f_1 = 28,000$ MHz; $f_2 = 28,001$ MHz.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.
H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor designed for use in class-A, AB and B operated high-power industrial and military transmitting equipment in the h.f. band.

The transistor offers excellent performance as a linear amplifier in s.s.b. applications. It is resistance stabilized and is made to withstand severe load-mismatch conditions. All leads are isolated from the flange.

The transistors are supplied in matched h_FE groups.

QUICK REFERENCE DATA

R.F. performance up to \( T_h = 25 \degree C \)

| mode of operation | \( V_{CE} \) V | \( |I_{C(ZS)}| \) A | \( f \) MHz | \( P_L \) W | \( G_p \) dB | \( \eta_{dt} \) % | \( d_3 \) dB | \( d_5^- \) dB |
|-------------------|----------------|-----------------|----------|---------|--------|--------|--------|--------|
| s.s.b. (class-AB) | 28             | 0,1             | 1,6 - 28 | 175 (PEP)| >11,5  | >40    | < -30  | < -30  |

MECHANICAL DATA

SOT-121 (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
Torque on screw:  
min. 0.60 Nm (6.0 kg cm)  
max. 0.75 Nm (7.5 kg cm)  

Recommended screw: cheese-head 4-40 UNC/2A  
Heatsink compound must be applied sparingly and evenly distributed.
H.F. power transistor

**RATINGS**

Limiting values in accordance with the Absolute Maximum System (IEC 134)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-emitter voltage (peak value)</td>
<td>$V_{BE} = 0$ open base</td>
</tr>
<tr>
<td>Emitter-base voltage (open collector)</td>
<td></td>
</tr>
<tr>
<td>Collector current</td>
<td></td>
</tr>
<tr>
<td>peak value; $f &gt; 1$ MHz</td>
<td></td>
</tr>
<tr>
<td>Total d.c. power dissipation at $T_h = 25^\circ C$</td>
<td></td>
</tr>
<tr>
<td>R.F. power dissipation $f &gt; 1$ MHz; $T_h = 25^\circ C$</td>
<td></td>
</tr>
<tr>
<td>Storage temperature</td>
<td></td>
</tr>
<tr>
<td>Operating junction temperature</td>
<td></td>
</tr>
</tbody>
</table>

**THERMAL RESISTANCE** (dissipation = 120 W; $T_h = 25^\circ C$ i.e. $T_{mb} = 49^\circ C$)

| From junction to mounting base | $R_{th \, j-mb}(dc) = 0,63 \, K/W$ |
| From junction to mounting base | $R_{th \, j-mb}(dc) = 0,48 \, K/W$ |
| From mounting base to heatsink  | $R_{th \, mb-h} = 0,20 \, K/W$   |

Fig. 2 D.C. SOAR.

Fig. 3 Power/temperature derating curves.

I Continuous d.c. operation
II Continuous r.f. operation ($f > 1$ MHz).
III Short-time operation during mismatch; ($f > 1$ MHz).
CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage

V_{BE} = 0; I_C = 50 mA
I_C = 100 mA; open base

Emitter-base breakdown voltage

I_E = 20 mA; open collector

Collector cut-off current

V_{CE} = 33 V; V_{BE} = 0

Second breakdown energy; L = 25 mH; f = 50 Hz
open base

R_{BE} = 10 Ω

D.C. current gain*

I_C = 10 A; V_{CE} = 5 V

D.C. current gain ratio of matched devices*

I_C = 10 A; V_{CE} = 5 V

Collector-emitter saturation voltage*

I_C = 25 A; I_B = 5 A

Transition frequency at f = 100 MHz**

\[ V_{CS} = 28 \text{ V} \]

Collector capacitance at f = 1 MHz

I_E = I_e = 0; V_{CB} = 28 V

Feedback capacitance at f = 1 MHz

I_C = 0; V_{CE} = 28 V

Collector-flange capacitance

V_{BRCES} > 65 V
V_{BRCEO} > 33 V
V_{BRCEO} > 4 V
I_{CES} < 20 mA
E_{SO} > 20 mJ
E_{SBR} > 20 mJ
h_{FE} typ. 30
h_{FE1/FE2} typ. 1,2
V_{CESat} typ. 2,4 V
f_T typ. 230 MHz
f_T typ. 235 MHz
C_c typ. 380 pF
C_re typ. 235 pF
C_cf typ. 4,5 pF

* Measured under pulse conditions: t_p = 500 µs.
** Measured under pulse conditions: t_p = 300 µs; δ = 0,02.
H.F. power transistor

Fig. 4 $T_j = 25 \, ^\circ\text{C}$.

Fig. 5 $T_j = 25 \, ^\circ\text{C}$; $f = 100 \, \text{MHz}$; $t_p = 300 \, \mu\text{s}$.

Fig. 6 $I_E = I_B = 0$; $f = 1 \, \text{MHz}$; $T_j = 25 \, ^\circ\text{C}$.

Fig. 7 $V_{CE} = 28 \, \text{V}$.
APPLICATION INFORMATION

R.F. performance in s.s.b. class-AB operation (linear power amplifier).

\[ V_{CE} = 28 \text{ V}; \quad T_h = 25 \degree C; \quad f_1 = 28,000 \text{ MHz}; \quad f_2 = 28,001 \text{ MHz}. \]

<table>
<thead>
<tr>
<th>output power</th>
<th>( P ) (dB)</th>
<th>( \eta_{dt} ) (%)</th>
<th>( I_C ) (A)</th>
<th>( d_3^* ) (dB)</th>
<th>( d_5^* ) (dB)</th>
<th>( I_C(ZS) ) (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>175 (PEP)</td>
<td>&gt; 11,5 typ. 13,0</td>
<td>&gt; 40 typ. 50</td>
<td>&lt; 7,8 typ. 6,3</td>
<td>&lt; -30 typ. -34</td>
<td>&lt; -30 typ. -38</td>
<td>0,1</td>
</tr>
</tbody>
</table>

* The stated intermodulation distortion levels are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

Fig. 8 Class-AB (s.s.b.) test circuit.

List of components:

- **C1** = 47 pF (500 V) multilayer ceramic chip capacitor
- **C2** = 100 pF film dielectric trimmer
- **C3** = 2 x 130 pF (300 V) multilayer ceramic chip capacitors in parallel
- **C4** = 280 pF film dielectric trimmer
- **C5** = 10 nF (50 V) multilayer ceramic chip capacitor 2222 856 13103
- **C6** = 2 x 180 pF (300 V) multilayer ceramic chip capacitors in parallel
- **C7** = 100 nF (50 V) multilayer ceramic chip capacitor 2222 856 48104
- **C8** = 10 nF (50 V) multilayer ceramic chip capacitor 2222 856 13103
- **C9** = 2,2 \( \mu \)F - 63 V solid aluminium electrolytic capacitor
- **C10** = 5 x 82 pF (500 V) multilayer ceramic chip capacitors in parallel
- **C11** = 250 pF air dielectric trimmer
- **C12** = 5 x 33 pF ceramic feed-through capacitors mounted in parallel on a brass plate
- **C13** = 100 pF air dielectric trimmer
- **C14** = 3 x 91 pF (500 V) multilayer ceramic chip capacitors in parallel
- **R1** = 0,7 \( \Omega \) - 7 W (7 x 4,7 \( \Omega \) - 1 W carbon resistors in parallel)
- **R2** = 27 \( \Omega \) - 0,25 W carbon resistor
- **R3** = 4,7 \( \Omega \) - 0,25 W carbon resistor

* American Technical Ceramics capacitor or capacitor of same quality.
**H.F. power transistor**

**BLW97**

L1 = 73 nH; 4 turns Cu wire (1,5 mm); int. dia. 7 mm; length 9,4 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke grade 3B (cat. no. 4312 020 36640); 6 leads in parallel
L3 = 70,4 nH; 4 turns Cu wire (2 mm); int. dia. 7 mm; length 14,8 mm; leads 2 x 5 mm
L4 = 83,5 nH; 4 turns Cu wire (2 mm); int. dia. 8 mm; length 15 mm; leads 2 x 5 mm
L5 = Ferroxcube wide-band h.f. choke grade 3 B (cat. no. 4312 020 36640) with 6 leads in parallel

Fig. 9 Intermodulation distortion (see note on preceding page).

Fig. 10 Power gain and double-tone efficiency.

Conditions for Figs 9 and 10:

\[ V_{CE} = 28 \text{ V}; I_{C(ZS)} = 0,1 \text{ A}; f_1 = 28,000 \text{ MHz}; f_2 = 28,001 \text{ MHz}; T_h = 25 \text{ °C}. \]

**RUGGEDNESS**

The BLW97 is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 150 W (P.E.P.) or a load mismatch (VSWR = 5 through all phases) up to 175 W (P.E.P.) under the following conditions:

\[ V_{CE} = 28 \text{ V}; f = 28 \text{ MHz}; T_h = 25 \text{ °C}; R_{th \, mb-h} = 0,2 \text{ K/W}. \]

Figures 11 and 12 on the next page present typical curves which are valid for one transistor of a push-pull amplifier in s.s.b. class-AB operation.
Conditions for Figs 11 and 12:

\[ V_{CE} = 28 \text{ V}; \quad I_{C(ZS)} = 0.1 \text{ A}; \quad P_L = 175 \text{ W(PEP)}; \quad T_h = 25 \degree C; \quad Z_L = 1.55 \Omega \]

Conditions for Figs 13, 14 and 15:

\[ V_{CE} = 28 \text{ V}; \quad P_L = 175 \text{ W}; \quad T_h = 25 \degree C; \quad \text{class-B operation.} \]
U.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in linear u.h.f. amplifiers of TV transposers and transmitters in band IV-V, as well as for driver stages in tube systems.

Features:

- diffused emitter ballasting resistors for an optimum temperature profile;
- gold sandwich metallization ensures excellent reliability.

The transistor has a 3/8” capstan envelope with ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Mode of Operation</th>
<th>( f_{\text{vision}} ) MHz</th>
<th>( V_{\text{CE}} ) V</th>
<th>( I_{\text{C}} ) mA</th>
<th>( T_{\text{H}} ) °C</th>
<th>( d_{\text{im}} ) dB</th>
<th>( P_{\text{o sync}} ) W</th>
<th>( G_{\text{p}} ) dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class-A</td>
<td>860</td>
<td>25</td>
<td>850</td>
<td>70</td>
<td>-60</td>
<td>&gt; 3.5</td>
<td>&gt; 6.5</td>
</tr>
<tr>
<td>Class-A</td>
<td>860</td>
<td>25</td>
<td>850</td>
<td>25</td>
<td>-60</td>
<td>typ. 4.4</td>
<td>typ. 7.0</td>
</tr>
</tbody>
</table>

* Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Fig. 1 SOT-122.

Dimensions in mm:

- Torque on nut: min. 0.75 Nm (7.5 kg cm)
- max. 0.85 Nm (8.5 kg cm)

Diameter of clearance hole in heatsink: max. 4.2 mm.

Mounting hole to have no burrs at either end.

De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage
(peak value); \( V_{BE} = 0 \)
open base

Emitter-base voltage (open collector)

Collector current
d.c.
(peak value); \( f > 1 \text{ MHz} \)

dc.

Total power dissipation at \( T_h = 70 \text{ }^\circ\text{C} \)

Storage temperature

Operating junction temperature

---

\[
\begin{array}{|c|c|c|}
\hline
V_{CESM} & \text{max.} & 50 \text{ V} \\
V_{CEO} & \text{max.} & 27 \text{ V} \\
V_{EBO} & \text{max.} & 3.5 \text{ V} \\
\hline
I_C & \text{max.} & 2 \text{ A} \\
I_{CM} & \text{max.} & 4 \text{ A} \\
P_{\text{tot}} & \text{max.} & 21.5 \text{ W} \\
T_{\text{stg}} & -65 \text{ to } +150 \text{ }^\circ\text{C} \\
T_j & \text{max.} & 200 \text{ }^\circ\text{C} \\
\hline
\end{array}
\]

---

Fig. 2 D.C. SOAR.

Fig. 3 Power derating curve vs. temperature.

THERMAL RESISTANCE\(\) (dissipation = 21,25 W; \( T_{mb} = 82,75 \text{ }^\circ\text{C}, T_h = 70 \text{ }^\circ\text{C} \))

From junction to mounting base

From mounting base to heatsink

\[
\begin{align*}
R_{th \text{ j-mb}} &= 5.45 \text{ K/W} \\
R_{th \text{ mb-h}} &= 0.6 \text{ K/W}
\end{align*}
\]
Fig. 4  Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. \( R_{th\ mb-h} = 0,6 \text{ K/W.} \)

Example

Nominal class-A operation (without r.f. signal): \( V_{CE} = 25 \text{ V; } I_C = 850 \text{ mA; } T_h = 70 \text{ °C.} \)

Fig. 4 shows:  
- \( R_{th\ j-h} \) max. 6,05 K/W  
- \( T_j \) max. 200 °C  

Typical device:  
- \( R_{th\ j-h} \) typ. 5,35 K/W  
- \( T_j \) typ. 183 °C
CHARACTERISTICS

$T_j = 25 \, ^\circ C$ unless otherwise specified

Collector-emitter breakdown voltage

$V_{BE} = 0; \, I_C = 10 \, mA$

open base, $I_C = 25 \, mA$

Emitter-base breakdown voltage

open collector, $I_E = 5 \, mA$

D.C. current gain*

$I_C = 850 \, mA; \, V_{CE} = 25 \, V$

Collector-emitter saturation voltage*

$I_C = 500 \, mA; \, I_B = 100 \, mA$

Transition frequency at $f = 500 \, MHz^{**}$

$I_E = 850 \, mA; \, V_{CB} = 25 \, V$

Collector capacitance at $f = 1 \, MHz$

$I_E = I_e = 0; \, V_{CB} = 25 \, V$

Feedback capacitance at $f = 1 \, MHz$

$I_C = 50 \, mA; \, V_{CE} = 25 \, V$

Collector-stud capacitance

---

$V_{BR(CE)} > 50 \, V$

$V_{BR(CEO)} > 27 \, V$

$V_{BR(EBO)} > 3.5 \, V$

$h_{FE} > 15$

typ. 40

$V_{Cesat}$

typ. 0.25 \, V

$f_T$

typ. 2.5 \, GHz

$C_c$

typ. 24 \, pF

$C_{re}$

typ. 15 \, pF

$C_{cs}$

typ. 1.2 \, pF

---

$V(BR)C_E > 50 \, V$

$V(BR)C_O > 27 \, V$

$V(BR)E_O > 3.5 \, V$

$h_{FE} > 15$

typ. 40

$V_{Cesat}$

typ. 0.25 \, V

$f_T$

typ. 2.5 \, GHz

$C_c$

typ. 24 \, pF

$C_{re}$

typ. 15 \, pF

$C_{cs}$

typ. 1.2 \, pF

---

Fig. 5 Typical values; $V_{CE} = 25 \, V$.

* Measured under pulse conditions: $t_p \leq 300 \, \mu s; \, \delta \leq 0.02$.

** Measured under pulse conditions: $t_p \leq 50 \, \mu s; \, \delta \leq 0.01$. 
U.H.F. linear power transistor

**Fig. 6** Typical values; $T_j = 25 \, ^\circ\text{C}$.

**Fig. 7** $I_E = I_e = 0$; $f = 1 \, \text{MHz}$; $T_j = 25 \, ^\circ\text{C}$.

**Fig. 8** $V_{CB} = 25 \, \text{V}$; $f = 500 \, \text{MHz}$; $T_j = 25 \, ^\circ\text{C}$.

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APPLICATION INFORMATION
R.F. performance in u.h.f. class-A operation (linear power amplifier)

<table>
<thead>
<tr>
<th>$f_{\text{vision}}$ (MHz)</th>
<th>$V_{CE}$ (V)</th>
<th>$I_C$ (mA)</th>
<th>$T_h$ (°C)</th>
<th>$d_{im}$ (dB)*</th>
<th>$P_o$ sync (W)*</th>
<th>$G_p$ (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>860</td>
<td>25</td>
<td>850</td>
<td>70</td>
<td>-60</td>
<td>&gt; 3,5</td>
<td>&gt; 6,5</td>
</tr>
<tr>
<td>860</td>
<td>25</td>
<td>850</td>
<td>70</td>
<td>-60</td>
<td>typ. 3,8</td>
<td>typ. 7,0</td>
</tr>
<tr>
<td>860</td>
<td>25</td>
<td>850</td>
<td>25</td>
<td>-60</td>
<td>typ. 4,4</td>
<td>typ. 7,0</td>
</tr>
</tbody>
</table>

* Three-tone test method (vision carrier $-8$ dB, sound carrier $-7$ dB, sideband signal $-16$ dB), zero dB corresponds to peak sync level.

VSWR input < 1,1

VSWR output < 2

List of components:

- $C_1 = C_2 = 1.4$ to $5.5$ pF film dielectric trimmer (cat. no. 2222 809 09001)
- $C_3 = C_4 = 100$ nF polyester capacitor
- $C_5 = C_6 = 1$ nF feed-through capacitor
- $C_7 = 5.6$ pF ceramic capacitor
- $C_8 = 2$ to $18$ pF film dielectric trimmer (cat. no. 2222 809 09003)
- $C_9 = 2$ to $9$ pF film dielectric trimmer (cat. no. 2222 809 09002)
- $C_{10} = 10$ µF/40 V solid aluminium electrolytic capacitor
- $C_{11} = 470$ nF polyester capacitor
- $C_{12} = 2 \times 3.3$ pF chip capacitors (in parallel)

Fig. 9 Class-A test circuit at $f_{\text{vision}} = 860$ MHz.
List of components: (continued)

R1 = 150 Ω carbon resistor (0.25 W)  
R2 = 1.8 kΩ carbon resistor (0.5 W)  
R3 = 33 Ω carbon resistor (0.5 W)  
R4 = 220 Ω carbon resistor (1 W)  
R5 = 4 x 12 Ω carbon resistors in parallel (1 W each)  
R6 = 1 kΩ carbon resistor (0.25 W)  
R7 = 220 Ω carbon potentiometer (0.25 W)

L1 = stripline (13.6 mm x 6.9 mm)  
L2 = microchoke 0.47 μH (cat. no. 4322 057 04770)  
L3 = 1 turn Cu wire (1 mm); internal diameter 5.5 mm; leads 2 x 5 mm  
L4 = stripline (40.8 mm x 6.9 mm)

L1 and L4 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric ($\varepsilon_r = 2.74$); thickness 1.5 mm.

Fig. 10 Component layout and printed circuit board for 860 MHz class-A test circuit.

The circuit and the components are on one side of the PTFE fibre-glass board, the other side is unetched copper to serve as a ground-plane. Earth connections are made by hollow rivets. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.
Fig. 11 Intermodulation distortion ($d_{\text{im}}$)* and cross-modulation distortion ($d_{\text{cm}}$)** as a function of $P_{0 \text{sync}}$. Typical values; $V_{\text{CE}} = 25$ V; $I_C = 850$ mA; $-T_h = 25$ °C; $-T_h = 70$ °C; $f_{\text{vision}} = 860$ MHz.

---

* Three-tone test method (vision carrier $-8$ dB, sound carrier $-7$ dB, sideband signal $-16$ dB), zero dB corresponds to peak sync level.

Intermodulation distortion of input signal $\leq -75$ dB.

** Two-tone test method (vision carrier 0 dB, sound carrier $-7$ dB), zero dB corresponds to peak sync level.

Cross-modulation distortion ($d_{\text{cm}}$) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to $-20$ dB.
Fig. 12 Input impedance (series components).

Fig. 13 Load impedance (series components).

Fig. 14.

Conditions for Figs 12, 13 and 14:
Typical values; $V_{CE} = 25$ V; $I_C = 850$ mA; class-A operation; $T_h = 70$ °C.
H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-AB and B operated high-power mobile transmitting equipment in the h.f. band.

The transistors are resistance-stabilized and are guaranteed to withstand severe load mismatch conditions. They are supplied in matched $h_{FE}$ groups.

The transistor has a 1/2 in 4-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance at $T_h = 25 \, ^\circ C$

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE} , V$</th>
<th>$I_{C(ZS)} , A$</th>
<th>$f , MHz$</th>
<th>$P_L , W$</th>
<th>$G_p , dB$</th>
<th>$\eta_{dt} , %$</th>
<th>$d_3 , dB$</th>
<th>$d_5 , dB$</th>
</tr>
</thead>
<tbody>
<tr>
<td>s.s.b. class-AB</td>
<td>12.5</td>
<td>0.15</td>
<td>1.6-28</td>
<td>80 (P.E.P.)</td>
<td>&gt; 12.5</td>
<td>&gt; 35</td>
<td>&lt; -24</td>
<td>&lt; -24</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-121.

Torque on screw: min. 0.60 Nm (6.0 kg cm)
max. 0.75 Nm (7.5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage
(peak value); \( V_{BE} = 0 \)
open base

Emitter-base voltage (open collector)

Collector current
average
(peak value); \( f > 1 \text{ MHz} \)

D.C. power dissipation at \( T_{mb} = 25 \text{ °C} \)

R.F. power dissipation
\( f > 1 \text{ MHz}; T_{mb} = 25 \text{ °C} \)

Storage temperature

Operating junction temperature

\[ \begin{align*}
V_{CESM} & \quad \text{max.} & 36 \text{ V} \\
V_{CEO} & \quad \text{max.} & 17 \text{ V} \\
V_{EBO} & \quad \text{max.} & 4 \text{ V} \\
I_{C(AV)} & \quad \text{max.} & 18 \text{ A} \\
I_{CM} & \quad \text{max.} & 55 \text{ A} \\
P_{tot(d.c.)} & \quad \text{max.} & 154 \text{ W} \\
P_{tot(rf)} & \quad \text{max.} & 192 \text{ W} \\
T_{stg} & & -65 \text{ to } +150 \text{ °C} \\
T_{j} & \quad \text{max.} & 200 \text{ °C}
\end{align*} \]

Fig. 2 D.C. SOAR.

Fig. 3 Power/temperature derating curves.

I Continuous d.c. operation
II Continuous r.f. operation; \( (f > 1 \text{ MHz}) \)
III Short-time r.f. operation during mismatch \( (f > 1 \text{ MHz}) \)

THERMAL RESISTANCE

Dissipation = 100 W; \( T_{mb} = 25 \text{ °C} \)

From junction to mounting base
(d.c. dissipation)

From junction to mounting base
(r.f. dissipation)

From mounting base to heatsink

\[ \begin{align*}
R_{th \ j-mb(d.c.)} & = 1,00 \text{ K/W} \\
R_{th \ j-mb(rf)} & = 0,75 \text{ K/W} \\
R_{th \ mb-h} & = 0,2 \text{ K/W}
\end{align*} \]
CHARACTERISTICS

$T_j = 25 ^\circ C$

Collector-emitter breakdown voltage

$V_{BE} = 0; I_C = 50 \text{ mA}$
open base; $I_C = 100 \text{ mA}$

Emitter-base breakdown voltage

open collector; $I_E = 20 \text{ mA}$

Collector cut-off current

$V_{BE} = 0; V_{CE} = 17 \text{ V}$

Second breakdown energy; $L = 25 \text{ mH}; f = 50 \text{ Hz}$
open base

$R_{BE} = 10 \text{ } \Omega$

D.C. current gain*

$I_C = 10 \text{ A}; V_{CE} = 5 \text{ V}$

D.C. current gain ratio of matched devices*

$I_C = 10 \text{ A}; V_{CE} = 5 \text{ V}$

Collector-emitter saturation voltage*

$I_C = 25 \text{ A}; I_B = 5 \text{ V}$

Transition frequency at $f = 100 \text{ MHz}$**

$-I_E = 10 \text{ A}; V_{CB} = 12.5 \text{ V}$
$-I_E = 20 \text{ A}; V_{CB} = 12.5 \text{ V}$

Collector capacitance at $f = 1 \text{ MHz}$

$I_E = I_E = 0; V_{CE} = 12.5 \text{ V}$

Feedback capacitance at $f = 1 \text{ MHz}$

$I_C = 0; V_{CE} = 12.5 \text{ V}$

Collector-flange capacitance

$\text{Typical values:}$

$V_{(BR)CES} > 36 \text{ V}$
$V_{(BR)CEO} > 17 \text{ V}$
$V_{(BR)EBO} > 4 \text{ V}$
$I_{CES} < 20 \text{ mA}$
$E_{SBO} > 12.5 \text{ mJ}$
$E_{SBR} > 12.5 \text{ mJ}$
$h_{FE} \text{ typ. } 15 \text{ to } 80$
$h_{FE1}/h_{FE2} < 1.2$
$V_{CEsat} \text{ typ. } 1.7 \text{ V}$
$f_T \text{ typ. } 290 \text{ MHz}$
$f_T \text{ typ. } 275 \text{ MHz}$
$C_C \text{ typ. } 400 \text{ pF}$
$C_{re} \text{ typ. } 265 \text{ pF}$
$C_{cf} \text{ typ. } 4.5 \text{ pF}$

* Measured under pulse conditions: $t_p = 500 \mu s$.
** Measured under pulse conditions: $t_p = 300 \mu s; \delta = 0.02$. 

Fig. 4 $T_j = 25 ^\circ C$.

Fig. 5 $f = 100 \text{ MHz}; T_j = 25 ^\circ C$. 

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APPLICATION INFORMATION

R.F. performance in s.s.b. class-AB operation (linear power amplifier) $V_{CE} = 12.5$ V; $T_h = 25\,^\circ$C;
$f_1 = 28,000$ MHz; $f_2 = 28,001$ MHz

<table>
<thead>
<tr>
<th>output power W</th>
<th>$G_p$ dB</th>
<th>$\eta_{dt}$ %</th>
<th>$I_C$ A</th>
<th>$d_3^*$ dB</th>
<th>$d_5^*$ dB</th>
<th>$I_C(ZS)$ A</th>
</tr>
</thead>
<tbody>
<tr>
<td>80 (P.E.P.)</td>
<td>$&gt; 12.5$</td>
<td>$&gt; 35$</td>
<td>$&lt; 9.1$</td>
<td>$&lt; -24$</td>
<td>$&lt; -24$</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>typ. 14</td>
<td>typ. 40</td>
<td>typ. 7.6</td>
<td>typ. -27</td>
<td>typ. -27</td>
<td></td>
</tr>
</tbody>
</table>

* The stated intermodulation distortion levels are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

Fig. 6 $I_E = i_e = 0$; $f = 1$ MHz; $T_j = 25\,^\circ$C.

Fig. 7 $V_{CE} = 12.5$ V; typ. values.

Fig. 8 Class-AB test circuit, s.s.b.
List of components:
C1 = C2 = 270 pF film dielectric trimmer capacitor
C3 = 220 nF chip capacitor
C4 = 1 nF chip capacitor
C5 = 100 nF chip capacitor
C6 = 47 µF — 63 V electrolytic capacitor
C7 = 3 x 180 pF multilayer ceramic chip capacitors in parallel*
C8 = 2 x 150 pF (500 V) multilayer ceramic chip capacitors*
C9 = C10 = 100 pF film dielectric trimmer capacitor
C11 = 150 pF multilayer ceramic chip capacitor*

R1 = 4 x 1,2 Ω carbon resistors in parallel (4 x 0,125 W)
R2 = 27 Ω carbon resistor (0,5 W)

L1 = 3 turns Cu wire (2 mm); int. dia. 8 mm; length 9 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke (cat. no. 4312 020 36640)
L3 = L4 = 2 turns Cu wire (2 mm); int. dia. 8 mm; length 5 mm; leads 2 x 5 mm
L5 = 3 turns Cu wire (2 mm); int. dia. 8,5 mm; length 8,5 mm; length 8,5 mm; leads 2 x 5 mm

* American Technical Ceramics capacitor type 100 B or capacitor of same quality.

Fig. 9 Intermodulation distortion (see note on preceding page); typ. values.
Fig. 10 Double-tone efficiency and power gain; typ. values.

Conditions for Figs 9 and 10:
VCE = 12,5 V; IC(ZS) = 0,15 A; f1 = 28,000 MHz; f2 = 28,001 MHz; T1 = 25 °C.
Fig. 11 R.F. SOAR: s.s.b. class-AB operation; $V_{CE} = 15$ V; $R_{th\ mb-h} = 0.2$ K/W; $f_1 = 28,000$ MHz; $f_2 = 28,001$ MHz.

This graph shows the permissible output power as a function of VSWR during mismatch conditions with the heatsink temperature as parameter.

Fig. 12 Power gain.

Conditions for Figs 12 and 13:
$V_{CE} = 12.5$ V; $I_{C(ZS)} = 0.15$ A; $Z_L = 0.65$ Ω; $P_L = 80$ W (PEP); $T_h = 25\degree$ C.

The curves in Figs 12 and 13 are typical and hold for one transistor of a push-pull amplifier in s.s.b. class-AB operation.
H.F./V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for s.s.b. in class-A and AB and in f.m. transmitting applications in class-C with a supply voltage up to 28 V. The transistor is resistance stabilized and tested under severe load mismatch conditions. It has a ¼ capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>V&lt;sub&gt;CE&lt;/sub&gt;</th>
<th>f&lt;sub&gt;1&lt;/sub&gt;</th>
<th>f&lt;sub&gt;2&lt;/sub&gt;</th>
<th>P&lt;sub&gt;L&lt;/sub&gt;</th>
<th>G&lt;sub&gt;P&lt;/sub&gt;</th>
<th>d&lt;sub&gt;3&lt;/sub&gt;</th>
<th>I&lt;sub&gt;C&lt;/sub&gt;</th>
<th>η&lt;sub&gt;dt&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>s.s.b. (class-A)</td>
<td>26</td>
<td>28,000</td>
<td>28,001</td>
<td>0.8(P.E.P.)</td>
<td>&gt; 18</td>
<td>&lt; -40</td>
<td>&lt; 1.2</td>
<td>-</td>
</tr>
<tr>
<td>s.s.b. (class-AB)</td>
<td>28</td>
<td>28,000</td>
<td>28,001</td>
<td>25(P.E.P.)</td>
<td>&gt; 18</td>
<td>typ. -35</td>
<td>typ. 1.28</td>
<td>typ. 35</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>V&lt;sub&gt;CE&lt;/sub&gt;</th>
<th>f</th>
<th>P&lt;sub&gt;S&lt;/sub&gt;</th>
<th>P&lt;sub&gt;L&lt;/sub&gt;</th>
<th>G&lt;sub&gt;P&lt;/sub&gt;</th>
<th>I&lt;sub&gt;C&lt;/sub&gt;</th>
<th>η</th>
<th>Ω</th>
<th>Y&lt;sub&gt;L&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w. (class-B)</td>
<td>28</td>
<td>70</td>
<td>typ. 0.5</td>
<td>25</td>
<td>typ. 17</td>
<td>typ. 1.49</td>
<td>typ. 60</td>
<td>0.53 – j1.4</td>
<td>42.5 – j54</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-56. Dimensions in mm

Torque on nut: min. 1.5 Nm (15 kg cm) max. 1.7 Nm (17 kg cm)

Diameter of clearance hole in heatsink: max. 4.9 mm. Mounting hole to have no burrs at either end. De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
CHARACTERISTICS

$T_j = 25 \, ^\circ\text{C}$ unless otherwise specified

Breakdown voltages

Collector-base voltage
  open emitter; $I_C = 50 \, \text{mA}$
  $V_{(BR)CBO} > 65 \, \text{V}$

Collector-emitter voltage
  open base; $I_C = 50 \, \text{mA}$
  $V_{(BR)CEO} > 36 \, \text{V}$

Emitter-base voltage
  open collector; $I_E = 10 \, \text{mA}$
  $V_{(BR)EBO} > 4.0 \, \text{V}$

Transient energy

$L = 25 \, \text{mH}; \, f = 50 \, \text{Hz}$
  open base
  $-V_{BE} = 1.5 \, \text{V}; \, R_{BE} = 33 \, \Omega$
  $> \, 8 \, \text{ms}$
  $E > \, 8 \, \text{ms}$

D.C. current gain

$I_C = 1.0 \, \text{A}; \, V_{CE} = 5 \, \text{V}$
  $h_{FE}$ typ. 50
  10 to 100

Transition frequency

$I_C = 3.0 \, \text{A}; \, V_{CE} = 20 \, \text{V}$
  $f_T$ typ. 500 MHz

Collector capacitance at $f = 1 \, \text{MHz}$

$I_E = I_c = 0; \, V_{CB} = 30 \, \text{V}$
  $C_c$ typ. $< 50 \, \text{pF}$
  65 \, \text{pF}$

Feedback capacitance

$I_C = 100 \, \text{mA}; \, V_{CE} = 30 \, \text{V}$
  $-C_{re}$ typ. 31 \, \text{pF}$

Collector-stud capacitance

$C_{cs}$ typ. 2 \, \text{pF}$
RATINGS  Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter) peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current (average)
Collector current (peak value) \( f > 1 \text{ MHz} \)
Total power dissipation up to \( T_h = 25 \text{ °C} \)
\( f > 1 \text{ MHz} \)

\[
\begin{align*}
V_{CBOM} & \quad \text{max.} \quad 65 \text{ V} \\
V_{CEO} & \quad \text{max.} \quad 36 \text{ V} \\
V_{EBO} & \quad \text{max.} \quad 4.0 \text{ V} \\
I_{C(AV)} & \quad \text{max.} \quad 3.0 \text{ A} \\
I_{CM} & \quad \text{max.} \quad 6.0 \text{ A} \\
P_{\text{tot}} & \quad \text{max.} \quad 62.5 \text{ W}
\end{align*}
\]

Storage temperature
Operating junction temperature

THERMAL RESISTANCE
From junction to mounting base
From mounting base to heatsink

\[
\begin{align*}
T_{\text{stg}} & \quad -30 \text{ to } +200 \text{ °C} \\
T_{j} & \quad \text{max.} \quad 200 \text{ °C} \\
R_{\text{th j-mb}} & \quad = \quad 2.5 \text{ K/W} \\
R_{\text{th mb-h}} & \quad = \quad 0.3 \text{ K/W}
\end{align*}
\]
H.F./V.H.F. power transistor

BLX13

- $V_{CE}=28\,\text{V}$
- $T_0=25^\circ\text{C}$

Graph showing $V_{BE}$ (V) vs. $I_C$ (A) with typical characteristics.
APPLICATION INFORMATION

R.F. performance in S.S. B. operation (linear power amplifier)

\[ V_{CE} = 26 \text{ V}; \ T_h \leq 25 \text{ °C} \]
\[ f_1 = 28.000 \text{ MHz}; \ f_2 = 28.001 \text{ MHz} \]

<table>
<thead>
<tr>
<th>output power (W)</th>
<th>( G_d ) (dB)</th>
<th>( d_3 ) (dB)</th>
<th>( I_C ) (A)</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-8 (PEP)</td>
<td>&gt; 18</td>
<td>&lt; -40</td>
<td>&lt; 1.2</td>
<td>A</td>
</tr>
</tbody>
</table>

Test circuit:

S.S.B.

class A

L1 = 3 turns enamelled Cu wire (1.5 mm); winding pitch 2.5 mm; int. diam. 7 mm leads 50 mm totally
L2 = 7 turns enamelled Cu wire (0.7 mm) on 3H1 toroid; 60 µH (code number of 3H1: 4322 020 36620)
L3 = 4 turns enamelled Cu wire (1.5 mm); winding pitch 2.5 mm; int. diam. 10 mm
L4 = 7 turns enamelled Cu wire (1.5 mm); winding pitch 2.5 mm; int. diam. 12 mm

Detailed information for a wide band application
1.6 to 28 MHz available on request

\[ 1 \) Stated figures are maxima encountered at any driving level between the specified values of PEP and are referred to the according level of either of the equal ampl. tones. Relative to the according peak envelope power these figures should be increased by 6 dB.\]
H.F./V.H.F. power transistor

-35
-40
-45
-50

\[ d_3 \text{ (dB)} \]

\[ V_{CE} = 26 \text{V} \]
\[ T_{th} = 70^\circ \text{C} \]
\[ R_{th mb-h} = 0.3^\circ \text{C/W} \]

\[ I_C = 0.8 \text{A} - 1.0 \text{A} - 1.2 \text{A} \]

P.E.P. (W) 0 5 10
**APPLICATION INFORMATION**

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

\[ V_{CE} = 28 \text{ V}; f_1 = 28,000 \text{ MHz}; f_2 = 28,001 \text{ MHz} \]

<table>
<thead>
<tr>
<th>output power</th>
<th>( \text{W} )</th>
<th>( G_p )</th>
<th>( \eta_{dt} )</th>
<th>( I_C )</th>
<th>( d_3^* )</th>
<th>( I_C(ZS) )</th>
<th>( T_h )</th>
<th>( \theta_C )</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 (P.E.P.)</td>
<td>&gt; 18</td>
<td>typ. 35</td>
<td>typ. 1,28</td>
<td>typ. –35</td>
<td>25</td>
<td>25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Test circuit; s.s.b. class-AB.](image)

**Fig. 9** Test circuit; s.s.b. class-AB.

List of components:

- \( L_1 = 3 \text{ turns enamelled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 7,0 mm; leads 50 mm (total)} \)
- \( L_2 = 7 \text{ turns enamelled Cu wire (0,7 mm) on 3H1 toroid; 60 } \mu \text{H (cat. no. of 3H1: 4322 020 36620)} \)
- \( L_3 = 4 \text{ turns enamelled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 10 mm} \)
- \( L_4 = 7 \text{ turns enamelled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 12 mm} \)

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.
H.F./V.H.F. power transistor

BLX13

Conditions:

\[ P_L = 25 \text{ W PEP} \]
\[ V_{CC} = 28 \text{ V} \]
\[ I_{CZS} = 25 \text{ mA} \]
\[ Z_L = 12.5 \Omega \]
\[ T_h = 25 \degree \text{C} \]
Conditions:

\( P_L = 25 \text{ W PEP} \)
\( V_{CC} = 28 \text{ V} \)
\( I_{CZS} = 25 \text{ mA} \)
\( Z_L = 12.5 \Omega \)
\( T_h = 25 \degree C \)
**APPLICATION INFORMATION**

R.F. performance in c.w. operation (class B)

\[ \text{V}_{CC} = 28 \text{ V}; \ T_h \text{ up to } 25^\circ\text{C} \]

<table>
<thead>
<tr>
<th>f (MHz)</th>
<th>( P_S ) (W)</th>
<th>( P_L ) (W)</th>
<th>( I_C ) (A)</th>
<th>( G_P ) (dB)</th>
<th>( \eta ) (%)</th>
<th>( Z_i ) (Ω)</th>
<th>( \overline{V_L} ) (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>typ. 0.5</td>
<td>25</td>
<td>typ. 1.49</td>
<td>typ. 17</td>
<td>typ. 60</td>
<td>0.53-j1.4</td>
<td>42.5-j34</td>
</tr>
</tbody>
</table>

Test circuit:

\[ L_1 = 93 \text{ nH}; 3 \text{ turns enameled Cu wire (1.5 mm); int. diam. 10 mm; length 8 mm;} \]
\[ L_2 = 147 \text{ nH}; 5 \text{ turns enameled Cu wire (1.5 mm); int. diam. 9 mm; length 14 mm;} \]
\[ L_3 = 118 \text{ nH}; 4 \text{ turns enameled Cu wire (1.5 mm); int. diam. 9 mm; length 10.5 mm;} \]
\[ L_4 = \text{FXC choke (code number 4312 020 36640)} \]
For high voltage operation, a stabilized power supply is generally used. The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heatsink temperature as parameter.
H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in transmitting amplifiers operating in the h.f. and v.h.f. bands, with a nominal supply voltage of 28 V. The transistor is specified for s.s.b. applications as linear amplifier in class-A and AB. The device is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

Matched $h_FE$ groups are available on request.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Mode of Operation</th>
<th>$V_CE_V$</th>
<th>$f_{MHz}$</th>
<th>$P_L_W$</th>
<th>$G_P_{dB}$</th>
<th>$\eta_{dt_{%}}$</th>
<th>$I_C_{A}$</th>
<th>$d_3_{dB}$</th>
<th>$T_H^OC$</th>
</tr>
</thead>
<tbody>
<tr>
<td>s.s.b. (class-A)</td>
<td>26</td>
<td>1.6-28</td>
<td>0-8 (P.E.P.)</td>
<td>&gt; 20</td>
<td>-</td>
<td>1,25</td>
<td>&lt; -40</td>
<td>70</td>
</tr>
<tr>
<td>s.s.b. (class-AB)</td>
<td>28</td>
<td>1.6-28</td>
<td>3-25 (P.E.P.)</td>
<td>typ. 21</td>
<td>typ. 45</td>
<td>typ. 1,0</td>
<td>typ. -30</td>
<td>25</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-120.

Torque on nut: min. 0,75 Nm (7,5 kg cm) max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.

Mounting hole to have no burrs at either end.

De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0)
- peak value

Collector-emitter voltage (open base)
Emitter-base voltage (open-collector)
Collector current (average)
Collector current (peak value); f > 1 MHz
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C
Storage temperature
Operating junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-emitter voltage (peak value)</td>
<td>V_{CESM}</td>
<td>max.</td>
<td>65 V</td>
</tr>
<tr>
<td>Collector-emitter voltage (open base)</td>
<td>V_{CEO}</td>
<td>max.</td>
<td>36 V</td>
</tr>
<tr>
<td>Emitter-base voltage (open-collector)</td>
<td>V_{EBO}</td>
<td>max.</td>
<td>4 V</td>
</tr>
<tr>
<td>Collector current (average)</td>
<td>I_{C(AV)}</td>
<td>max.</td>
<td>3 A</td>
</tr>
<tr>
<td>Collector current (peak value); f &gt; 1 MHz</td>
<td>I_{CM}</td>
<td>max.</td>
<td>9 A</td>
</tr>
<tr>
<td>R.F. power dissipation (f &gt; 1 MHz); T_{mb} = 25 °C</td>
<td>P_{rf}</td>
<td>max.</td>
<td>73 W</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>T_{stg}</td>
<td>-65 to +150 °C</td>
<td></td>
</tr>
<tr>
<td>Operating junction temperature</td>
<td>T_{j}</td>
<td>max.</td>
<td>200 °C</td>
</tr>
</tbody>
</table>

Fig. 2 D.C. SOAR.

Fig. 3 R.F. power dissipation; V_{CE} ≤ 28 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operating during mismatch

THERMAL RESISTANCE (dissipation = 32,5 W; T_{mb} = 85 °C, i.e. T_{h} = 70 °C)

From junction to mounting base (d.c. dissipation)
\[ R_{th \ j-mb (dc)} = 3,55 \ K/W \]
From junction to mounting base (r.f. dissipation)
\[ R_{th \ j-mb (rf)} = 2,65 \ K/W \]
From mounting base to heatsink
\[ R_{th \ mb-h} = 0,45 \ K/W \]
CHARACTERISTICS

$T_j = 25 \, ^\circ C$ unless otherwise specified

Collector-emitter breakdown voltage

$V_{BE} = 0; \, I_C = 10 \, mA$

Collector-emitter breakdown voltage

open base; $I_C = 50 \, mA$

Emitter-base breakdown voltage

open collector; $I_E = 10 \, mA$

Collector cut-off current

$V_{BE} = 0; \, V_{CE} = 36 \, V$

Second breakdown energy; $L = 25 \, mH; \, f = 50 \, Hz$

open base

$R_{BE} = 10 \, \Omega$

D.C. current gain *

$I_C = 1,25 \, A; \, V_{CE} = 5 \, V$

D.C. current gain ratio of matched devices *

$I_C = 1,25 \, A; \, V_{CE} = 5 \, V$

Collector-emitter saturation voltage *

$I_C = 3,75 \, A; \, I_B = 0,75 \, A$

Transition frequency at $f = 100 \, MHz$

$-I_E = 1,25 \, A; \, V_{CB} = 28 \, V$

$-I_E = 3,75 \, A; \, V_{CB} = 28 \, V$

Collector capacity at $f = 1 \, MHz$

$I_E = I_e = 0; \, V_{CE} = 28 \, V$

Feedback capacitance at $f = 1 \, MHz$

$I_C = 100 \, mA; \, V_{CE} = 28 \, V$

Collector-stud capacitance

$V_{(BR)CES} > 65 \, V$

$V_{(BR)CEO} > 36 \, V$

$V_{(BR)EBO} > 4 \, V$

$I_{CES} < 4 \, mA$

$E_{SBO} > 8 \, mJ$

$E_{SBR} > 8 \, mJ$

$h_{FE}$ typ. 50

10 to 100

$h_{FE1}/h_{FE2} < 1,2$

$V_{CEsat}$ typ. 1,5 V

$f_T$ typ. 530 MHz

$f_T$ typ. 530 MHz

$C_C$ typ. 50 pF

$C_{re}$ typ. 31 pF

$C_{cs}$ typ. 2 pF

* Measured under pulse conditions: $t_p \leq 200 \, \mu s; \, \delta \leq 0,02$. 

Fig. 4 Typical values; $V_{CE} = 28 \, V$. 

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Fig. 5 Typical values; $T_j = 25^\circ$C.

Fig. 6 $I_E = I_C = 0; f = 1$ MHz; $T_j = 25^\circ$C.

Fig. 7 Typical values; $f = 100$ MHz; $T_j = 25^\circ$C.
APPLICATION INFORMATION

R.F. performance in s.s.b. class-A operation (linear power amplifier)

\[ V_{CE} = 26 \text{ V} \; ; \; f_1 = 28,000 \text{ MHz} \; ; \; f_2 = 28,001 \text{ MHz} \]

<table>
<thead>
<tr>
<th>output power W</th>
<th>( G_p ) dB</th>
<th>( I_C ) A</th>
<th>( d_3 ) dB *</th>
<th>( d_5 ) dB *</th>
<th>( T_h ) °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 8 (P.E.P.)</td>
<td>&gt; 20</td>
<td>1,25</td>
<td>-40</td>
<td>&lt; -40</td>
<td>70</td>
</tr>
<tr>
<td>typ. 10 (P.E.P.)</td>
<td>typ. 24</td>
<td>1,25</td>
<td>-40</td>
<td>&lt; -40</td>
<td>25</td>
</tr>
</tbody>
</table>

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

Fig. 8 Test circuit; s.s.b. class-A.

List of components on page 6.
List of components in Fig. 8:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = 22 nF ceramic capacitor (63 V)
C4 = 47 µF/10 V electrolytic capacitor
C5 = 56 pF ceramic capacitor (500 V)
C6 = 47 µF/35 V electrolytic capacitor
C7 = C8 = 220 nF polyester capacitor
C9 = 10 µF/35 V electrolytic capacitor
C10 = 10 to 210 pF film dielectric trimmer
C11 = 15 to 575 film dielectric trimmer

L1 = 3 turns closely wound enamelled Cu wire (1.6 mm); int. dia. 9.0 mm; leads 2 x 5 mm
L2 = L3 = Ferroxcube wide-band h.f. choke, grade 38 (cat. no. 4312 020 36640)
L4 = 11 turns closely wound enamelled Cu wire (1.6 mm); int. dia. 11.0 mm
L5 = 14 turns closely enamelled Cu wire (1.6 mm); int. dia. 11.0 mm

R1 = 600 Ω; parallel connection of 2 x 1,2 kΩ carbon resistors (± 5%; 0.5 W each)
R2 = 15 Ω carbon resistor (± 5%; 0.25 W)
R3 = 1,2 Ω parallel connection of 4 x 4,7 Ω carbon resistors (± 5%; 0.125 W each)
R4 = 33 Ω carbon resistor (± 5%; 0.25 W)
R5 = 18 Ω carbon resistor (± 5%; 0.25 W)
R6 = 120 Ω wirewound resistor (± 5%; 5.5 W)
R7 = 1 Ω carbon resistor (± 5%; 0.125 W)
R8 = 47 Ω wirewound potentiometer (3 W)
R9 = 1,57 Ω; parallel connection of 3 x 4.7 Ω wirewound resistors (± 5%; 5.5 W each)

---

Fig. 9 Intermodulation distortion as a function of output power.
Typical values; \( V_{CE} = 26 \text{ V}; f_1 = 28,000 \text{ MHz}; f_2 = 28,001 \text{ MHz}; \)

\[ T_h = 70 \, ^\circ \text{C}; \quad \cdots \cdots \quad T_h = 25 \, ^\circ \text{C}. \]
**H.F./V.H.F. power transistor**

**BLX13C**

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

\[ V_{CE} = 28 \text{ V}; f_1 = 28,000 \text{ MHz}; f_2 = 28,001 \text{ MHz} \]

<table>
<thead>
<tr>
<th>output power W</th>
<th>( G_d ) dB</th>
<th>( \eta_{dt} ) (%) at 25 W P.E.P.</th>
<th>( I_C ) (A)</th>
<th>( d_3 ) dB</th>
<th>( d_5 ) dB*</th>
<th>( I_C(ZS) ) mA</th>
<th>( T_h ) °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 to 25 (P.E.P.)</td>
<td>typ. 21</td>
<td>typ. 45</td>
<td>typ. 1,0</td>
<td>typ. -30</td>
<td>&lt; -30</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>3 to 22 (P.E.P.)</td>
<td>typ. 21</td>
<td>-</td>
<td>-</td>
<td>typ. -30</td>
<td>&lt; -30</td>
<td>25</td>
<td>70</td>
</tr>
</tbody>
</table>

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

**List of components:**

- \( C_1 = C_2 = 10 \text{ to } 780 \text{ pF film dielectric trimmer} \)
- \( C_3 = C_5 = C_6 = 220 \text{ nF polyester capacitor} \)
- \( C_4 = 56 \text{ pF ceramic capacitor (500 V)} \)
- \( C_7 = C_8 = 15 \text{ to } 575 \text{ pF film dielectric trimmer} \)

- \( L_1 = 4 \text{ turns closely wound enamelled Cu wire (1,6 mm); int. dia. 7,0 mm; leads } 2 \times 5 \text{ mm} \)
- \( L_2 = \text{ Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)} \)
- \( L_3 = 4 \text{ turns enamelled Cu wire (1,6 mm); int. dia. 10 mm; length } 9,4 \text{ mm; leads } 2 \times 5 \text{ mm} \)
- \( L_4 = 7 \text{ turns enamelled Cu wire (1,6 mm); int. dia. 12 mm; length } 17,2 \text{ mm; leads } 2 \times 5 \text{ mm} \)

- \( R_1 = 1,2 \Omega; \text{ parallel connection of } 4 \times 4,7 \Omega \text{ carbon resistors} \)
- \( R_2 = 39 \Omega \text{ carbon resistor} \)

**Fig. 10** Test circuit; s.s.b. class-AB.
Fig. 11 Intermodulation distortion as a function of output power. *

Conditions for Fig. 11:
\[ V_{CE} = 28 \text{ V}; \quad I_{C(ZS)} = 25 \text{ mA}; \quad f_1 = 28,000 \text{ MHz}; \quad f_2 = 28,001 \text{ MHz}; \] typical values.

Fig. 12 Double-tone efficiency and power gain as a function of output power.

Conditions for Fig. 12:
\[ V_{CE} = 28 \text{ V}; \quad I_{C(ZS)} = 25 \text{ mA}; \quad f_1 = 28,000 \text{ MHz}; \quad f_2 = 28,001 \text{ MHz}; \quad T_h = 25 \, ^\circ\text{C}; \] typical values.

* See note on previous page.
Fig. 13 Power gain as a function of frequency.  
Fig. 14 Input impedance (series components) as a function of frequency.

Figs 13 and 14 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:

\( V_{CE} = 28 \text{ V} \); \( I_{C(ZS)} = 25 \text{ mA} \); \( P_L = 25 \text{ W} \); \( T_h = 25 \text{ °C} \); \( Z_L = 12 \Omega \).

Ruggedness in s.s.b. operation

The BLX13C is capable of withstanding a load mismatch (VSWR = 50) under the following conditions:

\( f_1 = 28,000 \text{ MHz} \); \( f_2 = 28,001 \text{ MHz} \); \( V_{CE} = 28 \text{ V} \); \( T_h = 70 \text{ °C} \) and \( P_L = 30 \text{ W (P.E.P.)} \).
H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in class-A, AB and B operated transmitting equipment in the h.f. and v.h.f. band.

- rated for 50 W P.E.P. at 1,6 MHz to 28 MHz (intermodulation distortion better than -30 dB); full load mismatch permissible at stud temperatures up to 70 °C
- rated at 50 W for frequencies up to 70 MHz in c.w. operation
- supply voltage 28 V
- plastic stripline package

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>V_{CE} V</th>
<th>f MHz</th>
<th>P_{L} W</th>
<th>G_{D} dB</th>
<th>d_{3} dB</th>
<th>I_{C(ZS)} A</th>
</tr>
</thead>
<tbody>
<tr>
<td>s.s.b. (class-A)</td>
<td>28</td>
<td>1,6</td>
<td>28</td>
<td>15 (P.E.P.)</td>
<td>&gt; 13</td>
<td>typ. -40</td>
</tr>
<tr>
<td>s.s.b. (class-AB)</td>
<td>28</td>
<td>1,6</td>
<td>28</td>
<td>7,5-50 (P.E.P.)</td>
<td>&gt; 13</td>
<td>&lt; -30</td>
</tr>
<tr>
<td>c.w. (class-B)</td>
<td>28</td>
<td>70</td>
<td>28</td>
<td>7,5</td>
<td>&lt; 13</td>
<td>&lt; -30</td>
</tr>
<tr>
<td>c.w. (class-B)</td>
<td>28</td>
<td>30</td>
<td>28</td>
<td>50</td>
<td>&gt; 7,5</td>
<td>typ. 16</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-55.

Dimensions in mm

- Torque on nut: min. 2,3 Nm (23 kg cm)
  max. 2,7 Nm (27 kg cm)

- Diameter of clearance hole in heatsink: max. 6,4 mm.
- Mounting hole to have no burrs at either end.
- De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
**RATINGS** Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter) peak value
Collector-emitter voltage \( (R_{BE} = 10 \, \Omega) \) peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current (average)
Collector current (peak value) \( f > 1 \, \text{MHz} \)
Total power dissipation up to \( T_h = 25 \, ^\circ\text{C} \) \( f > 1 \, \text{MHz} \)

\[
\begin{align*}
V_{CBOM} & \quad \text{max.} \quad 85 \, \text{V} \\
V_{CERM} & \quad \text{max.} \quad 85 \, \text{V} \\
V_{CEO} & \quad \text{max.} \quad 36 \, \text{V} \\
V_{EBO} & \quad \text{max.} \quad 4.0 \, \text{V} \\
I_{CAV} & \quad \text{max.} \quad 4.0 \, \text{A} \\
I_{CM} & \quad \text{max.} \quad 12 \, \text{A} \\
P_{tot} & \quad \text{max.} \quad 88 \, \text{W}
\end{align*}
\]

**THERMAL RESISTANCE**
From junction to mounting base
From mounting base to heatsink

\[
\begin{align*}
T_{Stg} & \quad -65 \text{ to } +200 \, ^\circ\text{C} \\
T_j & \quad \text{max.} \quad +200 \, ^\circ\text{C} \\
R_{th \ j-mb} & = 1.8 \, \text{K/W} \\
R_{th \ mb-h} & = 0.2 \, \text{K/W}
\end{align*}
\]
CHARACTERISTICS

\[ T_j = 25 \, ^\circ\text{C} \]

Collector-base breakdown voltage
open emitter; \( I_C = 25 \, \text{mA} \)

\[ V(BR)_{CBO} > 85 \, \text{V} \]

Collector-emitter breakdown voltage
\( R_{BE} = 10 \, \Omega; \ I_C = 25 \, \text{mA} \)
open base; \( I_C = 50 \, \text{mA} \)

\[ V(BR)_{CER} > 85 \, \text{V} \]

\[ V(BR)_{CEO} > 36 \, \text{V} \]

Emitter-base breakdown voltage
open collector; \( I_E = 10 \, \text{mA} \)

\[ V(BR)_{EBO} > 4.0 \, \text{V} \]

Collector-emitter saturation voltage
\( I_C = 0.7 \, \text{A}; \ I_B = 0.14 \, \text{A} \)
open base

\[ V_{CESat} < 1.0 \, \text{V} \]

Second breakdown energy; \( L = 25 \, \text{mH}; f = 50 \, \text{Hz} \)
open base

\[ E_{SBO} > 8 \, \text{mJ} \]

\[ E_{SBR} > 8 \, \text{mJ} \]

D.C. current gain
\( I_C = 1.4 \, \text{A}; \ V_{CE} = 6 \, \text{V} \)

\[ hFE \quad 15 \text{ to } 100 \]

Transition frequency
\( I_C = 3.0 \, \text{A}; \ V_{CE} = 20 \, \text{V} \)

\[ f_T \quad \text{typ.} \quad 250 \, \text{MHz} \]

Collector capacitance at \( f = 1 \, \text{MHz} \)
\( I_E = I_E = 0; \ V_{CB} = 30 \, \text{V} \)

\[ C_c \quad \text{typ.} \quad 115 \, \text{pF} \]

\[ C_c \quad < \quad 125 \, \text{pF} \]

Feedback capacitance at \( f = 1 \, \text{MHz} \)
\( I_C = 100 \, \text{mA}; \ V_{CE} = 30 \, \text{V} \)

\[ C_r \quad \text{typ.} \quad 90 \, \text{pF} \]

\[ C_s \quad \text{typ.} \quad 3.5 \, \text{pF} \]

Collector-stud capacitance
R.F. performance in s.s.b. class-AB operation (linear power amplifier)

\[ V_{CE} = 28 \, \text{V}; \quad f_1 = 28,000 \, \text{MHz}; \quad f_2 = 28,001 \, \text{MHz} \]

<table>
<thead>
<tr>
<th>output power W</th>
<th>Gp (dB)</th>
<th>( \eta_{dt} ) (%)</th>
<th>Ic (A)</th>
<th>( d_3^* ) (dB)</th>
<th>( d_5^* ) (dB)</th>
<th>Ic(ZS) (A)</th>
<th>( T_h ) (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.5 to 50 (P.E.P.)</td>
<td>&gt;13</td>
<td>&gt;35</td>
<td>&lt;2.55</td>
<td>&lt;−30</td>
<td>&lt;−30</td>
<td>0.1</td>
<td>25</td>
</tr>
</tbody>
</table>

At temperatures up to 90 °C the output power relative to that at 25 °C is diminished by –40 mW/K.

The transistor is designed to withstand a full load mismatch operating under 50 W P.E.P. at

\[ V_{CE} = 28 \, \text{V} \] and \( T_h = 70 \, \text{°C} \).

List of components:

- \( L_1 = 3 \) turns enamelled Cu wire (1.5 mm); winding pitch 2.5 mm; int. dia. 7.0 mm; leads 50 mm (total)
- \( L_2 = 7 \) turns enamelled Cu wire (0.7 mm) on 3H1 toroid; 60 \( \mu \)H (cat. no. of 3H1 4322 020 36620)
- \( L_3 = 4 \) turns enamelled Cu wire (1.5 mm); winding pitch 2.5 mm; int. dia. 10 mm
- \( L_4 = 7 \) turns enamelled Cu wire (1.5 mm); winding pitch 2.5 mm; int. dia. 12 mm

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.
S.S.B. class AB operation

- $P_L = 50 \text{ W PEP}$
- $V_{CC} = 28 \text{ V}$
- $I_C = 100 \text{ mA}$
- $Z_L = 6.25 \Omega$
- $T_h = 25 ^\circ \text{C}$

The drawn curve holds for an unneutralized amplifier.

The dashed curve holds for a push-pull amplifier with cross neutralization. Collector-base neutralizing capacitor: 82 pF
S.S.B. class AB operation

$P_L = 50 \text{ W PEP}$

$V_{CC} = 28 \text{ V}$

$I_C = 100 \text{ mA}$

$Z_L = 6.25 \Omega$

$T_h = 25 \text{ °C}$

The upper graph holds for a push-pull amplifier with cross neutralization.
Collector-base neutralizing capacitor: 82 pF

The lower graph holds for an unneutralized amplifier.
APPLICATION INFORMATION (continued)

R.F. performance in s.s.b. operation (linear power amplifier)

\( V_{CC} = 28 \, V; T_h \) up to 25 \( ^\circ\)C
\( f_1 = 28,000 \, MHz; f_2 = 28,001 \, MHz \)

<table>
<thead>
<tr>
<th>output power (W)</th>
<th>( G_p ) (dB)</th>
<th>( d_3 ) (dB)</th>
<th>( d_5 ) (dB)</th>
<th>( I_C ) (A)</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 PEP</td>
<td>&gt; 13</td>
<td>typ. -40</td>
<td>typ. -45</td>
<td>2.0</td>
<td>A</td>
</tr>
</tbody>
</table>

Test circuit:

**S.S.B. class-A**

- **L1** = 3 turns enameled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 7 mm leads 50 mm totally
- **L2** = 7 turns enameled Cu wire (0,7 mm) on 3H1 toroid; 60 \( \mu H \)
  - (code number of 3H1: 4322 020 36620)
- **L3** = 4 turns enameled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 10 mm
- **L4** = 7 turns enameled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 12 mm

---

[Graphs and diagrams showing typical values and performance characteristics]
APPLICATION INFORMATION

R.F. performance in c.w. operation (class B)

\[ V_{CC} = 28 \text{ V}; \, T_h \text{ up to } 25 ^\circ \text{C} \]

<table>
<thead>
<tr>
<th>( f ) (MHz)</th>
<th>( P_S ) (W)</th>
<th>( P_L ) (W)</th>
<th>( I_C ) (A)</th>
<th>( G_p ) (dB)</th>
<th>( \eta ) (%)</th>
<th>( z_1 ) (( \Omega ))</th>
<th>( V_L ) (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>&lt; 8.9</td>
<td>50</td>
<td>&lt; 3.25</td>
<td>&gt; 7.5</td>
<td>&gt; 55</td>
<td>1.0 + j0.2</td>
<td>120 - j75</td>
</tr>
<tr>
<td>50</td>
<td>typ. 4</td>
<td>50</td>
<td>typ. 3.25</td>
<td>typ. 11</td>
<td>typ. 55</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>30</td>
<td>typ. 1.2</td>
<td>50</td>
<td>typ. 3.25</td>
<td>typ. 16</td>
<td>typ. 55</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

At temperatures up to 90 °C the output power relative to that at 25 °C is diminished by a factor \(-40 \text{ mW/K}\)

Test circuit:

**C.W. 70 MHz**

- \( L_1 = 60 \text{ mm straight enamelled Cu wire (1.5 mm); 9 mm above chassis} \)
- \( L_2 = \text{FXC choke coil (code number 4322 020 36640)} \)
- \( L_3 = 2 \text{ turns enamelled Cu wire (1.5 mm); winding pitch 2 mm; internal diam. 10 mm; leads 55 mm totally} \)
- \( L_4 = 3 \text{ turns enamelled Cu wire (1.5 mm); winding pitch 2.5 mm; internal diam. 10 mm; leads 50 mm totally} \)
H.F./V.H.F. power transistor

BLX14

Typical values

[Graph showing characteristics of the transistor with various axes and curves]

- $V_{CE} = 28V$
- $f = 70MHz$
- $T_{th} = 25^\circ C$

Typical values for different power levels and voltages at $f = 70MHz$ and $T_{th} = 25^\circ C$.

Power Levels

- $P_L = 5W$
- $P_L = 2.5W$

Voltage Levels

- $V_{CE} = 28V$
- $V_{CE} = 24V$
- $V_{CE} = 13.5V$
- $V_{CE} = 12V$

Temperature vs. Power Levels

- $\frac{\Delta P_L}{\Delta T_{th}} = -40mW/\degree C$

Graph showing the relationship between temperature and power levels with a typical slope.

May 1971

805
For high voltage operation, a stabilized power supply generally used. The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heatsink temperature as parameter.
OPERATING NOTE  Below 50 MHz a base-emitter resistor of 6.8 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.
H.F./V.H.F. POWER TRANSISTOR

Silicon n-p-n power transistor for use in industrial and military s.s.b. and c.w. equipment operating in the h.f. and v.h.f. band:
- rated for 150 W P.E.P. at 1,6 MHz to 28 MHz
  (intermodulation distortion better than 30 dB down)
- rated at 150 W output power for frequencies up to 108 MHz in c.w. operation
- supply voltage up to 50 V
- plastic encapsulated stripline package
- delivered in matched hFE groups

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>f MHz</th>
<th>$P_L$ W</th>
<th>$G_p$ dB</th>
<th>$d_3$ dB</th>
<th>$I_C(ZS)$ A</th>
</tr>
</thead>
<tbody>
<tr>
<td>s.s.b. (class-AB)</td>
<td>50</td>
<td>1,6 to 28</td>
<td>20 to 150 (P.E.P.)</td>
<td>&gt; 14</td>
<td>&lt; -30</td>
<td>0,10</td>
</tr>
<tr>
<td>s.s.b. (class-A)</td>
<td>40</td>
<td>1,6 to 28</td>
<td>typ. 30 (P.E.P.)</td>
<td>&gt; 14</td>
<td>&lt; -40</td>
<td>2,5</td>
</tr>
<tr>
<td>c.w. (class-B)</td>
<td>50</td>
<td>70</td>
<td>150</td>
<td>&gt; 10</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>c.w. (class-B)</td>
<td>50</td>
<td>108</td>
<td>150</td>
<td>typ. 7,4</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-55.

When locking is required an adhesive is preferred instead of a lock washer.
Torque on nut: min. 2,3 Nm
(23 kg cm)
max. 2,7 Nm
(27 kg cm)

Diameter of clearance hole in heatsink: max.6,4 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter)  
peak value

Collector-emitter voltage ($R_{BE} = 10\Omega$)  
peak value

Collector-emitter voltage (open base)

Emitter-base voltage (open collector)

Collector current (average)

Collector current (peak value) $f > 1$ MHz

Storage temperature
Junction temperature

THERMAL RESISTANCE

From junction to mounting base
From mounting base to heatsink
CHARACTERISTICS

$T_j = 25 \, ^\circ C$ unless otherwise specified

Breakdown voltages

Collector-base voltage
\[ V_{(BR)CB} > 110 \, V \]
open emitter; $I_C = 100 \, mA$

Collector-emitter voltage
\[ V_{(BR)CE} > 110 \, V \]
$R_{BE} = 5 \, \Omega$; $I_C = 100 \, mA$

Collector-emitter voltage
\[ V_{(BR)CEO} > 53 \, V \]
open base; $I_C = 100 \, mA$

Emitter-base voltage
\[ V_{(BR)EBO} > 4.0 \, V \]
open collector; $I_E = 20 \, mA$

Transient energy
\[ L = 25 \, mH; f = 50 \, Hz \]
open base
\[ E > 12.5 \, ms \]
$V_{BE} = 1.5 \, V; R_{BE} = 33 \, \Omega$

D.C. current gain
\[ h_{FE} \]
$I_C = 1.4 \, A; V_{CE} = 6 \, V$

D.C. current gain ratio of matched devices
\[ h_{FE1}/h_{FE2} < 1.2 \]
$I_C = 1.4 \, A; V_{CE} = 6 \, V$

Transition frequency
\[ f_T \]
$C_C \]
typ. 185 \, pF$
$I_C = 6.0 \, A; V_{CE} = 35 \, V$
typ. 275 \, MHz$
$C_{re} \]
typ. 115 \, pF$
$I_E = I_e = 0; V_{CB} = 50 \, V$
typ. 3.5 \, pF$
$C_{cs}$
APPLICATION INFORMATION

R.F. performance in s.s.b. operation (linear power amplifier)

\[ T_h \leq 25 \, ^\circ\text{C} \]

\[ f_1 = 28,000 \, \text{MHz}; f_2 = 28,001 \, \text{MHz} \]

<table>
<thead>
<tr>
<th>output power (W)</th>
<th>( P_{\text{DP}} ) (dB)</th>
<th>( \eta_{\text{dt}} ) (%)</th>
<th>( d_3 ) (dB) ( 1) )</th>
<th>( d_5 ) (dB) ( 1) )</th>
<th>( I_{\text{C,ZS}} ) (A)</th>
<th>( I_C ) (A)</th>
<th>( V_{\text{CE}} ) (V)</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 to 150 (PEP)</td>
<td>( &gt; 14 )</td>
<td>( &gt; 37.5 )</td>
<td>( &lt; -30 )</td>
<td>( &lt; -30 )</td>
<td>0.10</td>
<td>( &lt; 4 )</td>
<td>50</td>
<td>AB</td>
</tr>
<tr>
<td>typ. 30 (PEP)</td>
<td>( &gt; 14 ) typ. 15</td>
<td>( &lt; -40 )</td>
<td>( &lt; -40 )</td>
<td>2.5</td>
<td>-</td>
<td>40</td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>

S.S.B. test circuit class AB, \( f = 28 \, \text{MHz} \)

1) Stated figures are maxima encountered at any driving level between the specified values of PEP and are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope power these figures should be increased by 6 dB.
APPLICATION INFORMATION (continued)

List of components:

Tr1 = BD135
Tr2 = BD228

C1 = C10 = 100 pF air dielectric capacitor (single insulated rotor type)
C2 = C6 = 27 pF ceramic capacitor
C3 = 180 pF ceramic capacitor
C4 = C13 = 100 pF air dielectric capacitor (single non-insulated rotor)
C5 = C7 = 3.9 nF polyester capacitor (±10%)
C8 = C14 = C15 = 100 nF polyester capacitor (±10%)
C9 = 2.2 μF moulded metallized polyester capacitor
C11 = 68 pF ceramic capacitor
C12 = 220 pF ceramic capacitor

L1 = 88 nH; 3 turns Cu wire (1.0 mm); internal diameter 9 mm; coil length 6.1 mm; leads 2 x 5 mm
L2 = L5 = ferroxcube bead, grade 3B (code number 4312 020 36640)
L3 = 180 nH; 4 turns enamelled Cu wire (1.5 mm); internal diameter 12 mm; coil length 9.9 mm; leads 2 x 10 mm
L4 = 350 nH; 7 turns enamelled Cu wire (1.5 mm); internal diameter 12 mm; coil length 19.1 mm; leads 2 x 10 mm

R1 = 0.66 Ω parallel connection of 5 x 3.3 Ω carbon resistors (±5%; 0.5 W each)
R2 = 27 Ω carbon resistor (±5%; 0.5 W)
R3 = 4.7 Ω carbon resistor (±5%; 0.5 W)
R4 = 5.6 kΩ carbon resistor (±5%; 1 W)
R5 = 15 Ω wire-wound potentiometer (3 W)
R6 = 157 Ω parallel connection of 3 x 470 Ω wire-wound resistors (5.5 W each)
R7 = 68 Ω carbon resistor (±5%; 0.5 W)

---

intermodulation distortion versus heatsink temp.

\[ \text{d}_{\text{im}} \text{ (dB)} \]

-20

\[ \text{d}_{\text{typ}} \] at 150 W P.E.P.

\[ V_{CC} = 50 \text{ V} \]
\[ f_1 = 28,000 \text{ MHz} \]
\[ f_2 = 28,001 \text{ MHz} \]
\[ I_{CZS} = 100 \text{ mA} \]

---

814 August 1973
S.S.B. class AB operation

\[ P_L = 150 \text{ W (PEP)} \]
\[ V_{CC} = 50 \text{ V} \]
\[ I_{CSS} = 100 \text{ mA} \]
\[ T_h = 25 \degree\text{C} \]
\[ Z_L = 6.25 \Omega \text{ in series with } 10.4 \text{ nH (in parallel with } -267 \text{ pF)} \]

The graphs hold for one transistor of a push-pull amplifier with cross neutralization; collector (Tr1) - base (Tr2), neutralizing capacitor: 82 pF.
S.S.B. class AB operation

\[ P_L = 150 \text{ W (PEP)} \]
\[ V_{CC} = 50 \text{ V} \]
\[ I_{CS} = 100 \text{ mA} \]
\[ T_h = 25 \text{ °C} \]
\[ Z_L = 6.25 \Omega \text{ in series with } 7.3 \text{ nH (in parallel with } -188 \text{ pF)} \]

The graphs hold for an unneutralized amplifier.
APPLICATION INFORMATION (continued)

S.S.B. test circuit class-A; \( f = 28 \text{ MHz} \)

List of components:

- **D1** = BY206
- **TR1** = BD204

- \( C1 = C10 = 100 \text{ pF air dielectric capacitor (single insulated rotor type)} \)
- \( C2 = C6 = 27 \text{ pF ceramic capacitor} \)
- \( C3 = 180 \text{ pF ceramic capacitor} \)
- \( C4 = C13 = 100 \text{ pF air dielectric capacitor (single non-insulated rotor)} \)
- \( C5 = C7 = 3.9 \text{ nF polyester capacitor (±10\%)} \)
- \( C8 = 100 \text{ nF polyester capacitor (±10\%)} \)
- \( C9 = 2.2 \mu\text{F moulded metallized polyester capacitor} \)
- \( C11 = 68 \text{ pF ceramic capacitor} \)
- \( C12 = 220 \text{ pF ceramic capacitor} \)
APPLICATION INFORMATION (continued)

List of components: (continued)

L1 = 88 nH; 3 turns Cu wire (1,0 mm); internal diameter 9 mm; coil length 6,1 mm; leads 2 x 5 mm
L2 = L5 = ferroxcube bead, grade 3B (code number 4312 020 36440)
L3 = 180 nH; 4 turns enamelled Cu wire (1,5 mm); internal diameter 12 mm; coil length 9,9 mm; leads 2 x 10 mm
L4 = 350 nH; 7 turns enamelled Cu wire (1,5 mm); internal diameter 12 mm; coil length 19,1 mm; leads 2 x 10 mm
R1 = 0,66 Ω parallel connection of 5 x 3,3 Ω carbon resistors (±5%; 0,5 W each)
R2 = 27 Ω carbon resistor (±5%; 0,5 W)
R3 = 4,7 Ω carbon resistor (±5%; 0,5 W)
R4 = 50 Ω wire-wound potentiometer (1 W)
R5 = 10 Ω carbon resistor (±5%; 1 W)
R6 = 560 Ω enamelled wire-wound resistor (5,5 W)
R7 = 270 Ω carbon resistor (±5%; 1 W)
R8 = 0,6 Ω parallel connection of 3 x 1,8 Ω wire-wound resistors (8 W each)
R9 = 90 Ω parallel connection of 3 x 270 Ω enamelled wire-wound resistor (5,5 W each)
R10 = 12 Ω carbon resistor (±5%; 1 W)

third order intermodulation distortion versus P.E.P. (class A operation)

-20 dB
-30 dB
-40 dB
-50 dB
-60 dB

P.E.P. (W)
0 10 20 30 40 50 60

I_C = 2 A 2,5 A 3 A

typ. values
V_C_E = 40 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
APPLICATION INFORMATION (continued)

R.F. performance in c.w. operation (class-B circuit)

\( V_{CE} = 50 \text{ V}; T_H \text{ up to } 25 \text{ } ^\circ\text{C} \)

<table>
<thead>
<tr>
<th>( f \text{ (MHz)} )</th>
<th>( P_S \text{ (W)} )</th>
<th>( P_L \text{ (W)} )</th>
<th>( I_C \text{ (A)} )</th>
<th>( G_p \text{ (dB)} )</th>
<th>( \eta \text{ (%)} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>&lt; 15</td>
<td>150</td>
<td>&lt; 4,6</td>
<td>&gt; 10</td>
<td>&gt; 65</td>
</tr>
<tr>
<td>108</td>
<td>typ. 27</td>
<td>150</td>
<td>typ. 4,0</td>
<td>typ. 7,4</td>
<td>typ. 75</td>
</tr>
</tbody>
</table>

Test circuit: 70 MHz; c.w. class-B.

List of components:

- \( L_1 = 60 \text{ mm straight enameled Cu wire (1,6 mm); 9 mm above chassis} \)
- \( L_2 = \text{Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)} \)
- \( L_3 = 18 \text{ turns enameled Cu wire (1,6 mm); internal diameter 10 mm; pitch 2 mm; leads 55 mm totally} \)
- \( L_4 = 3 \text{ turns enameled Cu wire (1,6 mm); internal diameter 10 mm; pitch 2,5 mm; leads 50 mm totally} \)
- \( C_1 = 4 \text{ to 29 } \mu\text{F concentric air trimmer in parallel with 10 } \mu\text{F ceramic capacitor} \)
- \( C_2 = 4 \text{ to 104 } \mu\text{F film dielectric trimmer in parallel with 56 } \mu\text{F ceramic capacitor} \)
- \( C_3 = 4 \text{ to 104 } \mu\text{F film dielectric trimmer} \)
- \( C_4 = 4 \text{ to 104 } \mu\text{F film dielectric trimmer in parallel with 47 } \mu\text{F ceramic capacitor} \)
- \( C_5 = 100 \text{ nF polyester capacitor (± 10%)} \)
- \( C_6 = 1 \text{ nF ceramic feed-through capacitor} \)
- \( R = 10 \Omega \text{ carbon resistor (0,5 W)} \)

At \( P_L = 150 \text{ W and } V_{CE} = 50 \text{ V} \), the output power at heatsink temperatures between 25 \text{ } ^\circ\text{C} \text{ and } 75 \text{ } ^\circ\text{C} \) relative to that at 25 \text{ } ^\circ\text{C} \text{ is diminished by 100 mW/K.}
Indicated load power as a function of overload.

The graph has been derived from an evaluation of the performance of transistors matched up to 180W load power in the test amplifier and subsequently subjected to various mismatch conditions at 50V with VSWR up to 50 and elevated heatsink temperatures. This indicates a restriction to the load power matched under nominal conditions in the recommended test configuration.
APPLICATION INFORMATION (continued)

Test circuit:

List of components:

- C1 = C2 = 40 pF film dielectric trimmer
- C3 = 400 pF parallel connection of 4 x 100 pF ceramic capacitors
- C4 = 270 pF ceramic capacitor
- C5 = 100 nF polyester capacitor (±10%)
- C6 = 20 pF parallel connection of 2 x 10 pF ceramic capacitors
- C7 = C8 = 60 pF film dielectric trimmer

- L1 = 49 nH; 2 turns enamelled Cu wire (1.5 mm); internal diameter 9 mm; coil length 4.8 mm; leads 2 x 5 mm
- L2 = strip-line (7.7 mm x 6 mm); tap for C3 is 7.5 mm from transistor edge
- L3 = L6 = ferroxcube bead, grade 3B (code number 4312 020 36640)
- L4 = 67 nH; 3 turns enamelled Cu wire (1.5 mm); internal diameter 8 mm; coil length 8.3 mm; leads 2 x 5 mm
- L5 = 57 nH; 2 turns enamelled Cu wire (1.5 mm); internal diameter 10 mm; coil length 4.5 mm; leads 2 x 5 mm

- R = 10 Ω carbon resistor (0.5 W)
APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 108 MHz test circuit.

Dimensions of printed circuit board 123 mm x 55 mm.

The circuit has been built on epoxy fibre-glass double copper clad printed circuit board (thickness 1/16"). To minimize the dielectric losses, the ground plane under the inter-connection of L5, C6 and C7 has been removed.
load power and efficiency versus source power (class B operation)

- $f = 108$ MHz
- $T_h = 25$ °C
- typ. values

$\eta (V_{CC} = 50 \text{ V})$

$V_{CC} = 50 \text{ V}$

40 V

28 V - 50

power gain versus frequency (class B operation)

- $V_{CC} = 50 \text{ V}$
- $P_L = 150 \text{ W}$
- $T_h = 25$ °C

input impedance (series components) versus frequency (class B operation)

typ. values

$V_{CC} = 50 \text{ V}$

$P_L = 150 \text{ W}$

load impedance (parallel components) versus frequency (class B operation)

typ. values

$V_{CC} = 50 \text{ V}$

$P_L = 150 \text{ W}$
H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Matched hFE groups are available on request.

It has a 3/8” capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25^\circ$C

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ (V)</th>
<th>$f$ (MHz)</th>
<th>$P_L$ (W)</th>
<th>$G_p$ (dB)</th>
<th>$\eta$ (%)</th>
<th>$Z_i$ (Ω)</th>
<th>$Y_L$ (mS)</th>
<th>$d_3$ (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w. (class-B)</td>
<td>28</td>
<td>175</td>
<td>45</td>
<td>$&gt;7,5$</td>
<td>$&gt;70$</td>
<td>$0,7 + j1,3$</td>
<td>110 – j62</td>
<td>–</td>
</tr>
<tr>
<td>s.s.b. (class-AB)</td>
<td>28</td>
<td>1,6–28</td>
<td>5–42,5(P.E.P)</td>
<td>typ. 19</td>
<td>19</td>
<td>50</td>
<td>–</td>
<td>typ. –30</td>
</tr>
<tr>
<td>s.s.b. (class-A)</td>
<td>26</td>
<td>1,6–28</td>
<td>15 (P.E.P)</td>
<td>typ. 20</td>
<td>20</td>
<td>–</td>
<td>–</td>
<td>typ. –42</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.

Torque on nut: min. 0,75 Nm (7,5 kg cm) max. 0,85 Nm (8,5 kg cm)

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage \( V_{BE} = 0 \)
- peak value

Collector-emitter voltage (open base)

Emitter-base voltage (open-collector)

Collector current (average)

Collector current (peak value); \( f > 1 \, \text{MHz} \)

R.F. power dissipation \( (f > 1 \, \text{MHz}); T_{mb} = 25 \, ^\circ\text{C} \)

Storage temperature

Operating junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_{CESM} ) max.</td>
<td>65 V</td>
</tr>
<tr>
<td>( V_{CEO} ) max.</td>
<td>36 V</td>
</tr>
<tr>
<td>( V_{EBO} ) max.</td>
<td>4 V</td>
</tr>
<tr>
<td>( I_{C(AV)} ) max.</td>
<td>4 A</td>
</tr>
<tr>
<td>( I_{CM} ) max.</td>
<td>12 A</td>
</tr>
<tr>
<td>( P_{rf} ) max.</td>
<td>100 W</td>
</tr>
<tr>
<td>( T_{stg} )</td>
<td>-65 to +150 , ^\circ\text{C}</td>
</tr>
<tr>
<td>( T_{J} ) max.</td>
<td>200 , ^\circ\text{C}</td>
</tr>
</tbody>
</table>

THERMAL RESISTANCE (dissipation = 40 W; \( T_{mb} = 88 \, ^\circ\text{C}, \, \text{i.e.} \, T_{h} = 70 \, ^\circ\text{C} \))

- From junction to mounting base (d.c. dissipation)
  \( R_{th \, \text{j-mb}(dc)} = 2.8 \, \text{K/W} \)

- From junction to mounting base (r.f. dissipation)
  \( R_{th \, \text{j-mb}(rf)} = 2.05 \, \text{K/W} \)

- From mounting base to heatsink
  \( R_{th \, \text{mb-h}} = 0.45 \, \text{K/W} \)

Fig. 2 D.C. SOAR.

Fig. 3 R.F. power dissipation; \( V_{CE} \leq 28 \, \text{V}; \, f > 1 \, \text{MHz} \).

I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch
CHARACTERISTICS

$T_j = 25 \, ^\circ C$ unless otherwise specified

Collector-emitter breakdown voltage

$V_{BE} = 0; \, I_C = 25 \, mA$

Collector-emitter breakdown voltage

open base; $I_C = 100 \, mA$

Emitter-base breakdown voltage

open collector; $I_E = 10 \, mA$

Collector cut-off current

$V_{BE} = 0; \, V_{CE} = 36 \, V$

Second breakdown energy; $L = 25 \, mH; \, f = 50 \, Hz$

open base

$R_{BE} = 10 \, \Omega$

D.C. current gain *

$I_C = 2,5 \, A; \, V_{CE} = 5 \, V$

D.C. current gain ratio of matched devices *

$I_C = 2,5 \, A; \, V_{CE} = 5 \, V$

Collector-emitter saturation voltage *

$I_C = 7,5 \, A; \, I_B = 1,5 \, A$

Transition frequency at $f = 100 \, MHz$

$-I_E = 2,5 \, A; \, V_{CB} = 28 \, V$

$-I_E = 7,5 \, A; \, V_{CB} = 28 \, V$

Collector capacitance at $f = 1 \, MHz$

$I_E = I_E = 0; \, V_{CB} = 28 \, V$

Feedback capacitance at $f = 1 \, MHz$

$I_C = 100 \, mA; \, V_{CE} = 28 \, V$

Collector-stud capacitance

$V_{(BR)CES} > 65 \, V$

$V_{(BR)CEO} > 36 \, V$

$V_{(BR)EBO} > 4 \, V$

$I_{CES} < 10 \, mA$

$E_{SBO} > 8 \, mJ$

$E_{SBR} > 8 \, mJ$

$\text{typ. 45}$

$h_{FE}$

$10 \text{ to } 80$

$h_{FE1}/h_{FE2} < 1,2$

$V_{CEsat}$

$\text{typ. 1,5 V}$

$f_T$

$\text{typ. 570 MHz}$

$f_T$

$\text{typ. 570 MHz}$

$C_C$

$\text{typ. 82 pF}$

$C_{re}$

$\text{typ. 54 pF}$

$C_{cs}$

$\text{typ. 2 pF}$

* Measured under pulse conditions: $t_p < 200 \, \mu s; \, \delta < 0,02.$

Fig. 4 Typical values; $V_{CE} = 28 \, V.$

July 1978
Fig. 5 Typical values; $T_J = 25^\circ C$.

Fig. 6 $I_E = I_C = 0$; $f = 1 MHz$; $T_J = 25^\circ C$.

Fig. 7 Typical values; $f = 100 MHz$; $T_J = 25^\circ C$. 

Figure 5 shows the typical $h_{FE}$ values for two different $V_{CE}$: 28 V and 5 V, with $I_C$ ranging from 0 to 15 A. Figure 6 illustrates the typical $C_C$ (pF) values with $V_{CB}$ ranging from 0 to 40 V. Figure 7 presents the typical $f_T$ (MHz) values for $V_{CB}$ at 28 V and 15 V, with $I_E$ ranging from 0 to 15 A.
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

<table>
<thead>
<tr>
<th>f (MHz)</th>
<th>V_{CE} (V)</th>
<th>P_L (W)</th>
<th>P_S (W)</th>
<th>G_P (dB)</th>
<th>I_C (A)</th>
<th>η (%)</th>
<th>Z_l (Ω)</th>
<th>Y_L (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>28</td>
<td>45</td>
<td>&lt; 8</td>
<td>&gt; 7,5</td>
<td>&lt; 2,47</td>
<td>&gt; 70</td>
<td>0,7 + j1,3</td>
<td>110 – j62</td>
</tr>
</tbody>
</table>

List of components:

- C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
- C2 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
- C3a = C3b = 47 pF ceramic capacitor (500 V)
- C4 = 120 pF ceramic capacitor (500 V)
- C5 = 100 nF polyester capacitor
- C6a = 2,2 pF ceramic capacitor (500 V)
- C6b = 1,8 pF ceramic capacitor (500 V)
- C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
- L1 = 14 nH; 1 turn Cu wire (1,6 mm); int. dia. 7,7 mm; leads 2 x 5 mm
- L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
- L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
- L6 = 80 nH; 3 turns Cu wire (1,6 mm); int. dia. 9,0 mm; length 8,0 mm; leads 2 x 5 mm
- L7 = 62 nH; 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 8,1 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = R2 = 10 Ω carbon resistor.

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 9.
Fig. 9 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

To minimize the dielectric losses, the ground plane under the interconnection of L7 and C7 has been removed.
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

Fig. 10 Typical values; $V_{CE} = 28\, \text{V}$; $f = 175\, \text{MHz}$.

Fig. 11 Typical values; $V_{CE} = 28\, \text{V}$; $f = 175\, \text{MHz}$; $\cdots - \cdots \quad T_h = 25\, ^\circ\text{C}; \quad \cdots - \cdots \quad T_h = 70\, ^\circ\text{C}.$

Fig. 12 R.F. SOAR; c.w. class-B operation; $f = 175\, \text{MHz}; \quad V_{CE} = 28\, \text{V}; \quad R_{th\ mb-h} = 0.45\, \text{K/W}$.

The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.
Fig. 13 Input impedance (series components).

Fig. 14 Load impedance (parallel components).

OPERATING NOTE
Below 75 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

Conditions for Figs 13; 14 and 15.
Typical values; $V_{CE} = 28$ V; $P_L = 45$ W; $T_h = 25$ °C.

Fig. 15 Power gain versus frequency.
R.F. performance in s.s.b. class-AB operation (linear power amplifier)

\[ V_{CE} = 28 \text{ V}; \ f_1 = 28,000 \text{ MHz}; \ f_2 = 28,001 \text{ MHz} \]

<table>
<thead>
<tr>
<th>Output Power W</th>
<th>Gp dB</th>
<th>( \eta_{df}(%) ) at 42,5 W (P.E.P)</th>
<th>Ic (A)</th>
<th>d3 dB*</th>
<th>d5 dB*</th>
<th>IC(ZS) mA</th>
<th>TH °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 to 42,5(P.E.P)</td>
<td>typ. 19</td>
<td>typ. 50</td>
<td>typ. 1,52</td>
<td>typt. -30</td>
<td>(&lt;-30)</td>
<td>50</td>
<td>25</td>
</tr>
<tr>
<td>5 to 37,5(P.E.P)</td>
<td>typ. 19</td>
<td>typ. -30</td>
<td></td>
<td>typt. -30</td>
<td>(&lt;-30)</td>
<td>50</td>
<td>70</td>
</tr>
</tbody>
</table>

Fig. 16 Test circuit; s.s.b. class-AB.

List of components:

- C1 = C2 = 10 to 780 pF film dielectric trimmer
- C3 = C5 = C6 = 220 nF polyester capacitor
- C4 = 56 pF ceramic capacitor (500 V)
- C7 = C8 = 15 to 575 pF film dielectric capacitor
- L1 = 4 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 7,0 mm; leads 2 x 5 mm
- L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- L3 = 4 turns enamelled Cu wire (1,6 mm); int. dia. 10 mm; length 9,4 mm; leads 2 x 5 mm
- L4 = 7 turns enamelled Cu wire (1,6 mm); int. dia. 12 mm; length 17,2 mm; leads 2 x 5 mm
- R1 = 1,2 \( \Omega \); parallel connection of 4 x 4,7 \( \Omega \) carbon resistors
- R2 = 39 \( \Omega \) carbon resistor

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.
Fig. 17 Intermodulation distortion as a function of output power.*

Conditions for Fig. 17:
V_{CE} = 28 V; I_{C(ZS)} = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; typical values.

Fig. 18 Double-tone efficiency and power gain as a function of output power.

Conditions for Fig. 18:
V_{CE} = 28 V; I_{C(ZS)} = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 70 °C; typical values.

* See note on previous page.
Fig. 19 Power gain as a function of frequency.

Fig. 20 Input impedance (series components) as a function of frequency.

Figs 19 and 20 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:
\[ V_{CE} = 28 \, \text{V}; \, I_C(ZS) = 50 \, \text{mA}; \, P_L = 42.5 \, \text{W}; \, T_h = 25 \, ^\circ\text{C}; \, Z_L = 7.4 \, \Omega. \]

Ruggedness in s.s.b. operation

The BLX39 is capable of withstanding a load mismatch (VSWR = 50) under the following conditions:

Class-AB operation; \( f_1 = 28,000 \, \text{MHz}; \, f_2 = 28,001 \, \text{MHz}; \, V_{CE} = 28 \, \text{V}; \, T_h = 70 \, ^\circ\text{C} \) and \( P_{L\text{nom}} = 45 \, \text{W P.E.P.} \)
R.F. performance in s.s.b. class-A operation (linear power amplifier)

$V_{CE} = 26 \, V; \, T_h = 70 \, ^\circ C; \, f_1 = 28,000 \, MHz; \, f_2 = 28,001 \, MHz$

<table>
<thead>
<tr>
<th>output power W</th>
<th>$G_p , dB$</th>
<th>$I_C , A$</th>
<th>$d_3 , dB$ *</th>
<th>$d_5 , dB$ *</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 (P.E.P)</td>
<td>typ. 20</td>
<td>1.55</td>
<td>typ. -42</td>
<td>&lt; -40</td>
</tr>
</tbody>
</table>

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

Fig. 21 Test circuit; s.s.b. class-A.
List of components in Fig. 21:

- C1 = C2 = 10 to 780 pF film dielectric trimmer
- C3 = 22 nF ceramic capacitor (63 V)
- C4 = 47 µF/10 V electrolytic capacitor
- C5 = 56 pF ceramic capacitor (500 V)
- C6 = 47 µF/35 V electrolytic capacitor
- C7 = C8 = 220 nF polyester capacitor
- C9 = 10 µF/35 V electrolytic capacitor
- C10 = 10 to 210 pF film dielectric trimmer
- C11 = 15 to 575 pF film dielectric trimmer

- L1 = 3 turns closely wound enamelled Cu wire (1.6 mm); int. dia. 9.0 mm; leads 2 x 5 mm
- L2 = L3 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- L4 = 11 turns closely wound enamelled Cu wire (1.6 mm); int. dia. 11.0 mm
- L5 = 14 turns closely wound enamelled Cu wire (1.6 mm); int. dia. 11.0 mm

- R1 = 600 Ω; parallel connection of 2 x 1,2 kΩ carbon resistors (± 5%; 0.5 W each)
- R2 = 15 Ω carbon resistor (± 5%; 0.25 W)
- R3 = 1.2 Ω; parallel connection of 4 x 4.7 Ω carbon resistors (± 5%; 0.125 W each)
- R4 = 33 Ω carbon resistor (± 5%; 0.25 W)
- R5 = 18 Ω carbon resistor (± 5%; 0.25 W)
- R6 = 120 Ω wirewound resistor (± 5%; 5.5 W)
- R7 = 1 Ω carbon resistor (± 5%; 0.125 W)
- R8 = 47 Ω wirewound potentiometer (3 W)
- R9 = 1.57 Ω; parallel connection of 3 x 4.7 Ω wirewound resistors (± 5%; 5.5 W each)

Fig. 22 Intermodulation distortion as a function of output power. Typical values; V_{CE} = 26 V; T_h = 70°C; f_1 = 28,000 MHz; f_2 = 28,001 MHz.
**U.H.F./V.H.F. TRANSMITTING TRANSISTOR**

N-P-N transistor intended for use in class-B and C operated mobile, industrial and military transmitters with a supply voltage of 13,8 V. It has a TO-39 metal envelope with the collector connected to the case.

**QUICK REFERENCE DATA**

R.F. performance up to $T_{\text{case}} = 25 \, ^{\circ}\text{C}$ in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{\text{CE}}$ V</th>
<th>$f$ MHz</th>
<th>$P_{\text{S}}$ W</th>
<th>$P_{\text{L}}$ W</th>
<th>$I_{\text{C}}$ A</th>
<th>$G_{\text{p}}$ dB</th>
<th>$\eta$ %</th>
<th>$\bar{z}_{1}$ $\Omega$</th>
<th>$\bar{V}_{L}$ mS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>13,8</td>
<td>470</td>
<td>typ. 0,4</td>
<td>2,0</td>
<td>typ. 0,22</td>
<td>typ. 7</td>
<td>typ. 66</td>
<td>5 + j11</td>
<td>17 – j19</td>
</tr>
<tr>
<td>c.w.</td>
<td>12,5</td>
<td>470</td>
<td>&lt; 0,5</td>
<td>2,0</td>
<td>&lt; 0,25</td>
<td>&gt; 6</td>
<td>&gt; 65</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>c.w.</td>
<td>12,5</td>
<td>175</td>
<td>typ. 0,12</td>
<td>2,0</td>
<td>typ. 0,21</td>
<td>typ. 12</td>
<td>typ. 75</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

**MECHANICAL DATA**

Fig. 1 TO-39; collector connected to case.

Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories: 56245 (distance disc).
RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter)
peak value

Collector-emitter voltage (V_{BE} = 0)
peak value

Collector-emitter voltage (open base)

Emitter-base voltage (open collector)

Collector current (average)

Collector current (peak value) f > 1 MHz

Total power dissipation up to T_{case} = 90 °C
f > 10 MHz

Storage temperature

Operating junction temperature

THERMAL RESISTANCE

From junction to case

From mounting base to heatsink with a boron nitride washer for electrical insulation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-base voltage (open emitter) peak value</td>
<td>V_{CBOM}</td>
<td>max.</td>
<td>36 V</td>
</tr>
<tr>
<td>Collector-emitter voltage (V_{BE} = 0) peak value</td>
<td>V_{CESM}</td>
<td>max.</td>
<td>36 V</td>
</tr>
<tr>
<td>Collector-emitter voltage (open base)</td>
<td>V_{CEO}</td>
<td>max.</td>
<td>18 V</td>
</tr>
<tr>
<td>Emitter-base voltage (open collector)</td>
<td>V_{EBO}</td>
<td>max.</td>
<td>4 V</td>
</tr>
<tr>
<td>Collector current (average)</td>
<td>I_{C(AV)}</td>
<td>max.</td>
<td>0.7 A</td>
</tr>
<tr>
<td>Collector current (peak value) f &gt; 1 MHz</td>
<td>I_{CM}</td>
<td>max.</td>
<td>2.0 A</td>
</tr>
<tr>
<td>Total power dissipation up to T_{case} = 90 °C f &gt; 10 MHz</td>
<td>P_{tot}</td>
<td>max.</td>
<td>3.0 W</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>T_{stg}</td>
<td>-65 to +150 °C</td>
<td></td>
</tr>
<tr>
<td>Operating junction temperature</td>
<td>T_{j}</td>
<td>max</td>
<td>165 °C</td>
</tr>
<tr>
<td>Thermal resistance from junction to case</td>
<td>R_{th j-c}</td>
<td>=</td>
<td>25 K/W</td>
</tr>
<tr>
<td>Thermal resistance from mounting base to heatsink with a boron nitride washer for electrical insulation</td>
<td>R_{th mb-h}</td>
<td>=</td>
<td>2.5 K/W</td>
</tr>
</tbody>
</table>
**CHARACTERISTICS**

T\(_j\) = 25 °C unless otherwise specified

Breakdown voltages

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Min. Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-base voltage</td>
<td>V(_{BR})CBO</td>
<td>&gt; 36 V</td>
</tr>
<tr>
<td>Collector-emitter voltage</td>
<td>V(_{BR})CES</td>
<td>&gt; 36 V</td>
</tr>
<tr>
<td>Collector-emitter voltage</td>
<td>V(_{BR})CEO</td>
<td>&gt; 18 V</td>
</tr>
<tr>
<td>Emitter-base voltage</td>
<td>V(_{BR})EBO</td>
<td>&gt; 4 V</td>
</tr>
</tbody>
</table>

Collector-emitter saturation voltage

I\(_C\) = 100 mA; I\(_B\) = 20 mA

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Min. Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.C. current gain</td>
<td>h(_FE)</td>
<td>&gt; 10</td>
</tr>
<tr>
<td>Transition frequency</td>
<td>f(_T)</td>
<td>typ. 1400 MHz</td>
</tr>
<tr>
<td>Collector capacitance at f = 1 MHz</td>
<td>C(_C)</td>
<td>typ. 6.5 pF</td>
</tr>
<tr>
<td>Feedback capacitance at f = 1 MHz</td>
<td>(-C(_{re}))</td>
<td>typ. 4.8 pF</td>
</tr>
</tbody>
</table>
BLX65

![Graph 1](image1)

- **$P_{tot}$ (W)**
  - Short time operation
  - V.S.W.R. > 3
  - $V_{CE} \leq 16.5\text{V}$
  - $f \geq 10\text{MHz}$

- **Normal operation**
  - V.S.W.R. < 3

![Graph 2](image2)

- **D.C. SOAR**
  - $T_{case} = 25\text{°C}$
  - $125\text{°C}$

- **$I_C$ (A)**

- **$V_{CE}$ (V)**

- **December 1971**
U.H.F./V.H.F. transmitting transistor

**BLX65**

**f<sub>T</sub>**
(MHz)

<table>
<thead>
<tr>
<th>0</th>
<th>500</th>
<th>1000</th>
<th>1500</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
<td>0.4</td>
</tr>
</tbody>
</table>

**I<sub>C</sub>**
(A)

<table>
<thead>
<tr>
<th>0</th>
<th>0.1</th>
<th>0.2</th>
<th>0.3</th>
<th>0.4</th>
<th>0.5</th>
<th>0.6</th>
</tr>
</thead>
</table>

**V<sub>CE</sub>** = 5V

**C<sub>C</sub>**
(pF)

<table>
<thead>
<tr>
<th>0</th>
<th>2.5</th>
<th>5</th>
<th>7.5</th>
<th>10</th>
</tr>
</thead>
</table>

**I<sub>E</sub>** = I<sub>e</sub> = 0

**f** = 1MHz

December 1971
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class B circuit)

\( T_{\text{case}} \) up to 25 °C

<table>
<thead>
<tr>
<th>( f ) (MHz)</th>
<th>( V_{\text{CC}} ) (V)</th>
<th>( P_S ) (W)</th>
<th>( P_L ) (W)</th>
<th>( I_C ) (A)</th>
<th>( G_p ) (dB)</th>
<th>( \eta ) (%)</th>
<th>( \bar{Z}_I ) (Ω)</th>
<th>( \bar{V}_L ) (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>470</td>
<td>13.8</td>
<td>typ. 0.4</td>
<td>2.0</td>
<td>typ. 0.22</td>
<td>typ. 7</td>
<td>typ. 66</td>
<td>5 + j11</td>
<td>17 - j19</td>
</tr>
<tr>
<td>470</td>
<td>12.5</td>
<td>&lt; 0.5</td>
<td>2.0</td>
<td>&lt; 0.25</td>
<td>&gt; 6</td>
<td>&gt; 65</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>175</td>
<td>12.5</td>
<td>typ. 0.12</td>
<td>2.0</td>
<td>typ. 0.21</td>
<td>typ. 12</td>
<td>typ. 75</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Test circuit I (470 MHz)

To obtain optimum gain performance the emitter lead length should not exceed 1.6 mm

- \( C_1 = C_2 = C_4 = C_5 = 1.8 \) to 18 pF film dielectric trimmer
- \( C_3 = 22 \) pF disc ceramic capacitor
- \( C_6 = 10 \) nF ceramic capacitor
- \( C_7 = 0.1 \) µF polyester capacitor
- \( C_8 = 4 \) nF feed-through capacitor
- \( L_1 = 1 \) turn Cu wire (1 mm); int. diam. 5 mm, max. lead length 1 mm
- \( L_2 = 0.22 \) µH choke
- \( L_3 = 1 \) turn Cu wire (1 mm); int. diam. 7 mm; lead length 2 mm
- \( L_4 = 1 \) turn Cu wire (1 mm); int. diam. 5 mm; lead length 2 mm
- \( R = 10 \Omega \) carbon

At \( P_L = 2.0 \) W and \( V_{\text{CC}} = 12.5 \) V the output power at case temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 5 mW/K

The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: \( V_{\text{CC}} = 16.5 \) V; \( f = 470 \) MHz; \( T_{\text{case}} = 70 \) °C

\( \text{V.S.W.R.} = 50 : 1 \) through all phases; \( P_S = P_{\text{Snom}} + 20 \% \)

where \( P_{\text{Snom}} = P_S \) for 1.4 W transistor output into 50 Ω load at \( V_{\text{CC}} = 13.8 \) V.
APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 470 MHz test circuit.

Shaded area copper
Back area not metalized
Material of printed circuit board: 1.5 mm epoxy fibre-glass
Conditions for R.F. SOAR

\[ f = 470 \text{ MHz} \]
\[ T_{\text{case}} = 70 \text{ °C} \]
\[ V_{\text{CCnom}} = 13.8 \text{ V} \]

The transistor was developed for use with unstabilized supply voltage \( V_{\text{CC}} \).

The above graph is based on its measured performance in test circuit 1.

Supply voltage was varied from \( V_{\text{CCnom}} \) to 1.2 \( V_{\text{CCnom}} \), and V.S.W.R. from 1 to 50. It shows the maximum allowable output power under nominal conditions in order not to exceed the maximum allowable power dissipation under conditions of supply overvoltage (\( V_{\text{CC}} > V_{\text{CCnom}} \)) and load mismatch (V.S.W.R. > 1).

It is assumed that the drive power increases linearly with the supply voltage; i.e.

\[ \frac{P_S}{P_{\text{Snom}}} = \frac{V_{\text{CC}}}{V_{\text{CCnom}}} \]
APPLICATION INFORMATION (continued)
Test circuit II (175 MHz)

To obtain optimum gain performance the emitter lead length should not exceed 1.6 mm.

C1 = C4 = 60 pF concentric air trimmer
C2 = C3 = 30 pF concentric air trimmer
C5 = 0.25 μF polyester capacitor
C6 = 4 nF feed-through capacitor

L1 = 25 mm straight Cu wire (1.2 mm); height above print 3 mm
L2 = 3 turns Cu wire (0.5 mm) on ferrite FX1115, d = 2 mm, D = 4 mm, L = 5 mm, material 3B (code number 3113 991 16740)
L3 = 5 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; lead length 5 mm
L4 = 3 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; lead length 5 mm
R = 10 Ω carbon
APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit:

Shaded area copper
Back area not metallized
Material of printed circuit board: 1.5 mm epoxy fibre-glass
OPERATING NOTE Below 200 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.

![Graphs showing power gain, input impedance, and load impedance versus frequency.](image-url)
V.H.F./U.H.F. POWER TRANSISTORS

N-P-N silicon planar epitaxial transistors in TO-39 envelope designed for use in portable and mobile radio transmitters in the v.h.f. and u.h.f. bands.

QUICK REFERENCE DATA

R.F. performance at $T_c = 25 \, ^\circ C$ in a common-emitter class-B circuit.

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_p$ dB</th>
<th>$\eta_c$ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.W.; narrow band</td>
<td>12,5</td>
<td>175</td>
<td>2</td>
<td>typ. 16</td>
<td>typ. 68</td>
</tr>
<tr>
<td></td>
<td>12,5</td>
<td>470</td>
<td></td>
<td>$\geq 9$</td>
<td>$\geq 55$</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 TO-39/3.
Emitter connected to case.

* Max. 4,9 for BLX65ES.

PRODUCT SAFETY  This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.


**RATINGS**

Limiting values in accordance with the Absolute Maximum System (IEC 134).

- **Collector-base voltage (open emitter)**
  - peak value
- **Collector emitter voltage (open base)**
- **Emitter-base voltage (open collector)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Max. Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector current</td>
<td>$I_C$</td>
<td>0.7 A</td>
</tr>
<tr>
<td>(peak value); $f &gt; 1$ MHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total power dissipation</td>
<td>$P_{tot}$</td>
<td>3.0 W</td>
</tr>
<tr>
<td>at $T_{mb} &lt; 90 , ^\circ C$; $f &gt; 1$ MHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage temperature</td>
<td>$T_{stg}$</td>
<td>-65 to +175 °C</td>
</tr>
</tbody>
</table>

**CHARACTERISTICS**

$T_J = 25 \, ^\circ C$ unless otherwise specified

- **Collector-base breakdown voltage**
  - open emitter; $I_C = 10$ mA
- **Collector-emitter breakdown voltage**
  - open base; $I_C = 25$ mA
- **Emitter-base breakdown voltage**
  - open collector; $+ I_E = 1.0$ mA
- **Collector-emitter saturation voltage**
  - $I_C = 100$ mA; $I_B = 20$ mA
- **D.C. current gain**
  - $I_C = 100$ mA; $V_{CE} = 5$ V
- **Transition frequency at $f = 500$ MHz**
  - $-I_E = 200$ mA; $V_{CB} = 5$ V
- **Collector capacitance at $f = 1$ MHz**
  - $I_E = i_e = 0$; $V_{CB} = 10$ V

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-base breakdown</td>
<td>$V_{(BR)CBO}$</td>
<td>$&gt; 36$ V</td>
</tr>
<tr>
<td>Collector-emitter breakdown</td>
<td>$V_{(BR)CEO}$</td>
<td>$&gt; 16$ V</td>
</tr>
<tr>
<td>Emitter-base breakdown</td>
<td>$V_{(BR)EBO}$</td>
<td>$&gt; 4$ V</td>
</tr>
<tr>
<td>Collector-emitter saturation</td>
<td>$V_{CE_{sat}}$</td>
<td>typ. 0.1 V</td>
</tr>
<tr>
<td>D.C. current gain</td>
<td>$h_{FE}$</td>
<td>typ. 40</td>
</tr>
<tr>
<td>Transition frequency</td>
<td>$f_T$</td>
<td>typ. 1.4 GHz</td>
</tr>
<tr>
<td>Collector capacitance</td>
<td>$C_C$</td>
<td>typ. 6.5 pF</td>
</tr>
</tbody>
</table>
### APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter circuit; class B); $T_c = 25\, ^\circ\text{C}$

<table>
<thead>
<tr>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_p$ dB</th>
<th>$\eta_C$ %</th>
<th>$Z_i$ Ω</th>
<th>$Z_L$ Ω</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.6</td>
<td>175</td>
<td>2.0</td>
<td>typ. 13</td>
<td>typ. 68</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>12.5</td>
<td>175</td>
<td>2.0</td>
<td>typ. 16</td>
<td>typ. 68</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>12.5</td>
<td>470</td>
<td>2.0</td>
<td>$\geq 9$</td>
<td>$&gt; 55$</td>
<td>$3 + j8$</td>
<td>$12 - j17$</td>
</tr>
<tr>
<td>12.5</td>
<td>470</td>
<td>2.0</td>
<td>typ. 10.6</td>
<td>typ. 68</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

*Fig. 2  Load power vs. source power; $V_{CE} = 12.5\, \text{V}; f = 470\, \text{MHz}; T_{mb} = 25\, ^\circ\text{C};$ class-B operation; typical values.*

### RUGGEDNESS

The device is capable of withstanding a full load mismatch ($\text{VSWR} = 50$; all phases) at rated load power up to a supply voltage of $15.0\, \text{V}, P_S + 20\%,$ $f = 470\, \text{MHz}$ and $T_{mb} = 25\, ^\circ\text{C}$. 
U.H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon transistor for use in class-B and C operated mobile, industrial and military transmitters with a supply voltage of 13.8 V.

It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25 \, ^\circ C$ in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$</th>
<th>$f$</th>
<th>$P_S$</th>
<th>$P_L$</th>
<th>$I_C$</th>
<th>$G_P$</th>
<th>$\eta$</th>
<th>$\overline{z_1}$</th>
<th>$\overline{V_L}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>13.8</td>
<td>470</td>
<td>typ. 0.15</td>
<td>1.5</td>
<td>typ. 0.17</td>
<td>typ. 10</td>
<td>typ. 65</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>c.w.</td>
<td>13.8</td>
<td>470</td>
<td>typ. 0.35</td>
<td>3.0</td>
<td>typ. 0.28</td>
<td>typ. 9.3</td>
<td>typ. 79</td>
<td>2.9 + j5.1</td>
<td>27 - j21</td>
</tr>
<tr>
<td>c.w.</td>
<td>12.5</td>
<td>470</td>
<td>&lt; 0.35</td>
<td>2.5</td>
<td>&lt; 0.31</td>
<td>&gt; 8.5</td>
<td>&gt; 65</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>c.w.</td>
<td>12.5</td>
<td>175</td>
<td>typ. 0.03</td>
<td>3.0</td>
<td>typ. 0.29</td>
<td>typ. 20</td>
<td>typ. 84</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-48/3

Dimensions in mm

Torque on nut: min. 0.75 Nm (7.5 kg cm)
max. 0.85 Nm (8.5 kg cm)

Diameter of clearance hole in heatsink: max. 4.2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
**RATINGS** Limiting values in accordance with the Absolute Maximum System (IEC134)

- Collector-base voltage (open emitter) peak value: \( V_{CBOM} \) max. 36 V
- Collector-emitter voltage \((R_{BE} = 0)\) peak value: \( V_{CESM} \) max. 36 V
- Collector-emitter voltage (open base): \( V_{CEO} \) max. 18 V
- Emitter-base voltage (open collector): \( V_{EBO} \) max. 4 V
- Collector current (average): \( I_{C(AV)} \) max. 0.7 A
- Collector current (peak value) \( f > 1 \text{ MHz} \): \( I_{CM} \) max. 2.0 A
- Total power dissipation up to \( T_h = 90 \, ^\circ\text{C} \): \( P_{tot} \) max. 4.5 W
- Storage temperature: \( T_{stg} \) -65 to +150 \( ^\circ\text{C} \)
- Junction temperature: \( T_j \) max. 150 \( ^\circ\text{C} \)

**THERMAL RESISTANCE**

- From junction to mounting base: \( R_{th\ j-mb} = 12 \, \text{K/W} \)
- From mounting base to heatsink: \( R_{th\ mb-h} = 0.6 \, \text{K/W} \)
CHARACTERISTICS

Breakdown voltages

Collector-base voltage
open emitter, $I_C = 10 \text{ mA}$
$V_{BR}CBO > 36 \text{ V}$

Collector-emitter voltage
$V_{BE} = 0; I_C = 10 \text{ mA}$
$V_{BR}CES > 36 \text{ V}$

Collector-emitter voltage
open base, $I_C = 25 \text{ mA}$
$V_{BR}CEO > 18 \text{ V}$

Emitter-base voltage
open collector, $I_E = 1,0 \text{ mA}$
$V_{BR}EBO > 4 \text{ V}$

Collector-emitter saturation voltage
$I_C = 100 \text{ mA}; I_B = 20 \text{ mA}$
$V_{Cesat \text{ typ.} 0,1 \text{ V}}$

D.C. current gain
$I_C = 100 \text{ mA}; V_{CE} = 5 \text{ V}$
$\beta_{FE} > 10 \text{ typ.} 40$

Transition frequency
$I_C = 0,2 \text{ A}; V_{CE} = 5 \text{ V}; f = 500 \text{ MHz}$
$f_T \text{ typ.} 1400 \text{ MHz}$

Collector capacitance at $f = 1 \text{ MHz}$
$I_E = I_C = 0; V_{CB} = 10 \text{ V}$
$C_c \text{ typ.} 6,5 \text{ pF}$

Feedback capacitance at $f = 1 \text{ MHz}$
$I_C = 20 \text{ mA}; V_{CE} = 10 \text{ V}$
$C_{re} \text{ typ.} 4,8 \text{ pF}$

Collector-stud capacitance
$C_{cs} \text{ typ.} 2 \text{ pF}$

$T_j = 25 \text{ °C unless otherwise specified}$
BLX67

$P_{\text{tot}}$  
$P_{\text{tot}}$ (W)

- Short time operation $V_{\text{SW.R.}} > 3$
- Normal operation $V_{\text{SW.R.}} < 3$

$V_{CE} \leq 16.5V$
$f \geq 10\text{MHz}$

$T_n (\text{°C})$

$D.C. \text{ SOAR}$

$I_C$ (A)

$T_n = 25^\circ\text{C}$
$125^\circ\text{C}$

$V_{CE}$ (V)

November 1971
V.H.F./U.H.F. power transistor

**BLX67**

### Graph 1

- **f_t (MHz)**
  - **V_C_E = 5V**
  - **Typ**

### Graph 2

- **C_C (pF)**
  - **I_E = I_C = 0**
  - **f = 1MHz**
  - **Typ**

**November 1971**
APPLICATION INFORMATION

T<sub>j</sub> = 25 °C unless otherwise specified

R. F. performance in c. w. operation (unneutralized common-emitter class B circuit)

T<sub>h</sub> up to 25 °C

<table>
<thead>
<tr>
<th>f (MHz)</th>
<th>V&lt;sub&gt;CC&lt;/sub&gt; (V)</th>
<th>P&lt;sub&gt;S&lt;/sub&gt; (W)</th>
<th>P&lt;sub&gt;L&lt;/sub&gt; (W)</th>
<th>I&lt;sub&gt;C&lt;/sub&gt; (A)</th>
<th>G&lt;sub&gt;p&lt;/sub&gt; (dB)</th>
<th>η (%)</th>
<th>Z&lt;sub&gt;1&lt;/sub&gt; (Ω)</th>
<th>V&lt;sub&gt;L&lt;/sub&gt; (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>470</td>
<td>13.8</td>
<td>typ. 0.15</td>
<td>1.5</td>
<td>typ. 0.17</td>
<td>typ. 10</td>
<td>typ. 65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>470</td>
<td>13.8</td>
<td>typ. 0.35</td>
<td>3.0</td>
<td>typ. 0.28</td>
<td>typ. 9.3</td>
<td>typ. 79</td>
<td>2.9 + j5.1</td>
<td>27 - j21</td>
</tr>
<tr>
<td>470</td>
<td>12.5</td>
<td>&lt; 0.35</td>
<td>2.5</td>
<td>&lt; 0.31</td>
<td>&gt; 8.5</td>
<td>&gt; 65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>175</td>
<td>12.5</td>
<td>typ. 0.03</td>
<td>3.0</td>
<td>typ. 0.29</td>
<td>typ. 20</td>
<td>typ. 84</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test circuit I (470 MHz)

C1 = C2 = C6 = C7 = 1.8 to 18 pF film dielectric trimmer
C3 = C4 = 18 pF disc ceramic capacitor
C5 = 4 nF feed-through capacitor
C8 = 0.1 µF polyester capacitor

L1 = 1 turn Cu wire (1.2 mm); int. diam. 6 mm; max. lead length 1 mm
L2 = 1 µH choke
L3 = 30 mm straight Cu wire (2 mm); height above print 2 mm
L4 = 2 turns closely wound Cu wire (0.5 mm); int. diam. 3 mm; max. lead length 8 mm
R = 10 Ω carbon

At P<sub>L</sub> = 2.5 W and V<sub>CC</sub> = 12.5 V, the output power at heatsink temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 5 mW/K

The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V<sub>CC</sub> = 16.5 V; f = 470 MHz; T<sub>h</sub> = 70 °C;
V.S.W.R. = 50 : 1 through all phases; P<sub>S</sub> = P<sub>Snom</sub> + 20 %
where P<sub>Snom</sub> = P<sub>S</sub> for 2.5 W transistor output into 50 Ω load and V<sub>CC</sub> = 13. 8 V
APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 470 MHz test circuit.

Shaded area copper
Back area completely copper clad.
Material of printed circuit board: 1.5 mm epoxy fibre glass.
typical values

\( f = 470 \text{MHz} \)

\( T_h = 25^\circ \text{C} \)

\( V_{CC} = 13.8 \text{V} \)

\( V_{CC} = 12.5 \text{V} \)

\( V_{CC} = 13.8 \text{V} \)
Conditions for R.F. SOAR

\[ f = 470 \text{ MHz} \]
\[ T_h = 70 \text{ }^\circ\text{C} \]
\[ V_{CC_{nom}} = 13.8 \text{ V} \]

The transistor was developed for use with unstabilized supply voltage \( V_{CC} \).
The above graph is based on its measured performance in test circuit 1.
Supply voltage was varied from \( V_{CC_{nom}} \) to 1.2 \( V_{CC_{nom}} \), and VSWR from 1 to 50.
It shows the max. permissible output power under nominal conditions in order not to exceed the max. permissible power dissipation under conditions of supply over-voltage (\( V_{CC} > V_{CC_{nom}} \)) and load mismatch (VSWR > 1).
It is assumed that the drive power increases linearly with the supply voltage; i.e.
\[ \frac{P_s}{P_{s_{nom}}} = \frac{V_{CC}}{V_{CC_{nom}}} \]
APPLICATION INFORMATION (continued)

Test circuit II (175 MHz)

C1 = C3 = C4 = 30 pF concentric air trimmer
C2 = 60 pF concentric air trimmer
C5 = 0.25 µF ceramic capacitor
C6 = 4 nF polyester capacitor

L1 = 25 mm straight Cu wire (1.2 mm); height above print max. 3 mm
L2 = 3 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; lead length 5 mm
L3 = 2 turns closely wound Cu wire (1.7 mm); int. diam. 12 mm; lead length 5 mm

R1 = 50 Ω carbon
R2 = 1.2 kΩ carbon
R3 = 5 Ω carbon
APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175MHz test circuit.

Shaded area copper
Back area not metalized
Material of pcb : 1.5 mm epoxy fibre glass
Operating Note: Below 200 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.
U.H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon transistor for use in class-B and C operated mobile, industrial and military transmitters with a supply voltage of 13.8 V.

It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25\,^\circ C$ in an unneutralized common-emitter class-B circuit.

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_S$ W</th>
<th>$P_L$ W</th>
<th>$I_C$ A</th>
<th>$G_P$ dB</th>
<th>$\eta$ %</th>
<th>$Z_L^\gamma$</th>
<th>$Y_L$ mS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>13.8</td>
<td>470</td>
<td>&lt; 2.0</td>
<td>7.0</td>
<td>&lt; 0.78</td>
<td>&gt; 5.4</td>
<td>&gt; 65</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>c.w.</td>
<td>13.8</td>
<td>470</td>
<td>typ. 2.0</td>
<td>7.8</td>
<td>typ. 0.81</td>
<td>typ. 5.9</td>
<td>typ. 70</td>
<td>2.4 + j6.7</td>
<td>60 – j20</td>
</tr>
<tr>
<td>c.w.</td>
<td>12.5</td>
<td>470</td>
<td>&lt; 2.2</td>
<td>7.0</td>
<td>&lt; 0.86</td>
<td>&gt; 5.0</td>
<td>&gt; 65</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>c.w.</td>
<td>12.5</td>
<td>175</td>
<td>typ. 0.4</td>
<td>7.2</td>
<td>typ. 0.87</td>
<td>typ.12.6</td>
<td>typ. 66</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-48/3.

Dimensions in mm

Torque on nut: min. 0.75 Nm (7.5 kg cm)
max. 0.85 Nm (8.5 kg cm)

Diameter of clearance hole in heatsink: max. 4.2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
**RATINGS** Limiting values in accordance with the Absolute Maximum System (IEC 134)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Max. Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-base voltage (open emitter) peak value</td>
<td>$V_{CBOM}$</td>
<td>36 V</td>
</tr>
<tr>
<td>Collector-emitter voltage ($R_{BE} = 0$) peak value</td>
<td>$V_{CESM}$</td>
<td>36 V</td>
</tr>
<tr>
<td>Collector-emitter voltage (open base)</td>
<td>$V_{CEO}$</td>
<td>18 V</td>
</tr>
<tr>
<td>Emitter-base voltage (open collector)</td>
<td>$V_{EBO}$</td>
<td>4 V</td>
</tr>
<tr>
<td>Collector current (average)</td>
<td>$I_{C(AV)}$</td>
<td>1.0 A</td>
</tr>
<tr>
<td>Collector current (peak value) $f &gt; 1$ MHz</td>
<td>$I_{CM}$</td>
<td>4.0 A</td>
</tr>
<tr>
<td>Total power dissipation up to $T_h = 70$ °C $f &gt; 10$ MHz</td>
<td>$P_{tot}$</td>
<td>10 W</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>$T_{stg}$</td>
<td>-65 to +150 °C</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>150 °C</td>
</tr>
</tbody>
</table>

**THERMAL RESISTANCE**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>From junction to mounting base</td>
<td>$R_{th\ j-mb}$</td>
<td>7.0 K/W</td>
</tr>
<tr>
<td>From mounting base to heatsink</td>
<td>$R_{th\ mb-h}$</td>
<td>0.6 K/W</td>
</tr>
</tbody>
</table>
### CHARACTERISTICS

**Breakdown voltages**

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-base voltage (open emitter, $I_C = 10 \text{ mA}$)</td>
<td>$V_{(BR)CBO}$</td>
<td>$&gt; 36 \text{ V}$</td>
</tr>
<tr>
<td>Collector-emitter voltage ($V_{BE} = 0$; $I_C = 10 \text{ mA}$)</td>
<td>$V_{(BR)CES}$</td>
<td>$&gt; 36 \text{ V}$</td>
</tr>
<tr>
<td>Collector-emitter voltage (open base, $I_C = 25 \text{ mA}$)</td>
<td>$V_{(BR)CEO}$</td>
<td>$&gt; 18 \text{ V}$</td>
</tr>
<tr>
<td>Emitter-base voltage (open collector, $I_E = 1.0 \text{ mA}$)</td>
<td>$V_{(BR)EBO}$</td>
<td>$&gt; 4 \text{ V}$</td>
</tr>
</tbody>
</table>

**Collector-emitter saturation voltage**

| $I_C = 500 \text{ mA}; I_B = 100 \text{ mA}$ | $V_{CE\text{sat}}$ | typ. $0.2 \text{ V}$ |

**D.C. current gain**

| $I_C = 500 \text{ mA}; V_{CE} = 5 \text{ V}$ | $h_{FE}$ | typ. $40$ |

**Transition frequency**

| $I_C = 500 \text{ mA}; V_{CE} = 5 \text{ V}; f = 500 \text{ MHz}$ | $f_T$ | typ. $1300 \text{ MHz}$ |

**Collector capacitance at $f = 1 \text{ MHz}$**

| $I_E = I_e = 0; V_{CB} = 10 \text{ V}$ | $C_C$ | typ. $14 \text{ pF}$; $< 20 \text{ pF}$ |

**Emitter capacitance at $f = 1 \text{ MHz}$**

| $I_C = I_c = 0; V_{EB} = 0$ | $C_E$ | typ. $65 \text{ pF}$ |

**Feedback capacitance at $f = 1 \text{ MHz}$**

| $I_C = 50 \text{ mA}; V_{CE} = 10 \text{ V}$ | $C_{re}$ | typ. $10.5 \text{ pF}$ |

**Collector-stud capacitance**

| $C_{cs}$ | typ. $2 \text{ pF}$ |

$T_j = 25 \text{ °C}$ unless otherwise specified

---

**Notes:**

- November 1971
- BLX68
BLX68

Diagram showing the relationship between power dissipation and temperature for normal and short-time operation.

- Normal operation: VSWR < 3
- Short-time operation: VSWR > 3

Graphs indicate:
- P_{tot} (W) vs. T_{th} (°C)
- V_C(E (V) vs. I_C (A))

- D.C. SOAR
- T_\text{th} = 25°C, 125°C
APPLICATION INFORMATION

R. F. performance in c. w. operation (unneutralized common-emitter class B circuit)

\( T_h \) up to 25 °C

<table>
<thead>
<tr>
<th>( f ) (MHz)</th>
<th>( V_{CC} ) (V)</th>
<th>( P_S ) (W)</th>
<th>( P_L ) (W)</th>
<th>( I_C ) (A)</th>
<th>( G_P ) (dB)</th>
<th>( \eta ) (%)</th>
<th>( z_L ) (Ω)</th>
<th>( Y_L ) (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>470</td>
<td>13.8</td>
<td>&lt; 2.0</td>
<td>7.0</td>
<td>&lt; 0.78</td>
<td>&gt; 5.4</td>
<td>&gt; 65</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>470</td>
<td>13.8</td>
<td>typ. 2.0</td>
<td>7.8</td>
<td>typ. 0.81</td>
<td>typ. 5.9</td>
<td>typ. 70</td>
<td>2.4 + j6.7</td>
<td>60 - j20</td>
</tr>
<tr>
<td>470</td>
<td>12.5</td>
<td>&lt; 2.2</td>
<td>7.0</td>
<td>&lt; 0.86</td>
<td>&gt; 5.0</td>
<td>&gt; 65</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>175</td>
<td>12.5</td>
<td>typ. 0.4</td>
<td>7.2</td>
<td>typ. 0.87</td>
<td>typ. 12.6</td>
<td>typ. 66</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Test circuit | (470 MHz)

C1 = C2 = C4 = C5 = 1.8 to 18 pF film dielectric trimmer
C3 = 6.8 pF ceramic capacitor
C6 = 0.1 μF polyester capacitor
C7 = 4 nF feed-through capacitor
C8 = 10 pF ceramic capacitor
L1 = L4 = L5 = 20 mm straight Cu wire (1.2 mm); height above print 12 mm
L2 = 0.47 μH choke
L3 = 1 turn Cu wire (1.7 mm); int. diam. 10 mm; max. lead length 5 mm
R = 10 Ω carbon

At \( P_L = 7.0 \text{ W} \) and \( V_{CC} = 12.5 \text{ V} \) the output power at heatsink temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 10 mW/K

The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: \( V_{CC} = 16.5 \text{ V} \); \( f = 470 \text{ MHz} \); \( T_h = 70 \text{ °C} \);
V.S.W.R. = 50 : 1 through all phases; \( P_S = P_{Snom} + 20 \% \)
where \( P_{Snom} = P_S \) for 7.0 W transistor output into 50 Ω load at \( V_{CC} = 13.8 \text{ V} \)
APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 470 MHz test circuit.

Shaded area copper
Back area completely copper clad
Material of printed circuit board: 1.5 mm epoxy fibre glass
Conditions for R.F. SOAR:

\[
\begin{align*}
\text{f} &= 470 \text{ MHz} \\
T_h &= 70 \text{ °C} \\
V_{CC_{\text{nom}}} &= 13.8 \text{ V}
\end{align*}
\]

\[P_{\text{Snom}} = P_S \text{ at } V_{CC} = V_{CC_{\text{nom}}} \text{ and } VSWR = 1\]

The transistor was developed for use with unstabilized supply voltage \(V_{CC}\).

The above graph is based on its measured performance in test circuit 1.

Supply voltage was varied from \(V_{CC_{\text{nom}}} \text{ to } 1.2 \times V_{CC_{\text{nom}}}, \text{ and } VSWR \text{ from } 1 \text{ to } 50.\)

It shows the max. permissible output power under nominal conditions in order not to exceed the max. permissible power dissipation under conditions of supply over-voltage (\(V_{CC} > V_{CC_{\text{nom}}}\)) and load mismatch (\(VSWR > 1\)).

It is assumed that the drive power increases linearly with the supply voltage; i.e.

\[\frac{P_S}{P_{\text{Snom}}} = \frac{V_{CC}}{V_{CC_{\text{nom}}}}.\]
APPLICATION INFORMATION (continued)

Test circuit II (175 MHz)

\[ \text{C1} = \text{C3} = \text{C4} = 30 \text{ pF concentric air trimmer} \]
\[ \text{C2} = 60 \text{ pF concentric air trimmer} \]
\[ \text{C5} = 0.25 \mu \text{F polyester capacitor} \]
\[ \text{C6} = 4.0 \text{ nF feed-through capacitor} \]

\[ \text{L1} = 25 \text{ mm straight Cu wire (1.2 mm); height above print 3 mm} \]
\[ \text{L2} = 3 \text{ turns Cu wire (0.5 mm) on Ferrite FX1115, d = 2 mm, D = 4 mm, } \]
\[ {\text{material 3B (code number 3113 99116740)}} \]
\[ \text{L3} = 5 \text{ turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; lead length 5 mm} \]
\[ \text{L4} = 3 \text{ turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; lead length 5 mm} \]

\[ \text{R} = 10 \Omega \text{ carbon} \]
APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit

Shaded area copper
Back area not metalized
Material of printed circuit board: 1.5 mm epoxy fibre glass
Power gain versus frequency (class B operation)

- $V_{CC} = 13.8 \text{ V}$
- $P_L = 7.8 \text{ W}$
- $T_h = 25 \degree \text{C}$

Input impedance (series components) versus frequency (class B operation)

- $V_{CC} = 13.8 \text{ V}$
- $P_L = 7.8 \text{ W}$
- $T_h = 25 \degree \text{C}$

Load impedance (parallel components) versus frequency (class B operation)

- $V_{CC} = 13.8 \text{ V}$
- $P_L = 7.8 \text{ W}$
- $T_h = 25 \degree \text{C}$

Typical values
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. Gold metallization ensures extremely high reliability.

It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance up to $T_{mb} = 25^\circ C$ in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_S$ W</th>
<th>$P_L$ W</th>
<th>$I_C$ A</th>
<th>$G_P$ dB</th>
<th>$\eta$ %</th>
<th>$\bar{Z}_i$ $\Omega$</th>
<th>$\bar{Y}_L$ mS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>13,5</td>
<td>470</td>
<td>&lt; 8,0</td>
<td>20</td>
<td>&lt; 2,28</td>
<td>&gt; 4</td>
<td>&gt; 65</td>
<td>1,2 + j4,5</td>
<td>163 - j35</td>
</tr>
<tr>
<td>c.w.</td>
<td>12,5</td>
<td>470</td>
<td>&lt; 6,8</td>
<td>17</td>
<td>&lt; 2,09</td>
<td>&gt; 4</td>
<td>&gt; 65</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-48/2.

Dimensions in mm

Torque on nut: min. 0,75 Nm (7,5 kg cm)  
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.  
Mounting hole to have no burrs at either end.  
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
**RATINGS** Limiting values in accordance with the Absolute Maximum System (IEC 134)

**Voltages**
- Collector-base voltage (open emitter) peak value
- Collector-emitter voltage (open base)
- Emitter-base voltage (open collector)

**Currents**
- Collector current (average)
- Collector current (peak value) $f > 1 \text{ MHz}$

**Power dissipation**
Total power dissipation up to $T_h = 25 \text{ °C}$ $f \geq 1 \text{ MHz}$

**Temperatures**
- Storage temperature
- Junction temperature

**THERMAL RESISTANCE**
- From junction to mounting base
- From mounting base to heatsink

### Ratings Table

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Maximum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CBOM}$</td>
<td>36 V</td>
</tr>
<tr>
<td>$V_{CEO}$</td>
<td>18 V</td>
</tr>
<tr>
<td>$V_{EBO}$</td>
<td>4 V</td>
</tr>
<tr>
<td>$I_{C(AV)}$</td>
<td>3.5 A</td>
</tr>
<tr>
<td>$I_{CM}$</td>
<td>10 A</td>
</tr>
<tr>
<td>$P_{tot}$</td>
<td>50 W</td>
</tr>
</tbody>
</table>

### Thermal Resistance
- $R_{th j-mb} = 2.9 \text{ K/W}$
- $R_{th mb-h} = 0.6 \text{ K/W}$

---

February 1975
CHARACTERISTICS

$T_j = 25 \, ^\circ C$ unless otherwise specified

Breakdown voltages

- Collector-base voltage
  - open emitter; $I_C = 25 \, mA$  
  - $V_{(BR)CBO} > 36 \, V$

- Collector-emitter voltage
  - open base; $I_C = 25 \, mA$  
  - $V_{(BR)CEO} > 18 \, V$

- Emitter-base voltage
  - open collector; $I_E = 10 \, mA$  
  - $V_{(BR)EBO} > 4 \, V$

Transient energy

- $L = 25 \, mH; f = 50 \, Hz$
  - open base
    - $-V_{BE} = 1.5 \, V; R_{BE} = 33 \, \Omega$
    - $E < 3.1 \, mWs$

D.C. current gain

- $I_C = 1 \, A; V_{CE} = 5 \, V$
  - $h_{FE} < 10$

Transition frequency

- $I_C = 2 \, A; V_{CE} = 10 \, V$
  - $f_T < 1.0 \, GHz$

Collector capacitance at $f = 1 \, MHz$

- $I_E = I_e = 0; V_{CB} = 15 \, V$
  - $C_c < 55 \, \mu F$

Feedback capacitance

- $I_C = 100 \, mA; V_{CE} = 15 \, V$
  - $C_{re} < 70 \, \mu F$

Collector-stud capacitance

- $C_{cs} < 2 \, \mu F$
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

$T_{mb}$ up to 25 °C

<table>
<thead>
<tr>
<th>$f$ (MHz)</th>
<th>$V_{CE}$ (V)</th>
<th>$P_S$ (W)</th>
<th>$P_L$ (W)</th>
<th>$I_C$ (A)</th>
<th>$G_B$ (dB)</th>
<th>$\eta$ (%)</th>
<th>$Z_i$ (Ω)</th>
<th>$\bar{Y_L}$ (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>470</td>
<td>13,5</td>
<td>&lt; 8,00</td>
<td>20</td>
<td>&lt; 2,28</td>
<td>&gt; 4</td>
<td>&gt; 65</td>
<td>1,2 + j4,5</td>
<td>163 – j35</td>
</tr>
<tr>
<td>470</td>
<td>12,5</td>
<td>&lt; 6,80</td>
<td>17</td>
<td>&lt; 2,09</td>
<td>&gt; 4</td>
<td>&gt; 65</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>175</td>
<td>12,5 typ. 1,35</td>
<td>17 typ. 2,30</td>
<td>typ. 11 typ. 60</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test circuit: 470 MHz; c.w. class-B.

![Circuit Diagram]

List of components:

- $C_1 = C_2 = C_7 = C_8 = 2,0$ to $9,0$ pF film dielectric trimmer (cat. no. 2222 809 09002)
- $C_3 = C_4 = 15$ pF chip capacitor
- $C_5 = 100$ pF feed-through capacitor
- $C_6 = 33$ nF polyester capacitor
- $R_1 = 1$ Ω carbon resistor
- $R_2 = 10$ Ω carbon resistor
- $L_1 =$ stripline ($41,1$ mm x $5,0$ mm)
- $L_2 =$ 13 turns closely wound enamelled Cu wire ($0,5$ mm); int. dia. $4,0$ mm ($0,32$ μH)
- $L_3 =$ 2 turns Cu wire ($1$ mm); winding pitch $1,5$ mm; int. dia. $4$ mm; leads $2$ x $5$ mm
- $L_4 =$ stripline ($52,7$ mm x $5,0$ mm)
- $L_5 =$ Ferroxcube choke coil. $Z$ (at $f =$ $50$ MHz) = $750$ Ω ± $20\%$ (cat. no. 4312 020 36640)
- $L_1$ and $L_4$ are striplines on a double Cu-clad print plate with PTFE fibre-glass dielectric. ($\epsilon_r = 2,74$); thickness $1,45$ mm.
APPLICATION INFORMATION (continued)

Component layout and printed-circuit board for 470 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph above for safe operation at supply voltages other than the nominal. The graph shows the allowable output power, under nominal conditions, as a function of the supply overvoltage ratio, with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{S\text{ nom}}) increases linearly with the supply overvoltage ratio.

The horizontal line at 20 W applies at V_{CC\text{ nom}} = 13.5 V.

For V_{CC\text{ nom}} = 12.5 V, P_L should be derated to 17 W.
Power gain versus frequency (class B operation)

$V_{CC} = 13.5 \text{ V}$
$P_L = 20 \text{ W}$
$T_{mb} = 25 \text{ °C}$

Input impedance (series components) versus frequency (class B operation)

$V_{CC} = 13.5 \text{ V}$
$P_L = 20 \text{ W}$
$T_{mb} = 25 \text{ °C}$

Typical values

Load impedance (parallel components) versus frequency (class B operation)

$V_{CC} = 13.5 \text{ V}$
$P_L = 20 \text{ W}$
$T_{mb} = 25 \text{ °C}$

Typical values
N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C with a supply voltage up to 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Gold metallization ensures extremely high reliability.

It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

**QUICK REFERENCE DATA**

R.F. performance up to $T_h = 25^\circ C$ in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_S$ mW</th>
<th>$P_L$ W</th>
<th>$I_C$ mA</th>
<th>$G_P$ dB</th>
<th>$\eta$ %</th>
<th>$Z_i$ $\Omega$</th>
<th>$Y_L$ mS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>24</td>
<td>470</td>
<td>typ. 50</td>
<td>0,85</td>
<td>typ. 67</td>
<td>typ. 12,3</td>
<td>typ. 53</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c.w.</td>
<td>28</td>
<td>470</td>
<td>$&lt; 80$</td>
<td>1,0</td>
<td>$&lt; 71$</td>
<td>$&gt; 11,0$</td>
<td>$&gt; 50$</td>
<td></td>
<td></td>
</tr>
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<td>c.w.</td>
<td>28</td>
<td>470</td>
<td>typ. 80</td>
<td>1,45</td>
<td>typ. 86</td>
<td>typ. 12,6</td>
<td>typ. 60</td>
<td>$2,5 + j0,2$</td>
<td>$3,4 - j16$</td>
</tr>
<tr>
<td>c.w.</td>
<td>28</td>
<td>1000</td>
<td>typ. 400</td>
<td>1,4</td>
<td>typ.100</td>
<td>typ. 5,4</td>
<td>typ. 50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MECHANICAL DATA**

Dimensions in mm

Fig. 1 SOT-48/3.

Torque on nut: min. 0,75 Nm (7,5 kg cm)  
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.  
Mounting hole to have no burrs at either end.  
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

**PRODUCT SAFETY**  
This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS  Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

Collector-base voltage (open emitter)  
peak value

Collector-emitter voltage (V_{BE} = 0)  
peak value

Collector-emitter voltage (open base)

Emitter-base voltage (open collector)

Currents

Collector current (d.c.)
Collector current (peak value); f \geq 10 \text{ MHz}

Power dissipation

Total power dissipation up to T_h = 70 \text{ °C}  
f \geq 10 \text{ MHz}

Temperatures

Storage temperature
Operating junction temperature

THERMAL RESISTANCE

From junction to mounting base
From mounting base to heatsink
U.H.F. power transistor

BLX91A

D.C. SOAR

$V_{CE} \leq 28 \text{ V}$

$Th = 70 \degree \text{C}$

$P_{\text{tot max (d.c.)}}$ derate by $33 \degree \text{C/W}$ for $70 \degree \text{C} < Th < 125 \degree \text{C}$

$I_C$ (A)

$10^2$

$10^{-2}$

$10^{-1}$

$10^{-2}$

$10^{-1}$

$100$

$200$

$0$

$100$

$200$

$0$

$P_{\text{tot (W)}}$

normal operation

VSWR $\leq 3$

short time operation

VSWR $\geq 3$

$R_{\text{th (junction to case)}} = (225 + 0.6) \degree \text{C/W}$

$R_{\text{th (case to ambient)}} = (25 + 0.6) \degree \text{C/W}$

$V_{CE} \leq 28 \text{ V}$

$f \geq 10 \text{ MHz}$

June 1976
CHARACTERISTICS

T\textsubscript{j} = 25°C unless otherwise specified

Breakdown voltages

Collector-base voltage
open emitter, I\textsubscript{C} = 10 mA

V(BR)\textsubscript{CBO} > 65 V

Collector-emitter voltage

V\textsubscript{BE} = 0, I\textsubscript{C} = 10 mA

V(BR)\textsubscript{CES} > 65 V

Collector-emitter voltage
open base, I\textsubscript{C} = 25 mA

V(BR)\textsubscript{CEO} > 33 V

Emitter-base voltage
open collector, I\textsubscript{E} = 1.0 mA

V(BR)\textsubscript{EBO} > 4.0 V

D. C. current gain

I\textsubscript{C} = 100 mA; V\textsubscript{CE} = 5.0 V

h\textsubscript{FE} > 10 typ. 35

Transition frequency

I\textsubscript{C} = 50 mA; V\textsubscript{CE} = 5.0 V

f\textsubscript{T} typ. 1.2 GHz

Collector capacitance at f = 1 MHz

I\textsubscript{E} = I\textsubscript{C} = 0; V\textsubscript{CB} = 10 V

C\textsubscript{C} typ. 3.5 pF

Emitter capacitance at f = 1 MHz

I\textsubscript{C} = I\textsubscript{C} = 0; V\textsubscript{EB} = 0

C\textsubscript{E} typ. 11 pF

Feedback capacitance at f = 1 MHz

I\textsubscript{C} = 5 mA; V\textsubscript{CE} = 10 V

C\textsubscript{re} typ. 2.5 pF

Collector-stud capacitance

C\textsubscript{CS} typ. 2.0 pF
U.H.F. power transistor

BLX91A

APPLICATION INFORMATION

R.F. performance in c.w. operation (Unneutralized common-emitter class-B circuit)

\[ T_h = 25 \, ^\circ C \]

<table>
<thead>
<tr>
<th>( V_{CC} (V) )</th>
<th>( f ) (MHz)</th>
<th>( P_s ) (mW)</th>
<th>( P_L ) (W)</th>
<th>( I_C ) (mA)</th>
<th>( G_p ) (dB)</th>
<th>( \eta ) (%)</th>
<th>( Z_i ) (Ω)</th>
<th>( Y_L ) (mS)</th>
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<tbody>
<tr>
<td>24</td>
<td>470</td>
<td>typ. 50</td>
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<td>-</td>
</tr>
<tr>
<td>28</td>
<td>&lt; 80</td>
<td>1,0</td>
<td>&lt; 71</td>
<td>&gt; 11,0</td>
<td>&gt; 50</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>28</td>
<td>470</td>
<td>typ. 80</td>
<td>typ. 86</td>
<td>typ. 12,6</td>
<td>typ. 60</td>
<td>2,5 + j0,2</td>
<td>3,4 - j16</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>1000</td>
<td>typ. 400</td>
<td>typ. 100</td>
<td>typ. 5,4</td>
<td>typ. 50</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Test circuit for 470 MHz:

\[ L_1 = 1 \text{ turn Cu wire} (1,2 \text{ mm}); \text{int. dia.} \ 5 \text{ mm}; \text{lead length} = 2 \text{ mm} \]

\[ L_2 = 0,47 \mu H \text{ choke} \]

\[ L_3 = 4 \text{ turns closely wound enamelled Cu wire} (1,2 \text{ mm}); \text{int. dia.} \ 6,5 \text{ mm}; \text{lead length} = 4 \text{ mm} \]

\[ L_4 = 5 \text{ turns closely wound enamelled Cu wire} (0,5 \text{ mm}); \text{int. dia.} \ 4 \text{ mm}; \text{lead length} = 5 \text{ mm} \]

\[ C_1 = C_2 = C_7 = 1,8 \text{ to} 18 \text{ pF film dielectric trimmer} \]

\[ C_3 = C_4 = 18 \text{ pF disc ceramic capacitor} \]

\[ C_5 = 1 \text{ nF feed-through capacitor} \]

\[ C_6 = 1,0 \text{ to} 9,0 \text{ pF film dielectric trimmer} \]

\[ C_8 = 0,1 \mu F \text{ polyester capacitor} \]

At \( P_L = 1,0 \text{ W} \) and \( V_{CC} = 28 \text{ V} \), the output power at heatsink temperatures between 25 \( ^\circ C \) and 90 \( ^\circ C \) relative to that at 25 \( ^\circ C \) is diminished by typ. 2 mW/K.

The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: \( V_{CC} = 28 \text{ V}; f = 470 \text{ MHz}; T_h = 90 \text{ C} \).

VSWR = 50 : 1 through all phases; \( P_L = 1,2 \text{ W} \).
APPLICATION INFORMATION (continued)

Component layout and printed-circuit board for 470 MHz test circuit.

Shaded area copper
Back area completely copper clad
Material of printed-circuit board: 1.5 mm epoxy fibre-glass
Indicated load power as a function of overload

The graph has been derived from an evaluation of the performance of transistors matched up to 1.6 W load power in the test amplifier and subsequently subjected to various mismatch conditions at 28 V with VSWR up to 50 and elevated heatsink temperatures. This indicates a restriction to the load power matched under nominal conditions in the recommended test configuration.
**OPERATING NOTE** Below 350 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.

![Graphs of power gain, input impedance, and load impedance versus frequency.](attachment:image.png)
SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily designed for use in fast-switching wide-band video amplifiers for driving the cathode of a picture tube.

The transistor has a common-base pin configuration and is sealed in a capstan envelope with a moulded cap. All the leads are isolated from the stud.

MECHANICAL DATA

Dimensions in mm

Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm

Mounting holes to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage
(peak value); $V_{BE} = 0$
open base

Emitter-base voltage (open collector)

Collector current
d.c.
(peak value); $f > 1$ MHz

D.C. power dissipation up to $T_h = 70$ °C
(see D.C. SOAR in Fig. 2)

Storage temperature

Operating junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CESM}$</td>
<td>65 V</td>
</tr>
<tr>
<td>$V_{CEO}$</td>
<td>33 V</td>
</tr>
<tr>
<td>$V_{EBO}$</td>
<td>4 V</td>
</tr>
<tr>
<td>$I_C$</td>
<td>400 mA</td>
</tr>
<tr>
<td>$I_{CM}$</td>
<td>800 mA</td>
</tr>
<tr>
<td>$P_{d.c.}$</td>
<td>4 W</td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>-65 to +150 °C</td>
</tr>
<tr>
<td>$T_j$</td>
<td>200 °C</td>
</tr>
</tbody>
</table>

Fig. 2 D.C. SOAR.

THERMAL RESISTANCE

From junction to mounting base (d.c.)

From mounting base to heatsink

$R_{th j-mb} = 32.5$ K/W

$R_{th mb-h} = 0.6$ K/W
CHARACTERISTICS

$T_j = 25 \, ^\circ\text{C}$ unless otherwise specified

Collector-emitter breakdown voltage

$V_{BE} = 0; \quad I_C = 10 \, mA$

$V_{CE} = 25 \, mA; \quad I_E = 0$

Emitter-base breakdown voltage

$V_{BE} = 1 \, mA; \quad I_e = 0$

Collector-base leakage current

$V_{CB} = 20 \, V; \quad I_C = 0$

D.C. current gain

$I_C = 100 \, mA; \quad V_{CE} = 5 \, V$

Transition frequency

$V_{CE} = 5 \, V$

Collector capacitance at $f = 1 \, MHz$

$V_{CE} = 10 \, V$

Emitter capacitance at $f = 1 \, MHz$

$V_{CE} = 0,5 \, V$

Feedback capacitance at $f = 1 \, MHz$

$V_{CE} = 10 \, V$

Collector-stud capacitance

$V_{BR} < V_{BR} > V_{BE} < I_{CBO}$

$V_{BR} > 65 \, V$

$V_{BR} > 33 \, V$

$V_{BR} < 4 \, V$

$I_{CBO} < 1 \, mA$

$h_{FE} = 10 \, to \, 160$

$V_{CE} = 20 \, V$

$f_T = 1000 \, GHz$

$C_c = 3,5 \, pF$

$C_e = 11 \, pF$

$C_{re} = 2,5 \, pF$

$C_{cs} = 2 \, pF$

Fig. 3 Current gain (d.c.) versus collector current.

Fig. 4 Collector capacitance versus $V_{CB}$:

$I_E = I_e = 0; \quad f = 1 \, MHz$. 

January 1984
Fig. 5 Transition frequency versus emitter current; $V_{CB} = 28$ V.
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C with a supply voltage up to 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Gold metallization ensures extremely high reliability.

It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance up to $T_H = 25 \, ^\circ C$ in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_s$ W</th>
<th>$P_L$ W</th>
<th>$I_C$ mA</th>
<th>$G_P$ dB</th>
<th>$\eta$ %</th>
<th>$\bar{Z}_i$ $\Omega$</th>
<th>$\bar{V}_L$ mS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>24</td>
<td>470</td>
<td>typ. 0,2</td>
<td>2,4</td>
<td>typ. 143</td>
<td>typ. 10,8</td>
<td>typ. 70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c.w.</td>
<td>28</td>
<td>470</td>
<td>&lt; 0,2</td>
<td>2,5</td>
<td>&lt; 149</td>
<td>&gt; 11,0</td>
<td>&gt; 60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c.w.</td>
<td>28</td>
<td>470</td>
<td>typ. 0,2</td>
<td>3,0</td>
<td>typ. 162</td>
<td>typ. 11,7</td>
<td>typ. 66</td>
<td>1,8 + j2,8</td>
<td>7,2 – j24</td>
</tr>
<tr>
<td>c.w.</td>
<td>28</td>
<td>1000</td>
<td>typ. 0,7</td>
<td>2,5</td>
<td>typ. 179</td>
<td>typ. 5,5</td>
<td>typ. 50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-48/3.

Dimensions in mm

Torque on nut: min. 0,75 Nm (7,5 kg cm) max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.

Mounting hole to have no burrs at either end.

De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
**RATINGS** Limiting values in accordance with the *Absolute Maximum System (IEC134)*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-base voltage (open emitter) peak value</td>
<td>V_{CBOM}</td>
<td>max. 65 V</td>
</tr>
<tr>
<td>Collector-emitter voltage (V_{BE} = 0) peak value</td>
<td>V_{CESM}</td>
<td>max. 65 V</td>
</tr>
<tr>
<td>Collector-emitter voltage (open base)</td>
<td>V_{CEO}</td>
<td>max. 33 V</td>
</tr>
<tr>
<td>Emitter-base voltage (open collector)</td>
<td>V_{EBO}</td>
<td>max. 4.0 V</td>
</tr>
<tr>
<td>Collector current (d.c.)</td>
<td>I_C</td>
<td>max. 0.7 A</td>
</tr>
<tr>
<td>Collector current (peak value) f ≥ 10 MHz</td>
<td>I_{CM}</td>
<td>max. 2.0 A</td>
</tr>
<tr>
<td>Total power dissipation up to T_h = 70 °C f ≥ 10 MHz</td>
<td>P_{tot}</td>
<td>max. 6.0 W</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>T_{stg}</td>
<td>-65 to +150 °C</td>
</tr>
<tr>
<td>Operating junction temperature</td>
<td>T_j</td>
<td>max. 200 °C</td>
</tr>
</tbody>
</table>

**THERMAL RESISTANCE**

<table>
<thead>
<tr>
<th>Term</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>From junction to mounting base</td>
<td>R_{th j-mb}</td>
<td>21.4 K/W</td>
</tr>
<tr>
<td>From mounting base to heatsink</td>
<td>R_{th mb-h}</td>
<td>0.6 K/W</td>
</tr>
</tbody>
</table>
U.H.F. power transistor

CHARACTERISTICS

Tj = 25 °C unless otherwise specified

Breakdown voltages

Collector-base voltage
open emitter, Ic = 10 mA

Collector-emitter voltage
Vbe = 0, Ic = 10 mA

Collector-emitter voltage
open base, Ic = 25 mA

Emitter-base voltage
open collector, Ie = 1,0 mA

Collector-emitter saturation voltage
Ic = 100 mA; Ib = 20 mA

D.C. current gain
Ic = 100 mA; Vce = 5,0 V

Transition frequency
Ic = 100 mA; Vce = 5,0 V

Collector capacitance at f = 1 MHz
Ie = Ic = 0; VCb = 10 V

Emitter capacitance at f = 1 MHz
Ic = Ic = 0; Veb = 0

Feedback capacitance at f = 1 MHz
Ic = 10 mA; Vce = 10 V

Collector-stud capacitance

V(BR)CBO > 65 V
V(BR)CES > 65 V
V(BR)CEO > 33 V
V(BR)EBO > 4,0 V
VCEsat typ. 0,17 V
hFE typ. 10
hFE typ. 40
fT typ. 1,2 GHz
Cc typ. 6,5 pF
Ce typ. 25 pF
Cre typ. 4,8 pF
Ccs typ. 2,0 pF
$P_{\text{tot}}$ (W)

- Short time operation
  - $\text{VSWR} \geq 3$
  - $R_{\text{th}, j-h} = (2.1 + 0.6) ^{\circ}C/W$

- Normal operation
  - $\text{VSWR} \leq 3$
  - $R_{\text{th}, j-h} = (2.1 + 0.6) ^{\circ}C/W$

$V_{CE} \leq 28 \text{ V}$

$f \geq 10 \text{ MHz}$

$P_{\text{tot}} \text{ max (d.c.) derate by } 22^\circ \text{C/W for }$

- $70^\circ \text{C} < T_h < 125^\circ \text{C}$
- $T_h = 25^\circ \text{C}$
- $T_h = 70^\circ \text{C}$
- $125^\circ \text{C}$

$I_C$ (A)

$T_h = 70^\circ \text{C}$

$I_C$ (A)

$P_{\text{tot}} \text{ max (d.c.) derate by } 22^\circ \text{C/W for }$

- $70^\circ \text{C} < T_h < 125^\circ \text{C}$
- $T_h = 25^\circ \text{C}$
- $T_h = 70^\circ \text{C}$
- $125^\circ \text{C}$

$V_{CE}$ (V)

$T_h = 70^\circ \text{C}$

$T_h = 25^\circ \text{C}$

$125^\circ \text{C}$

904 June 1976
U.H.F. power transistor

<table>
<thead>
<tr>
<th>f = 200 MHz</th>
<th>V_{CE} = 28 V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>typ. values</td>
</tr>
</tbody>
</table>

\[ |S_{fe}| (dB) \]

\[ I_E (mA) \]

\[ 0 \quad 100 \quad 200 \]

\[ 15 \]

\[ 0 \quad 5 \quad 10 \quad 15 \]

\[ C_C (pF) \]

\[ I_E = I_C = 0 \]

\[ f = 1 \text{ MHz} \]

\[ V_{CE} = 28 \text{ V} \]

\[ 7761875 \]

\[ 7761872 \]

\[ 7762861 \]

\[ f_T (MHz) \]

\[ I_C (mA) \]

\[ 0 \quad 50 \quad 100 \quad 150 \quad 200 \quad 250 \quad 300 \]

\[ 0 \quad 500 \quad 1000 \quad 1500 \quad 2000 \]

June 1976
|IE| = 100 mA
|VCE| = 28 V
typ. values

|S|_{ie} | (dB)
<table>
<thead>
<tr>
<th></th>
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<tbody>
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</tbody>
</table>

arg \( s_{ie} \)

|S|_{re} | (dB)
<table>
<thead>
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<tbody>
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</tr>
</tbody>
</table>

arg \( s_{re} \)

|S|_{fe} | (dB)
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</tbody>
</table>

arg \( s_{fe} \)

|S|_{oe} | (dB)
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<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>---</td>
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<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

arg \( s_{oe} \)
APPLICATION INFORMATION

R.F. performance in c.w. operation (Unneutralized common-emitter class-B circuit)

\[ T_h = 25 \, ^\circ C \]

<table>
<thead>
<tr>
<th>( V_{CC} (V) )</th>
<th>( f (MHz) )</th>
<th>( P_S (W) )</th>
<th>( P_L (W) )</th>
<th>( I_C (mA) )</th>
<th>( G_p (dB) )</th>
<th>( \eta (%) )</th>
<th>( Z_I (\Omega) )</th>
<th>( Y_L (mS) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>470</td>
<td>typ. 0,2</td>
<td>2,4</td>
<td>typ. 143</td>
<td>typ. 10,8</td>
<td>typ. 70</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>28</td>
<td>470</td>
<td>&lt; 0,2</td>
<td>2,5</td>
<td>&lt; 149</td>
<td>&gt; 11,0</td>
<td>&gt; 60</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>28</td>
<td>470</td>
<td>typ. 0,2</td>
<td>3,0</td>
<td>typ. 162</td>
<td>typ. 11,7</td>
<td>typ. 66</td>
<td>1,8 + j2,8</td>
<td>7,2 – j24</td>
</tr>
<tr>
<td>28</td>
<td>1000</td>
<td>typ. 0,7</td>
<td>2,5</td>
<td>typ. 179</td>
<td>typ. 5,5</td>
<td>typ. 50</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

Test circuit for 470 MHz:

\[ C_1 = C_2 = 1,8 \text{ to } 18 \text{ pF film dielectric trimmer} \]
\[ C_3 = C_4 = 18 \text{ pF disc ceramic capacitor} \]
\[ C_5 = 1 \text{ nF feed-through capacitor} \]
\[ C_6 = C_7 = 1,0 \text{ to } 9,0 \text{ pF film dielectric trimmer} \]
\[ C_8 = 0,1 \mu F polyester capacitor \]
\[ L_1 = 1 \text{ turn Cu wire (1,2 mm); int. dia. 5 mm; lead length = 2 mm} \]
\[ L_2 = 0,47 \mu H choke \]
\[ L_3 = 2 \text{ turns closely wound enamelled Cu wire (1,2 mm); int. dia. 6,5 mm; lead length = 4 mm} \]
\[ L_4 = 3 \text{ turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4,0 mm; lead length = 5 mm} \]
\[ R = 10 \Omega \text{ carbon} \]

At \( P_L = 2,5 \text{ W} \) and \( V_{CC} = 28 \text{ V} \), the output power at heatsink temperatures between 25 \( ^\circ C \) and 90 \( ^\circ C \) relative to that at 25 \( ^\circ C \) is diminished by typ. 5 mw/K

The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: \( V_{CC} = 28 \text{ V}; f = 470 \text{ MHz}; T_h = 90 \text{ \( ^\circ C \)} \).

VSWR = 50 : 1 through all phases; \( P_L = 2,5 \text{ W} \).
Component layout and printed-circuit board for 470 MHz test circuit.

Shade area copper
Back area completely copper clad
Material of printed-circuit board: 1.5 mm epoxy fibre-glass
Indicated load power as a function of overload

The graph has been derived from an evaluation of the performance of transistors matched up to 3.8 W load power in the test amplifier and subsequently subjected to various mismatch conditions at 28 V with VSWR up to 50 and elevated heatsink temperatures. This indicates a restriction to the load power matched under nominal conditions in the recommended test configuration.
OPERATING NOTE Below 350 MHz a base-emitter resistor of $10 \, \Omega$ is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C with a supply voltage up to 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Gold metallization ensures extremely high reliability.

It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance up to \( T_h = 25 \, ^\circ C \) in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>( V_{CE} ) V</th>
<th>( f ) MHz</th>
<th>( P_S ) W</th>
<th>( P_L ) W</th>
<th>( I_C ) A</th>
<th>( G_P ) dB</th>
<th>( \eta )</th>
<th>( Z_i ) ( \Omega )</th>
<th>( Y_L ) mS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>24</td>
<td>470</td>
<td>typ. 1,0</td>
<td>7,0</td>
<td>typ. 0,42</td>
<td>typ. 8,5</td>
<td>typ. 70</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>c.w.</td>
<td>28</td>
<td>470</td>
<td>&lt; 1,0</td>
<td>7,0</td>
<td>&lt; 0,42</td>
<td>&gt; 8,5</td>
<td>&gt; 60</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>c.w.</td>
<td>28</td>
<td>470</td>
<td>(typ. 1,0)</td>
<td>8,0</td>
<td>typ. 0,38</td>
<td>typ. 9,0</td>
<td>typ. 75</td>
<td>1,8 + j5,3</td>
<td>19 – j32</td>
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<tr>
<td>c.w.</td>
<td>28</td>
<td>1000</td>
<td>typ. 1,5</td>
<td>5,0</td>
<td>typ. 0,40</td>
<td>typ. 5,2</td>
<td>typ. 45</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-48/3.

Dimensions in mm

Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter)
  peak value
Collector-emitter voltage (VBE = 0)
  peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current (d.c.)
Collector current (peak value) f ≥ 10 MHz
Total power dissipation up to \( T_h = 70 \, ^\circ\text{C} \)
  f ≥ 10 MHz
Storage temperature
Operating junction temperature

THERMAL RESISTANCE
From junction to mounting base
From mounting base to heatsink
CHARACTERISTICS

Tj = 25 °C unless otherwise specified

Breakdown voltages

Collector-base voltage
  open emitter, IC = 10 mA

\[ V_{(BR)CBO} > 65 \text{ V} \]

Collector-emitter voltage
  open base, IC = 10 mA

\[ V_{(BR)CES} > 65 \text{ V} \]

Collector-emitter voltage
  open base, IC = 25 mA

\[ V_{(BR)CEO} > 33 \text{ V} \]

Emitter-base voltage
  open collector, IE = 1,0 mA

\[ V_{(BR)EBO} > 4,0 \text{ V} \]

D.C. current gain

\[ h_{FE} > 10 \text{ (typ. 35)} \]

Transition frequency

\[ f_T \text{ typ. 1,2 GHz} \]

Collector capacitance at f = 1 MHz

\[ C_C \text{ typ. 14 pF} \]

Emitter capacitance at f = 1 MHz

\[ C_e \text{ typ. 60 pF} \]

Feedback capacitance at f = 1 MHz

\[ C_{re} \text{ typ. 10 pF} \]

Collector-stud capacitance

\[ C_{cs} \text{ typ. 2,0 pF} \]
D.C. SOAR

\[ I_C (A) \]

\[ 10 \]

\[ 1 \]

\[ 10^{-1} \]

\[ 10^{-2} \]

\[ 1 \]

\[ 10 \]

\[ 100 \]

\[ V_C E (V) \]

\[ 10^2 \]

\[ P_{\text{tot max}} \] (d.c.)

Derate by 10.4 °C/W for:

\[ 70 \, ^\circ \text{C} < T_h < 125 \, ^\circ \text{C} \]

Second breakdown (d.c.)

\[ T_h = 25 \, ^\circ \text{C} \]

\[ 125 \, ^\circ \text{C} \]

\[ V_C E < 28 \, \text{V} \]

\[ f \geq 10 \, \text{MHz} \]

\[ P_{\text{tot}} (W) \]

\[ 0 \]

\[ 5 \]

\[ 10 \]

\[ 15 \]

\[ 20 \]

\[ 0 \]

\[ 50 \]

\[ 100 \]

\[ 150 \]

\[ T_h (^\circ \text{C}) \]

VSWR ≥ 3

Normal operation

VSWR ≤ 3

Short time operation

\[ R_{th-J-h} = (9.8 + 0.6) \, ^\circ \text{C/W} \]

June 1976
U.H.F. power transistor

- **$V_{CE} = 28$ V**
- **$I_E = I_C = 0$**
- **$f = 1$ MHz**

**Typical Values**

- $|s_{fe}| (dB)$
  - $f = 200$ MHz
  - $f = 400$ MHz
  - $f = 800$ MHz

- $C_C$ (pF)

- $f_T$ (GHz)
  - $V_{CE} = 28$ V
  - $V_{CE} = 20$ V

---

June 1976
APPLICATION INFORMATION

R.F. performance in c.w. operation (Unneutralized common-emitter class-B circuit)

\[ T_h = 25 \, ^\circ \text{C} \]

<table>
<thead>
<tr>
<th>( V_{CC} ) (V)</th>
<th>( f ) (MHz)</th>
<th>( P_S ) (W)</th>
<th>( P_L ) (W)</th>
<th>( I_C ) (A)</th>
<th>( G_p ) (dB)</th>
<th>( \eta ) (%)</th>
<th>( z_1 ) (( \Omega ))</th>
<th>( Y_L ) (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>470</td>
<td>typ. 1,0</td>
<td>7,0</td>
<td>typ. 0,42</td>
<td>typ. 8,5</td>
<td>typ. 70</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>28</td>
<td>470 &lt; 1,0</td>
<td>7,0</td>
<td>&lt; 0,42</td>
<td>&gt; 8,5</td>
<td>&gt; 60</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>28</td>
<td>470 typ. 1,0</td>
<td>8,0</td>
<td>typ. 0,38</td>
<td>typ. 9,0</td>
<td>typ. 75</td>
<td>1,8 + j5,3</td>
<td>19 - j32</td>
<td>--</td>
</tr>
<tr>
<td>28</td>
<td>1000 typ. 1,5</td>
<td>5,0</td>
<td>typ. 0,40</td>
<td>typ. 5,2</td>
<td>typ. 45</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

Test circuit for 470 MHz:

\[ P_L = 7,0 \, \text{W and } V_{CC} = 28 \, \text{V, the output power at heatsink temperatures between 25 \, ^\circ \text{C}} \]

\[ \text{and 90 \, ^\circ \text{C relative to that at 25 \, ^\circ \text{C is diminished by typ. 10 mW/K}} \]

The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: \( V_{CC} = 28 \, \text{V; } f = 470 \, \text{MHz; } T_h = 90 \, ^\circ \text{C} \).

\( VSWR = 50 : 1 \, \text{through all phases; } P_L = 7,0 \, \text{W.} \)
APPLICATION INFORMATION (continued)

Component layout and printed-circuit board for 470 MHz test circuit.

Shaded area copper
Back area completely copper clad
Material of printed-circuit board: 1.5 mm epoxy fibre-glass
Indicated load power as a function of overload

The graph has been derived from an evaluation of the performance of transistors matched up to 8 W load power in the test amplifier and subsequently subjected to various mismatch conditions at 28 V with VSWR up to 50 and elevated heatsink temperatures. This indicates a restriction to the load power matched under nominal conditions in the recommended test configuration.
OPERATING NOTE Below 250 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.
U.H.F. POWER TRANSISTORS

N-P-N silicon planar epitaxial transistors suitable for transmitting applications in class-A, B or C in the u.h.f. range for a nominal supply voltage up to 28 V. The transistors are resistance stabilized and tested under severe load mismatch conditions. Diffused emitter-ballasting resistors and gold sandwich metallization ensure excellent reliability properties.

These transistors are housed in capstan envelopes with ⅛” studs, the BLX94A has a transfer-moulded cap and the BLX94C a ceramic cap.

All leads are isolated from the stud.

QUICK REFERENCE DATA

<p>| R.F. performance at $T_h = 25$ °C in an unneutralized common-emitter class-B circuit |
|---------------------------------|--------|-----------------|---------|------|-------|------|</p>
<table>
<thead>
<tr>
<th>type number</th>
<th>mode of operation</th>
<th>$V_{CE}$</th>
<th>$f$</th>
<th>$P_L$</th>
<th>$G_D$</th>
<th>$\eta$</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLX94A</td>
<td>c.w.</td>
<td>28</td>
<td>470</td>
<td>25</td>
<td>&gt; 6</td>
<td>&gt; 55</td>
</tr>
<tr>
<td>BLX94C</td>
<td>c.w.</td>
<td>28</td>
<td>470</td>
<td>25</td>
<td>&gt; 6.5</td>
<td>&gt; 55</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

SOT-48/2 (see Fig. 1a)

SOT-122 (see Fig. 1b)
MECHANICAL DATA

Fig. 1a SOT-48/2 (BLX94A)

Torque on nut: min. 0,75 Nm (7,5 kg cm)  
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.  
Mounting hole to have no burrs at either end.  
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY  This device incorporates beryllium oxide, the dust of which is toxic. The device  
is entirely safe provided that the BeO disc is not damaged.
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage
(peak value); \( V_{BE} = 0 \)
open base

Emitter-base voltage (open collector)

Collector current
d.c. or average
(peak value); \( f > 1 \text{ MHz} \)
R.F. power dissipation (\( f > 1 \text{ MHz} \)); \( T_{mb} = 25 \degree C \)

Storage temperature

Operating junction temperature

(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

THERMAL RESISTANCE (dissipation = 20 W; \( T_{mb} = 82 \degree C \), i.e. \( T_{h} = 70 \degree C \))

From junction to mounting base (d.c. dissipation)
From junction to mounting base (r.f. dissipation)
From mounting base to heatsink

\[
\begin{align*}
R_{th \ j-mb \ (dc)} &= 4,0 \ \text{K/W} \\
R_{th \ j-mb \ (rf)} &= 2,7 \ \text{K/W} \\
R_{th \ mb-h} &= 0,6 \ \text{K/W}
\end{align*}
\]

Fig. 3 Power derating curve vs. temperature.

I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch
**CHARACTERISTICS**

$T_j = 25 \, ^\circ\text{C}$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{BE} = 0; I_C = 25 , \text{mA}$</td>
<td>$V_{(BR)CES} &gt; 65 , \text{V}$</td>
</tr>
<tr>
<td>$V_{BE} = 0; V_{CE} = 30 , \text{V}$</td>
<td>$V_{(BR)CEO} &gt; 30 , \text{V}$</td>
</tr>
<tr>
<td>$I_C = 100 , \text{mA}$</td>
<td></td>
</tr>
<tr>
<td>$V_{(BR)EBO} &gt; 4 , \text{V}$</td>
<td></td>
</tr>
<tr>
<td>$I_E = 10 , \text{mA}$</td>
<td></td>
</tr>
<tr>
<td>Collector cut-off current</td>
<td></td>
</tr>
<tr>
<td>$V_{BE} = 0; V_{CE} = 30 , \text{V}$</td>
<td>$I_{CES} &lt; 10 , \text{mA}$</td>
</tr>
<tr>
<td>Second breakdown energy; $L = 25 , \text{mH}; f = 50 , \text{Hz}$</td>
<td></td>
</tr>
<tr>
<td>open base</td>
<td>$E_{SBO} &gt; 3 , \text{mJ}$</td>
</tr>
<tr>
<td>$R_{BE} = 10 , \Omega$</td>
<td>$E_{SBR} &gt; 3 , \text{mJ}$</td>
</tr>
<tr>
<td>D.C. current gain*</td>
<td>$h_{FE} &gt; 15$</td>
</tr>
<tr>
<td>$I_C = 1,5 , \text{A}; V_{CE} = 5 , \text{V}$</td>
<td>$h_{FE} \text{ typ.} 50$</td>
</tr>
<tr>
<td>Collector-emitter saturation voltage*</td>
<td>$V_{CE\text{sat}} \text{ typ.} 1,5 , \text{V}$</td>
</tr>
<tr>
<td>$I_C = 4,0 , \text{A}; I_B = 0,8 , \text{A}$</td>
<td></td>
</tr>
<tr>
<td>Transition frequency at $f = 500 , \text{MHz}$*</td>
<td></td>
</tr>
<tr>
<td>$I_E = 1,5 , \text{A}; V_{CB} = 28 , \text{V}$</td>
<td>$f_T \text{ typ.} 1,1 , \text{GHz}$</td>
</tr>
<tr>
<td>$I_E = 4,0 , \text{A}; V_{CB} = 28 , \text{V}$</td>
<td>$f_T \text{ typ.} 0,75 , \text{GHz}$</td>
</tr>
<tr>
<td>Collector capacitance at $f = 1 , \text{MHz}$</td>
<td>$C_c \text{ typ.} 33 , \text{pF}$</td>
</tr>
<tr>
<td>$I_E = I_e = 0; V_{CB} = 28 , \text{V}$</td>
<td></td>
</tr>
<tr>
<td>Feedback capacitance at $f = 1 , \text{MHz}$</td>
<td>$C_{re} \text{ typ.} 18 , \text{pF}$</td>
</tr>
<tr>
<td>$I_C = 20 , \text{mA}; V_{CE} = 28 , \text{V}$</td>
<td></td>
</tr>
<tr>
<td>Collector-stud capacitance</td>
<td>$C_{cs} \text{ typ.} 1,2 , \text{pF}$</td>
</tr>
</tbody>
</table>

* Measured under pulse conditions: $t_p < 200 \, \mu\text{s}$; $\delta < 0,02$. 

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924  August 1986
U.H.F. power transistors

Fig. 4 Typical values; $T_j = 25 \, ^\circ\text{C}$.

Fig. 5 $I_E = 0; f = 1 \, \text{MHz}; T_j = 25 \, ^\circ\text{C}$.

Fig. 6 $V_{CB} = 28 \, \text{V}; T_j = 25 \, ^\circ\text{C}$. 
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

\( f = 470 \text{ MHz}; \ T_h = 25 ^\circ \text{C} \)

<table>
<thead>
<tr>
<th>type number</th>
<th>( V_{CE} (\text{V}) )</th>
<th>( P_L (\text{W}) )</th>
<th>( P_S (\text{W}) )</th>
<th>( G_P (\text{dB}) )</th>
<th>( I_C (\text{A}) )</th>
<th>( \eta (%) )</th>
<th>( z_i (\Omega) )</th>
<th>( Z_L (\Omega) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLX94A</td>
<td>28</td>
<td>25</td>
<td>&lt; 6,25 &gt; 6</td>
<td>&lt; 1,62 &gt; 55</td>
<td>typ. 1,49</td>
<td>typ. 60</td>
<td>0,9 + j4,1</td>
<td>6,6 + j6,4</td>
</tr>
<tr>
<td>BLX94C</td>
<td>28</td>
<td>25</td>
<td>&lt; 5,6 &gt; 6,5</td>
<td>&lt; 1,62 &gt; 55</td>
<td>typ. 1,54</td>
<td>typ. 58</td>
<td>0,7 + j2,6</td>
<td>5,8 + j6,3</td>
</tr>
</tbody>
</table>

![Fig. 7 470 MHz test circuit; c.w. class-B. For component layout and p.c.b. see Fig. 8.](image)

List of components:

- \( C_1 = C_2 = C_8 = 2 \text{ to } 9 \text{ pF film dielectric trimmer (cat. no. 2222 809 09002)} \)
- \( C_3 = C_4 = 15 \text{ pF chip capacitor} \)
- \( C_5 = 100 \text{ pF feed-through capacitor} \)
- \( C_6 = 33 \text{ nF polyester capacitor} \)
- \( C_7 = 2 \text{ to } 18 \text{ pF film dielectric trimmer (cat. no. 2222 809 09003)} \)
- \( R_1 = 1 \Omega \text{ carbon resistor} \)
- \( R_2 = 10 \Omega \text{ carbon resistor} \)
- \( L_1 = \text{stripline (41,1 mm x 5,0 mm)} \)
- \( L_2 = 13 \text{ turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4,0 mm} \)
- \( L_3 = 2 \text{ turns Cu wire (1 mm); winding pitch 1,5 mm; int. dia. 4 mm; leads 2 x 5 mm} \)
- \( L_4 = \text{stripline (52,7 mm x 5,0 mm)} \)
- \( L_5 = \text{Ferroxcube choke coil. Z (at f = 50 MHz) = 750 } \Omega \pm 20\% \text{ (cat. no. 4312 020 36640)} \)

\( L_1 \text{ and } L_4 \text{ are striplines on a double Cu-clad print plate with PTFE fibre-glass dielectric. (} \epsilon_r = 2,74) \text{; thickness 1,45 mm.} \)
Fig. 8 Component layout and printed-circuit board for 470 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.
Fig. 9 $V_{CE} = 28\,V; f = 470\,MHz; T_h = 25\,^\circ C$; typical values.

Fig. 10 $V_{CE} = 28\,V; f = 470\,MHz; T_h = 25\,^\circ C$; typ. values; —— BLX94A; —— BLX94C.

Fig. 11 For high voltage operation, a stabilized power supply is generally used. The graph shows the permissible output power under nominal conditions as a function of the VSWR, with heatsink temperature as parameter.
U.H.F. power transistors

Fig. 12 Input impedance (series components).

Fig. 13 Load impedance (series components).

Fig. 14.

Conditions for Figs 12, 13 and 14:
Typical values; $V_{CE} = 28$ V; $P_L = 25$ W;
$T_h = 25$ °C; class-B operation;
--- BLX94A; —— BLX94C.
U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C in the u.h.f. frequency range for supply voltages up to 28 V. The transistor is resistance stabilized and is tested under severe load mismatch conditions. Due to a gold metallization excellent reliability properties have been obtained. The transistor is housed in a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25 \, ^{\circ}\mathrm{C}$ in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_S$ W</th>
<th>$P_L$ W</th>
<th>$I_C$ A</th>
<th>$G_D$ dB</th>
<th>$\eta$ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>28</td>
<td>470</td>
<td>&lt; 14,2</td>
<td>40</td>
<td>&lt; 2,4</td>
<td>&lt; 4,5</td>
<td>&gt; 60</td>
</tr>
<tr>
<td>c.w.</td>
<td>28</td>
<td>175</td>
<td>typ. 3,2</td>
<td>40</td>
<td>typ. 1,9</td>
<td>typ. 11</td>
<td>typ. 75</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-56.

Torque on nut: min. 1,5 Nm (15 kg cm) max. 1,7 Nm (17 kg cm)

Diameter of clearance hole in heatsink: max. 4,9 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter) peak value
Collector-emitter voltage (RBE = 10Ω) peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current (average)
Collector current (peak value) \( f > 1 \text{ MHz} \)

\[
\begin{align*}
\text{VCBOM} & \quad \text{max.} \quad 65 \text{ V} \\
\text{VCERM} & \quad \text{max.} \quad 65 \text{ V} \\
\text{VCEO} & \quad \text{max.} \quad 30 \text{ V} \\
\text{VEBO} & \quad \text{max.} \quad 4 \text{ V} \\
\text{IC(AV)} & \quad \text{max.} \quad 3.0 \text{ A} \\
\text{ICM} & \quad \text{max.} \quad 10.0 \text{ A} \\
\end{align*}
\]

Storage temperature
Junction temperature
THERMAL RESISTANCE
From junction to mounting base
From mounting base to heatsink

\[
\begin{align*}
\text{Tstg} & \quad -65 \text{ to } +200 \text{ °C} \\
\text{Tj} & \quad \text{max.} \quad 200 \text{ °C} \\
R_{\text{th j-mb}} & = 2.0 \text{ K/W} \\
R_{\text{th mb-h}} & = 0.3 \text{ K/W} \\
\end{align*}
\]
CHARACTERISTICS

T\textsubscript{j} = 25 °C unless otherwise specified

Breakdown voltages

Collector-base voltage
   open emitter, I\textsubscript{C} = 50 mA
   \( V(BR)\text{CBO} > 65 \text{ V} \)

Collector-emitter voltage
   \( R_{BE} = 10\Omega, \ I_C = 50 \text{ mA} \)
   \( V(BR)\text{CER} > 65 \text{ V} \)

Collector-emitter voltage
   open base, \( I_C = 50 \text{ mA} \)
   \( V(BR)\text{CEO} > 30 \text{ V} \)

Emitter-base voltage
   open collector, \( I_E = 10 \text{ mA} \)
   \( V(BR)\text{EBO} > 4 \text{ V} \)

Transient energy

\[ L = 25 \text{ mF}; f = 50 \text{ Hz} \]
   open base
   \( -V_{BE} = 1,5 \text{ V}; R_{BE} = 33 \Omega \)
   \( E > 4,5 \text{ mS} \)

D.C. current gain

\( I_C = 1,0 \text{ A}; V_{CE} = 5 \text{ V} \)
   \( h_{FE} \geq 25 \text{ to 100} \)

Transition frequency

\( I_C = 4 \text{ A}; V_{CE} = 25 \text{ V} \)
   \( f_T \text{ typ. } 900 \text{ MHz} \)

Collector capacitance at f = 1 MHz

\( I_E = I_e = 0; V_{CB} = 30 \text{ V} \)
   \( C_c \text{ typ. } 68 \text{ pF} \)

Feedback capacitance at f = 1 MHz

\( I_C = 200 \text{ mA}; V_{CE} = 30 \text{ V} \)
   \( C_{re} \text{ typ. } 39 \text{ pF} \)

Collector-stud capacitance

\( C_{cs} \text{ typ. } 2 \text{ pF} \)
\[ h_{FE} \] vs \[ I_C \] (A)

- **V_{CE} = 5 \text{ V}**
- **T_j = 25 \text{ °C}**

\[ C_C \] (pF) vs \[ V_{CB} \] (V)

- **I_E = I_e = 0**
- **f = 1 \text{ MHz}**
- **T_j = 25 \text{ °C}**

\[ f_T \] (MHz) vs \[ I_C \] (A)

- **V_{CE} = 25 \text{ V}**
- **T_j = 25 \text{ °C}**
**APPLICATION INFORMATION**

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

\[ V_{CE} = 28 \text{ V}; \ T_h \text{ up to } 25 \text{ °C} \]

<table>
<thead>
<tr>
<th>( f \text{ (MHz)} )</th>
<th>( P_S \text{ (W)} )</th>
<th>( P_L \text{ (W)} )</th>
<th>( I_C \text{ (A)} )</th>
<th>( G_P \text{ (dB)} )</th>
<th>( \eta \text{ (%)} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>470</td>
<td>&lt; 14,2</td>
<td>40</td>
<td>&lt; 2,4</td>
<td>&gt; 4,5</td>
<td>&gt; 60</td>
</tr>
<tr>
<td>175</td>
<td>typ. 3,2</td>
<td>40</td>
<td>typ. 1,9</td>
<td>typ. 11</td>
<td>typ. 75</td>
</tr>
</tbody>
</table>

Test circuit: 470 MHz; c.w. class-B.

![Test circuit diagram](image)

**List of components:**

- \( C_1 = C_7 = C_8 = 2 \) to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
- \( C_2 = 1,8 \) to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
- \( C_3 = C_4 = 18 \) pF chip capacitor
- \( C_5 = 100 \) pF feed-through capacitor
- \( C_6 = 33 \) nF polyester capacitor
- \( C_9 = 2 \times 3,3 \) pF miniature ceramic plate capacitors (in parallel)
- \( R_1 = 1 \) Ω carbon resistor (0,25 W)
- \( R_2 = 10 \) Ω carbon resistor (0,25 W)
- \( L_1 = \) stripline (21,4 mm x 5,3 mm)
- \( L_2 = 13 \) turns closely wound enamelled Cu wire (0,5 mm); internal diameter 4,0 mm
- \( L_3 = \) stripline (43,8 mm x 3,0 mm)
- \( L_4 = \) stripline (45,5 mm x 5,3 mm)
- \( L_5 = \) Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- \( L_1; L_3; L_4 \) are striplines on a double Cu-clad print plate with PTFE fibre-glass dielectric. \((\epsilon_r = 2,74); \) thickness 1/32”.

At \( P_L = 40 \) W and \( V_{CE} = 28 \) V, the output power at heatsink temperatures between 25 °C and 70 °C relative to that at 25 °C is diminished by typ. 50 mW/K.

The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: \( V_{CE} = 28 \) V; \( f = 470 \) MHz; \( T_h = 70 \) °C.

\[ \text{VSWR} = 50 \text{ through all phases}; \ P_L = 36 \text{ W}. \]
APPLICATION INFORMATION (continued)
Component layout and printed-circuit board for 470 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.
Indicated load power as a function of overload.

The graph has been derived from an evaluation of the performance of transistors matched up to 46W load power in the test amplifier and subsequently subjected to various mismatch conditions at 28V with VSWR up to 50 and elevated heatsink temperatures. This indicates a restriction to the load power matched under nominal conditions in the recommended test configuration.
APPLICATION INFORMATION (continued)

Test circuit for 175 MHz:

List of components:

- **C1** = 2.5 to 20 pF film dielectric trimmer (code number 2222 809 07004)
- **C2** = 4 to 40 pF film dielectric trimmer (code number 2222 809 07008)
- **C3** = **C4** = 47 pF ceramic capacitor
- **C5** = 100 pF ceramic capacitor
- **C6** = 100 nF polyester capacitor
- **C7** = 6.8 pF ceramic capacitor
- **C8** = 4 to 60 pF film dielectric trimmer (code number 2222 809 07011)
- **C9** = 4 to 100 pF film dielectric trimmer (code number 2222 809 07015)
- **L1** = 0.5 turn enameled Cu wire (1.5 mm); int. diam. 6 mm; lead length 2 x 6 mm
- **L2** = 100 nH; 7 turns closely wound enameled Cu wire (0.5 mm); int. diam. 3 mm; lead length 2 x 5 mm
- **L3** = **L4** = ferroxcube choke coil (code number 4312 020 36640)
- **L5** = 53 nH; 2 turns enameled Cu wire (1.5 mm); int. diam. 10 mm; coil length 5.2 mm; lead length 2 x 5 mm
- **L6** = 46 nH; 2 turns enameled Cu wire (1.5 mm); int. diam. 9 mm; coil length 5.4 mm; lead length 2 x 5 mm
- **R1** = **R2** = 10 Ω carbon resistor (0.25 W)
APPLICATION INFORMATION (continued)
Component lay-out and printed circuit board for 175 MHz test circuit.

Dimensions of printed circuit board 123 mm x 55 mm.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.
Load power and efficiency versus source power (class B operation)

Typical values:
- $V_{CC} = 28 V$
- $f = 175 MHz$
- $T_h = 25 ^\circ C$

Power gain versus frequency (class B operation)

Typical values:
- $V_{CC} = 28 V$
- $P_L = 40 W$
- $T_h = 25 ^\circ C$

Input impedance (series components) versus frequency (class B operation)

Typical values:
- $V_{CC} = 28 V$
- $P_L = 40 W$
- $T_h = 25 ^\circ C$

Load impedance (parallel components) versus frequency (class B operation)

Typical values:
- $V_{CC} = 28 V$
- $P_L = 40 W$
- $T_h = 25 ^\circ C$
U.H.F. LINEAR POWER TRANSISTOR

N-P-N multi-emitter silicon planar epitaxial transistor primarily for use in linear u.h.f. amplifiers for television transposers and transmitters.

Features:
- guaranteed low intermodulation figures;
- gold metallization ensures excellent reliability.

The transistor has a ¼" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance in linear amplifier

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$f_{\text{vision}}$ MHz</th>
<th>$V_{\text{CE}}$ V</th>
<th>$I_C$ mA</th>
<th>$T_{\text{h}}$ °C</th>
<th>$d_{\text{im}}$ dB</th>
<th>$P_0$ sync* W</th>
<th>$G_p$ dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>class-A</td>
<td>860</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>-60</td>
<td>&gt; 0,5</td>
<td>&gt; 6</td>
</tr>
<tr>
<td>class-A</td>
<td>860</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>-60</td>
<td>typ. 0,6</td>
<td>typ. 7</td>
</tr>
</tbody>
</table>

* Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48/3.

Torque on nut: min. 0,75 Nm (7,5 kg cm)  
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.  
Mounting hole to have no burrs at either end.  
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
**RATINGS** Limiting values in accordance with the Absolute Maximum System (IEC134)

- Collector-base voltage (open emitter; peak value) \( V_{CBOM} \) max. 40 V
- Collector-emitter voltage (\( R_{BE} = 10 \Omega \); peak value) \( V_{CERM} \) max. 40 V
- Collector-emitter voltage (open base) \( V_{CEO} \) max. 27 V
- Emitter-base voltage (open collector) \( V_{EBO} \) max. 3.5 V
- Collector current (d.c.) \( I_C \) max. 0.4 A
- Collector current (peak value) \( f > 1 \text{ MHz} \) \( I_{CM} \) max. 1 A
- Total power dissipation up to \( T_h = 100^\circ C \) \( P_{tot} \) max. 6.25 W

**THERMAL RESISTANCE**

- From junction to mounting base \( R_{th \ j-mb} = 15 \text{ K/W} \)
- From mounting base to heatsink \( R_{th \ mb-h} = 0.6 \text{ K/W} \)

Storage temperature \( T_{stg} \) -65 to +200 °C
Junction temperature \( T_j \) max. 200 °C
CHARACTERISTICS

$T_J = 25 \, ^\circ C$ unless otherwise specified

Collector cut-off current

$\begin{align*}
I_E &= 0; V_{CB} = 20 \, V \\
I_{CBO} &< 100 \, \mu A
\end{align*}$

Breakdown voltages

$\begin{align*}
\text{Collector-base voltage} \\
\text{open emitter; } I_C = 1 \, mA \\
V_{(BR)CBO} &> 40 \, V
\end{align*}$

$\begin{align*}
\text{Collector-emitter voltage} \\
R_{BE} = 10 \, \Omega; I_C = 5 \, mA \\
\text{open base; } I_C = 5 \, mA \\
V_{(BR)CER} &> 40 \, V \\
V_{(BR)CEO} &> 27 \, V
\end{align*}$

$\begin{align*}
\text{Emitter-base voltage} \\
\text{open collector; } I_E = 1 \, mA \\
V_{(BR)EBO} &> 3.5 \, V
\end{align*}$

Saturation voltage

$\begin{align*}
I_C &= 200 \, mA; I_B = 20 \, mA \\
V_{CEsat} &< 0.75 \, V
\end{align*}$

D.C. current gain

$\begin{align*}
I_C &= 200 \, mA; V_{CE} = 20 \, V \\
\beta_{FE} &> 30 \\
I_C &= 400 \, mA; V_{CE} = 20 \, V \\
\beta_{FE} &> 20
\end{align*}$

Transition frequency

$\begin{align*}
I_C &= 200 \, mA; V_{CE} = 20 \, V \\
f_T &> 1.2 \, GHz \\
I_C &= 350 \, mA; V_{CE} = 20 \, V \\
f_T &> 1.0 \, GHz
\end{align*}$

Collector capacitance at $f = 1 \, MHz$

$\begin{align*}
I_E = I_E = 0; V_{CB} = 20 \, V \\
C_C &< 10 \, pF
\end{align*}$

Feedback capacitance at $f = 1 \, MHz$

$\begin{align*}
I_C = 10 \, mA; V_{CE} = 20 \, V; T_{mb} = 25 \, ^\circ C \\
C_{re} &\text{ typ. } 3.5 \, pF
\end{align*}$

Collector-stud capacitance

$\begin{align*}
C_{CS} &\text{ typ. } 2 \, pF
\end{align*}$
APPLICATION INFORMATION

<table>
<thead>
<tr>
<th>$d_{im}$ (dB)</th>
<th>$f_{vision}$ (MHz)</th>
<th>$V_{CE}$ (V)</th>
<th>$I_{C}$ (mA)</th>
<th>$G_{p}$ (dB)</th>
<th>$P_{o sync}$ (W)</th>
<th>$T_{R}$ (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-60</td>
<td>860</td>
<td>25</td>
<td>250</td>
<td>&gt; 6</td>
<td>&gt; 0.5</td>
<td>25</td>
</tr>
<tr>
<td>-60</td>
<td>860</td>
<td>25</td>
<td>250</td>
<td>typ. 7</td>
<td>typ. 0.6</td>
<td>25</td>
</tr>
</tbody>
</table>

*) Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -16 dB), zero dB corresponds to peak sync level.

Test circuit at $f_{vision} = 860$ MHz

List of components:

- $C_{1} = C_{2} = C_{10} = 2$ to $9$ pF film dielectric trimmers
- $C_{3} = C_{4} = C_{12} = 100$ nF polyester capacitors
- $C_{5} = C_{7} = C_{8} = 100$ pF feed-through capacitors
- $C_{6} = 2$ x $2.7$ pF in parallel, chip capacitors
- $C_{9} = 2$ to $18$ pF film dielectric trimmer
- $C_{11} = 10$ µF/40 V solid aluminium electrolytic capacitor

- $R_{1} = 220$ Ω
- $R_{2} = 4.7$ kΩ
- $R_{3} = 100$ Ω
- $R_{4} = 10$ Ω
- $R_{5} = 470$ Ω (1 W)
- $R_{6} = 3$ x $22$ Ω in parallel; (1 W)
- $R_{7} = 12$ kΩ
- $R_{8} = 1$ kΩ
APPLICATION INFORMATION (continued)

List of components: (continued)

L1 = stripline (14.8 mm x 4.3 mm)
L2 = 7 turns closely wound enameled Cu wire (0.5 mm); int. dia. 3 mm
L3 = 2 turns Cu wire (1 mm); winding pitch 1.5 mm; int. dia. 4.5 mm; leads 2 x 5 mm
L4 = stripline (29.5 mm x 4.3 mm)

L1 and L4 are striplines on a double Cu-clad print plate with PTFE fibre-glass dielectric ($\varepsilon_r = 2.74$); thickness 1.45 mm.

Layout of printed-circuit board for 860 MHz test circuit.

---

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

Layout of printed board bias circuit.
**U.H.F. linear power transistor**

**7262839**

Intermodulation distortion versus output power

- Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -16 dB).
- Zero dB corresponds to peak sync level.

- \( I_C = 250 \text{ mA} \)
- \( V_{CE} = 25 \text{ V} \)
- \( T_h = 25 \text{ °C} \)
- \( f = 860 \text{ MHz} \)

**7262835**

Power gain versus frequency

- \( I_C = 250 \text{ mA} \)
- \( V_{CE} = 25 \text{ V} \)
- \( T_h = 25 \text{ °C} \)

**7262838**

Input impedance (series components) versus frequency

- \( I_C = 250 \text{ mA} \)
- \( V_{CE} = 25 \text{ V} \)
- \( T_h = 25 \text{ °C} \)

**7262861**

Load impedance (parallel components) versus frequency

- \( I_C = 250 \text{ mA} \)
- \( V_{CE} = 25 \text{ V} \)
- \( T_h = 25 \text{ °C} \)
U.H.F. LINEAR POWER TRANSISTOR

N-P-N multi-emitter silicon planar epitaxial transistor primarily for use in linear u.h.f. amplifiers for television transposers and transmitters.

Features:
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- gold metallization ensures excellent reliability.

The transistor has a ¼" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance in linear amplifier

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>f_vision MHz</th>
<th>V_Ce V</th>
<th>I_C mA</th>
<th>T_h 0°C</th>
<th>d_{im} dB</th>
<th>P_o sync* W</th>
<th>G_p dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>class-A</td>
<td>860</td>
<td>25</td>
<td>500</td>
<td>25</td>
<td>-60</td>
<td>&gt; 1,0</td>
<td>&gt; 5,5</td>
</tr>
<tr>
<td>class-A</td>
<td>860</td>
<td>25</td>
<td>500</td>
<td>25</td>
<td>-60</td>
<td>typ. 1,1</td>
<td>typ. 6,5</td>
</tr>
</tbody>
</table>

* Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Fig. 1 SOT-48/3.

Dimensions in mm

Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter; peak value) \( V_{CBOM} \) max. 40 V
Collector-emitter voltage (\( R_{BE} = 10 \Omega \); peak value) \( V_{CERM} \) max. 40 V
Collector-emitter voltage (open base) \( V_{CEO} \) max. 27 V
Emitter-base voltage (open collector) \( V_{EBO} \) max. 3.5 V
Collector current (d.c.) \( I_C \) max. 0.8 A
Collector current (peak value) \( f > 1 \text{ MHz} \) \( I_{CM} \) max. 2 A
Total power dissipation up to \( T_h = 100 \degree C \) \( P_{tot} \) max. 12.5 W

Storage temperature
Junction temperature \( T_{stg} \) \(-65 \) to \(+200 \) \( ^\circ C \)
\( T_j \) max. \( 200 \) \( ^\circ C \)

THERMAL RESISTANCE

From junction to mounting base
\( R_{th \ j-mb} = 7.5 \) K/W
From mounting base to heatsink
\( R_{th \ mb-h} = 0.6 \) K/W
CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current

\[ I_E = 0; \ V_{CB} = 20 \ \text{V} \]

\[ I_{CBO} < 200 \ \mu\text{A} \]

Breakdown voltages

Collector-base voltage

\[ \text{open emitter; } I_C = 2 \ mA \]

\[ V_{(BR)CBO} > 40 \ \text{V} \]

Collector-emitter voltage

\[ R_{BE} = 10 \ \Omega; \ I_C = 10 \ mA \]

\[ V_{(BR)CER} > 40 \ \text{V} \]

\[ V_{(BR)CEO} > 27 \ \text{V} \]

Emitter-base voltage

\[ \text{open collector; } I_E = 2 \ mA \]

\[ V_{(BR)EBO} > 3.5 \ \text{V} \]

Saturation voltage

\[ I_C = 400 \ mA; \ I_B = 40 \ mA \]

\[ V_{CE\text{sat}} < 0.75 \ \text{V} \]

D. C. current gain

\[ I_C = 400 \ mA; \ V_{CE} = 20 \ \text{V} \]

\[ h_{FE} > 30 \]

\[ I_C = 800 \ mA; \ V_{CE} = 20 \ \text{V} \]

\[ h_{FE} > 20 \]

Transition frequency

\[ I_C = 400 \ mA; \ V_{CE} = 20 \ \text{V} \]

\[ f_T > 1.2 \ \text{GHz} \]

\[ I_C = 700 \ mA; \ V_{CE} = 20 \ \text{V} \]

\[ f_T > 1.0 \ \text{GHz} \]

Collector capacitance at f = 1 MHz

\[ I_E = I_e = 0; \ V_{CB} = 20 \ \text{V} \]

\[ C_c < 20 \ \text{pF} \]

Feedback capacitance at f = 1 MHz

\[ I_C = 20 \ mA; \ V_{CE} = 20 \ \text{V}; \ T_{mb} = 25 \ °C \]

\[ C_{re} \ \text{typ.} \ 7 \ \text{pF} \]

Collector-stud capacitance

\[ C_{cs} \ \text{typ.} \ 2 \ \text{pF} \]
BLX97

**APPLICATION INFORMATION**

<table>
<thead>
<tr>
<th>$d_{im}$ (dB) *</th>
<th>$f_{vision}$ (MHz)</th>
<th>$V_{CE}$ (V)</th>
<th>$I_C$ (mA)</th>
<th>$C_p$ (dB)</th>
<th>$P_{o sync}$ (W) *</th>
<th>$T_h$ (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-60</td>
<td>860</td>
<td>25</td>
<td>500</td>
<td>&gt; 5,5</td>
<td>&gt; 1,0</td>
<td>25</td>
</tr>
<tr>
<td>-60</td>
<td>860</td>
<td>25</td>
<td>500</td>
<td>typ. 6,5</td>
<td>typ. 1,1</td>
<td>25</td>
</tr>
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</table>

*) Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -16 dB), zero dB corresponds to peak sync level.

Test circuit at $f_{vision} = 860$ MHz

List of components: (see also page 6)

- $C1 = C2 = C10 = 2$ to $9$ pF film dielectric trimmers
- $C3 = C4 = C12 = 100$ nF polyester capacitors
- $C5 = C7 = C8 = 100$ pF feed-through capacitors
- $C6 = 2 \times 2,7$ pF in parallel, chip capacitors
- $C9 = 2$ to $18$ pF film dielectric trimmer
- $C11 = 10$ µF/40 V solid aluminium electrolytic capacitor

- $R1 = 220$ Ω
- $R2 = 4,7$ kΩ
- $R3 = 100$ Ω
- $R4 = 10$ Ω

- $R5 = 470$ Ω (1 W)
- $R6 = 3 \times 22$ Ω in parallel; (1 W)
- $R7 = 12$ kΩ
- $R8 = 1$ kΩ
APPLICATION INFORMATION (continued)

List of components: (continued)

L1 = stripline (14,8 mm x 4,3 mm)
L2 = 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm
L3 = 2 turns Cu wire (1 mm); winding pitch 1,5 mm; int. dia. 4,5 mm; leads 2 x 5 mm
L4 = stripline (29,5 mm x 4,3 mm)

L1 and L4 are striplines on a double Cu-clad print plate with PTFE fibre-glass dielectric ($\varepsilon_r = 2,74$); thickness 1,45 mm.

Layout of printed-circuit board for 860 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

Layout of printed board bias circuit.
Intermodulation distortion versus output power

Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -16 dB), zero dB corresponds to peak sync level.

-70 dB

Power gain versus frequency

$I_C = 500 \text{ mA}$
$V_{CE} = 25 \text{ V}$
$T_h = 25 \text{ °C}$

$860 \text{ MHz}$

Input impedance (series components) versus frequency

$I_C = 500 \text{ mA}$
$V_{CE} = 25 \text{ V}$
$T_h = 25 \text{ °C}$

Load impedance (parallel components) versus frequency

$I_C = 500 \text{ mA}$
$V_{CE} = 25 \text{ V}$
$T_h = 25 \text{ °C}$
U.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in linear u.h.f. amplifiers of television transposers and transmitters in band IV-V.

Features:
- diffused emitter ballasting resistors for an optimum temperature profile;
- gold metallization ensures excellent reliability.

The transistor has a ¾” capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance in linear amplifier

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>( f_{\text{vision}} ) MHz</th>
<th>( V_{\text{CE}} ) V</th>
<th>( I_C ) mA</th>
<th>( T_h ) °C</th>
<th>( d_{\text{im}}^* ) dB</th>
<th>( P_{\text{sync}}^* ) W</th>
<th>( G_p ) dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>class-A</td>
<td>860</td>
<td>25</td>
<td>850</td>
<td>70</td>
<td>-60</td>
<td>&gt; 3,5</td>
<td>&gt; 5,0</td>
</tr>
<tr>
<td>class-A</td>
<td>860</td>
<td>25</td>
<td>850</td>
<td>70</td>
<td>-60</td>
<td>typ. 4,0</td>
<td>typ. 5,5</td>
</tr>
</tbody>
</table>

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Fig. 1 SOT-48/2.

Dimensions in mm

- Diameter of clearance hole in heatsink: max. 4,2 mm.
- Mounting hole to have no burrs at either end.
- De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

8-32 UNC

metal
plastic

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

August 1986
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage
    (peak value); \( V_{BE} = 0 \)
    open base

Emitter-base voltage (open collector)

Collector current
d.c.
    (peak value); \( f > 1 \text{ MHz} \)

Total power dissipation at \( T_h = 70 \degree C \)

Storage temperature

Junction temperature

\[
\begin{align*}
V_{CESM} & \quad \text{max.} \quad 50 \text{ V} \\
V_{CEO} & \quad \text{max.} \quad 27 \text{ V} \\
V_{EBO} & \quad \text{max.} \quad 3.5 \text{ V} \\
I_C & \quad \text{max.} \quad 2 \text{ A} \\
I_{CM} & \quad \text{max.} \quad 4 \text{ A} \\
P_{\text{tot}} & \quad \text{max.} \quad 21.5 \text{ W} \\
T_{\text{stg}} & \quad -65 \text{ to } +200 \degree C \\
T_j & \quad \text{max.} \quad 200 \degree C
\end{align*}
\]

Fig. 2 D.C. SOAR.

**THERMAL RESISTANCE** (dissipation = 21.25 W; \( T_{mb} = 82.75 \degree C \), i.e. \( T_h = 70 \degree C \)).

From junction to mounting base
\[
R_{th j-mb} = 5.45 \text{ K/W}
\]

From mounting base to heatsink
\[
R_{th mb-h} = 0.6 \text{ K/W}
\]

Fig. 3 Power derating curve vs. temperature.
Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th \text{mb-h}} = 0.6 \text{ K/W}$.)

Example
Nominal class-A operation (without r.f. signal): $V_{CE} = 25 \text{ V}$; $I_C = 850 \text{ mA}$; $T_h = 70 \, ^\circ\text{C}$.

Fig. 4 shows:
- $R_{th \text{ j-h}}$ max. 6.05 K/W
- $T_j$ max. 200 $^\circ\text{C}$

Typical device:
- $R_{th \text{ j-h}}$ typ. 5.35 K/W
- $T_j$ typ. 183 $^\circ\text{C}$
CHARACTERISTICS

$T_j = 25 \, ^\circ\text{C}$ unless otherwise specified

Collector-emitter breakdown voltage

$V_{BE} = 0; I_C = 10 \, mA$

open base; $I_C = 25 \, mA$

Emitter-base breakdown voltage

open collector; $I_E = 5 \, mA$

D.C. current gain*

$I_C = 850 \, mA; V_{CE} = 25 \, V$

Collector-emitter saturation voltage*

$I_C = 500 \, mA; I_B = 100 \, mA$

Transition frequency at $f = 500 \, MHz^{**}$

$-I_E = 850 \, mA; V_{CB} = 25 \, V$

Collector capacitance at $f = 1 \, MHz$

$I_E = I_E = 0; V_{CB} = 25 \, V$

Feedback capacitance at $f = 1 \, MHz$

$I_C = 50 \, mA; V_{CE} = 25 \, V$

Collector-stud capacitance

$V_{(BR)CES} > 50 \, V$

$V_{(BR)CEO} > 27 \, V$

$V_{(BR)EBO} > 3.5 \, V$

$h_{FE} > 15$

typ. 40

$V_{CEsat} \text{ typ. } 0.25 \, V$

$f_T \text{ typ. } 2.5 \, GHz$

$C_C \text{ typ. } 24 \, pF$

$C_{re} \text{ typ. } 15 \, pF$

$C_{cs} \text{ typ. } 2 \, pF$

* Measured under pulse conditions: $t_p \leq 300 \, \mu s; \delta \leq 0.02.$

** Measured under pulse conditions: $t_p \leq 50 \, \mu s; \delta \leq 0.01.$

Fig. 5 Typical values; $V_{CE} = 25 \, V.$
Fig. 6 Typical values; $T_j = 25 \, ^\circ\text{C}$.

Fig. 7 $I_E = I_E = 0$; $f = 1 \, \text{MHz}$; $T_j = 25 \, ^\circ\text{C}$.

Fig. 8 $V_{CB} = 25 \, \text{V}$; $f = 500 \, \text{MHz}$; $T_j = 25 \, ^\circ\text{C}$.
APPLICATION INFORMATION

R.F. performance in u.h.f. class-A operation (linear power amplifier)

<table>
<thead>
<tr>
<th>$f_{\text{vision}}$ (MHz)</th>
<th>$V_{CE}$ (V)</th>
<th>$I_C$ (mA)</th>
<th>$T_h$ (°C)</th>
<th>$d_{im}$ (dB)*</th>
<th>$P_{o,\text{sync}}$ (W)*</th>
<th>$G_p$ (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>860</td>
<td>25</td>
<td>850</td>
<td>70</td>
<td>-60</td>
<td>&gt; 3,5</td>
<td>&gt; 5,0</td>
</tr>
<tr>
<td>860</td>
<td>25</td>
<td>850</td>
<td>70</td>
<td>-60</td>
<td>typ. 4,0</td>
<td>typ. 5,5</td>
</tr>
</tbody>
</table>

* Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -16 dB), zero dB corresponds to peak sync level.

VSWR input < 1.1

![Class-A test circuit at $f_{\text{vision}} = 860$ MHz.](image)

Fig. 9 Class-A test circuit at $f_{\text{vision}} = 860$ MHz.

List of components:
- C1 = C2 = 1.4 to 5.5 pF film dielectric trimmer (cat.no. 2222 809 09001)
- C3 = C4 = 100 nF polyester capacitor
- C5 = C6 = 1 nF feed-through capacitor
- C7 = 5.6 pF ceramic capacitor
- C8 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
- C9 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
- C10 = 10 µF/40 V solid aluminium electrolytic capacitor
- C11 = 470 nF polyester capacitor
- C12 = 2 x 3.3 pF chip capacitors (in parallel)

VSWR output < 2

V$\text{s}$
List of components: (continued)

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>150 Ω carbon resistor (0,25 W)</td>
<td></td>
</tr>
<tr>
<td>R2</td>
<td>1,8 kΩ carbon resistor (0,5 W)</td>
<td></td>
</tr>
<tr>
<td>R3</td>
<td>33 Ω carbon resistor (0,5 W)</td>
<td></td>
</tr>
<tr>
<td>R4</td>
<td>220 Ω carbon resistor (1 W)</td>
<td></td>
</tr>
<tr>
<td>R5</td>
<td>4 x 12 Ω carbon resistors in parallel (1 W each)</td>
<td></td>
</tr>
<tr>
<td>R6</td>
<td>1 kΩ carbon resistor (0,25 W)</td>
<td></td>
</tr>
<tr>
<td>R7</td>
<td>220 Ω carbon potentiometer (0,25 W)</td>
<td></td>
</tr>
<tr>
<td>L1</td>
<td>stripline (13,6 mm x 6,9 mm)</td>
<td></td>
</tr>
<tr>
<td>L2</td>
<td>microchoke 0,47 µH (cat. no. 4322 057 04770)</td>
<td></td>
</tr>
<tr>
<td>L3</td>
<td>1 turn Cu wire (1 mm); internal diameter 5,5 mm; leads 2 x 5 mm</td>
<td></td>
</tr>
<tr>
<td>L4</td>
<td>stripline (40,8 mm x 6,9 mm)</td>
<td></td>
</tr>
</tbody>
</table>

L1 and L4 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric ($\varepsilon_r = 2,74$); thickness 1,5 mm.

Fig. 10 Component layout and printed-circuit board for 860 MHz class-A test circuit.

The circuit and the components are on one side of the PTFE fibre-glass board, the other side is unetched copper to serve as a ground-plane. Earth connections are made by hollow rivets. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.
Fig. 11 Intermodulation distortion ($d_{im}$)* and cross-modulation distortion ($d_{cm}$)** as a function of $P_{o\, sync}$. Typical values; $V_{CE} = 25 \, \text{C}; I_C = 850 \, \text{mA}; \quad - - - \, T_h = 25 \, ^\circ\text{C}; \quad -- \, T_h = 70 \, ^\circ\text{C};$

\begin{align*}
\text{f}_{\text{vision}} & = 860 \, \text{MHz}. \\
\end{align*}

* Three-tone test method (vision carrier $-8 \, \text{dB}$, sound carrier $-7 \, \text{dB}$, sideband signal $-16 \, \text{dB}$), zero dB corresponds to peak sync level.

Intermodulation distortion of input signal $\leq -75 \, \text{dB}$.

** Two-tone test method (vision carrier 0 dB, sound carrier $-7 \, \text{dB}$), zero dB corresponds to peak sync level.

Cross-modulation distortion ($d_{cm}$) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to $-20 \, \text{dB}$.
Fig. 12 Input impedance (series components).

Fig. 13 Load impedance (series components).

Fig. 14.

Conditions for Figs 12, 13 and 14:
Typical values; $V_{CE} = 25\, \text{V}$; $I_C = 850\, \text{mA}$; class-A operation; $T_h = 70\, ^\circ\text{C}$.
V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in class-A, B and C operated mobile and military transmitters with a supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a 1/2" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance up to $T_{mb} = 25 \, ^\circ\mathrm{C}$ in an unneutralized common-emitter class-B circuit.

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_D$ dB</th>
<th>$\eta$ %</th>
<th>$\overline{z}_I$ $\Omega$</th>
<th>$\overline{V}_L$ mS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>13,5</td>
<td>175</td>
<td>8</td>
<td>&gt; 9</td>
<td>&gt; 70</td>
<td>2,8 + j1,2</td>
<td>76 – j16</td>
</tr>
<tr>
<td>c.w.</td>
<td>12,5</td>
<td>175</td>
<td>8</td>
<td>typ. 9</td>
<td>typ. 70</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-48/2.

Dimensions in mm

Torque on nut: min. 0,75 Nm (7,5 kg cm)

max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.

Mounting hole to have no burrs at either end.

De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
**BLY87A**

**RATINGS** Limiting values in accordance with the Absolute Maximum System (IEC 134)

- Collector-base voltage (open emitter) peak value
- Collector-emitter voltage (open base)
- Emitter-base voltage (open collector)
- Collector current (average)
- Collector current (peak value) \( f > 1 \text{ MHz} \)
- Total power dissipation up to \( T_h = 25 ^\circ\text{C} \) \( f > 1 \text{ MHz} \)

\[
\begin{align*}
V_{CBOM} & \quad \text{max.} \quad 36 \text{ V} \\
V_{CEO} & \quad \text{max.} \quad 18 \text{ V} \\
V_{EBO} & \quad \text{max.} \quad 4 \text{ V} \\
I_{C(AV)} & \quad \text{max.} \quad 1.25 \text{ A} \\
I_{CM} & \quad \text{max.} \quad 3.75 \text{ A} \\
P_{\text{tot}} & \quad \text{max.} \quad 17.5 \text{ W}
\end{align*}
\]

![Graph showing thermal resistance](image)

- Storage temperature
- Operating junction temperature

**THERMAL RESISTANCE**

- From junction to mounting base
- From mounting base to heatsink

\[
\begin{align*}
T_{stg} & \quad -30 \text{ to } +200 ^\circ\text{C} \\
T_j & \quad \text{max.} \quad 200 ^\circ\text{C} \\
R_{th \ j-mb} & \quad = \quad 9.4 \ \text{K/W} \\
R_{th \ mb-h} & \quad = \quad 0.6 \ \text{K/W}
\end{align*}
\]
CHARACTERISTICS

T<sub>j</sub> = 25°C unless otherwise specified

Collector cut-off current

I<sub>B</sub> = 0; V<sub>CE</sub> = 14 V

I<sub>CEO</sub> < 5 mA

Breakdown voltages

Collector-base voltage
open emitter, I<sub>C</sub> = 1 mA

V(BR)CBO > 36 V

Collector-emitter voltage
open base, I<sub>C</sub> = 10 mA

V(BR)CEO > 18 V

Emitter-base voltage
open collector, I<sub>E</sub> = 1 mA

V(BR)EBO > 4 V

Transient energy

L = 25 mH; f = 50 Hz

open base

-E = 1.5 V; R<sub>BE</sub> = 33Ω

E > 0.5 mS

D.C. current gain

I<sub>C</sub> = 500 mA; V<sub>CE</sub> = 5 V

h<sub>FE</sub> > 5

Transition frequency

I<sub>C</sub> = 500 mA; V<sub>CE</sub> = 10 V

f<sub>T</sub> typ. 700 MHz

Collector capacitance at f = 1 MHz

I<sub>E</sub> = I<sub>e</sub> = 0; V<sub>CB</sub> = 15 V

C<sub>c</sub> typ. < 15 pF

Feedback capacitance at f = 1 MHz

I<sub>C</sub> = 100 mA; V<sub>CE</sub> = 15 V

-C<sub>re</sub> typ. 11 pF

Collector-stud capacitance

C<sub>cs</sub> typ. 2 pF
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

\( f = 175 \text{ MHz}; T_{mb} \text{ up to } 25\degree C \)

<table>
<thead>
<tr>
<th>( V_{CC} (V) )</th>
<th>( P_S (W) )</th>
<th>( P_L (W) )</th>
<th>( I_C (A) )</th>
<th>( G_P (\text{dB}) )</th>
<th>( \eta (%) )</th>
<th>( Z_1 (\Omega) )</th>
<th>( \bar{V}_L (\text{mS}) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.5</td>
<td>&lt; 1.0</td>
<td>8</td>
<td>&lt; 0.85</td>
<td>&gt; 9</td>
<td>&gt; 70</td>
<td>2.8 + j1.2</td>
<td>76 – j16</td>
</tr>
<tr>
<td>12.5 typ. 1.0</td>
<td>typ. 0.91 8</td>
<td>typ. 9</td>
<td>typ. 70</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test circuit

\[ C1 = 2.5 \text{ to } 20 \text{ pF film dielectric trimmer (code number 2222 809 07004)} \]
\[ C2 = C6 = C7 = 4 \text{ to } 40 \text{ pF film dielectric trimmer (code number 2222 809 07008)} \]
\[ C3 = 47 \text{ pF ceramic} \]
\[ C4 = 100 \text{ pF ceramic} \]
\[ C5 = 150 \text{ nF polyester} \]
\[ L1 = 0.5 \text{ turn enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2x10 mm} \]
\[ L2 = L5 = \text{ ferroxcube choke (code number 4312 020 36640)} \]
\[ L3 = 2.5 \text{ turns closely wound enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2x10 mm} \]
\[ L4 = 4.5 \text{ turns enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2x10 mm} \]
\[ R = 10 \Omega \text{ carbon} \]
APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.
OPERATING NOTE  Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.

**power gain versus frequency**
- **V<sub>CC</sub> = 13.5 V**
- **P<sub>L</sub> = 8 W**
- **T<sub>mb</sub> = 25 °C**
- [Typ. values]

**input impedance (series components) versus frequency**
- **V<sub>CC</sub> = 13.5 V**
- **P<sub>L</sub> = 8 W**
- **T<sub>mb</sub> = 25 °C**
- [Typ. values]

**load impedance (parallel components) versus frequency**
- **V<sub>CC</sub> = 13.5 V**
- **P<sub>L</sub> = 8 W**
- **T<sub>mb</sub> = 25 °C**
- [Typ. values]
Conditions for R.F. SOAR:

\[ f = 175 \text{ MHz} \]

\[ \theta_h = 70 \text{ °C} \]

\[ \frac{P_{S, \text{nom}}}{P_{S, \text{sat}}} = \frac{V_{CC}}{V_{CC, \text{nom}}} \text{ and } V.S.W.R. = 1 \]

\[ V_{CC, \text{nom}} = 12.5 \text{ or } 13.5 \text{ V} \]

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graphs above for safe operation at supply voltages other than the nominal. The graphs show the allowable output power under nominal conditions, as a function of the supply overvoltage ratio, with V.S.W.R. as parameter.

The left hand graph applies to the situation in which the drive \( \left( \frac{P_S}{P_{S, \text{nom}}} \right) \) increases linearly with supply overvoltage ratio.

The right hand graph shows the derating factor to be applied when the drive \( \left( \frac{P_S}{P_{S, \text{nom}}} \right) \) increases as the square of the supply overvoltage ratio \( \left( \frac{V_{CC}}{V_{CC, \text{nom}}} \right) \).

Depending on the operating conditions, the appropriate derating factor may lie in the region between the linear and the square-law functions.
V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, h.f. and v.h.f. transmitters with a nominal supply voltage of 13.5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16.5 V.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>VcE</th>
<th>f</th>
<th>PL</th>
<th>GP</th>
<th>η</th>
<th>z_i</th>
<th>Y_L</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>13,5</td>
<td>175</td>
<td>8</td>
<td>&gt; 12,0</td>
<td>&gt; 60</td>
<td>2,2 + j0,4</td>
<td>96 - j28</td>
</tr>
<tr>
<td>c.w.</td>
<td>12,5</td>
<td>175</td>
<td>8</td>
<td>typ. 11,5</td>
<td>typ. 65</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-120.

Dimensions in mm

Torque on nut: min. 0.75 Nm
(7.5 kg cm)
max. 0.85 Nm
(8.5 kg cm)

Diameter of clearance hole in heatsink: max. 4.2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$)
  peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current (average)
Collector current (peak value); $f > 1$ MHz
R.F. power dissipation ($f > 1$ MHz); $T_{mb} = 25$ °C

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-emitter voltage</td>
<td>$V_{CESM}$</td>
<td>max. 36 V</td>
</tr>
<tr>
<td>Collector-emitter voltage</td>
<td>$V_{CEO}$</td>
<td>max. 18 V</td>
</tr>
<tr>
<td>Emitter-base voltage</td>
<td>$V_{EBO}$</td>
<td>max. 4 V</td>
</tr>
<tr>
<td>Collector current (average)</td>
<td>$I_{C(AV)}$</td>
<td>max. 1.5 A</td>
</tr>
<tr>
<td>Collector current (peak</td>
<td>$I_{CM}$</td>
<td>max. 4.0 A</td>
</tr>
<tr>
<td>value); $f &gt; 1$ MHz</td>
<td>$P_{rf}$</td>
<td>max. 20 W</td>
</tr>
</tbody>
</table>

Fig. 2 D.C. SOAR.

Fig. 3 R.F. power dissipation; $V_{CE} \leq 16.5$ V; $f > 1$ MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

Storage temperature
Operating junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage temperature</td>
<td></td>
<td>$-65$ to $+150$ °C</td>
</tr>
<tr>
<td>Operating junction temperature</td>
<td>$T_j$</td>
<td>max. 200 °C</td>
</tr>
</tbody>
</table>

THERMAL RESISTANCE (dissipation = 8 W; $T_{mb} = 73.5$ °C, i.e. $T_h = 70$ °C)

| From junction to mounting base (d.c. dissipation) | $R_{th j-mb(dc)}$ | 10.7 K/W |
| From junction to mounting base (r.f. dissipation) | $R_{th j-mb(rf)}$ | 8.6 K/W |
| From mounting base to heatsink                   | $R_{th mb-h}     $ | 0.45 K/W |
**CHARACTERISTICS**

- **Tj** = 25 °C

**Collector-emitter breakdown voltage**

- $V_{BE} = 0; I_C = 5 \text{ mA}$
- $V_{BR} \text{CES} > 36 \text{ V}$

**Collector-emitter breakdown voltage open base; $I_C = 25 \text{ mA}$**

- $V_{BR} \text{CEO} > 18 \text{ V}$

**Emitter-base breakdown voltage open collector; $I_E = 1 \text{ mA}$**

- $V_{BR} \text{EBO} > 4 \text{ V}$

**Collector cut-off current**

- $V_{BE} = 0; V_{CE} = 18 \text{ V}$
- $I_{CES} < 2 \text{ mA}$

**Second breakdown energy; $L = 25 \text{ mH}; f = 50 \text{ Hz}$ open base**

- $R_{BE} = 10 \text{ Ω}$
- $E_{SO} > 0.5 \text{ mJ}$
- $E_{SBR} > 0.5 \text{ mJ}$

**D.C. current gain**$

- I_C = 0.75 \text{ A}; V_{CE} = 5 \text{ V}$
- $\eta_{FE} \text{ typ. } 40$
- $10 \text{ to } 100$

**Collector-emitter saturation voltage** $

- I_C = 2 \text{ A}; I_B = 0.4 \text{ A}$
- $V_{CESat} \text{ typ. } 0.85 \text{ V}$

**Transition frequency at $f = 100 \text{ MHz}$**$

- I_E = 0.75 \text{ A}; V_{CB} = 13.5 \text{ V}$
- $f_T \text{ typ. } 950 \text{ MHz}$

- I_E = 2 \text{ A}; V_{CB} = 13.5 \text{ V}$
- $f_T \text{ typ. } 850 \text{ MHz}$

**Collector capacitance at $f = 1 \text{ MHz}$**$

- I_E = I_E = 0; V_{CB} = 13.5 \text{ V}$
- $C_C \text{ typ. } 16.5 \text{ pF}$

**Feedback capacitance at $f = 1 \text{ MHz}$**$

- I_C = 100 \text{ mA}; V_{CE} = 13.5 \text{ V}$
- $C_{re} \text{ typ. } 12 \text{ pF}$
- $C_{cs} \text{ typ. } 2 \text{ pF}$

* Measured under pulse conditions: $t_p < 200 \mu s; \delta < 0.02.$
Fig. 4 Typical values; T_j = 25 °C.

Fig. 5 I_E = I_e = 0; f = 1 MHz; T_j = 25 °C.

Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.
V.H.F. power transistor

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

\( T_h = 25 \, ^\circ C \)

<table>
<thead>
<tr>
<th>( f ) (MHz)</th>
<th>( V_{CE} ) (V)</th>
<th>( P_L ) (W)</th>
<th>( P_S ) (W)</th>
<th>( G_p ) (dB)</th>
<th>( I_C ) (A)</th>
<th>( \eta ) (%)</th>
<th>( z_l ) (( \Omega ))</th>
<th>( \sqrt{L} ) (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>13,5</td>
<td>8</td>
<td>&lt; 0,5</td>
<td>&gt; 12,0</td>
<td>&lt; 0,99</td>
<td>&gt; 60</td>
<td>2,2 + j0,4</td>
<td>96 – j28</td>
</tr>
<tr>
<td>175</td>
<td>12,5</td>
<td>8</td>
<td>–</td>
<td>typ. 11,5</td>
<td>–</td>
<td>typ. 65</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

Fig. 7 Test circuit; c.w. class-B.

List of components:

- **C1** = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
- **C2** = **C6** = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
- **C3** = 47 pF ceramic capacitor (500 V)
- **C4** = 120 pF ceramic capacitor (500 V)
- **C5** = 100 nF polyester capacitor
- **C7** = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
- **L1** = 2 turns Cu wire (1,6 mm); int. dia. 4,5 mm; length 5,7 mm; leads 2 x 5 mm
- **L2** = **L6** = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- **L3** = **L4** = strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor
- **L5** = 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 7,5 mm; leads 2 x 5 mm
- **L7** = 3 turns Cu wire (1,6 mm); int. dia. 6,5 mm; length 7,4 mm; leads 2 x 5 mm
- **L3** and **L4** are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16\".
- **R1** = 10 \( \Omega \) carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.
Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.
V.H.F. power transistor

Fig. 9 Typical values; \( f = 175 \text{ MHz} \);
- \( V_{CE} = 13.5 \text{ V} \)
- \( V_{CE} = 12.5 \text{ V} \)

Fig. 10 Typical values; \( f = 175 \text{ MHz} \);
- \( V_{CE} = 13.5 \text{ V} \)
- \( V_{CE} = 12.5 \text{ V} \)

Fig. 11 R.F. SOAR (short-time operation during mismatch); \( f = 175 \text{ MHz} \); \( T_h = 70 \text{ °C} \);
\( R_{th \, mb-h} = 0.45 \text{ K/W} \);
\( V_{CENom} = 13.5 \text{ V} \) or \( 12.5 \text{ V} \);
\( P_S = P_{SNom} \) at \( V_{CENom} \) and \( VSWR = 1 \).

Note to Fig. 11:
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive \( (P_S/P_{SNom}) \) increases linearly with supply over-voltage ratio.
Fig. 12 Input impedance (series components).

Fig. 13 Load impedance (parallel components).

Conditions for Figs 12, 13 and 14:
Typical values; \( V_{CE} = 13.5 \) V; \( P_L = 8 \) W; \( T_h = 25^\circ\text{C} \).

OPERATING NOTE
Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation.
This resistor must be effective for r.f. only.
V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. It has a ¼” capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance up to $T_{mb} = 25 \, ^\circ\text{C}$ in an unneutralized common-emitter class-B circuit.

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_{L}$ W</th>
<th>$G_{P}$ dB</th>
<th>$\eta$ %</th>
<th>$z_{i}$ Ω</th>
<th>$Y_{L}$ mS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>13,5</td>
<td>175</td>
<td>15</td>
<td>&gt; 7,5</td>
<td>&gt; 65</td>
<td>2,3 + j2,2</td>
<td>128 – j4,4</td>
</tr>
<tr>
<td>c.w.</td>
<td>12,5</td>
<td>175</td>
<td>15 typ. 7,5</td>
<td>typ. 65</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-48/2.

Dimensions in mm

Torque on nut: min. 0,75 Nm (7,5 kg cm) max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm. Mounting hole to have no burrs at either end. De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter) peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current (average)
Collector (peak value) f > 1 MHz

Total power dissipation up to T_h = 25 °C f > 1 MHz

Storage temperature
Operating junction temperature

THERMAL RESISTANCE

From junction to mounting base
From mounting base to heatsink

T_{stg} = -30 to +200 °C
T_j max. = 200 °C
R_{th j-mb} = 4.9 K/W
R_{mb-h} = 0.6 K/W
CHARACTERISTICS

TJ = 25 °C unless otherwise specified

Collector cut-off current

IB = 0; VCE = 14 V

ICEO < 10 mA

Breakdown voltages

Collector-base voltage

open emitter, IC = 3 mA

V(BR)CBO > 36 V

Collector-emitter voltage

open base, IC = 25 mA

V(BR)CEO > 18 V

Emitter-base voltage

open collector; IE = 3 mA

V(BR)EBO > 4 V

Transient energy

L = 25 mH; f = 50 Hz

open base

-E = -1.5 V; RBE = 33 Ω

E > 2.0 ms

E > 4.5 ms

D.C. current gain

IC = 500 mA; VCE = 5 V

hFE > 5

Transition frequency

IC = 1 A; VCE = 10 V

fT typ. 700 MHz

Collector capacitance at f = 1 MHz

IE = IE = 0; VCB = 15 V

Cc typ. 34 pF

Feedback capacitance at f = 1 MHz

IC = 100 mA; VCE = 15 V

-Cfe typ. 25 pF

Collector-stud capacitance

CcS typ. 2 pF
BLY88A

$\tau_{T}$ (MHz) vs $I_C$ (A)

$V_{CE} = 10\text{V}$

$I_C = I_C = 0$
$f = 1\text{MHz}$

$C_C$ (pF) vs $V_{CB}$ (V)

986 April 1971
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

\( f = 175 \text{ MHz}; T_{mb} \text{ up to } 25^\circ C \)

<table>
<thead>
<tr>
<th>( V_{CC}(V) )</th>
<th>( P_s(W) )</th>
<th>( P_L(W) )</th>
<th>( I_C(A) )</th>
<th>( G_p(\text{dB}) )</th>
<th>( \eta (%) )</th>
<th>( Z_i(\Omega) )</th>
<th>( Y_L(\text{mS}) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.5</td>
<td>&lt; 2.65</td>
<td>15</td>
<td>&lt; 1.71</td>
<td>&gt; 7.5</td>
<td>&gt; 65</td>
<td>2.3+j2.2</td>
<td>128-j4.4</td>
</tr>
<tr>
<td>12.5</td>
<td>typ. 2.65</td>
<td>15</td>
<td>typ. 1.85</td>
<td>typ. 7.5</td>
<td>typ. 65</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Test circuit

\[ C1 = 2.5 \text{ to } 20 \text{ pF, film dielectric trimmer (code number 2222 809 07004)} \]
\[ C2 = C6 = C7 = 4 \text{ to } 40 \text{ pF, film dielectric trimmer (code number 2222 809 07008)} \]
\[ C3 = 47 \text{ pF, ceramic} \]
\[ C4 = 100 \text{ pF, ceramic} \]
\[ C5 = 150 \text{ nF, polyester} \]
\[ L1 = 0.5 \text{ turn enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2 x 10 mm} \]
\[ L2 = L5 = \text{ferroxcube choke (code number 4312 020 36640)} \]
\[ L3 = 2.5 \text{ turns closely wound enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2 x 10 mm} \]
\[ L4 = 2.5 \text{ turns enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2 x 10 mm} \]
\[ R = 10 \Omega, \text{ carbon} \]
Component lay-out and printed circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.
OPERATING NOTE Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.
Conditions for R.F. SOAR:

\[ f = 175 \text{ MHz} \quad P_{\text{Snom}} = P_s \text{ at } V_{\text{CC}} = V_{\text{CCnom}} \text{ and } \text{V.S.W.R.} = 1 \]
\[ T_h = 70 \text{ °C} \quad R_{\text{th mb-h}} = 0.6 \text{ K/W} \]
\[ V_{\text{CCnom}} = 12.5 \text{ or } 13.5 \text{ V} \quad \text{see also page 5} \]

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graphs above for safe operation at supply voltages other than the nominal. The graphs show the allowable output power under nominal conditions, as a function of the supply overvoltage ratio, with V.S.W.R. as parameter.

The left hand graph applies to the situation in which the drive \( (P_s/P_{\text{Snom}}) \) increases linearly with supply overvoltage ratio.

The right hand graph shows the derating factor to be applied when the drive \( (P_s/P_{\text{Snom}}) \) increases as the square of the supply overvoltage ratio \( (V_{\text{CC}}/V_{\text{CCnom}}) \).

Depending on the operating conditions, the appropriate derating factor may lie in the region between the linear and the square-law functions.
V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, h.f. and v.h.f. transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a 3/8” capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25 \, ^\circ C$ in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ (V)</th>
<th>$f$ (MHz)</th>
<th>$P_L$ (W)</th>
<th>$G_P$ (dB)</th>
<th>$\eta$ (%)</th>
<th>$z_i$ (Ω)</th>
<th>$\frac{V_L}{mS}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>13,5</td>
<td>175</td>
<td>15</td>
<td>&gt; 8,0</td>
<td>&gt; 60</td>
<td>2,3 + j2,2</td>
<td>130 – j4,4</td>
</tr>
<tr>
<td>c.w.</td>
<td>12,5</td>
<td>175</td>
<td>15</td>
<td>typ. 7,5</td>
<td>typ. 67</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-120.

Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$)
  peak value

Collector-emitter voltage (open base)

Emitter-base voltage (open collector)

Collector current (average)

Collector current (peak value); $f > 1$ MHz

R.F. power dissipation ($f > 1$ MHz); $T_{mb} = 25$ °C

Storage temperature

Operating junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CESM}$ max.</td>
<td>36 V</td>
</tr>
<tr>
<td>$V_{CEO}$ max.</td>
<td>18 V</td>
</tr>
<tr>
<td>$V_{EBO}$ max.</td>
<td>4 V</td>
</tr>
<tr>
<td>$I_{C(AV)}$ max.</td>
<td>3 A</td>
</tr>
<tr>
<td>$I_{CM}$ max.</td>
<td>8 A</td>
</tr>
<tr>
<td>$P_{rf}$ max.</td>
<td>36 W</td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>-65 to +150 °C</td>
</tr>
<tr>
<td>$T_j$ max.</td>
<td>200 °C</td>
</tr>
</tbody>
</table>

Fig. 2 D.C. SOAR.

Fig. 3 R.F. power dissipation; $V_{CE} \leq 16.5$ V; $f > 1$ MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 15 W; $T_{mb} = 77$ °C, i.e. $T_h = 70$ °C)

From junction to mounting base (d.c. dissipation)

From junction to mounting base (r.f. dissipation)

From mounting base to heatsink

$R_{th\ j-mb(d)} = 6.55$ K/W
$R_{th\ j-mb(rf)} = 4.95$ K/W
$R_{th\ mb-h} = 0.45$ K/W
V.H.F. power transistor

CHARACTERISTICS

$T_j = 25 \, ^\circ\text{C}$

Collector-emitter breakdown voltage

$V_{BE} = 0; \, I_C = 10 \, \text{mA}$

Collector-emitter breakdown voltage
open base; $I_C = 50 \, \text{mA}$

Emitter-base breakdown voltage
open collector; $I_E = 4 \, \text{mA}$

Collector cut-off current

$V_{BE} = 0; \, V_{CE} = 18 \, \text{V}$

Second breakdown energy; $L = 25 \, \text{mH}; \, f = 50 \, \text{Hz}$
open base

$R_{BE} = 10 \, \Omega$

D.C. current gain*

$I_C = 1,5 \, \text{A}; \, V_{CE} = 5 \, \text{V}$

Collector-emitter saturation voltage*

$I_C = 4,5 \, \text{A}; \, I_B = 0,9 \, \text{A}$

Transition frequency at $f = 100 \, \text{MHz}$*

$-I_E = 1,5 \, \text{A}; \, V_{CB} = 13,5 \, \text{V}$

$-I_E = 4,5 \, \text{A}; \, V_{CB} = 13,5 \, \text{V}$

Collector capacitance at $f = 1 \, \text{MHz}$

$I_E = I_E = 0; \, V_{CB} = 13,5 \, \text{V}$

Feedback capacitance at $f = 1 \, \text{MHz}$

$I_C = 200 \, \text{mA}; \, V_{CE} = 13,5 \, \text{V}$

Collector-stud capacitance

$V_{(BR)CES} > 36 \, \text{V}$

$V_{(BR)CEO} > 18 \, \text{V}$

$V_{(BR)EBO} > 4 \, \text{V}$

$I_{CES} < 4 \, \text{mA}$

$E_{SBO} > 2,5 \, \text{mJ}$

$E_{SBR} > 2,5 \, \text{mJ}$

$h_{FE} \text{ typ.} \, 40$

range 10 to 100

$V_{CEsat} \text{ typ.} \, 1,0 \, \text{V}$

$f_T \text{ typ.} \, 850 \, \text{MHz}$

$f_T \text{ typ.} \, 800 \, \text{MHz}$

$C_c \text{ typ.} \, 32 \, \text{pF}$

$C_{re} \text{ typ.} \, 23 \, \text{pF}$

$C_{cs} \text{ typ.} \, 2 \, \text{pF}$

* Measured under pulse conditions: $t_p < 200 \, \mu\text{s}; \, \delta \leq 0,02$. 

May 1978

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Fig. 4 Typical values; $T_j = 25^\circ C$.

Fig. 5 $I_E = I_C = 0; f = 1$ MHz; $T_j = 25^\circ C$.

Fig. 6 Typical values; $f = 100$ MHz; $T_j = 25^\circ C$. 
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

\[ T_h = 25 \, ^\circ \text{C} \]

<table>
<thead>
<tr>
<th>( f ) (MHz)</th>
<th>( V_{CE} ) (V)</th>
<th>( P_L ) (W)</th>
<th>( P_S ) (W)</th>
<th>( G_p ) (dB)</th>
<th>( I_C ) (A)</th>
<th>( \eta ) (%)</th>
<th>( Z_t ) (( \Omega ))</th>
<th>( Y_L ) (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>13,5</td>
<td>15</td>
<td>&lt;2,4</td>
<td>&gt;8,0</td>
<td>&lt;1,85</td>
<td>&gt;60</td>
<td>2,3+j2,2</td>
<td>130-j4,4</td>
</tr>
<tr>
<td>175</td>
<td>12,5</td>
<td>15</td>
<td>--</td>
<td>typ. 7,5</td>
<td>--</td>
<td>typ. 67</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

Fig. 7 Test circuit; c.w. class-B.

List of components:

- \( C_1 = 2,5 \) to \( 20 \) pF film dielectric trimmer (cat. no. 2222 809 07004)
- \( C_2 = C_6 = 4 \) to \( 40 \) pF film dielectric trimmer (cat. no. 2222 809 07008)
- \( C_3 = 47 \) pF ceramic capacitor (500 V)
- \( C_4 = 120 \) pF ceramic capacitor (500 V)
- \( C_5 = 100 \) nF polyester capacitor
- \( C_7 = 5 \) to \( 60 \) pF film dielectric trimmer (cat. no. 2222 809 07011)
- \( L_1 = 2 \) turns Cu wire (1,6 mm); int. dia. 4,5 mm; length 5,7 mm; leads 2 \( \times 5 \) mm
- \( L_2 = L_6 = \) Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- \( L_3 = L_4 = \) strip (12 mm \( \times \) 6 mm); tap for \( C_3 \) at 5 mm from transistor
- \( L_5 = 3 \) turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 7,5 mm; leads 2 \( \times 5 \) mm
- \( L_7 = 3 \) turns Cu wire (1,6 mm); int. dia. 6,5 mm; length 7,4 mm; leads 2 \( \times 5 \) mm
- \( L_3 \) and \( L_4 \) are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16”.
- \( R_1 = 10 \) \( \Omega \) carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.
Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.
V.H.F. power transistor

Fig. 9 Typical values; $f = 175$ MHz; 
- $V_{CE} = 13,5$ V; 
- $V_{CE} = 12,5$ V.

Fig. 10 Typical values; $f = 175$ MHz; 
- $V_{CE} = 13,5$ V; 
- $V_{CE} = 12,5$ V.

Fig. 11 R.F. SOAR (short-time operation during mismatch); 
- $f = 175$ MHz; $T_h = 70$ OC; 
- $R_{th_{mb-h}} = 0,45$ K/W; $V_{CE_{nom}} = 13,5$ V or $12,5$ V; $P_S = P_{Snom}$ at $V_{CE_{nom}}$ and $V_{SWR} = 1$.

Note to Fig. 11:
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions ($V_{SWR} = 1$), as a function of the expected supply over-voltage ratio with $V_{SWR}$ as parameter.

The graph applies to the situation in which the drive ($P_S/P_{Snom}$) increases linearly with supply over-voltage ratio.
Conditions for Figs 12, 13 and 14:
Typical values: $V_{CE} = 13.5$ V; $P_L = 15$ W; $T_H = 25$ °C.

OPERATING NOTE
Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.
V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 13,5 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions with a supply over-voltage to 16,5 V. It has a 1/4” capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance up to $T_{mb} = 25 \, ^\circ C$ in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_S$ W</th>
<th>$P_L$ W</th>
<th>$I_C$ A</th>
<th>$G_P$ dB</th>
<th>$\eta$ %</th>
<th>$\bar{z}_j$ $\Omega$</th>
<th>$\bar{Y}_L$ mS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>13,5</td>
<td>175</td>
<td>&lt; 6,25</td>
<td>&lt; 2,64</td>
<td>&gt; 6</td>
<td>&gt; 70</td>
<td>1,6 + j1,4</td>
<td>213 + j5,5</td>
<td></td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-56.

Torque on nut: min. 1,5 Nm
(15 kg cm)
max. 1,7 Nm
(17 kg cm)

Diameter of clearance hole in heatsink: max. 4,9 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
BLY89A

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter) peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current (average)
Collector current (peak value) f > 1 MHz
Total power dissipation up to T_{mb} = 25 °C f > 1 MHz

\[
\begin{align*}
V_{CBOM} & \text{ max. } 36 \text{ V} \\
V_{CEO} & \text{ max. } 18 \text{ V} \\
V_{EBO} & \text{ max. } 4 \text{ V} \\
I_{C(AV)} & \text{ max. } 5 \text{ A} \\
I_{CM} & \text{ max. } 10 \text{ A}
\end{align*}
\]

Storage temperature
Operating junction temperature

THERMAL RESISTANCE
From junction to mounting base
From mounting base to heatsink

\[
\begin{align*}
T_{stg} & \text{ -30 to +200 °C} \\
T_{j} & \text{ max. } 200 \text{ °C} \\
R_{th j-mb} & = 2.5 \text{ K/W} \\
R_{th mb-h} & = 0.3 \text{ K/W}
\end{align*}
\]
V.H.F. power transistor

BLY89A

CHARACTERISTICS

\(T_j = 25 \, ^\circ C \) unless otherwise specified

Breakdown voltages

- **Collector-base voltage**
  - open emitter, \( I_C = 50 \, mA \)
  - \( V(BR)_{CBO} > 36 \, V \)

- **Collector-emitter voltage**
  - open base, \( I_C = 50 \, mA \)
  - \( V(BR)_{CEO} > 18 \, V \)

- **Emitter-base voltage**
  - open collector; \( I_E = 10 \, mA \)
  - \( V(BR)_{EBO} > 4 \, V \)

Transient energy

\( L = 25 \, mH; \, f = 50 \, Hz \)

- open base
  - \(-V_{BE} = 1.5 \, V; \, R_{BE} = 33 \, \Omega \)
  - \( E \)
  - \( E \) > 8 ms

D.C. current gain

\( I_C = 1 \, A; \, VCE = 5 \, V \)

- \( h_{FE} \)
  - typ. 50
  - 10 to 120

Transition frequency

\( I_C = 4 \, A; \, VCE = 10 \, V \)

- \( f_T \)
  - typ. 650 MHz

Collector capacitance at \( f = 1 \, MHz \)

\( I_E = I_E = 0; \, V_CB = 15 \, V \)

- \( C_C \)
  - typ. 65 < 90 pF

Feedback capacitance at \( f = 1 \, MHz \)

\( I_C = 100 \, mA; \, V_CE = 15 \, V \)

- \( C_{re} \)
  - typ. 41 pF

Collector-stud capacitance

- \( C_{cs} \)
  - typ. 2 pF
V.H.F. power transistor

BLY89A

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

\[ V_{CC} = 13.5 \text{ V; } T_{mb} \text{ up to } 25 \text{ }^\circ\text{C} \]

<table>
<thead>
<tr>
<th>f(MHz)</th>
<th>( P_s (W) )</th>
<th>( P_L (W) )</th>
<th>( I_C (A) )</th>
<th>( G_p (\text{dB}) )</th>
<th>( \eta (%) )</th>
<th>( Z_L (\Omega) )</th>
<th>( Y_L (\text{mS}) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>&lt; 6.25</td>
<td>25</td>
<td>&lt; 2.64</td>
<td>&gt; 6</td>
<td>&gt; 70</td>
<td>1.6+j1.4</td>
<td>213+j5.5</td>
</tr>
</tbody>
</table>

Test circuit

\[
\begin{align*}
C1 &= 4 \text{ to } 44 \text{ pF film dielectric trimmer (code number 2222 809 07008)} \\
C2 &= 2 \text{ to } 22 \text{ pF film dielectric trimmer (code number 2222 809 07004)} \\
C3 &= C4 = 47 \text{ pF ceramic} \\
C5 &= 100 \text{ pF ceramic} \\
C6 &= 150 \text{ nF polyester} \\
C7 &= 4 \text{ to } 104 \text{ pF film dielectric trimmer (code number 2222 809 07015)} \\
C8 &= 4 \text{ to } 64 \text{ pF film dielectric trimmer (code number 2222 809 07011)} \\
L1 &= 0.5 \text{ turn enameled Cu wire (1.5 mm); int. diam. 6 mm; leads 2x6 mm} \\
L2 &= L3 = \text{ ferroxcube choke (code number 4312 020 36640)} \\
L4 &= 3.5 \text{ turns closely wound enameled Cu wire (1.5 mm); int. diam. 6 mm; leads 2x6 mm} \\
L5 &= 1 \text{ turn enameled Cu wire (1.5 mm); int. diam. 6 mm; leads 2x6 mm} \\
R1 &= 10 \Omega \text{ carbon}
\end{align*}
\]
APPLICATION INFORMATION (continued)
Component lay-out and printed circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graphs next page for safe operation at supply voltages other than the nominal. The graphs show the allowable output power under nominal conditions, as a function of the supply overvoltage ratio, with V.S.W.R. as parameter.

The upper graph applies to the situation in which the drive \( (P_S/P_{S_{nom}}) \) increases linearly with supply overvoltage ratio.

The lower graph shows the derating factor to be applied when the drive \( (P_S/P_{S_{nom}}) \) increases as the square of the supply overvoltage ratio \( (V_{CC}/V_{CC_{nom}}) \).

Depending on the operating conditions, the appropriate derating factor may lie in the region between the linear and the square-law functions.
R.F. SOAR

- $f = 175 \text{MHz}$
- $T_h = 70^\circ \text{C}$
- $R_{\text{th,mb-h}} = 0.3 \text{ K/W}$
- $V_{CC_{\text{nom}}} = 13.5 \text{ V}$
- $P_{\text{nom}} = P_s$ at $V_{CC} = 13.5 \text{ V}$ and $V.S.W.R. = 1$

---

---
OPERATING NOTE  Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.
N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. It has a 3/8” capstan envelope with a ceramic cap. All leads are isolated from the stud.

**QUICK REFERENCE DATA**

R.F. performance up to $T_h = 25 \, ^\circ\text{C}$ in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CC}$ (V)</th>
<th>$f$ (MHz)</th>
<th>$P_L$ (W)</th>
<th>$G_p$ (dB)</th>
<th>$\eta$ (%)</th>
<th>$\bar{z}_i$ (Ω)</th>
<th>$\bar{Y}_L$ (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>13,5</td>
<td>175</td>
<td>25</td>
<td>&gt; 6</td>
<td>&gt; 70</td>
<td>1,6 + j1,4</td>
<td>210 + j5,5</td>
</tr>
</tbody>
</table>

**MECHANICAL DATA**

Fig. 1 SOT-120.

Dimensions in mm

When locking is required an adhesive is preferred instead of a lock washer.

**PRODUCT SAFETY** This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-emitter voltage \( (V_{BE} = 0) \)
- peak value

Collector-emitter voltage (open base)

Emitter-base voltage (open collector)

Collector current (average)

Collector current (peak value); \( f > 1 \text{ MHz} \)

R.F. power dissipation \( (f > 1 \text{ MHz}) \); \( T_{mb} = 25 ^\circ \text{C} \)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_{CESM} ) max</td>
<td>36 V</td>
</tr>
<tr>
<td>( V_{CEO} ) max</td>
<td>18 V</td>
</tr>
<tr>
<td>( V_{EBO} ) max</td>
<td>4 V</td>
</tr>
<tr>
<td>( I_{C(AV)} ) max</td>
<td>6 A</td>
</tr>
<tr>
<td>( I_{CM} ) max</td>
<td>12 A</td>
</tr>
<tr>
<td>( P_{rf} ) max</td>
<td>73 W</td>
</tr>
</tbody>
</table>

THERMAL RESISTANCE (dissipation 20 W; \( T_{mb} = 79 ^\circ \text{C} \), i.e. \( T_h = 70 ^\circ \text{C} \))

- From junction to mounting base (d.c. dissipation)
- From junction to mounting base (r.f. dissipation)
- From mounting base to heatsink

R.F. power dissipation; \( V_{CE} \leq 16,5 \text{ V}; f > 1 \text{ MHz} \)

Continuous d.c. operation
Continuous r.f. operation
Short-time operation during mismatch

\[
\begin{align*}
R_{th j-mb(dc)} &= 3,1 \text{ K/W} \\
R_{th j-mb(rf)} &= 2,3 \text{ K/W} \\
R_{th mb-h} &= 0,45 \text{ K/W}
\end{align*}
\]
CHARACTERISTICS

T<sub>j</sub> = 25 °C

Breakdown voltage

Collector-emitter voltage
V<sub>BE</sub> = 0; I<sub>C</sub> = 25 mA

Collector-emitter voltage
open base; I<sub>C</sub> = 50 mA

Emitter-base voltage
open collector; I<sub>E</sub> = 10 mA

Collector cut-off current
V<sub>BE</sub> = 0; V<sub>CE</sub> = 18 V

Transient energy
L = 25 mH; f = 50 Hz
open base
−V<sub>BE</sub> = 1,5 V; R<sub>BE</sub> = 33 Ω

D.C. current gain*
I<sub>C</sub> = 2,5 A; V<sub>CE</sub> = 5 V

Collector-emitter saturation voltage*
I<sub>C</sub> = 7,5 A; I<sub>E</sub> = 1,5 A

Transition frequency at f = 100 MHz*
I<sub>C</sub> = 2,5 A; V<sub>CE</sub> = 13,5 V
I<sub>C</sub> = 7,5 A; V<sub>CE</sub> = 13,5 V

Collector capacitance at f = 1 MHz
I<sub>E</sub> = I<sub>E</sub> = 0; V<sub>CB</sub> = 15 V

Feedback capacitance at f = 1 MHz
I<sub>C</sub> = 100 mA; V<sub>CE</sub> = 15 V

Collector-stud capacitance

\[ \begin{align*}
V(BR)CES & > 36 \text{ V} \\
V(BR)CEO & > 18 \text{ V} \\
V(BR)EBO & > 4 \text{ V} \\
I_{CES} & < 10 \text{ mA} \\
E & > 8 \text{ ms} \\
E & > 8 \text{ ms} \\
h_{FE} & \text{ typ } 50 \text{ to 80} \\
V_{CEsat} & \text{ typ } 1,7 \text{ V} \\
f_T & \text{ typ } 800 \text{ MHz} \\
f_T & \text{ typ } 750 \text{ MHz} \\
C_C & \text{ typ } 65 \text{ pF} \\
C_{CS} & \text{ typ } 2 \text{ pF} \\
C_{re} & \text{ typ } 41 \text{ pF} \\
\end{align*} \]

* Measured under pulse conditions: \( t_p \leq 200 \mu \text{s}; \delta \leq 0,02. \)
Typ values
$T_j = 25 \degree C$

$V_{CE} = 13.5 \text{ V}$

$V_{CE} = 5 \text{ V}$

$I_E = I_e = 0$

$f = 1 \text{ MHz}$

$V_{CE} = 13.5 \text{ V}$

$f = 100 \text{ MHz}$

$T_j = 25 \degree C$
V.H.F. power transistor

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

\[ T_h = 25 \, ^\circ C \]

<table>
<thead>
<tr>
<th>( f ) (MHz)</th>
<th>( V_{CC} ) (V)</th>
<th>( P_L ) (W)</th>
<th>( P_S ) (W)</th>
<th>( G_P ) (dB)</th>
<th>( I_C ) (A)</th>
<th>( \eta ) (%)</th>
<th>( z_I ) (( \Omega ))</th>
<th>( Y_L ) (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>13,5</td>
<td>25</td>
<td>(&lt;6,25)</td>
<td>(&gt;6)</td>
<td>(&lt;2,64)</td>
<td>(&gt;70)</td>
<td>(1,6 + j1,4)</td>
<td>(210 + j5,5)</td>
</tr>
<tr>
<td>175</td>
<td>12,5</td>
<td>25</td>
<td>(-)</td>
<td>(\text{typ 6,6})</td>
<td>(-)</td>
<td>(\text{typ 75})</td>
<td>(-)</td>
<td>(-)</td>
</tr>
</tbody>
</table>

Test circuit for 175 MHz

List of components:

- \( C_1 = 2,5 \) to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
- \( C_2 = C_8 = 4 \) to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
- \( C_{3a} = C_{3b} = 47 \) pF ceramic capacitor (500 V)
- \( C_4 = 120 \) pF ceramic capacitor
- \( C_5 = 100 \) nF polyester capacitor
- \( C_{6a} = C_{6b} = 8,2 \) pF ceramic capacitor (500 V)
- \( C_7 = 5 \) to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

- \( L_1 = 1 \) turn enameled Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
- \( L_2 = 100 \) nH; 7 turns closely wound enameled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
- \( L_3 = L_8 = \) Ferroxcube choke coil (cat. no. 4312 020 36640)
- \( L_4 = L_5 = \) strip (12 mm x 6 mm); taps for \( C_{3a} \) and \( C_{3b} \) at 5 mm from transistor
- \( L_6 = 2 \) turns enameled Cu wire (1,6 mm); int. dia. 5,0 mm; length 6,0 mm; leads 2 x 5 mm
- \( L_7 = 2 \) turns enameled Cu wire (1,6 mm); int. dia. 4,5 mm; length 6,0 mm; leads 2 x 5 mm

\( L_4 \) and \( L_5 \) are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

- \( R_1 = 10 \) \( \Omega \) (±10%) carbon resistor
- \( R_2 = 4,7 \) \( \Omega \) (±5%) carbon resistor
APPLICATION INFORMATION (continued)

Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive ($P_S/P_{Snom}$) increases linearly with supply over-voltage ratio.
OPERATING NOTE  Below 50 MHz a base-emitter resistor of 10 $\Omega$ is recommended to avoid oscillation. This resistor must be effective for r.f. only.

Measuring conditions for the graphs on this page
$V_{CC} = 13.5$ V
$P_L = 25$ W
$T_h = 25$ °C
typical values
V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 12.5 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions with a supply over-voltage to 15 V. It has a plastic encapsulated stripline package. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25$ °C in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>Mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_S$ W</th>
<th>$P_L$ W</th>
<th>$I_C$ A</th>
<th>$G_p$ dB</th>
<th>$\eta$ %</th>
<th>$\overline{Z_1}$ $\Omega$</th>
<th>$\overline{Y_L}$ mS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>12.5</td>
<td>175</td>
<td>&lt;15.8</td>
<td>50</td>
<td>&lt;5.33</td>
<td>&gt;5.0</td>
<td>&gt;75</td>
<td>1.3 + j1.6</td>
<td>270 + j170</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-55.

Dimensions in mm

Diameter of clearance hole in heatsink: max. 6.4 mm. Mounting hole to have no burrs at either end. De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS  Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)  
peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current (average)
Collector current (peak value) \( f > 1 \text{ MHz} \)

Total power dissipation up to \( T_{mb} = 25 \degree C \)
\( f > 1 \text{ MHz} \)

\[
\begin{align*}
V_{CBOM} & \max. \quad 36 \text{ V} \\
V_{CEO} & \max. \quad 18 \text{ V} \\
V_{EBO} & \max. \quad 4 \text{ V} \\
I_{C(AV)} & \max. \quad 8 \text{ A} \\
I_{CM} & \max. \quad 20 \text{ A} \\
\end{align*}
\]

Total power dissipation up to \( T_{mb} = 25 \degree C \)
\( f > 1 \text{ MHz} \)

\[
\begin{align*}
I_{C} (\text{A}) \\
V_{CE} (\text{V})
\end{align*}
\]

Storage temperature
Operating junction temperature

THERMAL RESISTANCE
From junction to mounting base
From mounting base to heatsink

\[
\begin{align*}
R_{th \: j-mb} & = 1.35 \text{ K/W} \\
R_{th \: mb-h} & = 0.2 \text{ K/W} \\
T_{stg} & = -65 \text{ to } +200 \degree C \\
T_{j} & \max. \quad 200 \degree C
\end{align*}
\]
CHARACTERISTICS

$T_j = 25 \, ^\circ\text{C}$ unless otherwise specified

Breakdown voltages

**Collector-base voltage**
- Open emitter, $I_C = 100 \, \text{mA}$
  - $V_{(BR)CBO} > 36 \, \text{V}$

**Collector-emitter voltage**
- Open base, $I_C = 100 \, \text{mA}$
  - $V_{(BR)CEO} > 18 \, \text{V}$

**Emitter-base voltage**
- Open collector, $I_E = 25 \, \text{mA}$
  - $V_{(BR)EBO} > 4 \, \text{V}$

**Transient energy**

$L = 25 \, \text{mH}; f = 50 \, \text{Hz}$
- Open base
  - $E > 8 \, \text{ms}$
  - $-V_{BE} = 1.5 \, \text{V}; R_{BE} = 33 \, \Omega$
  - $E > 8 \, \text{ms}$

**D.C. current gain**

$I_C = 1 \, \text{A}; V_{CE} = 5 \, \text{V}$
  - $h_{FE} > 10$
  - Typ. 50

**Transition frequency**

$I_C = 6 \, \text{A}; V_{CE} = 10 \, \text{V}$
  - $f_T$ typ. 550 MHz

**Collector capacitance at $f = 1 \, \text{MHz}$**

$I_E = I_C = 0; V_{CB} = 15 \, \text{V}$
  - $C_C$ typ. 130 pF
  - $C_C < 160$ pF

**Feedback capacitance**

$I_C = 200 \, \text{mA}; V_{CE} = 15 \, \text{V}$
  - $C_r_e$ typ. 82 pF

**Collector-stud capacitance**

$I_C = 200 \, \text{mA}; V_{CE} = 15 \, \text{V}$
  - $C_{cs}$ typ. 3.5 pF
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

\( f = 175 \text{ MHz} \); \( T_h \leq 25 \degree \text{C} \)

<table>
<thead>
<tr>
<th>( V_{CC} ) (V)</th>
<th>( P_S ) (W)</th>
<th>( P_L ) (W)</th>
<th>( I_C ) (A)</th>
<th>( G_P ) (dB)</th>
<th>( \eta ) (%)</th>
<th>( \bar{Z}_i ) (( \Omega ))</th>
<th>( \bar{Y}_L ) (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.5</td>
<td>&lt; 15.8</td>
<td>50</td>
<td>&lt; 5.33</td>
<td>&gt; 5.0</td>
<td>&gt; 75</td>
<td>1.3 + j 1.6</td>
<td>270 + j 170</td>
</tr>
</tbody>
</table>

Test circuit for 175 MHz:

\[ \text{C1} = 2 \text{ to } 20 \text{ pF film dielectric trimmer} \]
\[ \text{C2} = 4 \text{ to } 40 \text{ pF film dielectric trimmer} \]
\[ \text{C3} = \text{C4} = 27 \text{ pF ceramic capacitor} \]
\[ \text{C5} = \text{C6} = 56 \text{ pF ceramic capacitor} \]
\[ \text{C7} = 100 \text{ pF ceramic capacitor} \]
\[ \text{C8} = 100 \text{ nF polyester capacitor} \]
\[ \text{C9} = 4 \text{ to } 80 \text{ pF film dielectric trimmer} \]
\[ \text{C10} = 4 \text{ to } 60 \text{ pF film dielectric trimmer} \]
\[ \text{L1} = 1.5 \text{ turns enameled Cu wire (1.5 mm); int. dia. 6 mm; length 4 mm; leads 2 x 5 mm} \]
\[ \text{L2} = 7 \text{ turns closely wound enameled Cu wire (0.5 mm); int. dia. 3 mm; leads 2 x 5 mm} \]
\[ \text{L3} = \text{L4} = \text{Ferroxcube choke (code number 4312 020 36640)} \]
\[ \text{L5} = \text{bifilar wound enameled Cu wire (1.0 mm); see figure on next page} \]
\[ \text{R1} = 10 \text{ \( \Omega \) carbon resistor} \]
\[ \text{R2} = 4.7 \text{ \( \Omega \) carbon resistor} \]
APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power ($P_{L_{n}}$) must be derated in accordance with the adjacent graph for safe operation at supply voltage other than the nominal.

The graph shows the allowable output power under nominal conditions, as a function of the supply overvoltage ratio with V.S.W.R. as parameter. The graph applies to the situation in which the drive ($P_S/P_{S_{n}}$) increases linearly with supply overvoltage ratio ($V_{CC}/V_{CC_{n}}$).
power gain versus frequency
(class B operation)

Vcc = 12.5 V
P_L = 50 W
T_h = 25 °C

typ.

input impedance (series components) versus frequency
(class B operation)

Vcc = 12.5 V
P_L = 50 W
T_h = 25 °C
typ. values

load impedance (parallel components) versus frequency
(class B operation)

Vcc = 12.5 V
P_L = 50 W
T_h = 25 °C
typ. values
V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in class-A, B and C operated mobile, industrial and military transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a ¼" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance up to $T_{mb} = 25 \, ^\circ\text{C}$ in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_P$ dB</th>
<th>$\eta$ %</th>
<th>$Z_L$ $\Omega$</th>
<th>$\sqrt{V_L}$ mS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>28</td>
<td>175</td>
<td>8</td>
<td>$&gt;12$</td>
<td>$&gt;65$</td>
<td>$1,8 + j0,7$</td>
<td>$18 – j20$</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-48/2

Dimensions in mm

Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter) peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current (average)
Collector current (peak value) $f > 1$ MHz
Total power dissipation up to $T_h = 25 \, ^\circ\text{C}$ $f > 1$ MHz

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CB\text{OM}}$ max.</td>
<td>65 V</td>
</tr>
<tr>
<td>$V_{CEO}$ max.</td>
<td>36 V</td>
</tr>
<tr>
<td>$V_{EBO}$ max.</td>
<td>4 V</td>
</tr>
<tr>
<td>$I_{C(AV)}$ max.</td>
<td>0.75 A</td>
</tr>
<tr>
<td>$I_{CM}$ max.</td>
<td>2.25 A</td>
</tr>
<tr>
<td>$P_{tot}$ max.</td>
<td>17.5 W</td>
</tr>
</tbody>
</table>

Storage temperature
Operating junction temperature

THERMAL RESISTANCE
From junction to mounting base
From mounting base to heatsink

$T_{STG}$ = -30 to +200 °C
$T_j$ max. = 200 °C

$R_{th\ j-mb} = 9.4 \, \text{K/W}$
$R_{th\ mb-h} = 0.6 \, \text{K/W}$
### CHARACTERISTICS

**T<sub>j</sub> = 25 °C unless otherwise specified**

**Collector cut-off current**

I<sub>B</sub> = 0; V<sub>CE</sub> = 28 V

I<sub>CEO</sub> < 5 mA

**Breakdown voltages**

*Collector-base voltage*

open emitter; I<sub>C</sub> = 1 mA

V<sub>(BR)CBO</sub> > 65 V

*Collector-emitter voltage*

open base, I<sub>C</sub> = 10 mA

V<sub>(BR)CEO</sub> > 36 V

*Emitter-base voltage*

open collector; I<sub>E</sub> = 1 mA

V<sub>(BR)EBO</sub> > 4 V

**Transient energy**

L = 25 mH; f = 50 Hz

E > 0.5 ms

**D.C. current gain**

I<sub>C</sub> = 500 mA; V<sub>CE</sub> = 5 V

h<sub>FE</sub> > 5

**Transition frequency**

I<sub>C</sub> = 400 mA; V<sub>CE</sub> = 20 V

f<sub>T</sub> typ. 500 MHz

**Collector capacitance at f = 1 MHz**

I<sub>E</sub> = I<sub>E</sub> = 0; V<sub>CB</sub> = 30 V

C<sub>c</sub> typ. 10 pF

C<sub>c</sub> < 15 pF

**Feedback capacitance at f = 1 MHz**

I<sub>C</sub> = 50 mA; V<sub>CE</sub> = 30 V

C<sub>re</sub> typ. 7.5 pF

C<sub>cs</sub> typ. 2 pF
Typical values:

- **f_t (MHz)**
  - 0 to 1.5
  - 1.5 to 2.0

- **V_CE (V)**
  - 0 to 20

- **C_c (pF)**
  - 0 to 20
  - 20 to 10
  - 10 to 5
  - 5 to 0

Graphs showing the relationship between **f_t** and **I_C (A)**, and **C_c (pF)** and **V_CB (V)**.
### Application Information

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

\[ V_{CC} = 28 \text{ V}; \ T_{mb} \text{ up to } 25^\circ\text{C} \]

<table>
<thead>
<tr>
<th>f(MHz)</th>
<th>( P_s ) (W)</th>
<th>( P_L ) (W)</th>
<th>( I_C ) (A)</th>
<th>( G_p ) (dB)</th>
<th>( \eta (%) )</th>
<th>( Z_l ) (( \Omega ))</th>
<th>( Y_L ) (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>&lt; 0.50</td>
<td>8</td>
<td>&lt; 0.44</td>
<td>&gt; 12</td>
<td>&gt; 65</td>
<td>1.8 + j0.7</td>
<td>18 - j20</td>
</tr>
</tbody>
</table>

Test circuit

[Diagram of the test circuit]

- \( C_1 \) = 2.5 to 20 pF film dielectric trimmer (code number 2222 809 07004)
- \( C_2 = C_6 = C_7 \) = 4 to 40 pF film dielectric trimmer (code number 2222 809 07008)
- \( C_3 \) = 47 pF ceramic
- \( C_4 \) = 100 pF ceramic
- \( C_5 \) = 150 nF polyester

- \( L_1 \) = 0.5 turn enameled Cu wire (1.5 mm); int. diam. 6 mm; leads 2 x 10 mm
- \( L_2 \) = 6.5 turns closely wound enameled Cu wire (0.7 mm); int. diam. 4 mm; leads 2 x 5 mm
- \( L_3 = L_6 \) = ferroxcube choke (code number 4312 020 36640)
- \( L_4 \) = 7.5 turns enameled Cu wire (0.7 mm); int. diam. 4 mm; leads 2 x 5 mm
- \( L_5 \) = 4.5 turns enameled Cu wire (0.7 mm); int. diam. 6 mm; leads 2 x 7 mm
- \( L_7 \) = 3.5 turns enameled Cu wire (0.7 mm); int. diam. 6 mm; leads 2 x 7 mm

- \( R_1 = R_2 \) = 10 \( \Omega \) carbon

Component lay-out for 175 MHz test circuit see next page.
APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.
For high voltage operation, a stabilized power supply is generally used. The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heat-sink temperature as parameter.
OPERATING NOTE  Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.
V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25 \, ^\circ\text{C}$ in an unneutralized common-emitter class-B circuit.

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ (V)</th>
<th>$f$ (MHz)</th>
<th>$P_L$ (W)</th>
<th>$G_p$ (dB)</th>
<th>$\eta$ (%)</th>
<th>$z_i$ (Ω)</th>
<th>$Y_L$ (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>28</td>
<td>175</td>
<td>8</td>
<td>&gt; 12</td>
<td>&gt; 65</td>
<td>1,8 + j0,7</td>
<td>18 – j20</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Dimensions in mm

Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0)
- peak value
- Collector-emitter voltage (open base)
- Emitter-base voltage (open collector)
- Collector current (average)
- Collector current (peak value); f > 1 MHz
- R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C

Storage temperature
Operating junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>max. Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_{CESM}</td>
<td>65 V</td>
</tr>
<tr>
<td>V_{CEO}</td>
<td>36 V</td>
</tr>
<tr>
<td>V_{EBO}</td>
<td>4 V</td>
</tr>
<tr>
<td>I_{C(AV)}</td>
<td>0.9 A</td>
</tr>
<tr>
<td>I_{CM}</td>
<td>2.5 A</td>
</tr>
<tr>
<td>P_{rf}</td>
<td>20 W</td>
</tr>
<tr>
<td>T_{stg}</td>
<td>-65 to +150 °C</td>
</tr>
<tr>
<td>T_{j}</td>
<td>200 °C</td>
</tr>
</tbody>
</table>

Fig. 2 D.C. SOAR.

Fig. 3 R.F. power dissipation; V_{CE} ≤ 28 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 8 W; T_{mb} = 73.6 °C, i.e. T_{h} = 70 °C)

- From junction to mounting base (d.c. dissipation)
  \[ R_{th \ j-mb(d) c} = 10.7 \ K/W \]
- From junction to mounting base (r.f. dissipation)
  \[ R_{th \ j-mb(r) f} = 8.6 \ K/W \]
- From mounting base to heatsink
  \[ R_{th \ mb-h} = 0.45 \ K/W \]
CHARACTERISTICS

Tj = 25 °C

Collector-emitter breakdown voltage
  VBE = 0; IC = 2 mA

Collector-emitter breakdown voltage
  open base; IC = 10 mA

Emitter-base breakdown voltage
  open collector; IE = 1 mA

Collector cut-off current
  VBE = 0; VCE = 36 V

Second breakdown energy; L = 25 mH; f = 50 Hz
  open base
  RBE = 10 Ω

D.C. current gain*
  IC = 0.4 A; VCE = 5 V

Collector-emitter saturation voltage*
  IC = 1.25 A; IB = 0.25 A

Transition frequency at f = 100 MHz*
  –IE = 0.4 A; VCB = 28 V
  –IE = 1.25 A; VCB = 28 V

Collector capacitance at f = 1 MHz
  IE = Ie = 0; VCB = 28 V

Feedback capacitance at f = 1 MHz
  IC = 50 mA; VCE = 28 V

Collector-stud capacitance

V(BR)CES > 65 V
V(BR)CEO > 36 V
V(BR)EBO > 4 V
ICE < 1 mA
ESEBO > 0.5 mJ
ESEBR > 0.5 mJ
hFE typ. 50
10 to 100
VCEsat typ. 0.8 V
fT typ. 600 MHz
fT typ. 525 MHz
CC typ. 10 pF
CRE typ. 7.1 pF
CCS typ. 2 pF

* Measured under pulse conditions: tp ≤ 200 µs; δ ≤ 0.02.
Fig. 4 Typical values; $T_J = 25 \, ^\circ\text{C}$.

Fig. 5 $I_E = I_e = 0$; $f = 1 \, \text{MHz}; T_J = 25 \, ^\circ\text{C}$.

Fig. 6 Typical values; $f = 100 \, \text{MHz}; T_J = 25 \, ^\circ\text{C}$.
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

\[ T_h = 25 \, ^\circ C \]

<table>
<thead>
<tr>
<th>( f ) (MHz)</th>
<th>( V_{CE} ) (V)</th>
<th>( P_L ) (W)</th>
<th>( P_S ) (W)</th>
<th>( G_p ) (dB)</th>
<th>( I_C ) (A)</th>
<th>( \eta ) (%)</th>
<th>( Z_i ) (Ω)</th>
<th>( Y_L ) (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>28</td>
<td>8</td>
<td>&lt;0,5</td>
<td>&gt;12</td>
<td>&lt;0,44</td>
<td>&gt;65</td>
<td>1,8 + j0,7</td>
<td>18 – j20</td>
</tr>
</tbody>
</table>

Fig. 7 Test circuit; c.w. class-B.

List of components:

- \( C_1 = C_7 = 2,5 \text{ to } 20 \, \text{pF film dielectric trimmer} \) (cat. no. 2222 809 07004)
- \( C_2 = C_6 = 5 \text{ to } 60 \, \text{pF film dielectric trimmer} \) (cat. no. 2222 809 07011)
- \( C_3 = 27 \, \text{pF ceramic capacitor} \) (500 V)
- \( C_4 = 120 \, \text{pF ceramic capacitor} \) (500 V)
- \( C_5 = 100 \, \text{nF polyester capacitor} \)
- \( L_1 = 1 \text{ turn Cu wire} \) (1,6 mm); int. dia. 8,4 mm; leads 2 x 5 mm
- \( L_2 = 7 \text{ turns closely wound enamelled Cu wire} \) (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
- \( L_3 = L_8 \) = Ferroxcube wide band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- \( L_4 = L_5 \) = strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor
- \( L_6 = 3 \text{ turns closely wound enamelled Cu wire} \) (1,0 mm); int. dia. 9,0 mm; leads 2 x 5 mm
- \( L_7 = 3 \text{ turns closely wound enamelled Cu wire} \) (1,0 mm); int. dia. 8,2 mm; leads 2 x 5 mm
- \( L_4 \) and \( L_5 \) are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16”.
- \( R_1 = R_2 = 10 \, \Omega \) carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.
Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.
V.H.F. power transistor

Fig. 9 Typical values; $V_{CE} = 28$ V; $f = 175$ MHz.

Fig. 10 Typical values; $V_{CE} = 28$ V; $f = 175$ MHz.

Fig. 11 R.F. SOAR; c.w. class-B operation; $f = 175$ MHz; $V_{CE} = 28$ V; $R_{th}$ mb-h = 0.45 K/W
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.
Fig. 12 Input impedance (series components).

Fig. 13 Load impedance (parallel components).

Conditions for Figs 12, 13 and 14.

Typical values; $V_{CE} = 28$ V; $P_L = 8$ W; $T_h = 25$ °C.

OPERATING NOTE

Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.
V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in class-A, B and C operated mobile, industrial and military transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a ⅛" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance up to $T_{mb} = 25$ °C in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>Mode of operation</th>
<th>$V_{CE}$ (V)</th>
<th>$f$ (MHz)</th>
<th>$P_L$ (W)</th>
<th>$G_{d}$ (dB)</th>
<th>$\eta$ (%)</th>
<th>$\overline{z}_l$ (Ω)</th>
<th>$\overline{V}_L$ (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>28</td>
<td>175</td>
<td>15</td>
<td>&gt; 10</td>
<td>&gt; 65</td>
<td>1,4 + j1,85</td>
<td>33 – j27,5</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-48/2.

Dimensions in mm

Torque on nut: min. 0,75 Nm (7,5 kg cm), max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
**RATINGS** Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter) peak value

Collector-emitter voltage (open base)

Emitter-base voltage (open collector)

Collector current (average)

Collector current (peak value) \( f > 1 \text{ MHz} \)

Total power dissipation up to \( T_h = 25 \degree \text{C} \)

\( f > 1 \text{ MHz} \)

\[
\begin{align*}
V_{CBOM} & \quad \text{max.} \quad 65 \text{ V} \\
V_{CEO} & \quad \text{max.} \quad 36 \text{ V} \\
V_{EBO} & \quad \text{max.} \quad 4 \text{ V} \\
I_{C(AV)} & \quad \text{max.} \quad 1.5 \text{ A} \\
I_{CM} & \quad \text{max.} \quad 4.5 \text{ A} \\
P_{\text{tot}} & \quad \text{max.} \quad 32 \text{ W} \\
\end{align*}
\]

**Storage temperature**

**Operating junction temperature**

**THERMAL RESISTANCE**

From junction to mounting base

From mounting base to heatsink

\[
\begin{align*}
T_{stg} & \quad -30 \text{ to } +200 \degree \text{C} \\
T_{j} & \quad \text{max.} \quad 200 \degree \text{C} \\
R_{th j-mb} & = 4.9 \text{ K/W} \\
R_{th mb-h} & = 0.6 \text{ K/W} \\
\end{align*}
\]
CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current
I_B = 0; V_CE = 28 V

Breakdown voltages
Collector-base voltage
open emitter, I_C = 3 mA

Collector-emitter voltage
open base, I_C = 25 mA

Emitter-base voltage
open collector; I_E = 3 mA

Transient energy
L = 25 mH; f = 50 Hz
open base
-V_BE = 1.5 V; R_BE = 33 Ω

D.C. current gain
I_C = 500 mA; V_CE = 5 V

Transition frequency
I_C = 600 mA; V_CE = 20 V

Collector capacitance at f = 1 MHz
I_E = I_E = 0; V_CB = 30 V

Feedback capacitance at f = 1 MHz
I_C = 100 mA; V_CE = 30 V

Collector-stud capacitance
BLY92A

Graph 1: 
- $f_T$ (MHz) vs $I_C$ (A)
- $V_{CE}=20V$
- $V_C=500$

Graph 2: 
- $C_C$ (pF) vs $V_{CB}$ (V)
- $I_E=I_A=0$
- $f=1MHz$
- $V_C=500$
V.H.F. power transistor

**APPLICATION INFORMATION**

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

\[ V_{CE} = 28 \text{ V}; T_{mb} \text{ up to } 25^\circ \text{C} \]

<table>
<thead>
<tr>
<th>( f ) (MHz)</th>
<th>( P_S ) (W)</th>
<th>( P_L ) (W)</th>
<th>( I_C ) (A)</th>
<th>( G_P ) (dB)</th>
<th>( \eta ) (%)</th>
<th>( Z_i ) (Ω)</th>
<th>( Y_L ) (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>&lt;1.5</td>
<td>15</td>
<td>&lt;0.83</td>
<td>&gt;10</td>
<td>&gt;65</td>
<td>1.4 + j1.85</td>
<td>33 – j27.5</td>
</tr>
</tbody>
</table>

Test circuit: 175 MHz; c.w. class-B.

![Circuit Diagram](attachment://BLY92A_circuit.png)

C1 = 2.5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = C7 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 47 pF ceramic capacitor
C4 = 100 pF ceramic capacitor
C5 = 150 nF polyester capacitor
L1 = 0.5 turn enamelled Cu wire (1.6 mm); int. dia. 6 mm; leads 2 x 10 mm
L2 = 6.5 turns closely wound enamelled Cu wire (0.7 mm); int. dia. 4 mm; leads 2 x 5 mm
L3 = L5 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 2.5 turns enamelled Cu wire (0.7 mm); int. dia. 6 mm; leads 2 x 7 mm
L6 = 4.5 turns enamelled Cu wire (0.7 mm); int. dia. 6 mm; leads 2 x 7 mm
R1 = R2 = 10 Ω carbon resistor
APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.
For high voltage operation, a stabilized power supply is generally used. The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heat-sink temperature as parameter.
OPERATING NOTE Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.
V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a 3/8” capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance up to $T_H = 25 \, ^{\circ}\text{C}$ in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ (V)</th>
<th>$f$ (MHz)</th>
<th>$P_L$ (W)</th>
<th>$G_P$ (dB)</th>
<th>$\eta$ (%)</th>
<th>$\bar{z}_l$ ($\Omega$)</th>
<th>$\bar{V}_L$ (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>28</td>
<td>175</td>
<td>15</td>
<td>$&gt; 10$</td>
<td>$&gt; 65$</td>
<td>$1,4 + j1,85$</td>
<td>$33 - j27,5$</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-120.

Dimensions in mm

Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage \( (V_{BE} = 0) \)
- peak value

Collector-emitter voltage (open base)

Emitter-base voltage (open collector)

Collector current (average)

Collector current (peak value); \( f > 1 \text{ MHz} \)

R.F. power dissipation (\( f > 1 \text{ MHz} \)); \( T_{mb} = 25 \text{ °C} \)

Storage temperature

Operating junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_{CESM} )</td>
<td>max. 65 V</td>
</tr>
<tr>
<td>( V_{CEO} )</td>
<td>max. 36 V</td>
</tr>
<tr>
<td>( V_{EBO} )</td>
<td>max. 4 V</td>
</tr>
<tr>
<td>( I_C(AV) )</td>
<td>max. 1.75 A</td>
</tr>
<tr>
<td>( I_{CM} )</td>
<td>max. 5.0 A</td>
</tr>
<tr>
<td>( P_{rf} )</td>
<td>max. 36 W</td>
</tr>
<tr>
<td>( T_{stg} )</td>
<td>-65 to +150 °C</td>
</tr>
<tr>
<td>( T_{j} )</td>
<td>max. 200 °C</td>
</tr>
</tbody>
</table>

Fig. 2 D.C. SOAR.

Fig. 3 R.F. power dissipation; \( V_{CE} \leq 28 \text{ V} \);
\( f > 1 \text{ MHz} \).

I Continuous d.c. operation

II Continuous r.f. operation

III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 15 W; \( T_{mb} = 77 \text{ °C} \), i.e. \( T_{h} = 70 \text{ °C} \))

From junction to mounting base (d.c. dissipation)
\( R_{th \ j-mb (dc)} = 6.55 \text{ K/W} \)

From junction to mounting base (r.f. dissipation)
\( R_{th \ j-mb (rf)} = 4.95 \text{ K/W} \)

From mounting base to heatsink
\( R_{th \ mb-h} = 0.45 \text{ K/W} \)
V.H.F. power transistor

BLY92C

CHARACTERISTICS

$T_j = 25 \, ^\circ\text{C}$

Collector-emitter breakdown voltage
$V_{BE} = 0; \, I_C = 5 \, mA$

Collector-emitter breakdown voltage
open base; $I_C = 25 \, mA$

Emitter-base breakdown voltage
open collector; $I_E = 2 \, mA$

Collector cut-off current
$V_{BE} = 0; \, V_{CE} = 36 \, V$

Second breakdown energy; $L = 25 \, \text{mH}; \, f = 50 \, \text{Hz}$
open base
$R_{BE} = 10 \, \Omega$

D.C. current gain$^*$
$I_C = 0,7 \, A; \, V_{CE} = 5 \, V$

Collector-emitter saturation voltage$^*$
$I_C = 2 \, A; \, I_B = 0,4 \, A$

Transition frequency at $f = 100 \, \text{MHz}$
$-I_E = 0,7 \, A; \, V_{CB} = 28 \, V$
$-I_E = 2 \, A; \, V_{CB} = 28 \, V$

Collector capacitance at $f = 1 \, \text{MHz}$
$I_E = I_E = 0; \, V_{CB} = 28 \, V$

Feedback capacitance at $f = 1 \, \text{MHz}$
$I_C = 100 \, mA; \, V_{CE} = 28 \, V$

Collector-stud capacitance

$V_{(BR)CES} \quad > \quad 65 \, V$

$V_{(BR)CEO} \quad > \quad 36 \, V$

$V_{(BR)EBO} \quad > \quad 4 \, V$

$I_{CES} \quad < \quad 2 \, mA$

$E_{SO} \quad > \quad 2,5 \, mJ$

$E_{SBR} \quad > \quad 2,5 \, mJ$

$h_{FE} \quad \text{typ.} \quad 50$

$10 \, \text{to} \, 100$

$V_{CEsat} \quad \text{typ.} \quad 0,65 \, V$

$f_T \quad \text{typ.} \quad 650 \, \text{MHz}$

$f_T \quad \text{typ.} \quad 625 \, \text{MHz}$

$C_C \quad \text{typ.} \quad 18 \, \text{pF}$

$C_{re} \quad \text{typ.} \quad 12,8 \, \text{pF}$

$C_{cs} \quad \text{typ.} \quad 2 \, \text{pF}$

$^*$ Measured under pulse conditions: $t_p \leq 200 \, \mu\text{s}; \, \delta \leq 0,02$. 

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Fig. 4 Typical values; $T_j = 25 \, ^\circ\text{C}$.

Fig. 5 $I_E = I_e = 0$; $f = 1 \, \text{MHz}$; $T_j = 25 \, ^\circ\text{C}$.

Fig. 6 Typical values; $f = 100 \, \text{MHz}$; $T_j = 25 \, ^\circ\text{C}$.
V.H.F. power transistor

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

$T_h = 25 \, ^\circ\text{C}$

<table>
<thead>
<tr>
<th>$f$ (MHz)</th>
<th>$V_{CE}$ (V)</th>
<th>$P_L$ (W)</th>
<th>$P_S$ (W)</th>
<th>$G_p$ (dB)</th>
<th>$I_C$ (A)</th>
<th>$\eta$ (%)</th>
<th>$\bar{Z}_l$ (Ω)</th>
<th>$\bar{V}_L$ (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>28</td>
<td>15</td>
<td>$&lt; 1.5$</td>
<td>$&gt; 10$</td>
<td>$&lt; 0.83$</td>
<td>$&gt; 65$</td>
<td>$1.4 + j1.85$</td>
<td>$33 - j27.5$</td>
</tr>
</tbody>
</table>

List of components:

- $C1 = C7 = 2.5$ to $20 \, \text{pF}$ film dielectric trimmer (cat. no. 2222 809 07004)
- $C2 = C6 = 5$ to $60 \, \text{pF}$ film dielectric trimmer (cat. no. 2222 809 07011)
- $C3 = 27 \, \text{pF}$ ceramic capacitor (500 V)
- $C4 = 120 \, \text{pF}$ ceramic capacitor (500 V)
- $C5 = 100 \, \text{nF}$ polyester capacitor
- $L_1 = 1$ turn Cu wire (1.6 mm); int. dia. 8.4 mm; leads 2 x 5 mm
- $L_2 = 7$ turns closely wound enamelled Cu wire (0.5 mm); int. dia. 3 mm; leads 2 x 5 mm
- $L_3 = L_8 = \text{Ferroxcube wide band h.f. choke, grade 3B}$ (cat. no. 4312 020 36640)
- $L_4 = L_5 = \text{strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor}$
- $L_6 = 3$ turns closely wound enamelled Cu wire (1.0 mm); int. dia. 9.0 mm; leads 2 x 5 mm
- $L_7 = 3$ turns closely wound enamelled Cu wire (1.0 mm); int. dia. 8.2 mm; leads 2 x 5 mm
- $L_4$ and $L_5$ are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16”
- $R_1 = R_2 = 10 \, \Omega$ carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.
Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.
Fig. 9 Typical values; $V_{CE} = 28$ V; $f = 175$ MHz.

Fig. 10 Typical values; $V_{CE} = 28$ V; $f = 175$ MHz.

Fig. 11 R.F. SOAR; c.w. class-B operation; $f = 175$ MHz; $V_{CE} = 28$ V; $R_{th mb-h} = 0.45$ K/W

The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.
Fig. 12 Input impedance (series components).

Fig. 13 Load impedance (parallel components).

Conditions for Figs 12, 13 and 14.
Typical values: \( V_{CE} = 28 \text{ V} \); \( P_L = 15 \text{ W} \);
\( T_H = 25 \text{ °C} \).

**OPERATING NOTE**
Below 100 MHz a base-emitter resistor of 10 \( \Omega \) is recommended to avoid oscillation. This resistor must be effective for r.f. only.
V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 28 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions. It has a ½” capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance up to $T_{mb} = 25 \, ^\circ C$ in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ (V)</th>
<th>$f$ (MHz)</th>
<th>$P_S$ (W)</th>
<th>$P_L$ (W)</th>
<th>$I_C$ (A)</th>
<th>$G_D$ (dB)</th>
<th>$\eta$ (%)</th>
<th>$\overline{z}_i$ ($\Omega$)</th>
<th>$\overline{V}_L$ (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>28</td>
<td>175</td>
<td>&lt;3,1</td>
<td>&lt;1,5</td>
<td>&gt;9</td>
<td>&gt;60</td>
<td>1,0 + j1,2</td>
<td>58,8 – j53,8</td>
<td></td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-56.

Dimensions in mm

- Diameter of clearance hole in heatsink: max. 4,9 mm.
- Mounting hole to have no burrs at either end.
- De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

Torque on nut: min. 1,5 Nm
(15 kg cm)
max. 1,7 Nm
(17 kg cm)

Diameter of clearance hole in heatsink: max. 4,9 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.
RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter)
  peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current (average)
Collector current (peak value) f > 1 MHz
Total power dissipation up to T_{mb} = 25 ^\circ C
  f > 1 MHz

\[
\begin{align*}
V_{CBOM} & \quad \text{max.} & 65 \, \text{V} \\
V_{CEO} & \quad \text{max.} & 36 \, \text{V} \\
V_{EBO} & \quad \text{max.} & 4 \, \text{V} \\
I_{C(AV)} & \quad \text{max.} & 3 \, \text{A} \\
I_{CM} & \quad \text{max.} & 9 \, \text{A} \\
P_{\text{tot}} & \quad \text{max.} & 70 \, \text{W}
\end{align*}
\]

Storage temperature
Operating junction temperature

THERMAL RESISTANCE

From junction to mounting base
From mounting base to heatsink

\[
\begin{align*}
T_{\text{stg}} & \quad -30 \text{ to } +200 \, {\text{\degree C}} \\
T_j & \quad \text{max.} & 200 \, \text{\degree C} \\
R_{\text{th j-mb}} & = 2.5 \, \text{K/W} \\
R_{\text{th mb-h}} & = 0.3 \, \text{K/W}
\end{align*}
\]
## CHARACTERISTICS

$T_j = 25 \, ^\circ\text{C}$ unless otherwise specified

**Breakdown voltages**

- **Collector-base voltage**
  - open emitter, $I_C = 50 \, mA$
  
- **Collector-emitter voltage**
  - open base, $I_C = 50 \, mA$

- **Emitter-base voltage**
  - open collector; $I_E = 10 \, mA$

**Transient energy**

- $L = 25 \, mH$; $f = 50 \, Hz$
  
**D.C. current gain**

- $I_C = 1 \, A$; $V_{CE} = 5 \, V$

**Transition frequency**

- $I_C = 3 \, A$; $V_{CE} = 20 \, V$

**Collector capacitance at f = 1 MHz**

- $I_E = I_e = 0$; $V_{CB} = 30 \, V$

**Feedback capacitance at f = 1 MHz**

- $I_C = 100 \, mA$; $V_{CE} = 30 \, V$

**Collector-stud capacitance**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-base voltage</td>
<td>$V_{(BR)CBO}$</td>
<td>&gt;</td>
<td>$65 , V$</td>
</tr>
<tr>
<td></td>
<td>$V_{(BR)CEO}$</td>
<td>&gt;</td>
<td>$36 , V$</td>
</tr>
<tr>
<td></td>
<td>$V_{(BR)EBO}$</td>
<td>&gt;</td>
<td>$4 , V$</td>
</tr>
<tr>
<td>open base</td>
<td>$E$</td>
<td>&gt;</td>
<td>$8 , ms$</td>
</tr>
<tr>
<td>$-V_{BE} = 1.5 , V$</td>
<td>$E$</td>
<td>&gt;</td>
<td>$8 , ms$</td>
</tr>
<tr>
<td>D.C. current gain</td>
<td>$h_{FE}$</td>
<td>typ.</td>
<td>$50$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$10$ to $120$</td>
</tr>
<tr>
<td>Transition frequency</td>
<td>$f_T$</td>
<td>typ.</td>
<td>$500 , MHz$</td>
</tr>
<tr>
<td>Collector capacitance at f = 1 MHz</td>
<td>$C_c$</td>
<td>typ.</td>
<td>$50 , pF$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt;</td>
<td>$65 , pF$</td>
</tr>
<tr>
<td>Feedback capacitance at f = 1 MHz</td>
<td>$C_{re}$</td>
<td>typ.</td>
<td>$31 , pF$</td>
</tr>
<tr>
<td></td>
<td>$C_{cs}$</td>
<td>typ.</td>
<td>$2 , pF$</td>
</tr>
</tbody>
</table>
R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

\[ V_{CC} = 28 \text{ V}; \quad T_{mb} = 25 \text{ }^\circ\text{C} \]

<table>
<thead>
<tr>
<th>f(MHz)</th>
<th>( P_S ) (W)</th>
<th>( P_L ) (W)</th>
<th>( I_C ) (A)</th>
<th>( G_p ) (dB)</th>
<th>( \eta ) (%)</th>
<th>( Z_i ) (( \Omega ))</th>
<th>( \overline{V}_L ) (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>&lt; 3.1</td>
<td>25</td>
<td>&lt; 1.5</td>
<td>&gt; 9</td>
<td>&gt; 60</td>
<td>1.0+j1.2</td>
<td>58.8–j53.8</td>
</tr>
</tbody>
</table>

Test circuit

- \( C_1 = 4 \text{ to } 44 \text{ pF} \) film dielectric trimmer (code number 2222 809 07008)
- \( C_2 = 2 \text{ to } 22 \text{ pF} \) film dielectric trimmer (code number 2222 809 07004)
- \( C_3 = C_4 = 47 \text{ pF} \) ceramic
- \( C_5 = 100 \text{ pF} \) ceramic
- \( C_6 = 150 \text{ nF} \) polyester
- \( C_7 = 4 \text{ to } 104 \text{ pF} \) film dielectric trimmer (code number 2222 809 07015)
- \( C_8 = 4 \text{ to } 64 \text{ pF} \) film dielectric trimmer (code number 2222 809 07011)

- \( L_1 = 0.5 \text{ turn} \) enamelled Cu wire (1.5 mm); int.diam.6 mm; leads 2 x 6 mm
- \( L_2 = 6 \text{ turns} \) closely wound enamelled Cu wire (0.7 mm); int.diam.4 mm; leads 2 x 4 mm
- \( L_3 = L_4 \) = ferroxcube choke (code number 4312 020 36640)
- \( L_5 = 3.5 \text{ turns} \) enamelled Cu wire (1.5 mm); int.diam. 6 mm; leads 2 x 6 mm
- \( L_6 = 1.5 \text{ turns} \) enamelled Cu wire (1.5 mm); int.diam. 6 mm; leads 2 x 6 mm

- \( R_1 = R_2 = 10 \text{ } \Omega \) carbon
APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.
For high voltage operation, a stabilized power supply is generally used. The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heatsink temperature as parameter.
OPERATING NOTE  Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.
V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25$ °C in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_L$ W</th>
<th>$G_D$ dB</th>
<th>$\eta$ %</th>
<th>$Z_i$ Ω</th>
<th>$\overline{Y_L}$ mS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>28</td>
<td>175</td>
<td>25</td>
<td>&gt;9</td>
<td>&gt;60</td>
<td>1,0 + j1,2</td>
<td>59–j54</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.

Torque on nut: min. 0,75 Nm (7,5 kg cm)  
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)
Collector-emitter voltage ($V_{BE} = 0$)
  peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current (average)
Collector current (peak value); $f > 1$ MHz
R.F. power dissipation ($f > 1$ MHz); $T_{mb} = 25$ °C
Storage temperature
Operating junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CESM}$ max.</td>
<td>65 V</td>
</tr>
<tr>
<td>$V_{CEO}$ max.</td>
<td>36 V</td>
</tr>
<tr>
<td>$V_{EBO}$ max.</td>
<td>4 V</td>
</tr>
<tr>
<td>$I_{C(AV)}$ max.</td>
<td>3 A</td>
</tr>
<tr>
<td>$I_{CM}$ max.</td>
<td>9 A</td>
</tr>
<tr>
<td>$P_{rf}$ max.</td>
<td>70 W</td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>-65 to +150 °C</td>
</tr>
<tr>
<td>$T_j$ max.</td>
<td>200 °C</td>
</tr>
</tbody>
</table>

THERMAL RESISTANCE (dissipation = 20 W; $T_{mb} = 79$ °C, i.e. $T_h = 70$ °C)

- From junction to mounting base (d.c. dissipation)
  $R_{th \ j-mb \ (dc)} = 3,1 \ K/W$
- From junction to mounting base (r.f. dissipation)
  $R_{th \ j-mb \ (rf)} = 2,3 \ K/W$
- From mounting base to heatsink
  $R_{th \ mb-h} = 0,45 \ K/W$
**CHARACTERISTICS**

\[ T_J = 25 \, ^\circ\text{C} \]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-emitter breakdown voltage</td>
<td>( V_{BE} = 0 ); ( I_C = 10 , \text{mA} )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector-emitter breakdown voltage</td>
<td>open base; ( I_C = 50 , \text{mA} )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emitter-base breakdown voltage</td>
<td>open collector; ( I_E = 10 , \text{mA} )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector cut-off current</td>
<td>( V_{BE} = 0 ); ( V_{CE} = 36 , \text{V} )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second breakdown energy; ( L = 25 , \text{mH} ); ( f = 50 , \text{Hz} ) open base</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D.C. current gain *</td>
<td>( I_C = 1.25 , \text{A}; V_{CE} = 5 , \text{V} )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector-emitter saturation voltage *</td>
<td>( I_C = 3.75 , \text{A}; I_B = 0.75 , \text{A} )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transition frequency at ( f = 100 , \text{MHz} ) *</td>
<td>( -I_E = 1.25 , \text{A}; V_{CB} = 28 , \text{V} )</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>( -I_E = 3.75 , \text{A}; V_{CB} = 28 , \text{V} )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector capacitance at ( f = 1 , \text{MHz} )</td>
<td>( I_E = I_B = 0; V_{CB} = 28 , \text{V} )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feedback capacitance at ( f = 1 , \text{MHz} )</td>
<td>( I_C = 100 , \text{mA}; V_{CE} = 28 , \text{V} )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector-stud capacitance</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Measured under pulse conditions: \( t_p \leq 200 \, \mu\text{s}; \delta \leq 0.02. \)
Fig. 4 Typical values; $T_j = 25 \, ^\circ\text{C}$.

Fig. 5 $I_E = I_B = 0$; $f = 1 \, \text{MHz}; T_j = 25 \, ^\circ\text{C}$.

Fig. 6 Typical values; $f = 100 \, \text{MHz}; T_j = 25 \, ^\circ\text{C}$.
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

$T_h = 25 \, ^\circ C$

<table>
<thead>
<tr>
<th>$f$ (MHz)</th>
<th>$V_{CE}$ (V)</th>
<th>$P_L$ (W)</th>
<th>$P_S$ (W)</th>
<th>$G_P$ (dB)</th>
<th>$I_C$ (A)</th>
<th>$\eta$ (%)</th>
<th>$z_i$ (Ω)</th>
<th>$V_L$ (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>28</td>
<td>25</td>
<td>$&lt; 3,15$</td>
<td>$&gt; 9$</td>
<td>$&lt; 1.5$</td>
<td>$&gt; 60$</td>
<td>$1.0 + j1.2$</td>
<td>$59 – j54$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$Z_j$ (Ω)</th>
<th>$Y_L$ (mS)</th>
</tr>
</thead>
</table>

Fig. 7 Test circuit; c.w. class-B.

List of components

- $C1 = C7 = 2.5$ to $20$ pF film dielectric trimmer (cat. no. 2222 809 07004)
- $C2 = 5$ to $60$ pF film dielectric trimmer (cat. no. 2222 809 07011)
- $C3a = C3b = 47$ pF ceramic capacitor (500 V)
- $C4 = 120$ pF ceramic capacitor
- $C5 = 100$ nF polyester capacitor
- $C6a = 2.2$ pF ceramic capacitor (500 V)
- $C6b = 1.8$ pF ceramic capacitor (500 V)
- $C8 = 4$ to $40$ pF film dielectric trimmer (cat. no. 2222 809 07008)
- $L1 = 14$ nH; 1 turn Cu wire (1.6 mm); int. dia. 7.7 mm; leads 2 x 5 mm
- $L2 = 100$ nH; 7 turns closely wound enamelled Cu wire (0.5 mm); int. dia. 3 mm; leads 2 x 5 mm
- $L3 = L8 = $ Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- $L4 = L5 = $ strip (12 mm x 6 mm); taps for $C3a$ and $C3b$ at 5 mm from transistor
- $L6 = 80$ nH; 3 turns Cu wire (1.6 mm); int. dia. 9.0 mm; length 8.0 mm; leads 2 x 5 mm
- $L7 = 62$ nH; 3 turns Cu wire (1.6 mm); int. dia. 7.5 mm; length 8.1 mm; leads 2 x 5 mm

$L4$ and $L5$ are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness $1/16”$.

- $R1 = R2 = 10 \, \Omega$ carbon resistor (0.25 W)

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.
Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

To minimize the dielectric losses, the ground plane under the interconnection of L7 and C7 has been removed.
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.
OPERATING NOTE
Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

Conditions for Figs 12, 13 and 14:
Typical values; $V_{CE} = 28$ V; $P_L = 25$ W; $T_h = 25$ °C.
V.H.F. POWER TRANSISTOR

N-P-N planar epitaxial transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 28 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions. It has a plastic encapsulated stripline package. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance up to $T_{mb} = 25 \, ^\circ C$ in an unneutralized common-emitter class-B circuit

<table>
<thead>
<tr>
<th>mode of operation</th>
<th>$V_{CE}$ V</th>
<th>$f$ MHz</th>
<th>$P_S$ W</th>
<th>$P_L$ W</th>
<th>$I_C$ A</th>
<th>$G_P$ dB</th>
<th>$\eta$ %</th>
<th>$\overline{Z_i}$ $\Omega$</th>
<th>$\overline{Y_L}$ $mS$</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.w.</td>
<td>28</td>
<td>175</td>
<td>&lt; 10</td>
<td>50</td>
<td>&lt; 2,75</td>
<td>&gt; 7</td>
<td>&gt; 65</td>
<td>0,8 + j1,45</td>
<td>125 - j66</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOT-55.

Dimensions in mm

<table>
<thead>
<tr>
<th>Torque on nut:</th>
<th>min. 2,3 Nm (23 kg cm)</th>
<th>max. 2,7 Nm (27 kg cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter of clearance hole in heatsink:</td>
<td>max. 6,4 mm</td>
<td></td>
</tr>
<tr>
<td>Mounting hole to have no burrs at either end.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>De-burring must leave surface flat; do not chamfer or countersink either end of hole.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.
**RATINGS** Limiting values in accordance with the Absolute Maximum System (IBC 134)

Collector-base voltage (open emitter) peak value
Collector-emitter voltage (open base)
Emitter-base voltage (open collector)
Collector current (average)
Collector current (peak value) $f > 1$ MHz
Total power dissipation up to $T_{mb} = 25$ °C $f > 1$ MHz

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-base voltage</td>
<td>$V_{CBOM}$ max. 65 V</td>
</tr>
<tr>
<td>Collector-emitter voltage</td>
<td>$V_{CEO}$ max. 36 V</td>
</tr>
<tr>
<td>Emitter-base voltage</td>
<td>$V_{EBO}$ max. 4 V</td>
</tr>
<tr>
<td>Collector current (AV)</td>
<td>$I_{C(AV)}$ max. 6 A</td>
</tr>
<tr>
<td>Collector current (peak)</td>
<td>$I_{CM}$ max. 12 A</td>
</tr>
<tr>
<td>Total power dissipation</td>
<td>$P_{tot}$ max. 130 W</td>
</tr>
</tbody>
</table>

Storage temperature
Operating junction temperature

**THERMAL RESISTANCE**
From junction to mounting base
From mounting base to heatsink

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_{stg}$</td>
<td>-65 to +200 °C</td>
</tr>
<tr>
<td>$T_{j}$ max.</td>
<td>200 °C</td>
</tr>
<tr>
<td>$R_{th j-mb}$</td>
<td>1.35 K/W</td>
</tr>
<tr>
<td>$R_{th mb-h}$</td>
<td>0.2 K/W</td>
</tr>
</tbody>
</table>
CHARACTERISTICS

$T_J = 25 \, ^\circ C$ unless otherwise specified

Breakdown voltages

Collector-base voltage
open emitter, $I_C = 100 \, mA$

$V(BR)CBO > 65 \, V$

Collector-emitter voltage
open base, $I_C = 100 \, mA$

$V(BR)CEO > 36 \, V$

Emitter-base voltage
open collector; $I_E = 25 \, mA$

$V(BR)EBO > 4 \, V$

Transient energy

$L = 25 \, mH; f = 50 \, Hz$

open base
$-V_{BE} = 1.5 \, V; R_{BE} = 33 \, \Omega$

$E > 8 \, ms$

$E > 8 \, ms$

D.C. current gain

$I_C = 1 \, A; V_{CE} = 5 \, V$

$h_{FE} 10 \text{ to } 120$

Transition frequency

$I_C = 6 \, A; V_{CE} = 20 \, V$

$f_T \text{ typ. } 500 \, MHz$

Collector capacitance at $f = 1 \, MHz$

$I_E = I_e = 0; V_{CB} = 30 \, V$

$C_C \text{ typ. } 75 \text{ to } 130 \, pF$

Feedback capacitance

$I_C = 100 \, mA; V_{CE} = 30 \, V$

$C_{re} \text{ typ. } 47 \, pF$

Collector-stud capacitance

$C_{cs} \text{ typ. } 3.5 \, pF$
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

\[ f = 175 \text{ MHz}; \ \text{T}_{\text{mb}} \ \text{up to} \ 25^\circ\text{C} \]

<table>
<thead>
<tr>
<th>( V_{\text{CC}} (V) )</th>
<th>( P_S (W) )</th>
<th>( P_L (W) )</th>
<th>( I_C (A) )</th>
<th>( G_P (\text{dB}) )</th>
<th>( \eta (%) )</th>
<th>( Z_I (\Omega) )</th>
<th>( Y_L (\text{mS}) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>&lt; 10</td>
<td>50</td>
<td>&lt; 2.75</td>
<td>&gt; 7</td>
<td>&gt; 65</td>
<td>0.8+j1.45</td>
<td>125-j66</td>
</tr>
</tbody>
</table>

Test circuit for 175 MHz:

![Circuit Diagram](image)

List of components:

- \( C_1 = \) 2 to 20 pF film dielectric trimmer (code number 2222 809 07004)
- \( C_2 = \) 4 to 40 pF film dielectric trimmer (code number 2222 809 07008)
- \( C_3 = C_4 = \) 56 pF ceramic
- \( C_5 = \) 100 pF ceramic
- \( C_6 = \) 100 nF polyester
- \( C_7 = \) 4 to 60 pF film dielectric trimmer (code number 2222 809 07011)
- \( C_8 = \) 4 to 100 pF film dielectric trimmer (code number 2222 809 07015)
- \( C_9 = \) 6.8 pF ceramic
- \( L_1 = \) 36 nH; 2 turns enameled Cu wire (1.5 mm); int. diam. 7 mm; length 5 mm; lead length 2 x 5 mm
- \( L_2 = \) formed by the metallization on the p.c. board; see component lay-out
- \( L_3 = \) 100 nH; 7 turns closely wound enameled Cu wire (0.5 mm); int. diam 3 mm; lead length 2 x 5 mm
- \( L_4 = L_5 = \) ferroxcube choke (code number 4312 020 36640)
- \( L_6 = \) 53 nH; 2 turns enameled Cu wire (1.5 mm); int. diam. 10 mm; length 5.2 mm; lead length 2 x 5 mm
- \( L_7 = \) 46 nH; 2 turns enameled Cu wire (1.5 mm); int. diam. 9 mm; length 5.4 mm; lead length 2 x 5 mm
- \( R_1 = R_2 = \) 10 \( \Omega \) carbon

May 1974
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.
For high voltage operation, a stabilized power supply is generally used. The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heatsink temperature as parameter.
OPERATING NOTE Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.

**Power Gain Versus Frequency (Class B Operation)**

- $V_{CC} = 28 \text{ V}$
- $P_L = 50 \text{ W}$
- $T_{mb} = 25 \degree \text{C}$
- Typical values

**Input Impedance (Series Components) Versus Frequency (Class B Operation)**

- $V_{CC} = 28 \text{ V}$
- $P_L = 50 \text{ W}$
- $T_{mb} = 25 \degree \text{C}$
- Typical values

**Load Impedance (Parallel Components) Versus Frequency (Class B Operation)**

- $V_{CC} = 28 \text{ V}$
- $P_L = 50 \text{ W}$
- $T_{mb} = 25 \degree \text{C}$
- Typical values
SILICON EPITAXIAL PLANAR OVERLAY TRANSISTORS

The 2N3553 is an n-p-n overlay transistor in a TO-39 metal envelope with the collector connected to the case. The 2N3375 and the 2N3632 are n-p-n overlay transistors in TO-60 metal envelopes with the electrodes insulated from the studs. The 2N3553 and the 2N3375 are intended for v.h.f./u.h.f. and the 2N3632 for v.h.f. transmitting applications.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Collector-emitter voltage</th>
<th>V_{CEX} max.</th>
<th>2N3553</th>
<th>2N3375</th>
<th>2N3632</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_{BE} = 1,5 V</td>
<td>65</td>
<td>65</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>Collector-emitter voltage (open base)</td>
<td>V_{CEO} max.</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Collector current (peak value)</td>
<td>I_{CM} max.</td>
<td>1,0</td>
<td>1,5</td>
<td>3,0</td>
</tr>
<tr>
<td>Total power dissipation up to T_{mb} = 25 °C</td>
<td>P_{tot} max.</td>
<td>7</td>
<td>11,6</td>
<td>23</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>T_{j} max.</td>
<td>200</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>Transition frequency</td>
<td>f_{T} typ.</td>
<td>500</td>
<td>500</td>
<td>—</td>
</tr>
<tr>
<td>R.F. performance at V_{CE} = 28 V</td>
<td>f_{T} typ.</td>
<td>—</td>
<td>—</td>
<td>400 MHz</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>type number</th>
<th>f (MHz)</th>
<th>P_{o} (W)</th>
<th>P_{i} (W)</th>
<th>\eta (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2N3553</td>
<td>175</td>
<td>2,5</td>
<td>&lt;0,25</td>
<td>&gt;50</td>
</tr>
<tr>
<td>2N3375</td>
<td>100</td>
<td>7,5</td>
<td>&lt;1</td>
<td>&gt;65</td>
</tr>
<tr>
<td>2N3632</td>
<td>400</td>
<td>&gt;3</td>
<td>1</td>
<td>&gt;40</td>
</tr>
<tr>
<td>2N3632</td>
<td>175</td>
<td>&gt;13,5</td>
<td>3,5</td>
<td>&gt;70</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1a TO-39; collector connected to case.

Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories: 56245 (distance disc).
MECHANICAL DATA (continued)

Fig. 1b TO-60 (2N3375 and 2N3632).
The top pins should not be bent.

Torque on nut: min. 0,8 Nm (8 kg cm)
max. 1,7 Nm (17 kg cm)

Diameter of clearance hole in heatsink: 4,8 mm to 5,2 mm.

P.S. This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>2N3553</th>
<th>2N3375</th>
<th>2N3632</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-base voltage (open emitter)</td>
<td>VcBO max.</td>
<td>65 V</td>
<td></td>
</tr>
<tr>
<td>Collector-emitter voltage</td>
<td>VCEX max.</td>
<td>65 V</td>
<td></td>
</tr>
<tr>
<td>IC ≤ 200 mA; -VBE = 1,5 V (open base); IC ≤ 200 mA</td>
<td>VCEO max.</td>
<td>40 V</td>
<td></td>
</tr>
<tr>
<td>Emitter-base voltage (open collector)</td>
<td>VEOB max.</td>
<td>4 V</td>
<td></td>
</tr>
<tr>
<td>Collector current</td>
<td>IC max.</td>
<td>0,35 A</td>
<td></td>
</tr>
<tr>
<td>d.c. peak value</td>
<td>ICN max.</td>
<td>1,0 A</td>
<td></td>
</tr>
<tr>
<td>Total power dissipation up to Tmb = 25 °C</td>
<td>Ptot max.</td>
<td>7 W</td>
<td></td>
</tr>
<tr>
<td>Storage temperature</td>
<td>Tstg</td>
<td>-65 to +200 °C</td>
<td></td>
</tr>
<tr>
<td>Junction temperature</td>
<td>Tj max.</td>
<td>200 °C</td>
<td></td>
</tr>
</tbody>
</table>
Silicon epitaxial planar overlay transistors

THERMAL RESISTANCE

<table>
<thead>
<tr>
<th></th>
<th>2N3553</th>
<th>2N3375</th>
<th>2N3632</th>
</tr>
</thead>
<tbody>
<tr>
<td>From junction to mounting base R\text{th j-mb}</td>
<td>25</td>
<td>15</td>
<td>7.5 K/W</td>
</tr>
<tr>
<td>From mounting base to heatsink R\text{th mb-h}</td>
<td>0.6</td>
<td>0.6</td>
<td>0.6 K/W</td>
</tr>
</tbody>
</table>

CHARACTERISTICS

T\text{J} = 25 \degree\text{C} unless otherwise specified

Collector cut-off current

<table>
<thead>
<tr>
<th></th>
<th>2N3553</th>
<th>2N3375</th>
<th>2N3632</th>
</tr>
</thead>
<tbody>
<tr>
<td>I\text{B} = 0; V\text{CE} = 30 V</td>
<td>ICEO &lt; 100</td>
<td>100</td>
<td>250 \mu A</td>
</tr>
</tbody>
</table>

Breakdown voltages

<table>
<thead>
<tr>
<th></th>
<th>2N3553</th>
<th>2N3375</th>
<th>2N3632</th>
</tr>
</thead>
<tbody>
<tr>
<td>I\text{E} = 0; I\text{C} = 250 \mu A</td>
<td>V(BR)CBO &gt; 65</td>
<td>65</td>
<td>65 V</td>
</tr>
<tr>
<td>I\text{C} up to 200 mA</td>
<td>V(BR)CBO &gt; 65</td>
<td>65</td>
<td>65 V</td>
</tr>
<tr>
<td>-V\text{BE} = 1.5 V; R\text{B} = 33 \Omega \text{1)}</td>
<td>V(BR)CBO &gt; 65</td>
<td>65</td>
<td>65 V</td>
</tr>
<tr>
<td>I\text{B} = 0</td>
<td>V(BR)CEO &gt; 40</td>
<td>40</td>
<td>40 V</td>
</tr>
<tr>
<td>I\text{C} = 0; I\text{E} = 250 \mu A</td>
<td>V(BR)CEO &gt; 40</td>
<td>40</td>
<td>40 V</td>
</tr>
<tr>
<td>I\text{B} = 0, I\text{E} = 250 \mu A</td>
<td>V(BR)EBO &gt; 4</td>
<td>4</td>
<td>4 V</td>
</tr>
</tbody>
</table>

Base-emitter voltage

<table>
<thead>
<tr>
<th></th>
<th>2N3553</th>
<th>2N3375</th>
<th>2N3632</th>
</tr>
</thead>
<tbody>
<tr>
<td>I\text{C} = 250 mA; V\text{CE} = 5 V</td>
<td>V\text{BE} &lt; 1.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>I\text{C} = 500 mA; V\text{CE} = 5 V</td>
<td>V\text{BE} &lt; 1.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>I\text{C} = 1000 mA; V\text{CE} = 5 V</td>
<td>V\text{BE} &lt; 1.5</td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>

Saturation voltage

<table>
<thead>
<tr>
<th></th>
<th>2N3553</th>
<th>2N3375</th>
<th>2N3632</th>
</tr>
</thead>
<tbody>
<tr>
<td>I\text{C} = 250 mA; I\text{B} = 50 mA</td>
<td>V\text{CEsat} &lt; 1.0</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>I\text{C} = 500 mA; I\text{B} = 100 mA</td>
<td>V\text{CEsat} &lt; 1.0</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>I\text{C} = 1000 mA; I\text{B} = 200 mA</td>
<td>V\text{CEsat} &lt; 1.0</td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>

\text{1)} Pulse through an inductor of 25 mH; \delta = 0.5; f = 50 Hz

September 1970 1083
CHARACTERISTICS (continued)

T<sub>j</sub> = 25 °C unless otherwise specified

D.C. current gain

<table>
<thead>
<tr>
<th>IC (mA)</th>
<th>V&lt;sub&gt;CE&lt;/sub&gt; (V)</th>
<th>h&lt;sub&gt;FE&lt;/sub&gt;</th>
<th>2N3553</th>
<th>2N3375</th>
<th>2N3632</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>5</td>
<td>&gt;</td>
<td>15</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>200</td>
<td></td>
<td>&lt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>250</td>
<td>5</td>
<td>&gt;</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>100</td>
<td></td>
<td>&lt;</td>
<td></td>
<td></td>
<td>150</td>
</tr>
<tr>
<td>1000</td>
<td>5</td>
<td>&gt;</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt;</td>
<td></td>
<td></td>
<td>110</td>
</tr>
</tbody>
</table>

Collector capacitance at f = 1 MHz

I<sub>E</sub> = I<sub>e</sub> = 0; V<sub>CB</sub> = 28 V

<table>
<thead>
<tr>
<th>C&lt;sub&gt;C&lt;/sub&gt;</th>
<th>2N3553</th>
<th>2N3375</th>
<th>2N3632</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>10</td>
<td>20 pF</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Collector-case capacitance

< 6 pF

Transition frequency

I<sub>C</sub> = 125 mA; V<sub>CE</sub> = 28 V

<table>
<thead>
<tr>
<th>f&lt;sub&gt;T&lt;/sub&gt; (MHz)</th>
<th>typ.</th>
<th>500</th>
<th>500</th>
<th>MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>I&lt;sub&gt;C&lt;/sub&gt; = 250 mA; V&lt;sub&gt;CE&lt;/sub&gt; = 28 V</td>
<td></td>
<td>400</td>
<td>MHz</td>
<td></td>
</tr>
</tbody>
</table>

Real part of input impedance at f = 200 MHz

I<sub>C</sub> = 125 mA; V<sub>CE</sub> = 28 V

<table>
<thead>
<tr>
<th>Re (h&lt;sub&gt;ie&lt;/sub&gt;)</th>
<th>2N3553</th>
<th>2N3375</th>
<th>2N3632</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>20</td>
<td>Ω</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R.F. performance at V<sub>CE</sub> = 28 V

<table>
<thead>
<tr>
<th></th>
<th>f</th>
<th>P&lt;sub&gt;0&lt;/sub&gt;</th>
<th>P&lt;sub&gt;1&lt;/sub&gt;</th>
<th>I&lt;sub&gt;C&lt;/sub&gt;</th>
<th>η</th>
<th>Test circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>2N3553</td>
<td>175</td>
<td>2.5</td>
<td>&lt; 0.25</td>
<td>&lt; 180</td>
<td>&gt; 50</td>
<td>I</td>
</tr>
<tr>
<td>100</td>
<td>7.5</td>
<td>&lt; 1</td>
<td>&lt; 410</td>
<td>&gt; 65</td>
<td>II</td>
<td></td>
</tr>
<tr>
<td>400</td>
<td>&gt; 3</td>
<td>1</td>
<td>270</td>
<td>&gt; 40</td>
<td>III</td>
<td></td>
</tr>
<tr>
<td>175</td>
<td>&gt; 13.5</td>
<td>3.5</td>
<td>690</td>
<td>&gt; 70</td>
<td>I</td>
<td></td>
</tr>
</tbody>
</table>

NOTE

The transistors can withstand an output V.S.W.R. of 3:1 varied through all phases under conditions mentioned in the table above.
CHARACTERISTICS (continued)
Test circuit 1 (with the 2N3553 or the 2N3632 at $f = 175$ MHz)

---

*) The length of the external emitter wire of the 2N3553 is 1.6 mm.
The emitter of the 2N3632 should be connected to the case as short as possible.

Components

C1 = C2 = C3 = C4 = 4 to 29 pF  air trimmer
C5 = 10 nF  polyester
C6 = 100 pF  ceramic

L1 = 1 turn Cu wire (1.0 mm); int. diam. 10 mm; leads 2 x 10 mm
L2 = Ferroxcube choke coil. $Z$ (at $f = 175$ MHz) $= 550 \, \Omega \pm 20\%$
    (code number 4312 020 36640)
L3 = 15 turns closely wound enamelled Cu wire (0.7 mm); int. diam. 4 mm
L4 = 3 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 12 mm; leads 2 x 20 mm
R  = 0 for the 2N3553
R  = 0 to 2 \Omega for the 2N3632
CHARACTERISTICS (continued)

Test circuit II (with the 2N3375 at $f = 100$ MHz)

Components

- $C_1 = C_2 = \text{3.5 to 61.5 pF} \quad \text{air trimmer}$
- $C_3 = \text{10 nF} \quad \text{polyester}$
- $C_4 = C_5 = \text{4 to 29 pF} \quad \text{air trimmer}$
- $C_6 = \text{330 pF} \quad \text{ceramic}$
- $C_7 = \text{10 nF} \quad \text{polyester}$

- $L_1 = \text{2 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 10 mm; leads 2 x 10 mm}$
- $L_2 = \text{Ferroxcube choke coil. } Z \text{ (at } f = 100 \text{ MHz) } = 700 \Omega \pm 20\%$
  \hspace{1cm} \text{(code number 4312 020 36640)}$
- $L_3 = \text{23 turns closely wound enamelled Cu wire (0.7 mm); int. diam. 6 mm}$
- $L_4 = \text{5 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 12 mm; leads 2 x 10 mm}$

- $R_1 = \text{1.35 } \Omega \quad \text{carbon}$
- $R_2 = \text{10 } \Omega \quad \text{carbon}$
CHARACTERISTICS (continued)

Test circuit III (with the 2N3375 at f = 400 MHz)

*) The emitter should be connected to the case as short as possible.

Components

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1 = C2</td>
<td>0.7 to 6.7 pF</td>
<td>ceramic trimmer</td>
</tr>
<tr>
<td>C3</td>
<td>0.5 to 3.5 pF</td>
<td>ceramic trimmer</td>
</tr>
<tr>
<td>C4 = C5</td>
<td>3 to 19 pF</td>
<td>air trimmer</td>
</tr>
<tr>
<td>C6 = C7</td>
<td>15 pF</td>
<td>ceramic</td>
</tr>
<tr>
<td>C8</td>
<td>4700 pF</td>
<td>ceramic</td>
</tr>
</tbody>
</table>

L1 = 20 mm straight Cu wire; diam. 1.5 mm; spaced 8 mm from chassis
L2 = 17 turns closely wound enamelled Cu wire (0.5 mm); int. diam. 3 mm
L3 = 7 turns closely wound enamelled Cu wire (0.5 mm); int. diam. 3 mm
L4 = 1 turn Cu wire (1.5 mm); int. diam. 10 mm; leads 2 x 5 mm
R = 0 to 5 Ω
maximum allowable total power dissipation versus mounting base temp.

\[ P_{\text{tot}} = P_{\text{dc}} + P_I - P_O \]

1. 2N3375
2. 2N3553
3. 2N3632

July 1969
Silicon epitaxial planar overlay transistors

Region of permissible operation under all base-emitter conditions and at all frequencies, including d.c.

II Additional region of operation at $f \geq 1$ MHz.
Care must be taken to reduce the d.c. adjustment to region I before removing the a.c. signal. This may be achieved by an appropriate bias in class A, B or C.

III Operating during switching off in this region is allowed, provided the transistor is cut-off with $-V_{BB} \leq 1.5$ V and $R_{BE} \geq 33$ $\Omega$, $I_C \leq 200$ mA and the transient energy does not exceed 0.5 mWs.
2N3375
2N3553
2N3632

**Typical Values**

*V<sub>CE</sub> = 28V, T<sub>mb</sub> = 25°C*

**Po (W)**

<table>
<thead>
<tr>
<th>f (MHz)</th>
<th>P&lt;sub&gt;0&lt;/sub&gt; (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>100</td>
<td>5</td>
</tr>
<tr>
<td>200</td>
<td>2</td>
</tr>
<tr>
<td>300</td>
<td>1</td>
</tr>
<tr>
<td>400</td>
<td>0.5</td>
</tr>
</tbody>
</table>

**f (MHz)**

<table>
<thead>
<tr>
<th>0</th>
<th>100</th>
<th>200</th>
<th>300</th>
<th>400</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10</td>
<td>5</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>10</td>
<td>5</td>
<td>2</td>
<td>0.5</td>
</tr>
</tbody>
</table>

**Typical Values**

*V<sub>CE</sub> = 28V, T<sub>mb</sub> = 25°C*

**Po (W)**

<table>
<thead>
<tr>
<th>P&lt;sub&gt;0&lt;/sub&gt; (W)</th>
<th>f (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05W</td>
<td>100</td>
</tr>
<tr>
<td>0.25W</td>
<td>200</td>
</tr>
<tr>
<td>0.5W</td>
<td>300</td>
</tr>
</tbody>
</table>

**f (MHz)**

<table>
<thead>
<tr>
<th>0</th>
<th>100</th>
<th>200</th>
<th>300</th>
<th>400</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.05</td>
<td>0.25</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0.05</td>
<td>0.25</td>
<td>0.5</td>
<td></td>
</tr>
</tbody>
</table>

**Typical Values**

*V<sub>CE</sub> = 28V, T<sub>mb</sub> = 25°C*

**Po (W)**

<table>
<thead>
<tr>
<th>C&lt;sub&gt;c&lt;/sub&gt; (pF)</th>
<th>f (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>1MHz</td>
</tr>
<tr>
<td>30</td>
<td>1MHz</td>
</tr>
<tr>
<td>20</td>
<td>1MHz</td>
</tr>
</tbody>
</table>

**f (MHz)**

<table>
<thead>
<tr>
<th>0</th>
<th>20</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

**Typical Values**

*V<sub>CE</sub> = 28V, I<sub>E</sub> = 1mA, T<sub>j</sub> = 25°C*

**Po (W)**

<table>
<thead>
<tr>
<th>P&lt;sub&gt;1&lt;/sub&gt; (W)</th>
<th>f (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3W</td>
<td>1MHz</td>
</tr>
<tr>
<td>2.5W</td>
<td>1MHz</td>
</tr>
<tr>
<td>2W</td>
<td>1MHz</td>
</tr>
<tr>
<td>1.5W</td>
<td>1MHz</td>
</tr>
<tr>
<td>1W</td>
<td>1MHz</td>
</tr>
<tr>
<td>0.5W</td>
<td>1MHz</td>
</tr>
</tbody>
</table>

**f (MHz)**

<table>
<thead>
<tr>
<th>0</th>
<th>20</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>
Silicon epitaxial planar overlay transistors

Typical characteristics

\[ V_{CE} = 5 \text{ V} \]
\[ T_J = 25 \text{ °C} \]

- **2N3375**
- **2N3553**
- **2N3632**

**Forward characteristics**

- **2N3375**: \[ I_C = 5 \text{ mA} \]
- **2N3553**: \[ I_B = 5 \text{ mA} \]
- **2N3632**: \[ T_J = 25 \text{ °C} \]

**Saturation characteristics**

- **2N3375**: \[ I_C = 250 \text{ mA} \]
- **2N3553**: \[ I_B = 50 \text{ mA} \]

**Typical values**

- **2N3375**: \[ V_{CE} = 5 \text{ V} \]
- **2N3553**: \[ T_J = 25 \text{ °C} \]
- **2N3632**: \[ V_{CE} = 5 \text{ V} \]

**June 1968**

**Page 1091**
2N3375
2N3553
2N3632

base current versus collector current
$V_{CE}=5V$
$T_j=25^\circ C$

$I_C$ (mA)

$I_B$ (mA)

min

typ

max

1000

100

10

0.1

1

10

100

1000

1

10

100

1000

1092

June 1968
Silicon epitaxial planar overlay transistors

- 2N3375
- 2N3553
- 2N3632

Graphs showing h_FE for V_CE = 5V and Tj = 25°C.

Typical values for I_C versus I_B for V_CE = 5V and Tj = 25°C.
SILICON PLANAR EPITAXIAL OVERLAY TRANSISTORS

N-P-N overlay transistors in TO-39 metal envelopes with the collector connected to the case. The devices are primarily intended for class-A, B or C amplifiers, frequency multiplier and oscillator circuits. The transistors are suitable in output, driver or pre-driver stages in v.h.f. and u.h.f. equipment.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Collector-emitter voltage</th>
<th>2N3866</th>
<th>2N4427</th>
</tr>
</thead>
<tbody>
<tr>
<td>R_{BE} = 10 \Omega</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector-emitter voltage (open base)</td>
<td>V_{CER} max.</td>
<td>55</td>
</tr>
<tr>
<td>Emitter-base voltage (open collector)</td>
<td>V_{CEO} max.</td>
<td>30</td>
</tr>
<tr>
<td>Collector current (d.c. or averaged over any 20 ms period)</td>
<td>I_C max.</td>
<td>0.4</td>
</tr>
<tr>
<td>Total power dissipation up to T_{mb} = 25 °C</td>
<td>P_{tot} max.</td>
<td>5</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>T_J max.</td>
<td>200</td>
</tr>
<tr>
<td>Transition frequency</td>
<td>f_T min.</td>
<td>500</td>
</tr>
</tbody>
</table>

R.F. performance

<table>
<thead>
<tr>
<th>type number</th>
<th>f (MHz)</th>
<th>V_{CE} (V)</th>
<th>P_{o} (W)</th>
<th>G_{p} (dB)</th>
<th>\eta (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2N3866</td>
<td>400</td>
<td>28</td>
<td>1</td>
<td>&gt; 10</td>
<td>&gt; 45</td>
</tr>
<tr>
<td>2N4427</td>
<td>175</td>
<td>12</td>
<td>1</td>
<td>&gt; 10</td>
<td>&gt; 50</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-39; collector connected to case.

Maximum lead diameter is guaranteed only for 12,7 mm.
Accessories: 56245 (distance disc).
RATINGS  Limiting values in accordance with the Absolute Maximum System (IEC 134)

<table>
<thead>
<tr>
<th></th>
<th>2N3866</th>
<th>2N4427</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCBO max.</td>
<td>55 V</td>
<td>40 V</td>
</tr>
<tr>
<td>VCER max.</td>
<td>55 V</td>
<td>40 V</td>
</tr>
<tr>
<td>VCEO max.</td>
<td>30 V</td>
<td>20 V</td>
</tr>
<tr>
<td>VEBO max.</td>
<td>3.5 V</td>
<td>2.0 V</td>
</tr>
<tr>
<td>IC max.</td>
<td>0.4 A</td>
<td>0.4 A</td>
</tr>
<tr>
<td>ICM max.</td>
<td>0.4 A</td>
<td>0.4 A</td>
</tr>
<tr>
<td>Ptot max.</td>
<td>5 W</td>
<td>3.5 W</td>
</tr>
</tbody>
</table>

Collector-base voltage (open emitter) \(^1\)

Collector-emitter voltage \(^1\)

Collector-emitter voltage (open base) \(^1\)

Emitter-base voltage (open collector) \(^1\)

Collector current (d.c. or averaged over any 20 ms period) \(^1\)

Collector current (peak value) \(^1\)

Total power dissipation up to \(T_{mb} = 25\) °C \(^1\)

Temperatures

Storage temperature

Junction temperature

THERMAL RESISTANCE

From junction to ambient in free air

From junction to mounting base

From mounting base to heatsink mounted with:
- top clamping washer of 56218
- top clamping washer of 56218
- and a boron nitride washer for electrical insulation

<table>
<thead>
<tr>
<th>From junction to ambient in free air</th>
<th>2N3866</th>
<th>2N4427</th>
</tr>
</thead>
<tbody>
<tr>
<td>(R_{th\ j-a})</td>
<td>200 K/W</td>
<td></td>
</tr>
<tr>
<td>(R_{th\ j-mb})</td>
<td>35 K/W</td>
<td></td>
</tr>
<tr>
<td>(R_{th\ mb-h})</td>
<td>1.0 K/W</td>
<td></td>
</tr>
<tr>
<td>(R_{th\ mb-h})</td>
<td>2.5 K/W</td>
<td></td>
</tr>
</tbody>
</table>

1) See also graphs indicating areas of permissible operation.
Silicon planar epitaxial overlay transistors

CHARACTERISTICS

\( T_j = 25 \, ^\circ\text{C} \) unless otherwise specified

### Collector cut-off current

<table>
<thead>
<tr>
<th>I_B = 0; V_CE = 28 V</th>
<th>2N3866</th>
<th>2N4427</th>
</tr>
</thead>
<tbody>
<tr>
<td>I_CEO</td>
<td>&lt; 20 µA</td>
<td>&lt; 20 µA</td>
</tr>
</tbody>
</table>

### Breakdown voltages

<table>
<thead>
<tr>
<th>I_E = 0; I_C = 100 µA</th>
<th>V(BR)CBO &gt; 55 V</th>
<th>40 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>I_C = 5 mA; R_{BE} = 10 Ω</td>
<td>V(BR)CER &gt; 55 V</td>
<td>40 V</td>
</tr>
<tr>
<td>I_B = 0; I_C = 5 mA</td>
<td>V(BR)CEO &gt; 30 V</td>
<td>20 V</td>
</tr>
<tr>
<td>I_C = 0; I_E = 100 µA</td>
<td>V(BR)EBO &gt; 3,5 V</td>
<td>2 V</td>
</tr>
</tbody>
</table>

### Collector-emitter saturation voltage

| I_C = 100 mA; I_E = 20 mA | V_CESat < 1,0 V | 0,5 V |

### D.C. current gain

<table>
<thead>
<tr>
<th>I_C = 50 mA; V_CE = 5 V</th>
<th>h_FE</th>
<th>10 to 200</th>
</tr>
</thead>
<tbody>
<tr>
<td>I_C = 100 mA; V_CE = 5 V</td>
<td>h_FE</td>
<td>10 to 200</td>
</tr>
<tr>
<td>I_C = 360 mA; V_CE = 5 V</td>
<td>h_FE</td>
<td>&gt; 5</td>
</tr>
</tbody>
</table>

### Transition frequency

| I_C = 50 mA; V_CE = 15 V; f = 200 MHz | f_T | ≥ 500 |

### Collector capacitance

<table>
<thead>
<tr>
<th>V_CB = 28 V; I_E = I_e = 0; f = 1 MHz</th>
<th>C_C</th>
<th>&lt; 3 pF</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_CB = 12 V; I_E = I_e = 0; f = 1 MHz</td>
<td>C_C</td>
<td>&lt; 4 pF</td>
</tr>
</tbody>
</table>

### R.F. performance at \( T_{mb} = 25 \, ^\circ\text{C} \)

<table>
<thead>
<tr>
<th>f (MHz)</th>
<th>V_CE (V)</th>
<th>P_o (W)</th>
<th>G_p (dB)</th>
<th>I_C (mA)</th>
<th>( \eta ) (%)</th>
<th>test circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>2N3866</td>
<td>100</td>
<td>28</td>
<td>1,8</td>
<td>&gt; 10</td>
<td>&lt;107</td>
<td>&gt; 60</td>
</tr>
<tr>
<td>2N3866</td>
<td>250</td>
<td>28</td>
<td>1,5</td>
<td>&gt; 10</td>
<td>&lt;107</td>
<td>&gt; 50</td>
</tr>
<tr>
<td>2N3866</td>
<td>400</td>
<td>28</td>
<td>1,0</td>
<td>&gt; 10</td>
<td>&lt; 79</td>
<td>&gt; 45</td>
</tr>
<tr>
<td>2N4427</td>
<td>175</td>
<td>12</td>
<td>1,0</td>
<td>&gt; 10</td>
<td>&lt;167</td>
<td>&gt; 50</td>
</tr>
<tr>
<td>2N4427</td>
<td>470</td>
<td>12</td>
<td>0,4</td>
<td>&gt; 10</td>
<td>67</td>
<td>50</td>
</tr>
</tbody>
</table>

* The transistor can withstand an output V.S.W.R. of 3 : 1 varied through all phases for conditions, mentioned in the table above.
CHARACTERISTICS (continued)

Test circuit 1 (with the 2N3866 at \( f = 400 \text{ MHz} \))

\[ \begin{align*}
\text{C1} &= \text{C2} = \text{C3} = 4 \text{ to } 29 \text{ pF} \quad \text{air trimmer} \\
\text{C4} &= 4 \text{ to } 14 \text{ pF} \quad \text{air trimmer} \\
\text{C5} &= 1 \text{ nF} \quad \text{feed through} \\
\text{C6} &= 12 \text{ pF} \\
\text{C7} &= 12 \text{ nF} \\
\text{R1} &= 5.6 \text{ } \Omega \\
\text{R2} &= 10 \text{ } \Omega
\end{align*} \]

\( \text{L1} = 2 \text{ turns Cu wire (1 mm); int. diam. 6 mm; winding pitch 3 mm} \)
\( \text{L2} = \text{Ferroxcube choke coil; } Z ( \text{at } f = 250 \text{ MHz}) = 450 \text{ } \Omega \text{ (code number 4312 020 36690)} \)
\( \text{L3} = \text{L4} = 6 \text{ turns enamelled Cu wire (0.5 mm); int. diam. 3.5 mm (100 nH)} \)
\( \text{L5} = 2 \text{ turns Cu wire (1 mm); int. diam. 7 mm; winding pitch 2.5 mm; leads 2x15 mm.} \)
APPLICATION INFORMATION (continued)

Test circuit II (with the 2N4427 at f = 175 MHz)

!*) The length of the external emitter wire is 1.6 mm

C1 = C2 = C3 = C4 = 4 to 29 pF  air trimmer
C5 = 1 nF  feed through
C6 = 12 nF
R = 10 Ω

L1 = 2 turns Cu wire (1 mm); int. diam. 6 mm; winding pitch 2 mm; leads 2x10 mm
L2 = Ferroxcube choke coil; Z (at f = 175 MHz) = 550 Ω (code number 4312 020 36640)
L3 = 2 turns Cu wire (1 mm); int. diam. 5 mm; winding pitch 2 mm; leads 2x10 mm
L4 = 3 turns Cu wire (1.5 mm); int. diam. 10 mm; winding pitch 2 mm; leads 2x15 mm
\[
P_{\text{tot}} = P_{\text{d.c.}} + P_{\text{i}} - P_{\text{o}}
\]
I Region of permissible operation under all base-emitter conditions and at all frequencies, including d.c.

II Additional region of operation at $f \geq 1 \text{ MHz}$.
Care must be taken to reduce the d.c. adjustment to region I before removing the a.c. signal. This may be achieved by an appropriate bias in class A, B or C.

III Operating during switching off in this region is allowed, provided the transistor is cut-off with $-V_{BB} \leq 1.5 \text{ V}$ and $R_{BE} \geq 33 \Omega$, $I_C \leq 100 \text{ mA}$ and the transient energy does not exceed 0.125 mWs.
SILICON PLANAR EPITAXIAL OVERLAY TRANSISTORS

The 2N3924 is an n-p-n overlay transistor in a TO-39 metal envelope with the collector connected to the case. The 2N3926 and the 2N3927 are n-p-n overlay transistors in TO-60 metal envelopes with the emitter connected to the case. The transistors are intended for v.h.f. transmitting applications.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Collector-emitter voltage $-V_{BE} = 1.5, \text{V}$</th>
<th>$V_{CEO}$ max.</th>
<th>2N3924</th>
<th>2N3926</th>
<th>2N3927</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-emitter voltage (open base)</td>
<td>$V_{CEX}$ max.</td>
<td>36</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>Collector current (peak value)</td>
<td>$I_{CM}$ max.</td>
<td>1.5</td>
<td>3.0</td>
<td>4.5</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{mb} = 25, ^\circ\text{C}$</td>
<td>$P_{tot}$ max.</td>
<td>7</td>
<td>11.6</td>
<td>23</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_{J}$ max.</td>
<td>200</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>Transition frequency</td>
<td>$f_{T}$</td>
<td>&gt; 250</td>
<td>250</td>
<td>–</td>
</tr>
</tbody>
</table>

R.F. performance at $V_{CE} = 13.5\, \text{V}$; $f = 175\, \text{MHz}$

<table>
<thead>
<tr>
<th>type number</th>
<th>$P_{O}$ (W)</th>
<th>$P_{I}$ (W)</th>
<th>$\eta$ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2N3924</td>
<td>4</td>
<td>&lt; 1</td>
<td>&gt; 70</td>
</tr>
<tr>
<td>2N3926</td>
<td>7</td>
<td>&lt; 2</td>
<td>&gt; 70</td>
</tr>
<tr>
<td>2N3927</td>
<td>12</td>
<td>&lt; 4</td>
<td>&gt; 80</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1a TO-39; collector connected to case.

Maximum lead diameter is guaranteed only for 12.7 mm.

Accessories: 56245 (distance disc).
MECHANICAL DATA (continued)

Fig. 1b TO-60 (2N3926 and 2N3927).
Emitter connected to case.
The top pins should not be bent.

Torque on nut: 
min. 0,8 Nm (8 kg cm)
max. 1,7 Nm (17 kg cm)

Diameter of clearance hole in heatsink: 4,8 mm to 5,2 mm.

P.S. This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter) $V_{CBO}$ max. 36 V
Collector-emitter voltage

$I_C \leq 400 $ mA; $V_{BE} = 1,5 $ V
(open base); $I_C \leq 400 $ mA

$V_{CEX}$ max. 36 V
$V_{CEO}$ max. 18 V
$V_{EBO}$ max. 4 V

Emitter-base voltage (open collector)

$d.c.$

$I_C$ max. 0,5 1,0 1,5 A
$P_{tot}$ max. 7 11,6 23 W

Storage temperature

$T_{stg}$ -65 to +200 $^\circ$C

Junction temperature

$T_j$ max. 200 $^\circ$C

Dimensions in mm
## THERMAL RESISTANCE

<table>
<thead>
<tr>
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<th>2N3924</th>
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<th>2N3927</th>
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<tbody>
<tr>
<td>From junction to mounting base</td>
<td>$R_{th \ j-mb}$</td>
<td>25</td>
<td>15</td>
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<tr>
<td>From mounting base to heatsink</td>
<td>$R_{th \ mb-h}$</td>
<td>0.6</td>
<td>0.6</td>
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## CHARACTERISTICS

$T_j = 25 \degree C$ unless otherwise specified

### Collector cut-off current

<table>
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<tbody>
<tr>
<td>$I_E = 0; V_{CB} = 15 , V$</td>
<td>$I_{CBO}$</td>
<td>&lt; 100</td>
<td>100</td>
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<tr>
<td>$I_E = 0; V_{CB} = 15 , V; T_j = 150 , ^\circ C$</td>
<td>$I_{CB0}$</td>
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### Breakdown voltages

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<th>2N3927</th>
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</thead>
<tbody>
<tr>
<td>$I_E = 0; I_C = 250 , \mu A$</td>
<td>$V_{(BR)CBO}$</td>
<td>&gt; 36</td>
<td>36</td>
</tr>
<tr>
<td>$I_C \text{ up to } 400 , mA$</td>
<td>$V_{(BR)CEX}$</td>
<td>&gt; 36</td>
<td>36</td>
</tr>
<tr>
<td>$-V_{BE} = 1.5 , V; R_B = 33 , \Omega$</td>
<td>$V_{(BR)CEO}$</td>
<td>&gt; 18</td>
<td>18</td>
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<tr>
<td>$I_B = 0$</td>
<td>$V_{(BR)EBO}$</td>
<td>&gt; 4</td>
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### Base-emitter voltage

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<tbody>
<tr>
<td>$I_C = 250 , mA; V_{CE} = 5 , V$</td>
<td>$V_{BE}$</td>
<td>&lt; 1.5</td>
<td>V</td>
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<tr>
<td>$I_C = 500 , mA; V_{CE} = 5 , V$</td>
<td>$V_{BE}$</td>
<td>&lt; 1.5</td>
<td>V</td>
</tr>
<tr>
<td>$I_C = 1000 , mA; V_{CE} = 5 , V$</td>
<td>$V_{BE}$</td>
<td>&lt; 1.5</td>
<td>V</td>
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### Saturation voltage

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<tbody>
<tr>
<td>$I_C = 250 , mA; I_B = 50 , mA$</td>
<td>$V_{CE\text{sat}}$</td>
<td>&lt; 0.75</td>
<td>V</td>
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<tr>
<td>$I_C = 500 , mA; I_B = 100 , mA$</td>
<td>$V_{CE\text{sat}}$</td>
<td>&lt; 0.75</td>
<td>V</td>
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<td>$I_C = 1000 , mA; I_B = 200 , mA$</td>
<td>$V_{CE\text{sat}}$</td>
<td>&lt; 1.0</td>
<td>V</td>
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</table>

1) Pulsed through an inductor of 25 mH; $\delta = 0.5$; $f = 50 \, Hz$
CHARACTERISTICS (continued)

$T_j = 25^\circ C$ unless otherwise specified

### D.C. current gain

<table>
<thead>
<tr>
<th>$I_C$ (mA)</th>
<th>$V_{CE}$ (V)</th>
<th>$h_{FE}$</th>
<th>2N3924</th>
<th>2N3926</th>
<th>2N3927</th>
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<td>5</td>
<td>$&gt;$</td>
<td>10</td>
<td>&lt; 150</td>
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<tr>
<td>500</td>
<td>5</td>
<td>$&gt;$</td>
<td>5</td>
<td>&lt; 150</td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td>5</td>
<td>$&gt;$</td>
<td>5</td>
<td>&lt; 150</td>
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### Collector capacitance at $f = 1$ MHz

<table>
<thead>
<tr>
<th>$I_E = I_e = 0$; $V_{CB} = 13.5$ V</th>
<th>$C_c$ (pF)</th>
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<tbody>
<tr>
<td>2N3924</td>
<td>&lt; 20</td>
</tr>
<tr>
<td>2N3926</td>
<td>20</td>
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<tr>
<td>2N3927</td>
<td>45</td>
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### Transition frequency

<table>
<thead>
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<th>$I_C$ (mA)</th>
<th>$V_{CE} = 13.5$ V</th>
<th>$f_T$ (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>200</td>
<td>&gt; 250</td>
</tr>
<tr>
<td>200</td>
<td>200</td>
<td>&gt; 200</td>
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</tbody>
</table>

### Real part of input impedance at $f = 200$ MHz

<table>
<thead>
<tr>
<th>$I_C$ (mA)</th>
<th>$V_{CE} = 13.5$ V</th>
<th>$Re(h_{ie})$ (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>200</td>
<td>&lt; 20</td>
</tr>
<tr>
<td>200</td>
<td>200</td>
<td>&lt; 20</td>
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</table>

### R.F. performance at $V_{CE} = 13.5$ V; $f = 175$ MHz

<table>
<thead>
<tr>
<th>$P_o$ (W)</th>
<th>$P_i$ (W)</th>
<th>$I_C$ (mA)</th>
<th>$\eta$ (%)</th>
<th>Test circuit</th>
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</thead>
<tbody>
<tr>
<td>2N3924</td>
<td>4</td>
<td>&lt; 1</td>
<td>&lt; 420</td>
<td>&gt; 70</td>
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<tr>
<td>2N3926</td>
<td>7</td>
<td>&lt; 2</td>
<td>&lt; 740</td>
<td>&gt; 70</td>
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<tr>
<td>2N3927</td>
<td>12</td>
<td>&lt; 4</td>
<td>&lt; 1100</td>
<td>&gt; 80</td>
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**NOTE**

The transistors can withstand an output V.S.W.R. of 3:1 varied through all phases under conditions mentioned in the table above.
CHARACTERISTICS (continued)

Test circuit I (with the 2N3924 at $f = 175$ MHz)

*) The length of the external emitter wire of the 2N3924 is 1.6 mm.

Components

$C1 = C2 = C3 = C4 = 4$ to 29 pF air trimmer

$C5 = 10$ nF polyester

$L1 = 1$ turn Cu wire (1.0 mm); int. diam. 10 mm; leads 2 x 10 mm

$L2 = \text{Ferroxcube choke coil. } Z(\text{at } f = 175 \text{ MHz}) = 550 \Omega \pm 20\%$

(code number 4312 020 36640)

$L3 = 15$ turns closely wound enamelled Cu wire (0.7 mm); int. diam. 4 mm

$L4 = 3$ turns closely wound enamelled Cu wire (1.5 mm); int. diam. 12 mm; leads 2 x 20 mm
CHARACTERISTICS (continued)

Test circuit II (with the 2N3926 or 2N3927 at $f = 175$ MHz)

Components

C1 = C2 = C3 = C4 = 4 to 29 pF  
air trimmer

C5 = 100 pF  
ceramic

C6 = 10 nF  
polyester

L1 = 1 turn Cu wire (1.0 mm); int. diam. 10 mm; leads 2 x 10 mm

L2 = Ferroxcube choke coil. $Z$ (at $f = 175$ MHz) = 550 $\Omega \pm 20\%$

code number 431202036640

L3 = 15 turns closely wound enamelled Cu wire (0.7 mm); int. diam. 4 mm

L4 = 2 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 8.5 mm; leads 2 x 20 mm

R = 10 $\Omega$  
carbon
Silicon epitaxial planar overlay transistors

**2N3924**

**2N3926**

**2N3927**

---

**Typical Values**

**V_{CE} = 13.5V**

**T_{mb} = 25°C**

---

**Graphs**

- **Power Output (W)** vs. Frequency (MHz)
- **Collector Capacitance (pF)** vs. Collector-Base Voltage (V)

---

**June 1968**

1111
maximum allowable total power dissipation versus mounting base temp.

\[ P_{\text{tot}} = P_{\text{dc}} + P_{i} - P_{o} \]

maximum allowable total power dissipation versus mounting base temp.

\[ P_{\text{tot}} = P_{\text{dc}} + P_{i} - P_{o} \]
I Region of permissible operation under all base-emitter conditions and at all frequencies, including d.c.

II Additional region of operation at \( f \geq 1 \text{ MHz} \).

Care must be taken to reduce the d.c. adjustment to region I before removing the a.c. signal. This may be achieved by an appropriate bias in class A, B or C.

III Operating during switching off in this region is allowed, provided the transistor is cut-off with \( -V_{BB} \leq 1.5 \text{ V} \) and \( R_{BE} \geq 33 \Omega \), \( I_C \leq 400 \text{ mA} \) and the transient energy does not exceed 2 mWs.
SILICON EPITAXIAL PLANAR OVERLAY TRANSISTOR

For data of this transistor please refer to type 2N3866
SOT-48/2

MECHANICAL DATA

Dimensions in mm
SOT-48/3

MECHANICAL DATA

Dimensions in mm
SOT-48/4

MECHANICAL DATA

Dimensions in mm

- Metal
- Plastic
SOT-55

MECHANICAL DATA

Dimensions in mm

ENVELOPES

August 1986
SOT-56

MECHANICAL DATA

Dimensions in mm
SOT-75A

MECHANICAL DATA

Dimensions in mm

ENVELOPES

February 1984
MECHANICAL DATA

Dimensions in mm

SOT-119

ENVELOPES

August 1986
SOT-120

MECHANICAL DATA

Dimensions in mm

---

[Diagram with dimensions and annotations]
MECHANICAL DATA

Dimensions in mm

ENVELOPES

SOT-121

August 1986
MECHANICAL DATA

Dimensions in mm

metal
BeO

ceramic

August 1986
SOT-122D

MECHANICAL DATA

Dimensions in mm
SOT-132B

MECHANICAL DATA

Dimensions in mm
SOT-132C

MECHANICAL DATA

Dimensions in mm

[Diagram showing the mechanical dimensions of SOT-132C package with annotations in mm.]
SOT-147

MECHANICAL DATA

Dimensions in mm

---

ENVELOPES

1134  August 1986
MECHANICAL DATA

Dimensions in mm

ENVELOPES

SOT-160

August 1986
SOT-171

MECHANICAL DATA

Dimensions in mm

[Diagram showing mechanical dimensions and tolerances]
SOT-172A1

MECHANICAL DATA

Dimensions in mm

0.9
0.6 (2x)

27
24

3.35 (2x)

3.00 (2x)

8.5
min (4x)

2.9

1.52

8-32 UNC

5.25
max

5.35
max

6.9
min

3.3

2.9

2.3

11.8

10.8

5.2
max

7285903.1
SOT-181

MECHANICAL DATA

Dimensions in mm

ENVELOPES
SOT-183

Dimensions in mm

MECHANICAL DATA
SOT-200

MECHANICAL DATA

Dimensions in mm
TO-39/1

MECHANICAL DATA

Collector connected to case.
(TO-39/1)
TO-39/3

MECHANICAL DATA

Dimensions in mm

Emitter connected to case.
(TO-39/3)
ENVELOPES

TO-60

MECHANICAL DATA

Dimensions in mm

5.1
8.6 max

4.83 max

10-32 UNF

1.1 max

1.98 max

3.1 max

7.6 max

11.5 max

11.0

9.5

10-32 UNF

February 1984
56245

MECHANICAL DATA

(Distance disc) for TO-39.
Insulating material.
Maximum permissible temperature 100 °C.
The inclusion of a type number in this publication does not necessarily imply its availability.

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Mm = Microminiature semiconductors for hybrid circuits
SD = Small-signal diodes
Sp = Special diodes
T = Tuner diodes
Vrg = Voltage regulator diodes
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FET = Field-effect transistors  
Mm = Microminiature semiconductors for hybrid circuits  
P = Low-frequency power transistors  
Sm = Small-signal transistors  
T = Tuner diodes  

1150 August 1986
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FET = Field-effect transistors  
P = Low-frequency power transistors  
HVP = High-voltage power transistors  
Sm = Small-signal transistors  
Mm = Micronium semiconductors  
WBT = Wideband transistors  
for hybrid circuits
| type no.  | section type no. book section type no. book section type no. book section |
|-----------|---------------------------------|---------------------------------|---------------------------------|
| BF990     | S7/S5 Mm/FET BFQ51 S10 WBT     | BFT24 S10 WBT                   |
| BF991     | S7/S5 Mm/FET BFQ51C S10 WBT    | BFT25;R S7 Mm                   |
| BF992     | S7/S5 Mm/FET BFQ52 S10 WBT     | BFT44 S3 Sm                     |
| BF994     | S7/S5 Mm/FET BFQ53 S10 WBT     | BFT45 S3 Sm                     |
| BF996     | S7/S5 Mm/FET BFQ63 S10 WBT     | BFT46 S7/S5 Mm/FET              |
| BFG23     | S10 WBT BFQ65 S10 WBT          | BFT92;R S7 Mm                   |
| BFG32     | S10 WBT BFQ66 S10 WBT          | BFT93;R S7 Mm                   |
| BFG34     | S10 WBT BFQ67 S7 Mm            | BFW10 S5 FET                    |
| BFG51     | S10 WBT BFQ68 S10 WBT          | BFW11 S5 FET                    |
| BFG65     | S10 WBT BFQ136 S10 WBT         | BFW12 S5 FET                    |
| BFG67     | S7 Mm BFQ29 S5 FET             | BFW13 S5 FET                    |
| BFG90A    | S10 WBT BFQ30 S7/S5 Mm/FET     | BFW16A S10 WBT                  |
| BFG91A    | S10 WBT BFQ31 S7/S5 Mm/FET     | BFW17A S10 WBT                  |
| BFG96     | S10 WBT BFQ49 S10 WBT          | BFW30 S10 WBT                   |
| BFP90A    | S10 WBT BFQ53;R S7 Mm          | BFW61 S5 FET                    |
| BFP91A    | S10 WBT BFQ54 S3 Sm            | BFW92 S10 WBT                   |
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| BFQ15     | S5 FET BFQ92;R S7 Mm           | BFX85 S3 Sm                     |
| BFQ16     | S5 FET BFQ92A;R S7 Mm          | BFX86 S3 Sm                     |
| BFQ17     | S7 Mm BFQ93;R S7 Mm            | BFX87 S3 Sm                     |
| BFQ18A    | S7 Mm BFQ93A;R S7 Mm           | BFX88 S3 Sm                     |
| BFQ19     | S7 Mm BFQ94 S10 WBT            | BFX89 S10 WBT                   |
| BFQ22S    | S10 WBT BFQ95 S10 WBT          | BFY50 S3 Sm                     |
| BFQ23     | S10 WBT BFQ96 S10 WBT          | BFY51 S3 Sm                     |
| BFQ23C    | S10 WBT BFQ96S S10 WBT         | BFY52 S3 Sm                     |
| BFQ24     | S10 WBT BFQ96S S10 WBT         | BFY55 S3 Sm                     |
| BFQ32     | S10 WBT BFQ101A;B7/S5 Mm/FET   | BFY90 S10 WBT                   |
| BFQ32C    | S10 WBT BFQ136 S10 WBT         | BGY2000 S1 RT                   |
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| BFQ33     | S10 WBT BFQ30 S10 WBT          | BGD102 S10 WBM                  |
| BFQ34     | S10 WBT BFQ30 S10 WBT          | BGD102E S10 WBM                 |
| BFQ34T    | S10 WBT BFQ30 S10 WBT          | BGD104 S10 WBM                  |
| BFQ42     | S6 RFP BFQ55 S6 RFP            | BGD104E S10 WBM                 |
| BFQ43     | S6 RFP BFQ55S S6 RFP           | BGX11* S2b ThM                  |
| BFQ43S    | S6 RFP BFQ55S S6 RFP           | BGX12* S2b ThM                  |

* = series
FET = Field-effect transistors
Mm = Microminiature semiconductors
Sm = Small-signal transistors
for hybrid circuits
ThM = Thyristor modules
RFP = R.F. power transistors and modules
WBM = Wideband hybrid IC modules
RT = Tripler
WBT = Wideband transistors

August 1986
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* = series  
FET = Field-effect transistors  
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**RFP** = R.F. power transistors and modules  
**Mm** = Microminiature semiconductors for hybrid circuits  
**Sm** = Small-signal transistors  
**PDT** = Photodiodes or transistors  
**Th** = Thyristors
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* = series
FET = Field-effect transistors
Mm = Microminiature semiconductors for hybrid circuits
Sm = Small-signal transistors
SP = Low-frequency switching power transistors
Th = Thyristors
Tri = Triacs

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* = series  
PM = Power MOS transistors  
R = Rectifier diodes  
SP = Low-frequency switching power transistors
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* = series  
**LED** = Light-emitting diodes  
**M** = Microwave transistors  
**Mm** = Microminiature semiconductors for hybrid circuits  
**Ph** = Photoconductive devices  
**PhC** = Photocouplers  
**R** = Rectifier diodes  
**TS** = Transient suppressor diodes  
**Vrf** = Voltage reference diodes  
**Vrg** = Voltage regulator diodes  

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* = series
A = Accessories
I = Infrared devices
LED = Light-emitting diodes
M = Microwave transistors
PhC = Photocouplers
SEN = Sensors
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I = Infrared devices
M = Microwave transistors
Mm = Microminiature semiconductors
for hybrid circuits
P = Low-frequency power transistors
PhC = Photocouplers
R = Rectifier diodes
SD = Small-signal diodes
SEN = Sensors
Sm = Small-signal transistors
SP = Low-frequency switching power transistors
St = Rectifier stacks
WBM = Wideband hybrid IC modules
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* = series  
I = Infrared devices  
M = Microwave transistors  
P = Low-frequency power transistors  
PhC = Photocouplers  
R = Rectifier diodes  
SD = Small-signal diodes  
Vrf = Voltage reference diodes
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A = Accessories  
FET = Field-effect transistors  
Ph = Photoconductive devices  
PhC = Photocouplers  
R = Rectifier diodes  
RFP = R.F. power transistors and modules  
SD = Small-signal diodes  
Sm = Small-signal transistors  
WBT = Wideband transistors
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