Light emitting diodes
LIGHT EMITTING DIODES

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DATA HANDBOOK SYSTEM

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 viii.

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
The purple series of data handbooks comprises:

**EXISTING SERIES**

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Note

Books available in the new series are shown with their date of publication.

COMPONENTS AND MATERIALS (GREEN SERIES)

The green series of data handbooks comprises:

C1  Programmable controller modules
    PLC modules, PC20 modules
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
C10 Connectors
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
C21* Assemblies for industrial use
    HNIL FZ/30 series, NORbits 60-, 61-, 90-series, input devices
C22 Film capacitors

* To be issued shortly.
SELECTION GUIDE
## SELECTION GUIDE

### LEDs (visible light) grouped according to light families

5 mm round lens top

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<tr>
<th>dimensions in mm/case</th>
<th>type</th>
<th>crystal</th>
<th>light colour</th>
<th>$\lambda_{\text{peak}}$ nm</th>
<th>$\theta_{1/2}$</th>
<th>$V_{F}$ at $I_{F} = 10$ mA</th>
<th>$I_{F}$ max. mA</th>
<th>package colour/diffusor</th>
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<td>20°</td>
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<td>clear</td>
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* Also available in long leads (25 mm); add suffix L, e.g. COX24L.
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* \( I_v \) max. not specified.

X Type unclassified.
LEDs (visible light) grouped according to light families
3 mm round lens and 2 mm flat top

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<th>dimensions in mm/case</th>
<th>type</th>
<th>crystal</th>
<th>light colour</th>
<th>$\lambda_{peak}$ nm</th>
<th>$\theta_{1/2}$</th>
<th>$V_F$ at $I_F = 10$ mA</th>
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▲ This device has to be used behind a diffusing screen.
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* \( I_V \) max. not specified.

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* Also available in long leads (25 mm); add suffix L, e.g. CQX42L.
### Existing $I_v$ Classes in mcd at $I_F = 10 \text{ mA}$

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* $I_v$ max. not specified.

X Type unclassified.
Infrared LEDs and photo-sensitive devices

<table>
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<th>dimensions in mm/case</th>
<th>type</th>
<th>crystal</th>
<th>light colour</th>
<th>λpeak nm</th>
<th>φ½ o</th>
<th>V_F at I_F = 10 mA</th>
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<td>BPW50</td>
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<td>φ 3 SOD-53F</td>
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<td>φ 5 SOD-63D2</td>
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TYPE NUMBER SURVEY
In this alphanumeric list we present all light emitting diodes mentioned in this handbook.

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<tr>
<th>Type Number</th>
<th>Description</th>
<th>Page</th>
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<tbody>
<tr>
<td>BPW22A</td>
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<td>LED, ultra-red, φ 5 mm, SOD-63A1</td>
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<td>CQT10B</td>
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<td>CQT24</td>
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<td>CQT60</td>
<td>LED, bi-colour, hyper-red or super-green, SOD-75B2</td>
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<td>CQT70</td>
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<td>CQT80L</td>
<td>LED, hyper-red, super-green or orange, SOD-74L</td>
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<td>CQV80UL</td>
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<td>CQV81L</td>
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<td>LED, hyper-red, 5 x 5 mm, SOD-76A2 and SOD-76L</td>
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<td>CQW12B(L)</td>
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<td>CQW20A</td>
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<td>LED, hyper-red, φ 3 mm, SOD-53E</td>
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<td>TYPE NUMBER</td>
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</table>
GENERAL

Safety recommendations
Rating system
Letter symbols
Definitions
Dimensioning
Driving GaAlAs LEDs
Tape packaging of LEDs
Soldering and mounting recommendations
GENERAL SAFETY RECOMMENDATIONS
OPTOELECTRONIC DEVICES

1. GENERAL
When properly used and handled, optoelectronic devices do not constitute a risk to health or environment. Modern high technology materials have been used in the manufacture of these devices to ensure optimum performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the devices are heated to destruction and it is important that the following recommendations are observed.

Care should be taken to ensure that all personnel who may handle, use or dispose of these products are aware of the necessary precautions.

Individual product data sheets will indicate whether any specific hazards are likely to be present.

2. DISPOSAL
These devices should be disposed of in accordance with the relevant legislation; in the United Kingdom disposal should therefore be carried out in accordance with the Deposit of Poisonous Waste Act 1972 and the Control of Pollution Act 1974, or with the latest legislation.

3. FIRE
Optoelectronic devices themselves, when used within the specified limits, do not present a fire hazard.

Devices can contain arsenic, beryllium, cadmium, lead, mercury, selenium, tellurium or similar hazardous materials or compounds, which, if exposed to high temperatures may emit toxic or noxious fumes.

Most packaging materials are flammable and care should be taken in the disposal of such materials, some of which will emit toxic fumes if burned.

4. HANDLING
Care must be exercised with those devices incorporating glass or plastic. If these devices are broken, precautions must be taken against the following hazards that may arise:
- Broken glass or ceramic. Protective clothing such as gloves should be worn.
- Contamination from toxic materials and vapours. In particular, skin contact and inhalation must be avoided.
- Access to live contacts which may be at high potential. Devices must be isolated from the mains supply prior to their removal.

5. BERYLLIUM COMPOUNDS
Beryllium oxide dust is toxic if inhaled or if particles enter a cut or an abrasion. At all times avoid handling beryllium oxide ceramics; if they are touched, the hands must be washed thoroughly with soap and water. Do nothing to beryllium oxide ceramics that may produce dust or fumes.

Care should be taken upon eventual disposal that they are not thrown out with general industrial waste. Users seeking disposal of devices incorporating beryllium oxide ceramics should first take advice from the manufacturer's service department.

This potential hazard is present at all times from receipt to disposal of devices.
6. CADMIUM COMPOUNDS

Cadmium compounds are toxic. In the event of accidental breakage, cadmium dust may be released. Gloves should be worn and the dust should be mopped up with a damp cloth. Upon disposal, the cloth should be sealed in a plastic bag and the hands washed thoroughly with soap and water. Controlled disposal of devices containing cadmium compounds should be conducted in the open air or in a well ventilated area. Inhalation of cadmium dust must be avoided.

This potential hazard is present, if breakage occurs, at all times from receipt to disposal of devices.

7. OTHER COMPOUNDS

Other compounds, such as those containing arsenic, indium, lead, lithium, selenium, tantalum, tellurium etc., may be toxic by ingestion or inhalation.

The above information and recommendations are given in good faith and are in accordance with the best knowledge and opinion available at the date of the compilation of the data sheets.
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.
RATING SYSTEMS

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 = current
V, v = voltage
P, p = 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 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
S, s  As first or second subscript: Source terminal (for FETS only)
     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.
LETTER SYMBOLS

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
- I, i (or l) = input
- L, l = load
- O, o (or 2) = output
- R, r = reverse; reverse transfer
- S, s = source

Examples: $h_{FE}$, $h_{F}$

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: $h_{FE}$, $h_{FE'}$, $h_{RE'}$, $h_{fe}$
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 $h_{ii}$), $h_o$ (or $h_{11}$), $h_f$ (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: $Re\ (h_{ib})$ etc. for the real part of $h_{ib}$

$Im\ (h_{ib})$ etc. for the imaginary part of $h_{ib}$
DEFINITIONS AND UNITS OF RADIATION AND LIGHT QUANTITIES

Radiant flux, radiant power $\phi$, $P$, ($\phi_e$)

This is the power emitted, transferred or received as radiation, i.e. the radiant energy ($dQ_e$) emitted per second.

$$\phi_e = \frac{dQ_e}{dt} \quad \text{unit: watt, W}$$

Radiant intensity $I_e$, $I$

For a source of given direction, the radiant intensity is the radiant power leaving the source, or an element of the source, in an element of solid angle ($\Omega$) containing the given direction, divided by that element of solid angle.

$$I_e = \frac{d\phi_e}{d\Omega} \quad \text{unit: watt per steradian, W/sr}$$

Irradiance $E$, ($E_e$)

At a point on a surface, the irradiance is the radiant power incident on an element of the surface containing the point divided by the area ($A$) of that element.

$$E = \frac{d\phi_e}{dA} \quad \text{unit: watt per square metre, W/m}^2$$

Light

This is radiation capable of stimulating the eye. Exceptions to this definition are made where necessary in the data sheets, e.g. dark and light currents of a phototransistor and light rise time of a near-infrared light emitting diode.

Luminous flux $\phi$, ($\phi_v$)

The luminous flux $d\phi$ of a source of luminous intensity $I_v$ in an element of solid angle of $d\Omega$, is given by:

$$d\phi = I_v d\Omega \quad \text{unit: lumen, lm}$$

Lumen

This is the luminous flux radiating from a point source of uniform luminous intensity of 1 candela, contained within a solid angle of 1 steradian.

$$1 \text{ lm} = 1 \text{ cd} \cdot \text{sr}$$

Luminous intensity $I_v$, ($I$)

For a source of given direction, the luminous intensity is the luminous flux leaving the source, or an element of the source, in an element of solid angle ($\Omega$) containing the given direction, divided by that element of solid angle.

$$I_v = \frac{d\phi_v}{d\Omega} \quad \text{unit: candela, cd}$$

Candela

This is the luminous intensity, in the perpendicular direction, of a surface of 1/600 000 square metre of a black body at the temperature of freezing platinum under a pressure of 101 325 pascal.
GENERAL

Illuminance \( E_v \), (E)
At a point on a surface, the illuminance is the luminous flux incident on an element of the surface containing the point, divided by the area \( A \) of that element.

\[
E_v = \frac{d\phi_v}{dA} \quad \text{unit: lux, lx}
\]

Lux lx
This is the illumination produced when 1 lumen of flux falls on a surface of area 1 square metre. It will be seen that an illumination of 1 lx is produced on a area of 1 square metre at a distance of 1 metre from a point source of 1 candela.

Distribution temperature \( T_d \)
This is the temperature of a black body at which the spectral radiation distribution of the radiator under consideration, in a given wavelength range, is proportional or approximately proportional to the spectral radiation distribution of the black body. If the wavelength range given includes visible radiation, then the distribution temperature corresponds to the colour temperature.

Colour temperature \( T_c \)
The colour temperature of a radiator is the temperature of a black body which has the same, or approximately the same, spectral radiation distribution in the visible range as the radiator under consideration.

DEFINITIONS OF ELECTRICAL QUANTITIES

Photocurrent \( I_{ph} \)
This is the change in output current from the photocathode due to incident radiation.

Dark current \( I_d \)
This is the current flowing in a photoelectric device in the absence of illumination.

Dark current equivalent radiation \( E_d \)
This is the incident radiation required to give a d.c. signal output current equal to the dark current.

Quantum efficiency
This is the ratio of the number of emitted photoelectrons to the number of incident photons. Quantum efficiency (Q.E.) at a given wavelength of incident radiation may be calculated as follows:

\[
\text{Q.E.} = \frac{\text{constant} \times S_k}{\lambda}
\]

where \( S_k \) = spectral sensitivity (A/W) at wavelength \( \lambda \)
\( \lambda \) = wavelength of incident radiation (nm)

constant \( = \frac{hc}{e} = 1,24 \times 10^3 \text{ W.nm/A} \)

\( h \) = Planck's constant \( (6,6256 \times 10^{-34} \text{ Js}) \)
\( c \) = velocity of electromagnetic waves in vacuo \( = 2,997925 \times 10^8 \text{ m/s} \)
\( e \) = elementary charge \( = 1,60210 \times 10^{-19} \text{ coulomb or 4,80298 \times 10^{-19} e.s.u.} \)

Saturation voltage \( V_{CE_{sat}} \)
This is the lowest operating voltage which causes no change in photocurrent when this voltage is increased with constant radiation.
Definitions for optoelectronic devices

GENERAL

Saturation current $I_{C_{E_{sat}}}$
This is the output current of a photosensitive device which is not changed by an increase of either:
   a. the irradiance under constant operating conditions, or,
   b. the operating voltage under constant irradiance.

Thermal resistance
This is the ratio of temperature rise to power dissipation or
$$R_{th_{j-a}} = \frac{T_j - T_{amb}}{P_{tot}}$$
The thermal resistance is also the reciprocal of the derating factor.

Pulsed operation
Under these conditions higher peak power dissipation is possible. In general, the shorter the pulse and lower the frequency, the lower is the temperature that the junction reaches.
By analogy with thermal resistance:
$$Z_{th_{j-a}} = \frac{T_j - T_{amb}}{P_{tot}}$$

DEFINITIONS OF SENSITIVITY
These definitions apply more directly to photocathode sensitivity. For devices in which it is necessary to define the anode (overall) sensitivity, the signal output current should be considered instead of the photocurrent.

Actinimetric radiation $Z$
This is the ratio of the sensitivity to a given radiation to the sensitivity to a reference radiation.

Radiant sensitivity $S_R$
This may be expressed as either:
   a. the ratio of the photocurrent of the device to the incident radiant power, expressed in amperes per watt (A/W), or,
   b. the ratio of the photocurrent of the device to the incident irradiance, expressed in amperes per watt per square metre (A/W/m²).

Absolute spectral sensitivity $s(\lambda)$
This is the radiant sensitivity for monochromatic radiation of a stated wavelength.

Relative spectral sensitivity $s(\lambda)_{rel}$
This is the ratio of the radiant sensitivity at a particular wavelength to the radiant sensitivity at a reference wavelength, usually the wavelength of maximum response.

Note
For non-linear detectors, it is necessary to refer to constant photocurrent at all wavelengths.
Luminous sensitivity $S_L$
This may be expressed as either:

a. the ratio of the photocurrent of the device to the incident luminous flux, expressed in amperes per lumen (A/Im), or,

b. the ratio of the photocurrent of the device to the incident illuminance, expressed in amperes per lux (A/lx).

Dynamic sensitivity $S_D$
Under stated operating conditions, this is the ratio of the variation of the photocurrent of the device to the initiating small variation in the incident radiant or luminous power.

Note
Distinction is made between luminous dynamic sensitivity and radiant sensitivity.

Spectral sensitivity characteristics
This is the relationship, usually shown in graphical form, between the wavelength and the absolute or relative spectral sensitivity.

Absolute spectral sensitivity characteristics
This is the relationship, usually shown in graphical form, between the wavelength and the absolute spectral sensitivity.

Relative spectral sensitivity characteristics
This is the relationship between wavelength and the relative spectral sensitivity.

Quantum efficiency characteristic
This is the relationship, usually shown in graphical form, between the wavelength and the quantum efficiency.

DEFINITIONS OF TIME QUANTITIES

Rise time $t_r$
This is the time required for the photocurrent to rise from a stated low percentage to a stated higher percentage of the maximum value when a steady state of radiation is instantaneously applied. It is usual to consider the 10% and 90% levels (see Figs 1 and 2).

Fall time $t_f$
This is the time required for the photocurrent to fall from a stated high percentage to a stated lower percentage of the maximum value when the steady state of radiation is instantaneously removed.
Definitions for optoelectronic devices

GENERAL

It is usual to consider the 90% and 10% levels (see Figs 1 and 2).

DEFINITIONS AND UNITS OF INFRARED SENSITIVE DEVICES

Emissivity
This is the ratio of the radiant exitance of a thermal radiator to that of a black body radiator at the same temperature.

Absolute refractive index $n$
This is the ratio of the velocity of light in vacuo to that in a particular medium. For most practical purposes the velocity of light in vacuo can be replaced by that in air.

Detectivity
This is the signal-to-noise ratio per unit radiant power. Thus it is the reciprocal of the N.E.P. Care must be exercised when considering detectivity as this term has also been used in the definitions of $D^*$.

unit: $1/\text{watts (1/W)}$

$D^*$
This is an independent figure of merit which is defined as the r.m.s. signal-to-noise ratio in a 1 Hz bandwidth per unit r.m.s. incident radiant power per square root of detector area. Unless otherwise stated, it is assumed that the detector field of view is hemispherical ($2\pi$ steradian).

unit: $\text{cm}\sqrt{\text{Hz/W}}$

Wave number
This is the reciprocal of the wavelength in centimetres. ($\frac{1}{\lambda}$)

N.E.P. (Noise Equivalent Power)
This is the r.m.s. value of the incident, chopped, radiant power necessary to produce an r.m.s. signal to r.m.s. noise ratio of unity. The r.m.s. noise refers to the value calculated for unit square root bandwidth $V/\sqrt{\text{Hz}}$.

unit: $\text{W}/\sqrt{\text{Hz}}$

Responsivity
This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped, radiant power.

unit: $\text{V/W}$
Noise equivalent irradiation
This is the value of incident radiation which, when modulated in a stated manner, produces a signal output power equal to the noise power, both of which are in a stated bandwidth.

Radiance \( L_e \)
This is the radiant intensity \( (I_e) \) at a point on a surface and in a given direction, of an element of that surface, divided by the area of the orthogonal projection of the element on a plane perpendicular to the given direction.

\[
L_e = \frac{d\phi_e}{dA}
\]
unit: watt per steradian square metre, W/sr.m\(^2\)

Radiant exitance (radiant emittance) \( M_e \)
At a point on a surface, this is the radiant power leaving an element of that surface, divided by the area of the element.

\[
M_e = \frac{d\phi_e}{dA}
\]
unit: watt per square metre, W/m\(^2\)

Luminous exitance (luminous emittance) \( M_v \)
At a point on a surface, this is the luminous flux leaving an element of that surface, divided by the area of that element.

\[
M_v = \frac{d\phi_v}{dA}
\]
unit: lumen per square metre, lm/m\(^2\)

Luminance \( L_v \)
This is the luminous intensity \( (I_v) \) at a point on a surface and in a given direction, of an element of that surface divided by the area of the orthogonal projection of the element on a plane perpendicular to the given direction.

\[
L_v = \frac{d\phi_v}{dA}
\]
unit: candela per square metre, cd/m\(^2\)

Steradian sr (see Fig. 3)
This is the solid angle subtended at the centre of a sphere by an element of the surface area equal to the square of the radius of the sphere. There are, therefore, \( 4\pi \) steradians in a complete sphere.

![Fig. 3.](image)
The dimensioning of the envelopes contained in this handbook is in accordance with the I.E.C. publication 191: Mechanical Standardization of Semiconductor devices.

The following section defines the different characteristics of LED dimensions.

The Base Plane
As the base of the plastic body is irregular, due to the manufacturing process, the base plane is defined as:
- for Ø5 mm LEDs (or equivalent) a 4,4 mm hole,
- for Ø3 mm LEDs (or equivalent) a 1,5 mm slot.

The Seating Plane
This is defined as when the flanges of the leads are seated on a gauge with 0,8 mm Ø holes which are 2,54 mm apart.
The Emission Area

The emission area is defined by top view dimensions such as \( \odot D1 \), D1 and E1.

Pinning

The cathode, anode, emitter and collector are indicated on the drawings. Only the flat on the body or the shortest lead are used for pinning reference. The wider part of the lead must not be taken as a reference as different configurations may exist according to version and variant.

Envelope numbering

In the absence of international standards the following numbering system is used:

```
prefix  envelope designation
SOD63A2  variants and versions derived from basic envelope
```
GaAlAs LEDs should be driven from a constant current supply to avoid small changes in forward voltage leading to large current changes. It is, however, possible to pulse the current to increase the efficiency of the LEDs by taking advantage of the non-linear relationship between luminous intensity and forward current (Fig. 1).

![Luminous Intensity vs Forward Current](image)

As the figure shows, a forward current of 4 mA results in a luminous intensity of 3.2 mcd, while a forward current of 20 mA results in a luminous intensity of 23 mcd. If the 20 mA current is pulsed with a duty factor of 0.2, the average forward current is still 4 mA, and the average luminous intensity becomes 4.6 mcd. Thus the effective luminance intensity is 1.44 times as great with pulsed current as with d.c. of the same average value.

The effect is greatest at low average current; at higher currents the gain diminishes. This is because, at higher peak currents $I_{FM}$, the average power $P_{(AV)}$ increases as $V_{FM}I_{FMD}$, where $V_{FM}$ is the peak voltage. The increase in $P_{(AV)}$ causes the diode junction temperature $T_j$ to increase by $\Delta T_j = P_{(AV)}R_H$, where $R_H$ is the thermal resistance of the diode junction. Since the luminous intensity is related to the junction temperature by $\frac{dlv}{dT_j} = -0.7\% \text{ per } ^\circ C$, the advantage of pulsed operation is lost if the average current is too high.

Junction temperature is also affected by the pulse duration $t_D$, since average current increases with increasing duration.
Figure 2 shows the effect of the peak current ($I_{FM}$) and pulse duration ($t_p$) on the average luminous intensity, and Fig. 3 shows how the duty factor and pulse duration affect the absolute maximum ratings of $I_F$. 

**LUMINOUS INTENSITY VERSUS FORWARD CURRENT AND PULSE DURATION**

**FORWARD CURRENT VERSUS DUTY CYCLE AND PULSE DURATION**
The peak wavelength of the colour emitted by the LED also changes with junction temperature, according to the relation $d \lambda_p/d T_j = +0.15$ to $0.20$ nm/K. Detection of a colour difference between two LEDs depends on the dominant wavelength. Figure 4 shows how the response of the eye varies with wavelength, and Fig. 5, the change in wavelength just detectable by eye as a function of wavelength.

**SPECTRAL RESPONSE OF HUMAN EYE**

![Graph showing the sensitivity of the human eye to different wavelengths.](image)

**Fig. 4.**

**CHANGE IN WAVELENGTH JUST DETECTABLE BY HUMAN EYE VERSUS WAVELENGTH**

![Graph showing the change in wavelength just detectable by human eye.](image)

**Fig. 5.**
LEDs can be supplied on tape, with unidirectional leads for automatic insertion into PCBs. The tape packaging can be delivered on bandolier/rolls or meander/concertina packing as shown in Fig. 1.

The packaging consists of a carrier tape and a fixing tape as specified by IEC Publication 286. The relevant dimensions are given in Fig. 2 and the table.

### MECHANICAL DATA

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Specification</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body width</td>
<td>A₁</td>
<td>12,7 ±1</td>
<td>Dimensions derived from relevant comp. spec.</td>
</tr>
<tr>
<td>Body height</td>
<td>A</td>
<td>12,7 ±0,2</td>
<td>Cumulative error 1mm/20 pitch</td>
</tr>
<tr>
<td>Body thickness</td>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead wire dimensions</td>
<td>b, c</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pitch of component</td>
<td>P</td>
<td>6,35 ±0,4</td>
<td>To be measured at 10 mm from feed hole centre</td>
</tr>
<tr>
<td>Feed hole pitch</td>
<td>P₀</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feed hole centre to component centre</td>
<td>P₂</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feed hole centre to lead</td>
<td>P₁</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance between outer leads</td>
<td>F</td>
<td>2,54 ±0,2</td>
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</tr>
<tr>
<td>Lead to lead distance</td>
<td>F₁F₂</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Component alignment</td>
<td>Δh</td>
<td>±1</td>
<td>At top of body</td>
</tr>
<tr>
<td>Component alignment</td>
<td>Δh₁</td>
<td>±1</td>
<td>At top of body</td>
</tr>
<tr>
<td>Lead alignment after cutting</td>
<td>Δ₂</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parallelism</td>
<td>Δ₃</td>
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<td></td>
</tr>
<tr>
<td>Tape width</td>
<td>W</td>
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</tr>
<tr>
<td>Hold down tape width</td>
<td>W₀</td>
<td>6 ±0,3</td>
<td></td>
</tr>
<tr>
<td>Hole position</td>
<td>W₁</td>
<td>9 ±0,5</td>
<td></td>
</tr>
<tr>
<td>Hold down tape position</td>
<td>W₂</td>
<td>0,5 ±0,2</td>
<td></td>
</tr>
<tr>
<td>Feed hole diameter</td>
<td>D₀</td>
<td>4 ±0,2</td>
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</tr>
<tr>
<td>Total tape thickness</td>
<td>t</td>
<td>0,9 max.</td>
<td></td>
</tr>
<tr>
<td>Height of component from tape centre</td>
<td>H</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead wire clinch height</td>
<td>H₀</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Component height</td>
<td>H₁</td>
<td>H+A +0−0,2</td>
<td></td>
</tr>
<tr>
<td>Length of snipped leads</td>
<td>L₁</td>
<td>11 max.</td>
<td></td>
</tr>
<tr>
<td>Lead wire taped portion</td>
<td>L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pull out force</td>
<td>(P)</td>
<td>6N min.</td>
<td></td>
</tr>
<tr>
<td>Pull out force from tape end/reel</td>
<td></td>
<td>2,5N max.</td>
<td></td>
</tr>
</tbody>
</table>
MECHANICAL DATA

UNREELING

Dimensions in mm

Fig. 2 See table.
SOLDERING AND MOUNTING RECOMMENDATIONS

Because LEDs are encapsulated in cast resin and not in transfer-moulded housings, they tend to soften when heated, as for instance during soldering. If there happens to be any mechanical stresses on the leads at this time, they tend to be displaced in a direction that minimizes the stress, with the result that the internal connections of the LED are fractured. This is one of the major reasons for LED failure.

To overcome the problem, it is essential:

a) to form and crop the leads before soldering;
b) to ensure that the holes in the printed circuit board (PCB) are of sufficient size (0.8 mm) to allow the LED to be inserted without stressing the leads while still allowing a good soldered joint to be made;
c) to ensure that the holes in the PCB are adequately spaced (2.54 mm) so as not to stress the leads;
d) that any spacers used do not impose stresses on the leads;
e) that any sockets are able to secure the LED without stress.

If it is necessary to crop the leads after soldering, the LED must first be allowed to cool to room temperature. This may take from 30 seconds to 3 minutes depending upon the circumstances.

Long sockets are particularly hazardous for the LED as they rarely have the same expansion characteristics as the PCB. The resulting distortion can easily be fatal for the LEDs unless great care is taken to ensure that the holes in the sockets and the PCB are not only in perfect alignment, but also that they are of adequate size and spacing. The longer the socket, the greater the care needed.

Soldering should be done with a solder-bath or temperature-controlled iron. In either case, the temperature should be accurately controlled (preferably at 245 °C) and, in the case of the solder-bath, it is useful to record the temperature. The maximum temperature must not exceed 260 °C and the maximum time is 7 seconds. Solder must not be less than 1.5 mm from the seating plane. When using a solder-bath, take care to avoid the pressure of the solder-wave bending the PCB.

The way in which the LED is cast means that the lower surface of the device is not suitable as a reference surface. The top of the device or the top of any flange should therefore be used. A slightly less accurate reference is the seating plane.

Figure 1 shows the effect on the lower surface of the LED of (a) under filling, and (b), over filling the mould. Other dimensions are within 0.1 mm and can be used as reference.

---

Fig. 1.
When mounting arrays of LEDs, it is preferable to use the top as the reference surface and if possible to use a screen in front of them. The screen not only makes any small differences of position less noticeable but also removes the need for the LEDs to withstand the mechanical tests required by some countries (see Fig. 2).

Finally, Fig. 3 shows a recommended mounting arrangement using sockets. The LED is held on the PCB by a double-sided adhesive tape and the socket presses the device against it. With the correct hole size and spacing, no stress is imposed on the leads and soldering can be done in complete safety.
DEVICE DATA
SILICON PHOTOTRANSISTOR

N-P-N silicon phototransistor in epoxy resin encapsulation intended for optical coupling and encoding. The base is inaccessible. Combination with LED CQY58A is recommended.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-emitter voltage</td>
<td>$V_{CEO}$  max. 50 V</td>
</tr>
<tr>
<td>Collector current (d.c.)</td>
<td>$I_C$ max. 25 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 25$ °C</td>
<td>$P_{tot}$ max. 100 mW</td>
</tr>
<tr>
<td>Collector dark current $V_{CE} = 30$ V; $E = 0$</td>
<td>$I_{CEO(D)}$ &lt; 100 nA</td>
</tr>
<tr>
<td>Collector light current $V_{CE} = 5$ V; $E = 1$ mW/cm²; $\lambda_{pk} = 930$ nm</td>
<td>$I_{CEO(L)}$ BPW22A-1 &gt; 1.5 to 8 mA, BPW22A-2 &gt; 5 to 25 mA</td>
</tr>
<tr>
<td>Wavelength at peak response</td>
<td>$\lambda_p$ typ. 800 nm</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOD-53F.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-emitter voltage</td>
<td>VCE</td>
<td>V</td>
<td>max. 50</td>
</tr>
<tr>
<td>Emitter-collector voltage</td>
<td>VECO</td>
<td>V</td>
<td>max. 7</td>
</tr>
<tr>
<td>Collector current</td>
<td>IC</td>
<td>mA</td>
<td>max. 25</td>
</tr>
<tr>
<td>peak value</td>
<td>ICM</td>
<td>mA</td>
<td>max. 50</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{\text{amb}} = 25 \degree \text{C}$</td>
<td>$P_{\text{tot}}$</td>
<td>mW</td>
<td>max. 100</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>$T_{\text{stg}}$</td>
<td>°C</td>
<td>-55 to +100</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>°C</td>
<td>max. 100</td>
</tr>
<tr>
<td>Lead soldering temperature</td>
<td>$T_{\text{slid}}$</td>
<td>°C</td>
<td>max. 260</td>
</tr>
</tbody>
</table>

$> 1.5 \text{ mm from the seating plane; } t_{\text{slid}} < 7 \text{ s}$

THERMAL RESISTANCE
From junction to ambient,

- device mounted on printed-circuit board

$$R_{\text{th j-a}} = 750 \text{ K/W}$$

![Fig. 2 Power derating curve versus ambient temperature.](image-url)
CHARACTERISTICS

Tj = 25 °C unless otherwise specified

Collector dark current

\[ V_{CE} = 30 \text{ V}; \quad E = 0 \]

Collector light current

\[ V_{CE} = 5 \text{ V}; \quad E_e = 1 \text{ mW/cm}^2; \quad \lambda_p = 930 \text{ nm} \]

Collector-emitter saturation voltage

\[ I_C = 1 \text{ mA}; \quad E_e = 1 \text{ mW/cm}^2; \quad \lambda_p = 930 \text{ nm} \]

Wavelength at peak response

Bandwidth at half height

Beamwidth between half-intensity directions

Switching times (see Figs 3, 4, 9 and 10)

\[ I_{Con} = 2 \text{ mA}; \quad V_{CC} = 5 \text{ V}; \quad R_E = 100 \Omega; \quad T_{amb} = 25 \degree C \]

turn-on time

turn-off time

\[ I_{Con} = 2 \text{ mA}; \quad V_{CC} = 5 \text{ V}; \quad R_E = 1 \text{k}\Omega; \quad T_{amb} = 25 \degree C \]

turn-on time

turn-off time

\[
\begin{align*}
I_{CEO(D)} &< 100 \text{ nA} \\
I_{CEO(L)} &< 100 \text{ nA} \\
I_{CEO(L)} &< 5 \text{ to } 25 \text{ mA}
\end{align*}
\]

BPW22A-1
BPW22A-2

\[
\begin{align*}
V_{CE_{sat}} &< 0.4 \text{ V} \\
\lambda_p \text{ typ.} & 800 \text{ nm} \\
\Delta \lambda \text{ typ.} & 400 \text{ nm} \\
\theta_{\frac{1}{2}} \text{ typ.} & 20^\circ
\end{align*}
\]

\[
\begin{align*}
t_{on} \text{ typ.} & 3 \mu s \\
t_{off} \text{ typ.} & 3 \mu s \\
t_{on} \text{ typ.} & 12,0 \mu s \\
t_{off} \text{ typ.} & 12,0 \mu s
\end{align*}
\]

Fig. 3 Switching circuit with light emitting diode CQY58A. T.U.T. = BPW22A.

Fig. 4 Input and output switching waveforms.
Fig. 5 $E = 0; T_j = 25 \, ^\circ C$.

Fig. 6 $E = 0; V_{CE} = 30 \, V$.

Fig. 7 GaAs source: $\lambda_{pk} = 930 \, nm$; $V_{CE} = 5 \, V; T_j = 25 \, ^\circ C$.

Fig. 8 $\lambda_{pk} = 930 \, nm; T_j = 25 \, ^\circ C$; typical values.
Silicon phototransistor

Fig. 9  $V_{CC} = 5 \text{ V}; T_{amb} = 25 \text{ °C};$ typical values; see also Figs 3 and 4.

Fig. 10  $V_{CC} = 5 \text{ V}; T_{amb} = 25 \text{ °C};$ typical values; see also Figs 3 and 4.

Fig. 11.
Fig. 12 Spectral response.

Fig. 13 $V_{CE} = 5 \text{ V}; t_D (I_{FM}) = 10 \mu s; T = 1 \text{ ms}; d^* = 10 \text{ mm}; T_{amb} = 25 ^\circ\text{C}$.

Fig. 14 $V_{CE} = 5 \text{ V}; T_{amb} = 25 ^\circ\text{C}$; typical values.

Fig. 15 $V_{CE} = 5 \text{ V}; d^* = 10 \text{ mm}$; typical values.

* $d^*$ = shortest free distance of mechanical on-axis when BPW22A is coupled with CQY58A.
SILICON PHOTO P-I-N DIODE

Silicon photo p-i-n diode in a plastic envelope with an infrared filter.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$</td>
<td>max. 32 V</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 47.5$°C</td>
<td>$P_{tot}$</td>
<td>max. 150 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>max. 100 °C</td>
</tr>
<tr>
<td>Dark reverse current</td>
<td>$I_{R(D)}$</td>
<td>&lt; 30 nA</td>
</tr>
<tr>
<td>Light reverse current</td>
<td>$I_{R(L)}$</td>
<td>&gt; 30 µA</td>
</tr>
<tr>
<td>Wavelength at peak response</td>
<td>$\lambda_p$</td>
<td>typ. 930 nm</td>
</tr>
<tr>
<td>Sensitive area</td>
<td>$A$</td>
<td>typ. 5 mm$^2$</td>
</tr>
</tbody>
</table>

Wavelength at peak response

$V_R = 5$ V

Sensitive area

MECHANICAL DATA

Fig. 1 SOD-67.

Dimensions in mm

(1) Reference for the positional tolerance of the sensitive area.
BPW50

RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)
Continuous reverse voltage
Total power dissipation up to $T_{amb} = 47.5 \, ^\circ C$
Storage temperature
Junction temperature
Lead soldering temperature
up to the seating plane; $t_{sld} < 10 \, \text{s}$

THERMAL RESISTANCE
From junction to ambient in free air

CHARACTERISTICS
$T_j = 25 \, ^\circ C$
Dark reverse current
$V_R = 10 \, \text{V}; E_e = 0$
Light reverse current
$V_R = 5 \, \text{V}; E_e = 1 \, \text{mW/cm}^2; \lambda = 930 \, \text{nm}$
Reverse voltage
$I_R = 0.1 \, \text{mA}; E_e = 0$
Wavelength at peak response
$V_R = 5 \, \text{V}$
Diode capacitance
$V_R = 3 \, \text{V}$
$V_R = 0$
Light switching times (see Figs 2 and 3)
Rise time and fall time
$V_{KK} = 10 \, \text{V}; R_A = 1 \, \text{k}\Omega$

---

Fig. 2 Switching circuit.

Fig. 3 Input and output switching waveforms.
Fig. 4 Maximum permissible power dissipation as a function of temperature.

Fig. 5 $T_{amb} = 25 \, ^{\circ}C$. 

Silicon photo p-i-n diode

$P_{tot} \quad (mW)$

$R_{hi-a} = 350 \, K/W$

$C_d \quad (pF)$

$V_R \quad (V)$
Fig. 6 $E = 0; T_{\text{amb}} = 25 \, ^{\circ}\text{C}$.

Fig. 7 $E = 0$; typical values.

Fig. 8 $V_R = 5 \, \text{V}; \lambda = 930 \, \text{nm}; T_{\text{amb}} = 25 \, ^{\circ}\text{C}$.
Fig. 9 $E_e = 1 \text{ mW/cm}^2; \lambda = 930 \text{ nm}$.

Fig. 10 $V_R = 5 \text{ V}; T_{\text{amb}} = 25 ^\circ \text{C}$.

Fig. 11.
LIGHT EMITTING DIODES

Circular light emitting diodes with a diameter of 5 mm which emit red light (GaP:ZnO; ultra-red) at a typical peak wavelength of 700 nm when forward biased.

The CQS51 and CQS51L have a SOD-63 outline and are encapsulated in a red coloured diffusing resin. The CQS51L is the long lead version of the CQS51 and has no seating plane but is in all other respects equal to the CQS51.

These LEDs are specially designed for low current applications.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
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<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$</td>
<td>max.</td>
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<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>max.</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 65 , ^\circ C$</td>
<td>$P_{tot}$</td>
<td>max.</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>max.</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td>$I_V$</td>
<td>min.</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_p$</td>
<td>typ.</td>
</tr>
<tr>
<td>Beamwidth at half-intensity directions</td>
<td>$\theta_{1/2}$</td>
<td>typ.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>CQS51(L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_V$</td>
<td>min.</td>
</tr>
<tr>
<td>$0.7 , mcd$</td>
<td></td>
</tr>
<tr>
<td>$\lambda_p$</td>
<td>typ.</td>
</tr>
<tr>
<td>$700 , nm$</td>
<td></td>
</tr>
<tr>
<td>$\theta_{1/2}$</td>
<td>typ.</td>
</tr>
<tr>
<td>$70 , ^\circ$</td>
<td></td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig. 1 SOD-63A1.

Dimensions in mm

Note: Solderability not guaranteed in tie-bar zone.
Light emitting diodes

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

Continuous reverse voltage
Forward current
- d.c.
  - peak value; \( t_p = 1 \mu s; f = 300 \text{ Hz} \)
  - peak value; \( t_{\text{on}} = 1 \text{ ms}; \delta = 0.33 \)

Total power dissipation up to \( T_{\text{amb}} = 65 \degree \text{C} \)

Storage temperature
Junction temperature

Lead soldering temperature; \( t_{\text{sld}} < 7 \text{ s;} \)
- \( > 1.5 \text{ mm from the seating plane for CQS51} \)
- \( > 5 \text{ mm from the plastic body for CQS51L} \)

THERMAL RESISTANCE
From junction to ambient when the device is mounted on a p.c. board

CHARACTERISTICS
\( T_{\text{amb}} = 25 \degree \text{C} \) unless otherwise specified

Forward voltage
Reverse current

Beamwidth at half-intensity directions
\( \theta_{\frac{1}{2}} \)

Bandwidth at half height
\( \Delta \lambda \)

Wavelength at peak emission
\( \lambda_p \)

Luminous intensity
\( I_F = 10 \text{ mA} \)

Diode capacitance
\( V_R = 0; f = 1 \text{ MHz} \)

CQS51
CQS51L
Fig. 2 Typical values.

Fig. 3 $I_F = f (V_F)$.

Fig. 4 $I_V = f (I_F)$.

Fig. 5 Typical values.

Fig. 6 Typical values.

Fig. 7 Typical values.
Fig. 8 Typical values.
LIGHT Emitting Diode

Circular light emitting diode with a diameter of 3 mm which emits red light (GaP:ZnO; ultra-red) at a typical peak wavelength of 700 nm when forward biased.

The CQS54 has a SOD-53 outline and is encapsulated in a red coloured diffusing resin.

This LED is specially designed for low current applications.

QUICK REFERENCE DATA

- Continuous reverse voltage: $V_R$ max. 5 V
- Forward current (d.c.): $I_F$ max. 30 mA
- Total power dissipation up to $T_{amb} = 55 \^\circ C$: $P_{tot}$ max. 90 mW
- Junction temperature: $T_J$ max. 100 $^\circ C$
- Luminous intensity: $I_V$ min. 0.7 mcd
- Wavelength at peak emission: $\lambda_p$ typ. 700 nm
- Beamwidth at half-intensity directions: $\theta_{1/2}$ typ. 70 $^\circ$
MECHANICAL DATA

Fig. 1 SOD-53E.

Dimensions in mm
RATINGS

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

Continuous reverse voltage
Forward current
d.c.
peak value; $t_p = 1 \mu s$; $f = 300$ Hz
peak value; $t_{on} = 1$ ms; $\delta = 0,33$

Total power dissipation up to $T_{amb} = 55^\circ C$
Storage temperature
Junction temperature
Lead soldering temperature; $t_{sld} < 7$ s;
> 1,5 mm from the seating plane

THERMAL RESISTANCE

From junction to ambient when
the device is mounted on a p.c. board

CHARACTERISTICS

$T_{amb} = 25^\circ C$ unless otherwise specified

Forward voltage
Reverse current
$V_R = 5$ V
Beamwidth at half-intensity directions
Bandwidth at half height
Wavelength at peak emission
Luminous intensity
Luminous intensity
Diode capacitance

$V_R \quad max. \quad 5 \ V$
$I_F \quad max. \quad 30 \ mA$
$I_{FRM} \quad max. \quad 1 \ A$
$P_{tot} \quad max. \quad 90 \ mA$
$T_{stg} \quad -55 \ to \ +100 \ ^\circ C$
$T_{j} \quad max. \quad 100 \ ^\circ C$
$T_{sld} \quad max. \quad 260 \ ^\circ C$
$R_{th j-a} \quad max. \quad 500 \ K/W$
$V_F \quad typ. \quad 2,0 \ V$
$max. \quad 2,6 \ V$
$I_R \quad max. \quad 100 \ \mu A$
$\theta_1/2 \quad typ. \quad 70 \ ^\circ$
$\Delta \lambda \quad typ. \quad 90 \ nm$
$\lambda_p \quad typ. \quad 700 \ nm$
$I_v \quad typ. \quad mcd$
Luminous intensity
Luminous intensity

$C_{d} \quad typ. \quad 45 \ pF$

$CQS54 \quad I_v \quad min. \quad 0,7 \ mcd$
$CQS54-2 \quad I_v \quad 1,0 \ to \ 2,2 \ mcd$
$CQS54-3 \quad I_v \quad min. \quad 1,6 \ mcd$
Fig. 2 Typical values.

Fig. 3 $I_F = f(V_F)$.

Fig. 4 $I_V = f(I_F)$.

Fig. 5 Typical values.

Fig. 6 Typical values.

Fig. 7 Typical values.
Fig. 8 Typical values.
Circular light emitting diode which emits red light at a typical peak wavelength of 650 nm (GaAsP; standard red) when forward biased.

The CQS82L has a flangeless SOD-85 outline and is encapsulated in a red coloured diffusing resin.

Together with the CQS84L and CQS86L, the CQS82L forms one family and is available only in the long lead (L) version.

**QUICK REFERENCE DATA**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$ max. 5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$ max. 50 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb}$ = 60 °C</td>
<td>$P_{tot}$ max. 100 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$ max. 100 °C</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td>$I_V$ min. CQS82L 0.7 mcd</td>
</tr>
<tr>
<td></td>
<td>$I_V$ 1.0 to 1.2 mcd CQS82L-2</td>
</tr>
<tr>
<td></td>
<td>$I_V$ 1.6 to 3.5 mcd CQS82L-3</td>
</tr>
<tr>
<td></td>
<td>$I_V$ min. 3.0 mcd CQS82L-4</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_p$ typ. 650 nm</td>
</tr>
<tr>
<td>$I_F = 20$ mA</td>
<td>$\theta_{\frac{1}{2}}$ typ. 70 °</td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig. 1 SOD-85AL.

Note: Solderability not guaranteed in tie-bar zone.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage
Forward current
d.c.
peak value; \( t_p = 1 \mu s; f = 300 \text{ Hz} \)
peak value; \( t_p = 10 \mu s; \delta = 0,01 \)
Total power dissipation up to \( T_{\text{amb}} = 60^\circ \text{C} \)
Storage temperature
Junction temperature
Lead soldering temperature; \( t_{\text{slid}} < 7 \text{ s}; \)
> 5 mm from the plastic body

THERMAL RESISTANCE
From junction to ambient when
the device is mounted on a p.c. board

CHARACTERISTICS
\( T_{\text{amb}} = 25^\circ \text{C} \) unless otherwise specified

Forward voltage
\( I_F = 20 \text{ mA} \)

Reverse current
\( V_R = 5 \text{ V} \)

Beamwidth at half-intensity directions
\( I_F = 20 \text{ mA} \)

Bandwidth at half height

Wavelength at peak emission
\( I_F = 20 \text{ mA} \)

Luminous intensity
\( I_F = 20 \text{ mA} \)

Diode capacitance
\( V_R = 0; f = 1 \text{ MHz} \)
Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.
Fig. 6. Typical values.

Fig. 7. Typical values.

Fig. 8. Typical values.

Fig. 9. Typical values.
Fig. 10 Typical values.
Circular light emitting diode which emits red light at a typical peak wavelength of 650 nm (GaAlAs; hyper-red) when forward biased.

The CQS82AL has a flangeless SOD-85 outline and is encapsulated in a red diffusing resin.

Together with the CQS84L and the CQS86L, the CQS82AL forms one family and is available only in the long lead (L) version.

**QUICK REFERENCE DATA**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage V&lt;sub&gt;R&lt;/sub&gt; max.</td>
<td>5 V</td>
</tr>
<tr>
<td>Forward current (d.c.) I&lt;sub&gt;F&lt;/sub&gt; max.</td>
<td>100 mA</td>
</tr>
<tr>
<td>Total power dissipation up to T&lt;sub&gt;amb&lt;/sub&gt; = 25 °C P&lt;sub&gt;tot&lt;/sub&gt; max.</td>
<td>215 mW</td>
</tr>
<tr>
<td>Junction temperature T&lt;sub&gt;j&lt;/sub&gt; max.</td>
<td>100 °C</td>
</tr>
<tr>
<td>Luminous intensity I&lt;sub&gt;F&lt;/sub&gt; = 10 mA CQS82AL I&lt;sub&gt;l&lt;/sub&gt; min.</td>
<td>1.6 mcd</td>
</tr>
<tr>
<td></td>
<td>CQS82AL-4 I&lt;sub&gt;l&lt;/sub&gt;</td>
</tr>
<tr>
<td></td>
<td>CQS82AL-5 I&lt;sub&gt;l&lt;/sub&gt;</td>
</tr>
<tr>
<td></td>
<td>CQS82AL-6 I&lt;sub&gt;l&lt;/sub&gt;</td>
</tr>
<tr>
<td>Wavelength at peak emission I&lt;sub&gt;F&lt;/sub&gt; = 10 mA</td>
<td>λ&lt;sub&gt;p&lt;/sub&gt; typ. 650 nm</td>
</tr>
<tr>
<td>Beamwidth at half-intensity directions</td>
<td>θ&lt;sub&gt;1/2&lt;/sub&gt; typ. 70 °</td>
</tr>
</tbody>
</table>
MECHANICAL DATA
Fig. 1 SOD-85AL.

Dimensions in mm

Note: Solderability not guaranteed in tie-bar zone.
Light emitting diode

CQS82AL

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

Continuous reverse voltage

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
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<tbody>
<tr>
<td>Reverse voltage</td>
<td>VR max.</td>
<td>5 V</td>
</tr>
<tr>
<td>Forward current</td>
<td>IF max.</td>
<td>100 mA</td>
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<tr>
<td>Peak value; t = 1 µs; f = 300 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak value; t = 20 µs; δ = 0.01</td>
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<td></td>
</tr>
<tr>
<td>Total power dissipation up to Tamb = 25 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junction temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead soldering temperature; tsld &lt; 7 s; &gt;5 mm from the plastic body</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

THERMAL RESISTANCE
From junction to ambient when the device is mounted on a p.c. board

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal resistance</td>
<td>Rth j-a max.</td>
<td>350 K/W</td>
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CHARACTERISTICS
Tamb = 25 °C unless otherwise specified

Forward voltage

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
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<tbody>
<tr>
<td>IF = 10 mA</td>
<td>VF typ.</td>
<td>1.75 V</td>
</tr>
<tr>
<td>IF = 100 mA</td>
<td>VF max.</td>
<td>2.2 V</td>
</tr>
<tr>
<td></td>
<td>VF typ.</td>
<td>2.0 V</td>
</tr>
<tr>
<td></td>
<td>VF max.</td>
<td>2.5 V</td>
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Reverse current

<table>
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<th>Value</th>
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<tbody>
<tr>
<td>VR = 5 V</td>
<td>IR max.</td>
<td>100 µA</td>
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Beamwidth at half-intensity directions

<table>
<thead>
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<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
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<tbody>
<tr>
<td>IF = 10 mA; in the plane of the leads</td>
<td>θ½ typ.</td>
<td>70 °</td>
</tr>
<tr>
<td>Bandwidth at half height</td>
<td>Δλ typ.</td>
<td>20 nm</td>
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Wavelength at peak emission

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IF = 10 mA</td>
<td>λp typ.</td>
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Luminous intensity

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
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<tbody>
<tr>
<td>IF = 10 mA</td>
<td>Cov min.</td>
<td>1.6 mcd</td>
</tr>
<tr>
<td>CQS82AL-4</td>
<td>Cov</td>
<td>3.0 to 7.0 mcd</td>
</tr>
<tr>
<td>CQS82AL-5</td>
<td>Cov</td>
<td>5.0 to 12 mcd</td>
</tr>
<tr>
<td>CQS82AL-6</td>
<td>Cov min.</td>
<td>10 mcd</td>
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</tbody>
</table>

Diode capacitance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VR = 0; f = 1 MHz</td>
<td>Cd typ.</td>
<td>80 pF</td>
</tr>
</tbody>
</table>
Fig. 2. 

Fig. 3 T_{amb} = 25 °C; typ. values.

Fig. 4 t_{on} = 20 \mu s; \delta = 0,01; T_{amb} = 25 °C; typ. values.

Fig. 5 I_{F} = 10 mA; typ. values.

Fig. 6 Typical values.

Fig. 7 t_{p} = 50 \mu s; typ. values.
Fig. 8  $I_F = 10 \text{ mA}; T_{\text{amb}} = 25 \degree \text{C}; \text{typ. values.}$

Fig. 9  Typical values.
LIGHT EMITTING DIODE

Circular light emitting diode which emits green light at a typical peak wavelength of 565 nm (GaP; super-green) when forward biased.

The CQS84L has a flangeless SOD-85 outline and is encapsulated in a green diffusing resin.

Together with the CQS82AL and the CQS86L, the CQS84L forms one family and is available only in the long lead (L) version.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$ max. 5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$ max. 60 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 35^\circ C$</td>
<td>$P_{tot}$ max. 180 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_J$ max. 100 $^\circ$ C</td>
</tr>
<tr>
<td>Luminous intensity $I_F = 10$ mA</td>
<td>$I_V$ CQS84L min. 0,7 mcd</td>
</tr>
<tr>
<td></td>
<td>CQS84L-3 $I_V$ 1,6 to 3,5 mcd</td>
</tr>
<tr>
<td></td>
<td>CQS84L-4 $I_V$ 3,0 to 7,0 mcd</td>
</tr>
<tr>
<td></td>
<td>CQS84L-5 $I_V$ min. 5,0 mcd</td>
</tr>
<tr>
<td>Wavelength at peak emission $I_F = 10$ mA</td>
<td>$\lambda_p$ typ. 565 nm</td>
</tr>
<tr>
<td>Beamwidth at half-intensity directions</td>
<td>$\theta_{1/2}$ typ. 70 $^\circ$</td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig. 1 SOD-85AL.

Note: Solderability not guaranteed in tie-bar zone.
LIGHT-EMITTING DIODE

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

Continuous reverse voltage
\[ V_R \text{ max.} \quad 5 \text{ V} \]

Forward current
\[ I_F \text{ max.} \quad 60 \text{ mA} \]
\[ I_{FRM} \text{ max.} \quad 1 \text{ A} \]
\[ P_{tot} \text{ max.} \quad 180 \text{ mW} \]

Total power dissipation up to \( T_{amb} = 35 \degree C \)

Storage temperature
\[ T_{stg} \quad -55 \text{ to } +100 \degree C \]

Junction temperature
\[ T_j \text{ max.} \quad 100 \degree C \]

Lead soldering temperature; \( t_{sld} < 7 \text{ s} \);
\[ > 5 \text{ mm from the plastic body} \]
\[ T_{sld} \text{ max.} \quad 260 \degree C \]

THERMAL RESISTANCE
From junction to ambient when
the device is mounted on a p.c. board
\[ R_{th j-a} \text{ max.} \quad 350 \text{ K/W} \]

CHARACTERISTICS
\( T_{amb} = 25 \degree C \) unless otherwise specified

Forward voltage
\[ I_F = 10 \text{ mA} \]
\[ V_F \text{ typ.} \quad 2,1 \text{ V} \]
\[ V_F \text{ max.} \quad 2,6 \text{ V} \]

Reverse current
\[ V_R = 5 \text{ V} \]
\[ I_R \text{ max.} \quad 100 \mu A \]

Beamwidth at half-intensity directions
\[ I_F = 10 \text{ mA} \]
\[ \theta_\frac{1}{2} \text{ typ.} \quad 70 \degree \]

Bandwidth at half height
\[ \Delta \lambda \text{ typ.} \quad 30 \text{ nm} \]

Wavelength at peak emission
\[ I_F = 10 \text{ mA} \]
\[ \lambda_p \text{ typ.} \quad 565 \text{ nm} \]

Luminous intensity
\[ I_F = 10 \text{ mA} \]
\[ I_v \quad \text{COS84L} \text{ min.} \quad 1,0 \text{ mcd} \]
\[ I_v \quad \text{COS84L-3} \quad 1,6 \text{ to } 3,5 \text{ mcd} \]
\[ I_v \quad \text{COS84L-4} \quad 3,0 \text{ to } 7,0 \text{ mcd} \]
\[ I_v \quad \text{COS84L-5} \text{ min.} \quad 5,0 \text{ mcd} \]

Diode capacitance
\[ V_R = 0; f = 1 \text{ MHz} \]
\[ C_d \text{ typ.} \quad 20 \text{ pF} \]
Fig. 2.

Fig. 4  $t_{on} = 1 \text{ ms} ; \delta = 0.33 ;$

$T_{\text{amb}} = 25 \degree \text{C} ; \text{typ. values}.$

Fig. 5  Typical values.

Fig. 6  Typical values.

Fig. 7  $t_{p} = 50 \mu\text{s} ; \text{typ. values}.$
Fig. 8 \( I_F = 10 \text{ mA}; \) typ. values.

Fig. 9 \( I_F = 10 \text{ mA}; \) typ. values.
LIGHT EMITTING DIODE

Circular light emitting diode which emits yellow light at a typical peak wavelength of 590 nm (GaPAs) when forward biased.

The CQS86L has a flangeless SOD-85 outline and is encapsulated in a yellow diffusing resin.

Together with the COS82AL and the COS84L, the COS86L forms one family and is available only in the long lead (L) version.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th></th>
<th>VR max.</th>
<th>IF max.</th>
<th>P_{tot} max.</th>
<th>T_j max.</th>
<th>\lambda_p typ.</th>
<th>\theta_{1/2} typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>5 V</td>
<td>30 mA</td>
<td>90 mW</td>
<td>100 °C</td>
<td>590 nm</td>
<td>70 °</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total power dissipation up to T_{amb} = 65 °C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junction temperature</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Luminous intensity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I_F = 10 mA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CQS86L</td>
<td>l_v min.</td>
<td>0,7 mcd</td>
<td></td>
<td></td>
<td>590 nm</td>
<td></td>
</tr>
<tr>
<td>CQS86L-3</td>
<td>l_v</td>
<td>1,6 to 3,5 mcd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CQS86L-4</td>
<td>l_v</td>
<td>3,0 to 7,0 mcd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CQS86L-5</td>
<td>l_v min.</td>
<td>5,0 mcd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Wavelength at peak emission

I_F = 10 mA

Beamwidth at half-intensity directions

\theta_{1/2} typ. 70 °
MECHANICAL DATA

Fig. 1 SOD-85AL

Dimensions in mm

Note: Solderability not guaranteed in tie-bar zone.
Light emitting diode

CQS86L

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

Continuous reverse voltage
Forward current
d.c.
peak value; \( t_p = 1 \mu s; f = 300 \text{ Hz} \)
peak value; \( t_p < 1 \text{ ms}; \delta = 0.33 \)

Total power dissipation up to \( T_{\text{amb}} = 65 \degree \text{C} \)
Storage temperature
Junction temperature
Lead soldering temperature; \( t_{\text{slld}} < 7 \text{ s; } > 5 \text{ mm from the plastic body} \)

THERMAL RESISTANCE
From junction to ambient when the device is mounted on a p.c. board

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

Forward voltage
Reverse current
\( V_R = 5 \text{ V} \)
Beamwidth at half-intensity directions
I\(_F\) = 10 mA
Bandwidth at half height
Wavelength at peak emission
I\(_F\) = 10 mA
Luminous intensity
I\(_F\) = 10 mA
Diode capacitance
\( V_R = 0; f = 1 \text{ MHz} \)
Fig. 2.

Fig. 3  \( T_{\text{amb}} = 25 \, ^\circ\text{C} \); typ. values.

Fig. 4 \( t_{\text{on}} = 50 \, \mu\text{s}; \delta = 0.33; \)
\( T_{\text{amb}} = 25 \, ^\circ\text{C} \); typ. values.

Fig. 5 Typical values.

Fig. 6 Typical values.

Fig. 7 \( t_{\text{p}} = 50 \, \mu\text{s} \); typ. values.
Light emitting diode

Fig. 8 Typical values.

Fig. 9 Typical values.
LIGHT EMITTING DIODE

Circular light emitting diode with a diameter of 3 mm which emits red light at a typical peak wavelength of 700 nm (GaP:ZnO; ultra-red) when forward biased.

The CQS93 has a SOD-82 outline and is encapsulated in a red coloured diffusing resin.

Together with the CQS95 and CQS97, the CQS93 forms one family.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>CQS93</th>
<th>CQS93-2</th>
<th>CQS93-3</th>
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<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$</td>
<td>max.</td>
<td>5 V</td>
<td></td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>max.</td>
<td>25 mA</td>
<td></td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 65 , ^\circ C$</td>
<td>$P_{tot}$</td>
<td>max.</td>
<td>70 mW</td>
<td></td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>max.</td>
<td>100 °C</td>
<td></td>
</tr>
<tr>
<td>Luminous intensity</td>
<td>$I_V$</td>
<td>min.</td>
<td>0,7 mcd</td>
<td>1,0 to 2,2 mcd</td>
</tr>
<tr>
<td>$I_F = 20 , mA$</td>
<td></td>
<td></td>
<td>1,6 mcd</td>
<td></td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_p$</td>
<td>typ.</td>
<td>700 nm</td>
<td></td>
</tr>
<tr>
<td>Beamwidth at half-intensity directions</td>
<td>$\theta_{1/2}$</td>
<td>typ.</td>
<td>60 °</td>
<td></td>
</tr>
</tbody>
</table>
MECHANICAL DATA
Fig. 1 SOD-82C.

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

Reverse voltage
- $V_R$ max. 5 V

Forward current
- d.c.
  - peak value; $t_p = 1 \mu s$; $f = 300$ Hz
  - peak value; $t_p = 1$ ms; $\delta = 0,33$
- $I_F$ max. 25 mA
- $I_{FRM}$ max. 1 A
- $P_{tot}$ max. 70 mW

Total power dissipation up to $T_{amb} = 65$ °C
- $I_{Ptot}$ max. 1 A
- $I_{1m}$ max. 30 mA

Storage temperature
- $T_{stg}$ max. -30 to +100 °C

Junction temperature
- $T_{j}$ max. 100 °C

Lead soldering temperature; $t_{slid} < 7s; > 3$ mm from the plastic body
- $T_{slid}$ max. 260 °C

THERMAL RESISTANCE
From junction to ambient
- when the device is mounted on a p.c. board

CHARACTERISTICS
$T_j = 25$ °C unless otherwise specified

Forward voltage
- $I_F = 20$ mA

Reverse current
- $V_R = 5$ V

Beamwidth at half-intensity directions
- $I_F = 20$ mA

Bandwidth at half height

Wavelength at peak emission
- $I_F = 20$ mA

Luminous intensity
- $I_F = 20$ mA
  - COS93 $I_v$ min. 0,7 mcd
  - COS93-2 $I_v$ min. 1,0 to 2,2 mcd
  - COS93-3 $I_v$ min. 1,6 mcd
Fig. 2.

Fig. 3 $T_{\text{amb}} = 25^\circ \text{C}$; typ. values.

Fig. 4 Typical values.

Fig. 5 $T_{\text{amb}} = 25^\circ \text{C}$; typ. values.
Fig. 6  $I_F = 20$ mA; $T_{amb} = 25$ °C; typ. values.

Fig. 7  Typical values.
LIGHT EMITTING DIODE

Circular light emitting diode with a diameter of 3 mm which emits red light at a typical peak wavelength of 700 nm (GaP:ZnO; ultra-red) when forward biased.

The CQS93E has a SOD-82 outline and is encapsulated in a red coloured diffusing resin.

The additional letter E signifies extremely long leads (34 mm).

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$ max. 5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$ max. 25 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 65 , ^\circ C$</td>
<td>$P_{tot}$ max. 70 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$ max. 100 °C</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td>$I_v$ min. 0.7 mcd</td>
</tr>
<tr>
<td>$I_F = 20$ mA</td>
<td></td>
</tr>
<tr>
<td>CQS93E</td>
<td></td>
</tr>
<tr>
<td>CQS93E-2</td>
<td>$I_v$ typ. 1 to 2.2 mcd</td>
</tr>
<tr>
<td>CQS93E-3</td>
<td>$I_v$ min. 1.6 mcd</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_p$ typ. 700 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$\theta_{1/2}$ typ. 50 °</td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig. 1 SOD-82B.

Dimensions in mm

- a(+) 5.1 ± 0.3
- k(-) 1.1 max
- 5.5 ± 0.2
- not soldered
- 2 max
- 1.5
- 1.5
- 3.45 ± 1
- 1.0

Dimensions in mm

- 3.6 ± 0.2
- 3.0 ± 0.2
- 2.54
- 0.6 ± 0.1 (2x)
### Ratings

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse voltage</td>
<td>$V_R$</td>
<td>5 V</td>
</tr>
<tr>
<td>Forward current d.c.</td>
<td>$I_F$</td>
<td>25 mA</td>
</tr>
<tr>
<td>peak value; $t_{on} = 1$ ms; $\delta = 0.33$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>peak value; $t_p = 1$ $\mu$s; $f = 300$ Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 65$ °C</td>
<td>$P_{tot}$</td>
<td>70 mW</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>$T_{stg}$</td>
<td>-30 to +100 °C</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>100 °C</td>
</tr>
<tr>
<td>Lead soldering temperature; $t_{sld} &lt; 7$ s; $\geq 1.5$ mm from the seating plane</td>
<td>$T_{sld}$</td>
<td>260 °C</td>
</tr>
</tbody>
</table>

### Thermal Resistance

From junction to ambient when the device is mounted on a p.c. board

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistance</td>
<td>$R_{th j-a}$</td>
<td>500 K/W</td>
</tr>
</tbody>
</table>

### Characteristics

$T_{amb} = 25$ °C unless otherwise specified

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward voltage</td>
<td>$V_F$</td>
<td>typ. 2.2 V</td>
</tr>
<tr>
<td>$I_F = 20$ mA</td>
<td></td>
<td>max. 2.8 V</td>
</tr>
<tr>
<td>Reverse current</td>
<td>$I_R$</td>
<td>max. 5 $\mu$A</td>
</tr>
<tr>
<td>$V_R = 5$ V</td>
<td>$\theta_{/2}$</td>
<td>typ. 50 °</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$\Delta\lambda$</td>
<td>typ. 100 nm</td>
</tr>
<tr>
<td>Bandwidth at half height</td>
<td>$\lambda_p$</td>
<td>typ. 700 nm</td>
</tr>
<tr>
<td>Wavelength at peak emission; $I_F = 20$ mA</td>
<td>$I_V$</td>
<td>min. 0.7 mcd</td>
</tr>
</tbody>
</table>

#### CQS93E

<table>
<thead>
<tr>
<th>Device</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CQS93E</td>
<td>$I_V$</td>
<td>0.7 mcd</td>
</tr>
<tr>
<td>CQS93E-2</td>
<td>$I_V$</td>
<td>1.0 to 2.2 mcd</td>
</tr>
<tr>
<td>CQS93E-3</td>
<td>$I_V$</td>
<td>1.6 mcd</td>
</tr>
</tbody>
</table>

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Fig. 2.

Fig. 3. $T_{\text{amb}} = 25 \, ^\circ\text{C}$; typ. values.

Fig. 4. Typ. values.

Fig. 5.
Fig. 6 Typ. values.

Fig. 7 Typ. values.
LIGHT EMITTING DIODE

Circular light emitting diode with a diameter of 3 mm which emits red light at a typical peak wavelength of 700 nm (GaP:ZnO; ultra-red) when forward biased.

The CQS93L has a SOD-82 outline and is encapsulated in a red coloured diffusing resin.

The additional letter L signifies long leads (26 mm).

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>VR max.</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>IF max.</td>
</tr>
<tr>
<td>Total power dissipation up to Tamb = 65 °C</td>
<td>Pt max.</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>Tj max.</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td>IV min.</td>
</tr>
<tr>
<td>IF = 20 mA</td>
<td></td>
</tr>
<tr>
<td>CQS93L</td>
<td>0.7 mcd</td>
</tr>
<tr>
<td>CQS93L-2</td>
<td>1.0 to 2.2 mcd</td>
</tr>
<tr>
<td>CQS93L-3</td>
<td>1.6 mcd</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>λp typ.</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>θ/2 typ.</td>
</tr>
</tbody>
</table>

Wavelength at peak emission typ. 700 nm
Beamwidth between half-intensity directions typ. 50 °
MECHANICAL DATA

Fig. 1 SOD-82A.

Dimensions in mm

- $3.6 \pm 0.2$ mm
- $3.0 \pm 0.2$ mm
- $1.6$ mm
- $2.54$ mm
- $2.54$ mm
- $1.0$ mm
- $1.5$ mm
- $26.5 \pm 1$ mm
- $0.8 \max$ mm
- $1.1 \max$ mm
- $1.5$ mm
- $4.1 \pm 0.3$ mm
- $5.5 \pm 0.2$ mm
- $1.0$ mm

- $0.6 \pm 0.1$ mm

(2x)
Light emitting diode

CQS93L

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

Reverse voltage
Forward current
  d.c.
  peak value; \( t_{on} = 1 \) ms; \( \delta = 0.33 \)
  peak value; \( t_{p} = 1 \) \( \mu \)s; \( f = 300 \) Hz

Total power dissipation up to \( T_{amb} = 65 \) °C

Storage temperature
Junction temperature
Lead soldering temperature; \( t_{sld} < 7 \) s;
  > 1.5 mm from the seating plane

THERMAL RESISTANCE
From junction to ambient when the device is mounted on a p.c. board

CHARACTERISTICS
\( T_{amb} = 25 \) °C unless otherwise specified

Forward voltage
  \( I_F = 20 \) mA
  \( V_F \) typ. 2.2 V
  \( V_F \) max. 2.8 V

Reverse current
  \( V_R = 5 \) V
  \( I_R \) max. 5 \( \mu \)A

Beamwidth between half-intensity directions
  \( I_F = 20 \) mA
  \( \theta_{1/2} \) typ. 50 °

Beamwidth at half height
  \( \Delta \lambda \) typ. 100 nm

Wavelength at peak emission
  \( I_F = 20 \) mA
  \( \lambda_p \) typ. 700 nm

Luminous intensity
  \( I_F = 20 \) mA
  \( I_V \) CQS93L min. 0.7 mcd
  \( I_V \) CQS93L-2 min. 1.0 to 2.2 mcd
  \( I_V \) CQS93L-3 min. 1.6 mcd

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Fig. 2. $P_{\text{tot}}$ (mW) vs. $T_{\text{amb}}$ (°C)

Fig. 3. $T_{\text{amb}}$ = 25 °C; typ. values.

Fig. 4. Typ. values.

Fig. 5. Typ. values.
Fig. 6 Typ. values.

Fig. 7 Typ. values.
LIGHT EMITTING DIODE

Circular light emitting diode with diameter of 3 mm which emits green light at a typical peak wavelength of 565 nm (GaP; super-green) when forward biased.

The CQS95 has a SOD-82 outline and is encapsulated in a green coloured diffusing resin.

Together with the CQS93 and the CQS97, the CQS95 forms one family.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$</td>
<td>max. 5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>max. 30 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 55$ °C</td>
<td>$P_{tot}$</td>
<td>max. 90 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>max. 100 °C</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td>$I_V$</td>
<td></td>
</tr>
<tr>
<td>$I_F = 10$ mA</td>
<td>CQS95</td>
<td>min. 0.7 mcd</td>
</tr>
<tr>
<td></td>
<td>CQS95-2</td>
<td>1.0 to 2.2 mcd</td>
</tr>
<tr>
<td></td>
<td>CQS95-3</td>
<td>min. 1.6 mcd</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_p$</td>
<td>typ. 565 nm</td>
</tr>
<tr>
<td>Beamwidth at half-intensity directions</td>
<td>$\theta$</td>
<td>typ. 60 °</td>
</tr>
</tbody>
</table>
MECHANICAL DATA
Fig. 1 SOD-82C.

Dimensions in mm

- 3,8 ±0,15
- 3,0 ±0,2
- 1,7

- D 0,5
- ±0,1

- 2,54

- 1,5

- 15±1

- 5±0,2

- 0,8 max (2x)

- 0,6

- 4,5±0,3

- 5,5±0,5

- 0,5
- ±0,1

(2x)
### Ratings

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Units</th>
</tr>
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<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$</td>
<td>max. 5 V</td>
</tr>
<tr>
<td>Forward current, d.c.</td>
<td>$I_F$</td>
<td>max. 30 mA</td>
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<tr>
<td>peak value; $t_d = 1 \mu s$; $f = 300$ Hz</td>
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<td></td>
</tr>
<tr>
<td>peak value; $t_{on} = 1$ ms; $\delta = 0.33$</td>
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</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 55$ $^\circ$C</td>
<td>$P_{tot}$</td>
<td>max. 90 mW</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>$T_{stg}$</td>
<td>-30 to +100 $^\circ$C</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>max. 100 $^\circ$C</td>
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<tr>
<td>Lead soldering temperature; $t_{sld} &lt; 7$ s; $&gt; 3$ mm from the plastic body</td>
<td>$T_{sld}$</td>
<td>max. 260 $^\circ$C</td>
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<tr>
<td>THERMAL RESISTANCE</td>
<td>$R_{th j-a}$</td>
<td>max. 500 K/W</td>
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### Characteristics

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

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<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
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<tr>
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<td>$V_F$</td>
<td>typ. 2.2 V, max. 2.8 V</td>
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<tr>
<td>Reverse current</td>
<td>$I_R$</td>
<td>max. 10 $\mu$A</td>
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<td>$V_R = 5$ V</td>
<td>$\theta_{1/2}$</td>
<td>typ. 60 $^\circ$</td>
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<tr>
<td>Beamwidth at half-intensity directions</td>
<td>$\Delta \lambda$</td>
<td>typ. 30 nm</td>
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<tr>
<td>Bandwidth at half height</td>
<td>$\lambda_p$</td>
<td>typ. 565 nm</td>
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<tr>
<td>Wavelength at peak emission</td>
<td>$I_F = 20$ mA</td>
<td>$I_v$ min. 0.7 mcd</td>
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<td>Luminous intensity</td>
<td>$I_F = 10$ mA</td>
<td>$I_v$ 1.0 to 2.2 mcd</td>
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<tr>
<td>CQS95</td>
<td>$I_v$</td>
<td>min. 1.6 mcd</td>
</tr>
<tr>
<td>CQS95-2</td>
<td>$I_v$</td>
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</tr>
<tr>
<td>CQS95-3</td>
<td>$I_v$</td>
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Fig. 2 Typical values.

Fig. 3 $T_{\text{amb}} = 25 \, ^\circ\text{C}$; typ. values.

Fig. 4 Typical values.

Fig. 5 $T_{\text{amb}} = 25 \, ^\circ\text{C}$; typ. values.
Fig. 6 $I_F = 10 \text{ mA}; T_{\text{Amb}} = 25 \degree \text{C};$ typ. values.

Fig. 7 Typical values.
LIGHT EMITTING DIODE

Circular light emitting diode with diameter of 3 mm which emits green light at a typical peak wavelength of 565 nm (GaP; super-green) when forward biased.

The CQS95E has a SOD-82 outline and is encapsulated in a green coloured diffusing resin.

The additional letter E signifies extremely long leads (34 mm).

**QUICK REFERENCE DATA**

<table>
<thead>
<tr>
<th></th>
<th>$V_R$</th>
<th>$I_F$</th>
<th>$P_{tot}$</th>
<th>$T_j$</th>
<th>$I_v$</th>
<th>$\lambda_p$</th>
<th>$\theta_{1/2}$</th>
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<tr>
<td>Total power dissipation up to $T_{amb} = 55 , ^\circ C$</td>
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<tr>
<td>Junction temperature</td>
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<tr>
<td>Luminous intensity</td>
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<tr>
<td>$I_F = 10 , mA$</td>
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<td>min.</td>
<td>3.0 to 7.0 mcd</td>
<td>5.0 mcd</td>
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<tr>
<td></td>
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<td></td>
<td>min.</td>
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<tr>
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<tr>
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<td>min.</td>
<td>5.0 mcd</td>
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<tr>
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<td></td>
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</tr>
<tr>
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<td></td>
<td>typ.</td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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MECHANICAL DATA
Fig. 1 SOD-82B.

Dimensions in mm

- Diameter: 3.6 ± 0.2
- Height: 3.0 ± 0.2
- Width: 1.6
- 2.54
- a (+)
- k (-)
- 1.5
- 34.5 ± 1
- 1.1 max
- 5.1 ± 0.3
- 5.5 ± 0.2
- 2 max
- 1.5
- 1.0
- 0.6 ± 0.1 (2x)
Light emitting diode

CQS95E

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

Reverse voltage
Forward current
d.c.
peak value; \( t_{on} = 1 \text{ ms} \); \( \delta = 0.01 \)
peak value; \( t_p = 1 \mu s \); \( f = 300 \text{ Hz} \)
Total power dissipation up to \( T_{amb} = 55 \degree \text{C} \)
Storage temperature
Junction temperature
Lead soldering temperature; \( t_{slid} < 7 \text{ s;} \)
\( > 1.5 \text{ mm from the seating plane} \)

THERMAL RESISTANCE
From junction to ambient when the device is mounted on a p.c. board

CHARACTERISTICS
\( T_{amb} = 25 \degree \text{C} \) unless otherwise specified
Forward voltage
Reverse current
Beamwidth between half-intensity directions
Bandwidth at half height
Wavelength at peak emission
Luminous intensity

\[
\begin{align*}
V_R & \quad \text{max.} \quad 5 \text{ V} \\
I_F & \quad \text{max.} \quad 30 \text{ mA} \\
I_{FRM} & \quad \text{max.} \quad 1 \text{ A} \\
P_{tot} & \quad \text{max.} \quad 90 \text{ mW} \\
T_{stg} & \quad -30 \text{ to } +100 \degree \text{C} \\
T_j & \quad \text{max.} \quad 100 \degree \text{C} \\
T_{slid} & \quad \text{max.} \quad 260 \degree \text{C} \\
R_{th j-a} & \quad \text{max.} \quad 500 \text{ K/W} \\
V_F & \quad \text{typ.} \quad 2.2 \text{ V} \\
I_R & \quad \text{max.} \quad 10 \mu \text{A} \\
\theta_{1/2} & \quad \text{typ.} \quad 50 \degree \\
\Delta \lambda & \quad \text{typ.} \quad 30 \text{ nm} \\
\lambda_p & \quad \text{typ.} \quad 565 \text{ nm} \\
CQS95E & \quad I_V \quad \text{min.} \quad 1.6 \text{ mcd} \\
CQS95E-4 & \quad I_V \quad 3.0 \text{ to } 7.0 \text{ mcd} \\
CQS95E-5 & \quad I_V \quad \text{min.} \quad 5.0 \text{ mcd}
\end{align*}
\]
Fig. 2.

Fig. 3  $T_{\text{amb}} = 25^\circ\text{C}$; typ. values.

Fig. 4 Typ. values.

Fig. 5 Typ. values.
Light emitting diode

Fig. 6 Typ. values.

Fig. 7 Typ. values.
LIGHT EMITTING DIODE

Circular light emitting diode with a diameter of 3 mm which emits green light at a typical peak wavelength of 565 nm (GaP; super-green) when forward biased.

The CQS95L has a SOD-82 outline and is encapsulated in a green coloured diffusing resin.

The additional letter L signifies long leads (26 mm).

### QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$</td>
<td>max. 5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>max. 30 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 55 , ^\circ$C</td>
<td>$P_{tot}$</td>
<td>max. 90 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_J$</td>
<td>max. 100 , ^\circ$C</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td>$I_V$</td>
<td>min.</td>
</tr>
<tr>
<td>$I_F = 10 , mA$</td>
<td>COS95L</td>
<td>1,6 mcd</td>
</tr>
<tr>
<td></td>
<td>COS95L-4</td>
<td>3,0 to 7,0 mcd</td>
</tr>
<tr>
<td></td>
<td>COS95L-5</td>
<td>5,0 mcd</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_P$</td>
<td>typ. 565 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$\theta_{1/2}$</td>
<td>typ. 50 , ^\circ</td>
</tr>
</tbody>
</table>
CQS95L

MECHANICAL DATA
Fig. 1 SOD-82A.

Dimensions in mm

- 3.6 ±0.2
- 3.0 ±0.2
- 1.5

- 2.54
- 2 max
- 0.8 max
- 1.1 max
- 1.5
- 26.5 ±1
- 1.0
- 5.5 ±0.2
- 1.45
- 4.1 ±0.3

- a (+)
- k (-)

0.6 ±0.1
(2x)
### 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>Reverse voltage $V_R$ max.</td>
<td>5 V</td>
</tr>
<tr>
<td>Forward current $I_F$ max.</td>
<td>30 mA</td>
</tr>
<tr>
<td>$I_{FRM}$ max.</td>
<td>40 mA</td>
</tr>
<tr>
<td>$I_{i}$ max.</td>
<td>1 A</td>
</tr>
<tr>
<td>$P_{tot}$ max.</td>
<td>90 mW</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb}$ = 55 °C</td>
<td></td>
</tr>
<tr>
<td>Storage temperature $T_{stg}$</td>
<td>-30 to +100 °C</td>
</tr>
<tr>
<td>Junction temperature $T_j$ max.</td>
<td>100 °C</td>
</tr>
<tr>
<td>Lead soldering temperature; $t_{sld}$ &lt; 7 s; $&gt;1.5$ mm from the seating plane $T_{sld}$ max.</td>
<td>260 °C</td>
</tr>
</tbody>
</table>

### THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board $R_{th j-a}$ max. 500 K/W

### CHARACTERISTICS

$T_{amb}$ = 25 °C unless otherwise specified

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Forward voltage $I_F$ = 20 mA</td>
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</tr>
<tr>
<td>$V_F$ typ.</td>
<td>2.2 V</td>
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<tr>
<td>$V_F$ max.</td>
<td>2.8 V</td>
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<tr>
<td>Reverse current $V_R$ = 5 V</td>
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</tr>
<tr>
<td>$I_R$ max.</td>
<td>10 µA</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions $I_F$ = 20 mA</td>
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</tr>
<tr>
<td>$\theta_{1/2}$ typ.</td>
<td>50 °</td>
</tr>
<tr>
<td>Bandwidth at half height $\Delta \lambda$ typ.</td>
<td>30 nm</td>
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<tr>
<td>Wavelength at peak emission $I_F$ = 20 mA</td>
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</tr>
<tr>
<td>$\lambda_p$ typ.</td>
<td>565 nm</td>
</tr>
<tr>
<td>Luminous intensity $I_F$ = 10 mA</td>
<td></td>
</tr>
<tr>
<td>CQS95L</td>
<td>1,6 mcd</td>
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<tr>
<td>CQS95L-4</td>
<td>3,0 to 7,0 mcd</td>
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<tr>
<td>CQS95L-5</td>
<td>5,0 mcd</td>
</tr>
</tbody>
</table>
Fig. 2

Fig. 3 \( T_{\text{amb}} = 25 \, ^\circ\text{C} \); typ. values.

Fig. 4 Typ. values.

Fig. 5 Typ. values.
Fig. 6 Typ. values.

Fig. 7 Typ. values.
LIGHT EMITTING DIODE

Circular light emitting diode with a diameter of 3 mm which emits yellow light at a typical peak wavelength of 590 nm (GaPAs) when forward biased.

The CQS97 has a SOD-82 outline and is encapsulated in a yellow coloured diffusing resin. Together with the CQS93 and CQS95, the CQS97 forms one family.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
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<tbody>
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<td>max. 5 V</td>
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<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>max. 30 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 55 , ^\circ C$</td>
<td>$P_{tot}$</td>
<td>max. 90 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>max. 100 $^\circ C$</td>
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<tr>
<td>Luminous intensity $I_F = 10 , mA$</td>
<td>$I_V$</td>
<td>min. 0,7 mcd</td>
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<td>CQS97</td>
<td>$I_V$</td>
<td>1,0 to 2,2 mcd</td>
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<tr>
<td>CQS97-2</td>
<td>$I_V$</td>
<td>min. 1,6 mcd</td>
</tr>
<tr>
<td>CQS97-3</td>
<td>$\lambda_p$</td>
<td>typ. 590 nm</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>$\theta_{\frac{\pi}{2}}$</td>
<td>typ. 60 $^\circ$</td>
</tr>
</tbody>
</table>

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MECHANICAL DATA

Fig. 1 SOD-82C.

Dimensions in mm

[Diagram with measurements]
RATINGS

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

Continuous reverse voltage
Forward current
   d.c.
      peak value; t_p = 1 μs; f = 300 Hz
      peak value; t_p = 1 ms; δ = 0,33
Total power dissipation up to T_amb = 55 °C
Storage temperature
Junction temperature
Lead soldering temperature; t_sld < 7 s
   > 3 mm from the plastic body

THERMAL RESISTANCE
From junction to ambient when the device is mounted on a p.c. board

CHARACTERISTICS
T_j = 25 °C unless otherwise specified

Forward voltage
Reverse current
Beamwidth at half-intensity directions
Bandwidth at half height
Wavelength at peak emission
Luminous intensity
Fig. 2 Typical values.

Fig. 3 $T_{\text{amb}} = 25 \, ^{\circ}\text{C}$; typ. values.

Fig. 4 $T_{\text{amb}} = 25 \, ^{\circ}\text{C}$; typ. values.
Fig. 6 $I_f = 20 \text{ mA}; T_{\text{amb}} = 25 \degree \text{C};$ typ. values.

Fig. 7 Typical values.
Circular light emitting diode with a diameter of 3 mm which emits yellow light at a typical peak wavelength of 590 nm (GaPAs) when forward biased.

The CQS97E has a SOD-82 outline and is encapsulated in a yellow coloured diffusing resin.

The additional letter E signifies long leads (34 mm)

### QUICK REFERENCE DATA

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<td>Forward current (d.c.)</td>
<td>$I_F$ max. 30 mA</td>
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<tr>
<td>Total power dissipation up to $T_{amb} = 55 \degree C$</td>
<td>$P_{tot}$ max. 90 mW</td>
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<tr>
<td>Junction temperature</td>
<td>$T_J$ max. 100 \degree C</td>
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<tr>
<td>Luminous intensity $I_F = 10$ mA</td>
<td>$I_V$ min. 1.6 mcd</td>
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<td>CQS97E</td>
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</tr>
<tr>
<td>CQS97E-4</td>
<td>$I_V$ 3.0 to 7.0 mcd</td>
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<tr>
<td>CQS97E-5</td>
<td>$I_V$ min. 5.0 mcd</td>
</tr>
<tr>
<td>Wavelength at peak emission $I_F = 20$ mA</td>
<td>$\lambda_p$ typ. 590 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$\theta_{1/2}$ typ. 50 \degree</td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig. 1 SOD-82B.

Dimensions in mm

0.6
±0.1
(2x)

2.54

1.6

3.6
±0.2

3.0
±0.2

1.5

34.5 ± 1

5.1 ± 0.3

5.5 ± 0.2

1.5

2 max

not soldered

1.1 max

1.0

0.6
±0.1
(2x)
Light emitting diode

CQS97E

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

Continuous reverse voltage

\[ V_R \] max. 5 V

Forward current

d.c. \[ I_F \] max. 30 mA
peak value \[ I_{FRM} \] max. 40 mA

Total power dissipation up to \( T_{amb} = 55 \, ^\circ C \)

\[ P_{tot} \] max. 90 mW

Storage temperature

\[ T_{stg} \] -30 to +100 \, ^\circ C

Junction temperature

\[ T_j \] max. 100 \, ^\circ C

Lead soldering temperature; \( t_{sld} < 7 \, s \);

\( > 1,5 \, \text{mm from the seating plane} \)

\[ T_{sld} \] max. 260 \, ^\circ C

THERMAL RESISTANCE

From junction to ambient when the device is mounted

on a p.c. board \( R_{th j-a} \) max. 500 K/W

CHARACTERISTICS

\( T_{amb} = 25 \, ^\circ C \) unless otherwise specified

Forward voltage

\[ I_F = 20 \, mA \]

\[ V_F \] typ. 2.2 V

max. 2.8 V

Reverse current

\[ V_R = 5 \, V \]

\[ I_R \] max. 10 \, \mu A

Beamwidth between half-intensity directions

\[ I_F = 20 \, mA \]

\[ \theta_{1/2} \] typ. 50 \, ^\circ

Bandwidth at half height

\[ \Delta \lambda \] typ. 30 nm

Wavelength at peak emission

\[ I_F = 20 \, mA \]

\[ \lambda_p \] typ. 590 nm

Luminous intensity

\[ I_F = 10 \, mA \]

CQS97E \[ I_V \] min. 1.6 mcd
CQS97E-4 \[ I_V \] 3.0 to 7.0 mcd
CQS97E-5 \[ I_V \] min. 5.0 mcd
Fig. 2.

Fig. 3  $T_{amb} = 25^\circ$; typ. values.

Fig. 4  Typ. values.

Fig. 5  Typ. values.
Fig. 6  $I_F = 20$ mA; $T_{amb} = 25$ °C.

Fig. 7  Typ. values.
LIGHT EMITTING DIODE

Circular light emitting diode with a diameter of 3 mm which emits yellow light at a typical peak wavelength of 590 nm (GaPAs) when forward biased.

The CQS97L has a SOD-82 outline and is encapsulated in a yellow coloured diffusing resin. The additional letter L signifies long leads (26 mm).

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>CQS97L</th>
<th>CQS97L-4</th>
<th>CQS97L-5</th>
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</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>VR</td>
<td>max.</td>
<td>5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>IF</td>
<td>max.</td>
<td>30 mA</td>
</tr>
<tr>
<td>Total power dissipation up to T_{amb} = 55 °C</td>
<td>P_{tot}</td>
<td>max.</td>
<td>90 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>T_j</td>
<td>max.</td>
<td>100 °C</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td>l_V</td>
<td>min.</td>
<td>1.6 mcd</td>
</tr>
<tr>
<td>IF = 10 mA</td>
<td></td>
<td>3,0 to 7,0 mcd</td>
<td></td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>\lambda_p</td>
<td>typ.</td>
<td>590 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>\theta_\frac{1}{2}</td>
<td>typ.</td>
<td>50 °</td>
</tr>
</tbody>
</table>
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)
Reverse voltage
Forward current
  d.c.
    peak value; $t_{\text{ON}} = 1 \text{ ms}; \delta = 0.01$
    peak value; $t_{\text{p}} = 1 \mu\text{s}; f = 300 \text{ Hz}$
Total power dissipation up to $T_{\text{amb}} = 55 ^\circ \text{C}$
Storage temperature
Junction temperature
Lead soldering temperature; $t_{\text{sl}} < 7 \text{ s}$;
  $> 1.5 \text{ mm from the seating plane}$

THERMAL RESISTANCE
From junction to ambient when the device is mounted on a p.c. board

CHARACTERISTICS
$T_{\text{amb}} = 25 ^\circ \text{C}$ unless otherwise specified
Forward voltage
  $I_F = 20 \text{ mA}$
Reverse voltage
  $V_R = 5 \text{ V}$
Beamwidth between half-intensity directions
  $I_F = 20 \text{ mA}$
Bandwidth at half height
  $I_F = 20 \text{ mA}$
Wavelength at peak emission
  $I_F = 20 \text{ mA}$
Luminous intensity
  $I_F = 10 \text{ mA}$

<table>
<thead>
<tr>
<th>Device</th>
<th>$I_V$</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CQS97L-4</td>
<td>min.</td>
<td>3.0 to 7.0 mcd</td>
</tr>
<tr>
<td>CQS97L-5</td>
<td>min.</td>
<td>5.0 mcd</td>
</tr>
<tr>
<td>CQS97L</td>
<td>min.</td>
<td>1.6 mcd</td>
</tr>
</tbody>
</table>
Fig. 2.

Fig. 3 $T_{\text{amb}} = 25\, \text{°C};$ typ. values.

Fig. 4 Typ. values.

Fig. 5 $T_{\text{amb}} = 25\, \text{°C};$ typical values.
Fig. 6 Typical values.

Fig. 7 Typical values.
LIGHT EMITTING DIODE

Rectangular light emitting diode of 5 mm x 2.5 mm which emits red light at a typical peak wavelength of 650 nm (GaAlAs; hyper-red) or green light at a typical peak wavelength of 565 nm (GaP; super-green) depending on the polarity of the current.

The CQT10B has a SOD-76 outline and is encapsulated in a colourless diffusing resin. The SOD-76 envelope enables the CQT10B to be used in configurations together with the CQW10B family.

The bicolour function gives this light emitting block special possibilities e.g.
- as level sensor overdrive indicator or
- as zero point indicator or
- as tuning indicator

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>red</th>
<th>green</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward current (d.c.)</td>
<td>I_F</td>
<td>max.</td>
<td>100 mA</td>
</tr>
<tr>
<td>Total power dissipation up to T_amb = 25 °C</td>
<td>P_tot</td>
<td>max.</td>
<td>215 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>T_j</td>
<td>max.</td>
<td>100 °C</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td>I_v</td>
<td>min.</td>
<td>1.0 mcd</td>
</tr>
<tr>
<td></td>
<td></td>
<td>typ.</td>
<td>1.5 mcd</td>
</tr>
<tr>
<td>Wave length at peak emission</td>
<td>\lambda_p</td>
<td>typ.</td>
<td>650 nm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>565 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>\theta_{1/2}</td>
<td>typ.</td>
<td>100 °</td>
</tr>
</tbody>
</table>
MECHANICAL DATA
Fig. 1 SOD-76A2

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

Forward current
d.c.

<table>
<thead>
<tr>
<th></th>
<th>red</th>
<th>green</th>
</tr>
</thead>
<tbody>
<tr>
<td>I_F (max.)</td>
<td>100 mA</td>
<td>60 mA</td>
</tr>
<tr>
<td>I_FRM (max.)</td>
<td>1 A</td>
<td>150 mA</td>
</tr>
</tbody>
</table>

Total power dissipation up to T_amb = 25 °C

P_tot (max.) = 215 mW

Junction temperature

T_j (max.) = 100 °C

Storage temperature

T_stg (-55 to +100 °C)

Lead soldering temperature

T_sld (max.) = 260 °C

THERMAL RESISTANCE

R_th_ja (max.) = 350 K/W

CHARACTERISTICS

T_amb = 25 °C unless otherwise specified

Forward voltage

<table>
<thead>
<tr>
<th></th>
<th>red</th>
<th>green</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_F (typ.)</td>
<td>1,75 V</td>
<td>2,2 V</td>
</tr>
<tr>
<td>V_F (max.)</td>
<td>2,1 V</td>
<td>3,0 V</td>
</tr>
</tbody>
</table>

Beamwidth between half-intensity directions

\( \theta_{1/2} \) (typ.) = 100 °

Wavelength at peak emissions

\( \lambda_p \) (typ.) = 650 nm

Capacitance

C_d (typ.) = 100 pF

Luminous intensity

<table>
<thead>
<tr>
<th></th>
<th>red</th>
<th>green</th>
</tr>
</thead>
<tbody>
<tr>
<td>I_V (min.)</td>
<td>1,0 mcd</td>
<td>1,5 mcd</td>
</tr>
</tbody>
</table>

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Fig. 2.

Fig. 3 \( T_{\text{amb}} = 25^\circ \text{C}; \) typ values.

Fig. 4 \( t_{\text{on}} = 20 \mu \text{s}; \) \( \delta = 0.01; \) 
\( T_{\text{amb}} = 25^\circ \text{C}; \) typical values.

Fig. 5 \( I_F = 10 \text{ mA}; \) typical values.

Fig. 6 \( t_p = 50 \mu \text{s}; \) typ. values.

Fig. 7 \( t_p = 50 \mu \text{s}; \) typ. values.
Fig. 8 Typical values.

Fig. 9 $I_F = 10$ mA; typical values.

Fig. 10 Typical values.
LIGHT EMITTING DIODE

Circular light emitting diode with a diameter of 5 mm which emits red light at a typical peak wavelength of 650 nm (GaAlAs; hyper-red) or green light at a typical peak wavelength of 565 nm (GaP; super-green) depending on the polarity of the current.

The CQT24 has a SOD-63 outline and is encapsulated in a clear diffusing resin. Because of its resistance to high forward currents, the CQT24 is suitable for high $I_v$ applications, for example, moving information display panels.

Other applications are:
- mains indicator
- temperature indicator
- motor control indicator

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse current</td>
<td>$V_R$</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$ max.</td>
</tr>
<tr>
<td>red</td>
<td>100 mA</td>
</tr>
<tr>
<td>green</td>
<td>60 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 25 \degree C$</td>
<td>$P_{tot}$ max.</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_J$ max.</td>
</tr>
<tr>
<td></td>
<td>100 \degree C</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td>$I_v$ min.</td>
</tr>
<tr>
<td>red at $I_F = 10 \text{ mA}$</td>
<td>3 mcd</td>
</tr>
<tr>
<td>green at $I_F = 20 \text{ mA}$</td>
<td>3 mcd</td>
</tr>
<tr>
<td></td>
<td>$I_v$ typ.</td>
</tr>
<tr>
<td></td>
<td>10 mcd</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_p$ typ.</td>
</tr>
<tr>
<td>red</td>
<td>565 nm</td>
</tr>
<tr>
<td>green</td>
<td></td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$\theta_{1/2}$ typ.</td>
</tr>
</tbody>
</table>

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MECHANICAL DATA
Fig. 1 SOD-63A2.

Dimensions in mm

1,0 min 12,7 min 12,4
5,7
8,8
8,1

0,56 0,45

anode green

0,56 0,45

anode red

1,30 1,10

14,0 min

0,56 0,45

unflattened base plane

7286999.1
**RATINGS**

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

Forward current (d.c.)
- red: $I_F$ max. 100 mA
- green: $I_F$ max. 60 mA

Forward current
- peak value; $t_p = 1$ μs; $f = 300$ Hz: $I_{FRM}$ max. 1 A
- peak value; $t_{ON} = 1$ ms; $\delta = 0,33$: $I_{FRM}$ max. 150 mA

Total power dissipation up to $T_{amb} = 25$ °C
- $P_{tot}$ max. 215 mW

Junction temperature $T_j$ max. 100 °C

Storage temperature $T_{stg}$ -55 to +100 °C

Lead soldering temperature
- $T_{sld}$ max. 260 °C

**THERMAL RESISTANCE**
From junction to ambient when the device is mounted on a p.c. board
- $R_{th j-a}$ max. 350 K/W

**CHARACTERISTICS**

$T_{amb} = 25$ °C unless otherwise specified

Forward voltage
- red: at $I_F = 10$ mA: $V_F$ typ. 1.75 V, max. 2.2 V
- green: at $I_F = 20$ mA: $V_F$ typ. 2.1 V, max. 3.0 V

Beamwidth between half-intensity directions
at $I_F = 10$ mA (in the plane of the leads)
- $\theta_{1/2}$ typ. 70 °

Wavelength at peak emissions
at $I_F = 10$ mA
- red: $\lambda_p$ typ. 650 nm
- green: $\lambda_p$ typ. 565 nm

Diode capacitance
at $V_R = 0$; $f = 1$ MHz
- $C_d$ typ. 160 pF

Luminous intensity
red at $I_F = 10$ mA
- $I_V$ min. 3 mcd
- $I_V$ typ. 10 mcd

red at $I_F = 10$ mA
- $I_V$ min. 3 mcd
- $I_V$ typ. 10 mcd
Fig. 2. 

Fig. 3. \( T_{\text{amb}} = 25^\circ \text{C} \); typ. values.

Fig. 4. \( t_{\text{on}} = 20 \mu\text{s}; \delta = 0.01; \) 
\( T_{\text{amb}} = 25^\circ \text{C} \); typical values.

Fig. 5. \( I_F = 10 \text{ mA} \); typical values.

Fig. 6. \( t_p = 50 \mu\text{s} \); typ. values.

Fig. 7. \( t = 50 \mu\text{s} \); typical values.
Light emitting diode

Fig. 8 Typical values.

Fig. 9 $I_F = 10$ mA; typical values.

Fig 10 $I_F = 10$ mA; typical values.
LIGHT EMITTING DIODE

Rectangular light emitting diode of 5 mm x 1 mm which emits red light at a typical peak wavelength of 650 nm (GaAlAs; hyper-red) or green light at a typical peak wavelength of 565 nm (GaP; super-green) depending on the polarity of the current.

The CQT60 has a SOD-75 outline and is encapsulated in a colourless diffusing resin. Because of its SOD-75 envelope, the CQT60 can be used in configurations together with the CQW60 family.

The bicolour function gives this light emitting device special application possibilities, e.g.

- as level sensor overdrive indicator
- as zero point indicator
- as tuning indicator

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Forward current (d.c.)</strong></td>
<td></td>
</tr>
<tr>
<td>red</td>
<td>$I_F$ max. 100 mA</td>
</tr>
<tr>
<td>green</td>
<td>$I_F$ max. 60 mA</td>
</tr>
<tr>
<td><strong>Total power dissipation up to $T_{amb} = 25^\circ C$</strong></td>
<td>$P_{tot}$ max. 215 mW</td>
</tr>
<tr>
<td><strong>Junction temperature</strong></td>
<td>$T_j$ max. 100 °C</td>
</tr>
<tr>
<td><strong>Luminous intensity</strong></td>
<td></td>
</tr>
<tr>
<td>red at $I_F = 10$ mA</td>
<td>$L_v$ min. 1.0 mcd</td>
</tr>
<tr>
<td>green at $I_F = 20$ mA</td>
<td>$L_v$ typ. 1.5 mcd</td>
</tr>
<tr>
<td><strong>Wavelength at peak emission</strong></td>
<td></td>
</tr>
<tr>
<td>red</td>
<td>$\lambda_p$ typ. 650 nm</td>
</tr>
<tr>
<td>green</td>
<td>$\lambda_p$ typ. 565 nm</td>
</tr>
<tr>
<td><strong>Beamwidth between half-intensity directions</strong></td>
<td>$\theta_{\frac{1}{2}}$ typ. 110 °</td>
</tr>
</tbody>
</table>

June 1985
CQT60

MECHANICAL DATA

Fig. 1 SOD-7582

Dimensions in mm

[Diagram with dimensions and labels]
RATINGS

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

Forward current
red 
IF max. 100 mA
green 
IF max. 60 mA

Forward current
peak value; \( t_p = 1 \mu s \); \( f = 300 \text{ Hz} \)
peak value, \( t_{on} = 1 \text{ ms} \); \( \delta = 0,33 \)

IFRM max. 1 A

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

PTot max. 215 mW

Junction temperature

Tj max. 100 °C

Storage temperature

Tstg -55 to +100 °C

Lead soldering temperature

Tslid max. 260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board

Rth j-a max. 350 K/W

CHARACTERISTICS

\( T_{amb} = 25 \text{ °C} \) unless otherwise specified

Forward voltage
red at \( I_F = 10 \text{ mA} \)
\( V_F \) typ. 1,75 V
max. 2,2 V
green at \( I_F = 20 \text{ mA} \)
\( V_F \) typ. 2,1 V
max. 3,0 V

Beamwidth between half-intensity directions
at \( I_F = 10 \text{ mA} \)
\( \theta_\frac{1}{2} \) typ. 110 °

Wavelength at peak emission
at \( I_F = 10 \text{ mA} \)
red
\( \lambda_p \) typ. 650 nm
green
\( \lambda_p \) typ. 565 nm

Luminous intensity
red at \( I_F = 10 \text{ mA} \)
\( I_V \) min. 1,0 mcd
green at \( I_V = 20 \text{ mA} \)
\( I_V \) typ. 1,5 mcd

Diode capacitance
at \( V_R = 0; f = 1 \text{ MHz} \)
\( C_d \) typ. 100 pF
Fig. 2.

Fig. 3 \( T_{\text{amb}} = 25 \, ^\circ\text{C} \); typ. values.

Fig. 4 \( t_{\text{on}} = 20 \, \mu\text{s}; \delta = 0.01; \)
\( T_{\text{amb}} = 25 \, ^\circ\text{C} \); typical values.

Fig. 5 \( I_F = 10 \, \text{mA} \); typical values.

Fig. 6 \( t_p = 50 \, \mu\text{s} \); typ. values.

Fig. 7 \( t_p = 50 \, \mu\text{s} \); typ. values.
Light emitting diode

Fig. 8 Typical values.

Fig. 9 $I_F = 10$ mA; typical values.

Fig. 10 $I_F = 10$ mA; typical values.
LIGHT EMITTING DIODE

Rectangular light emitting diode of 5 mm x 3 mm which emits red light at a typical peak wavelength of 650 nm (GaAlAs; hyper-red) or green light at a typical peak wavelength of 565 nm (GaP; super-green) depending on the polarity of the current.

The CQT70 has a SOD-77 outline and is encapsulated in a colourless diffusing resin. Because of its SOD-77 envelope, the CQT70 can be used in configurations together with the CQV70 family.

The bicolour function gives this light emitting device special application possibilities, e.g.

- as level sensor overdrive indicator
- as zero point indicator
- as tuning indicator
- as temperature indicator
- for motor control
- in bicolour information panels

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward current (d.c.)</td>
<td>I_F</td>
<td>max. 100 mA</td>
</tr>
<tr>
<td>red</td>
<td></td>
<td>max. 60 mA</td>
</tr>
<tr>
<td>green</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total power dissipation up to T_amb = 25 °C</td>
<td>P_tot</td>
<td>max. 215 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>T_j</td>
<td>max. 100 °C</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td>I_L</td>
<td>min. 1.0 mcd</td>
</tr>
<tr>
<td>red at I_F = 20 mA</td>
<td></td>
<td>typ. 1.5 mcd</td>
</tr>
<tr>
<td>green at I_F = 20 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>\lambda_p</td>
<td>typ. 650 nm</td>
</tr>
<tr>
<td>red</td>
<td></td>
<td></td>
</tr>
<tr>
<td>green</td>
<td></td>
<td>typ. 565 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions in the plane of the leads</td>
<td>\theta_{1/2}</td>
<td>typ. 110 °</td>
</tr>
</tbody>
</table>
MECHANICAL DATA
Fig. 1 SOD-77A2.

Dimensions in mm

1,0 min
12,7 min
13,3
12,5
10,1
9,6
5,4
5,2
2,54
0,56
0,45
0,9
0,56
0,45
1,3
1,1
5,7
5,3
14,0 min
0,56
0,45
unflat base plane
3,5
3,1
3,2
3,0
Light emitting diode

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

Forward current (d.c.)
- red: IF max. 100 mA
- green: IF max. 60 mA

Forward current
- peak value; t_p = 1 µs; f = 300 Hz
- peak value; t_on = 1 ms; δ = 0.33

Total power dissipation up to T_amb = 35 °C
- P_tot max. 215 mW

Junction temperature
- T_j max. 100 °C

Storage temperature
- T_stg -55 to +100 °C

Lead soldering temperature
- T_slid max. 260 °C

THERMAL RESISTANCE
From junction to ambient when the device is mounted on a p.c. board
- R_θ_j-a max. 350 K/W

CHARACTERISTICS
T_amb = 25 °C unless otherwise specified

Forward voltage
- red at I_F = 10 mA: V_F typ. 1.75 V
- green at I_F = 20 mA: V_F typ. 2.1 V

Beamwidth between half-intensity directions
- at I_F = 10 mA: θ_1/2 typ. 110 °

Wavelength at peak emission
- red at I_F = 10 mA: λ_p typ. 650 nm
- green: λ_p typ. 565 nm

Luminous intensity
- red at I_F = 10 mA: I_v min. 1.0 mcd
- green at I_v = 20 mA: I_v typ. 1.5 mcd

Diode capacitance
- at V_R = 0; f = 1 MHz: C_d 100 pF
Fig. 2. $P_{tot}$ vs. Tamb ($^\circ$C). $\eta_{red} = 560$ K/W. Drawn up to 50°C.

Fig. 3. $T_{amb} = 25^\circ$C; typ. values.

Fig. 4. $t_{on} = 20 \mu s; \delta = 0.01$; $T_{amb} = 25^\circ$C, typ. values.

Fig. 5. $I_F = 10$ mA; typical values.

Fig. 6. $t_p = 50 \mu s$; typ. values.

Fig. 7. $t_p = 50 \mu s$; typ. values.
Light emitting diode

CQT70

Fig. 8 Typical values.

Fig. 9 $I_F = 10$ mA; typical values.

Fig. 10 $I_F = 10$ mA; typical values.

Note. Formerly known as the CQT10.
LIGHT EMITTING DIODE

Rectangular light emitting diode of 5 mm x 5 mm which emits red light at a typical peak wavelength of 650 nm (GaAlAs; hyper-red) or green light at a typical peak wavelength of 565 nm (GaP; super-green) depending on the polarity of the current. The CQT80L has a SOD-74L envelope and is encapsulated in a clear diffusing resin.

Because of its high $I_V$ the CQT80L is suitable for applications where only low currents are available. The CQT80L is suitable for surface illumination such as announcing boards, score boards, moving advertisements and electronic games applications. A third colour (orange) is available when an alternating current is applied.

QUICK REFERENCE DATA

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward current (d.c.)</td>
<td></td>
</tr>
<tr>
<td>red</td>
<td>$I_F$ max. 100 mA</td>
</tr>
<tr>
<td>green</td>
<td>$I_F$ max. 60 mA</td>
</tr>
<tr>
<td>Total power dissipation</td>
<td>$P_{tot}$ max. 215 mW</td>
</tr>
<tr>
<td>up to $T_{amb} = 25 \degree C$</td>
<td></td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_J$ max. 100 °C</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td>$I_V$ min. 1.0 mcd</td>
</tr>
<tr>
<td>red at $I_F = 10$ mA</td>
<td>typ. 2.0 mcd</td>
</tr>
<tr>
<td>green at $I_F = 20$ mA</td>
<td></td>
</tr>
<tr>
<td>Wavelength at peak</td>
<td>$\lambda_p$ typ. 650 nm</td>
</tr>
<tr>
<td>emission</td>
<td></td>
</tr>
<tr>
<td>red</td>
<td>$\lambda_p$ typ. 565 nm</td>
</tr>
<tr>
<td>green</td>
<td></td>
</tr>
<tr>
<td>Beamwidth between</td>
<td>$\theta_{1/2}$ typ. 100 °</td>
</tr>
<tr>
<td>half-intensity directions</td>
<td></td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig. 1 SOD-74L.

Dimensions in mm

Note. Solderability not guaranteed in tie-bar zone.
RATINGS

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

Forward current (d.c.)
- red
  - $I_F$ max. 100 mA
- green
  - $I_F$ max. 60 mA

Forward current
- peak value; $t_p = 1 \mu s; f = 300$ Hz
- peak value; $t_{on} = 1$ ms; $\delta = 0,33$

Peak forward current
- $I_{FRM}$ max. 1 A
- $P_{tot}$ max. 215 mW

Total power dissipation up to $T_{amb} = 25$ °C

Storage temperature
- $T_{stg}$ -55 to +100 °C

Junction temperature
- $T_j$ max. 100 °C

Lead soldering temperature
- > 5,0 mm from the plastic body; $t_{sld} < 7$ s

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board

$R_{th \; j-a}$ max. 350 K/W

CHARACTERISTICS

$T_{amb} = 25$ °C unless otherwise specified

Forward voltage
- red at $I_F = 10$ mA
  - $V_F$ typ. 1,75 V
  - $V_F$ max. 2,2 V
- green at $I_F = 20$ mA
  - $V_F$ typ. 2,1 V
  - $V_F$ max. 3,0 V

Beamwidth between half-intensity directions
- $I_F = 10$ mA
  - $\theta_{1/2}$ typ. 100 °

Wavelength at peak emission at $I_F = 10$ mA
- red
  - $\lambda_p$ typ. 650 nm
- green
  - $\lambda_p$ typ. 565 nm

Luminous intensity
- red at $I_F = 10$ mA
  - $I_v$ min. 1,0 mcd
  - $I_v$ typ. 2,0 mcd
- green at $I_F = 20$ mA

Diode capacitance
- $V_R = 0; f = 1$ MHz
  - $C_d$ typ. 100 pF

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Fig. 2.

Fig. 3 \( T_{\text{amb}} = 25 \, ^\circ\text{C} \); typ. values.

Fig. 4 \( t_{\text{on}} = 20 \, \mu\text{s} \); \( \delta = 0.01 \); \( T_{\text{amb}} = 25 \, ^\circ\text{C} \); typical values.

Fig. 5 \( I_F = 10 \, \text{mA} \); typical values.

Fig. 6 \( t_p = 50 \, \mu\text{s} \); typ. values.

Fig. 7 \( t_p = 50 \, \mu\text{s} \); typ. values.
Fig. 8 Typical values.

Fig. 9 $I_F = 10 \text{ mA}$; typ. values.

Fig. 10 Typical values.
LIGHT EMITTING DIODES

Rectangular light emitting diodes with a diameter of 5 mm x 3 mm which emit red light at a typical peak wavelength of 630 nm (GaAsP/GaP; super-red) when forward biased. The CQV70 and CQV70L have a SOD-77 envelope and are encapsulated in a red diffusing resin.

When stacked in an array these SOD-77 LEDs can be used as level indicators. The CQV70L is similar to the CQV70 but has long leads and has no seating plane.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Continuous reverse voltage</th>
<th>V_R</th>
<th>max.</th>
<th>5 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward current (d.c.)</td>
<td>I_F</td>
<td>max.</td>
<td>30 mA</td>
</tr>
<tr>
<td>Total power dissipation up to T_amb = 65 °C</td>
<td>P_tot</td>
<td>max.</td>
<td>90 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>T_j</td>
<td>max.</td>
<td>100 °C</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I_F = 10 mA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COV70(L)</td>
<td>I_v</td>
<td>min.</td>
<td>0,7 mcd</td>
</tr>
<tr>
<td>COV70(L)-2</td>
<td>I_v</td>
<td>typ.</td>
<td>1,0 to 2,2 mcd</td>
</tr>
<tr>
<td>COV70(L)-3</td>
<td>I_v</td>
<td></td>
<td>1,6 to 3,5 mcd</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I_F = 10 mA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>λ_p</td>
<td>typ.</td>
<td>630 nm</td>
<td></td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions in the plane of the leads, I_F = 10 mA</td>
<td>( \theta_{\frac{1}{2}} )</td>
<td>typ.</td>
<td>100 °</td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig. 1 SOD-77A1.
CQV70.

Fig. 1b SOD-77L.
CQV70L.

Dimensions in mm

Note: Solderability not guaranteed in tie-bar zone.
Light emitting diodes

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

Reverse voltage
\[ V_R \] max. 5 V

Forward current
\[ I_F \] max. 30 mA
\[ I_{FRM} \] max. 60 mA

Total power dissipation up to \( T_{amb} = 65 \, ^\circ C \)
\[ P_{tot} \] max. 90 mW

Storage temperature
\[ T_{stg} \] -55 to +100 \, ^\circ C

Junction temperature
\[ T_j \] max. 100 \, ^\circ C

Lead soldering temperature at \( t_{sld} < 7 \, s \)
> 1,5 mm from the seating plane for CQV70
> 5 mm from the plastic body for CQV70L
\[ T_{sld} \] max. 260 \, ^\circ C

THERMAL RESISTANCE
From junction to ambient when the device is mounted on a p.c. board
\[ R_{th \, j-a} \] max. 350 K/W

CHARACTERISTICS

\( T_j = 25 \, ^\circ C \) unless otherwise specified

Forward voltage
\[ I_F = 10 \, mA \]
\[ V_F \] typ. 2,1 V
\[ VF \] max. 3,0 V

Reverse current
\[ V_R = 5 \, V \]
\[ I_R \] max. 100 \, \mu A

Beamwidth between half-intensity directions in the plane of the leads; \( I_F = 10 \, mA \)
\[ \theta_{1/2} \] typ. 100 \, \degree

Bandwidth at half height
\[ \Delta \lambda \] typ. 45 nm

Wavelength at peak emission
\[ I_F = 10 \, mA \]
\[ \lambda_p \] typ. 630 nm

Luminous intensity
\[ I_F = 10 \, mA \]
\[ CQV70(L) \] \[ I_v \] min. 0,7 mcd
\[ CQV70(L)-2 \] \[ I_v \] 1,0 to 2,2 mcd
\[ CQV70(L)-3 \] \[ I_v \] 1,6 to 3,5 mcd

Diode capacitance
\[ V_R = 0; \, f = 1 \, MHz \]
\[ C_d \] typ. 10 pF
Fig. 2.  

Fig. 3.  

Fig. 4.  

Fig. 5.  Typical values.  

Fig. 6.  

Fig. 7.  

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Fig. 8 \( I_F = 10 \text{ mA}; T_{\text{amb}} = 25 \, ^\circ\text{C}; \) typical values.

Fig. 9 Typical values.
LIGHT Emitting Diodes

Rectangular light emitting diodes of 5 mm x 3 mm which emit red light at a typical peak wavelength of 650 nm (GaAlAs, hyper-red) when forward biased. The CQV70A and CQV70AL have SOD-77 envelopes and are encapsulated in a red diffusing resin. Its high luminosity enables the CQV70A to be used in applications where only low currents are available and because of its high \( I_{F\text{max}} \) it can be used in high \( I_V \) applications.

These SOD-77 LEDs, when stacked in an array, can be used as level indicators. The CQV70AL is similar to the CQV70A but has long leads and has no seating plane.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>( V_R ) max. 5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>( I_F ) max. 100 mA</td>
</tr>
<tr>
<td>Total power dissipation up to ( T_{\text{Amb}} = 25 \degree C )</td>
<td>( P_{\text{tot}} ) max. 215 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>( T_J ) max. 100 \degree C</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td></td>
</tr>
<tr>
<td>( I_F = 10 \text{ mA} ) CQV70A(L)</td>
<td>( I_V ) min. 0.7 mcd</td>
</tr>
<tr>
<td>( I_F = 10 \text{ mA} ) CQV70A(L)-3</td>
<td>( I_V ) 1.6 to 3.5 mcd</td>
</tr>
<tr>
<td>( I_F = 10 \text{ mA} ) CQV70A(L)-4</td>
<td>( I_V ) 3.0 to 7.0 mcd</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>( \lambda_p ) typ. 650 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions in the plane of the leads; ( I_F = 10 \text{ mA} )</td>
<td>( \theta_\frac{1}{2} ) typ. 100 \degree</td>
</tr>
</tbody>
</table>

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MECHANICAL DATA

Fig. 1a SOD-77A2.
CQV70A.

Fig. 1b SOD-77L.
CQV70AL.

Note: Solderability not guaranteed in tie-bar zone.

Dimensions in mm

- Anode green: 0.56, 0.45, 0.9
- Anode red: 0.56, 0.45, 1.1
- 1.0 min
- 12.7 min
- 13.3 min
- 12.5 min
- 10.1 min
- 9.6 min
- 5.4 mm
- 5.2 mm
- 3.2 mm
- 3.0 mm
- 3.5 mm
- 3.1 mm

Unflat base plane

Note: Solderability not guaranteed in tie-bar zone.
Light emitting diodes

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

Reverse voltage
Forward current
d.c.
peak value; \( t_p = 1 \mu s; f = 300 \text{ Hz} \)
peak value; \( t_{on} = 20 \mu s; \delta = 0,01 \)

Total power dissipation up to \( T_{amb} = 25^\circ \text{C} \)
Storage temperature
Junction temperature
Lead soldering temperature at \( \tau_{sld} < 7 \text{ s} \)
> 1,5 mm from the seating plane for CQV70A
> 5 mm from the plastic body for CQV70AL

THERMAL RESISTANCE
From junction to ambient when the device is mounted on a p.c. board

CHARACTERISTICS
\( T_j = 25^\circ \text{C} \) unless otherwise specified

Forward voltage
Reverse current

Beamwidth between half-intensity directions

Bandwidth at half height

Wavelength at peak emission

Luminous intensity

Diode capacitance

---

\( V_R \) max. \( 5 \text{ V} \)
\( I_F \) max. \( 100 \text{ mA} \)
\( I_{FRM} \) max. \( 1 \text{ A} \)
\( P_{tot} \) max. \( 215 \text{ mW} \)
\( T_{stg} \) –55 to +100 \( ^\circ \text{C} \)
\( T_{j} \) max. \( 100 \text{ \( ^\circ \text{C} \)} \)
\( T_{sld} \) max. \( 260 \text{ \( ^\circ \text{C} \)} \)

\( R_{th \ j-a} \) max. \( 350 \text{ K/W} \)

\( V_f \) typ. \( 1,75 \text{ V} \)
max. \( 2,2 \text{ V} \)

\( I_R \) max. \( 100 \mu \text{A} \)

\( \theta_{\frac{1}{2}} \) typ. \( 100^\circ \)

\( \Delta \lambda \) typ. \( 20 \text{ nm} \)

\( \lambda_p \) typ. \( 650 \text{ nm} \)

\( I_I \) min. \( 0,7 \text{ mcd} \)

\( I_{V} \) 1,6 to 3,5 mcd

\( I_V \) 3,0 to 7,0 mcd

\( C_d \) typ. \( 80 \text{ pF} \)
Fig. 2

Fig. 3 \( T_{\text{amb}} = 25^\circ\text{C}; \) typ. values.

Fig. 4 \( t_{\text{on}} = 20 \mu\text{s}; \delta = 0.01; \) typ. values.

Fig. 5 \( I_F = 10 \text{ mA}; \) typ. values.

Fig. 6 Typical values.

Fig. 7 \( t_D = 50 \mu\text{s}; \) typ. values.
Light emitting diodes

Fig. 8 $I_F = 10$ mA; $T_{amb} = 25$ °C; typ. values.

Fig. 9 Typical values.
LIGHT EMITTING DIODES

Rectangular light emitting diodes of 5 mm x 3 mm which emit red light at a typical peak wavelength of 700 nm (GaP:ZnO; ultra-red) when forward biased.

The CQV70U and CQV70UL have a SOD-77 outline and are encapsulated in a red diffusing resin.

The CQV70UL is similar to the CQV70U but has longer leads and no seating plane.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse voltage</td>
<td>$V_R$</td>
<td>max. 5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>max. 30 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 65 , ^\circ C$</td>
<td>$P_{tot}$</td>
<td>max. 90 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>max. 100 °C</td>
</tr>
<tr>
<td>Luminous intensity at $I_F = 10$ mA</td>
<td>$I_L$</td>
<td>min. 0.7 mcd</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_p$</td>
<td>typ. 700 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$\theta_{1/2}$</td>
<td>typ. 100 °</td>
</tr>
</tbody>
</table>
Note: Solderability not guaranteed in tie-bar zone.
RATINGS

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

Reverse voltage $V_R$ max. 5 V

Forward current

- d.c. peak value; $t_p = 1 \mu s; f = 300$ Hz
- peak value; $t_{on} = 1$ ms; $\delta = 0.33$

Forward current

- $I_F$ max. 30 mA
- $I_{FRM}$ max. 1 A
- $I_{FRM}$ max. 60 mA

Total power dissipation up to $T_{amb} = 25$ °C

Junction temperature $T_J$ max. 100 °C

Storage temperature $T_{stg}$

Lead soldering temperature

- $> 1.5$ mm from the seating plane; $t_{sld} < 7$ s COV70U
- $> 5$ mm from the seating plane; $t_{sld} < 7$ s COV70UL

Thermal resistance

From junction to ambient when the device is mounted on a p.c. board $R_{thj-a}$ max. 350 K/W

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board $R_{thj-a}$ max. 350 K/W

CHARACTERISTICS

$T_{amb} = 25$ °C unless otherwise specified

Forward voltage

- at $I_F = 10$ mA $V_F$ typ. 2.0 V
- at $I_F = 10$ mA $V_F$ max. 2.6 V

Reverse current

- at $V_R = 5$ V $I_R$ max. 100 $\mu$A

Beamwidth between half-intensity directions

- at $I_F = 10$ mA $\theta_\frac{1}{2}$ typ. 100 °

Wavelength at peak emission

- at $I_F = 10$ mA $\lambda_p$ typ. 700 nm

Capacitance

- at $V_R = 0; f = 1$ MHz $C_d$ typ. 45 pF

Bandwidth at half height

- typ. 90 nm

Luminous intensity

- at $I_F = 10$ mA COV70U(L) $I_v$ min. 0.7 mcd
- COV70U(L)-2 $I_v$ 1.0 to 2.2 mcd
- COV70U(L)-3 $I_v$ 1.6 to 3.5 mcd
Fig. 2 Typical values.

Fig. 3 Typical values.

Fig. 4 Typical values.

Fig. 5 Typical values.

Fig. 6 Typical values.

Fig. 7 Typical values.
Fig. 8 Typical values.
LIGHT EMITTING DIODES

Rectangular light emitting diodes of 5 mm x 3 mm which emit green light at a typical peak wavelength of 565 nm (GaP, super-green) when forward biased. The CQV71A and CQV71AL have SOD-77 envelopes and are encapsulated in a green diffusing resin.

When stacked in an array these SOD-77 LEDs can be used as level indicators.
The CQV71AL is similar to the CQV71A but has long leads and has no seating plane.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$</td>
<td>max. 5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>max. 60 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 35 \degree C$</td>
<td>$P_{tot}$</td>
<td>max. 180 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>max. 100 \degree C</td>
</tr>
</tbody>
</table>
| Luminous intensity  
  $I_F = 10$ mA                                | $I_V$  | min. 0.7 mcd |
  CQV71A(L)                                      |        |        |
  CQV71A(L)-2                                    |        | 1,0 to 2,2 mcd |
  CQV71A(L)-3                                    |        | 1,6 to 3,5 mcd |
| Wavelength at peak emission  
  $I_F = 10$ mA                                 | $\lambda_p$ | typ. 565 nm |
| Beamwidth between half-intensity directions  
  in the plane of the leads; $I_F = 10$ mA     | $\theta_{1/2}$ | typ. 100 \degree |
MECHANICAL DATA

Fig. 1a SOD-77A1.
CQV71A.

Dimensions in mm

Fig. 1b SOD-77L.
CQV71AL.

Note: Solderability not guaranteed in tie-bar zone.
Light emitting diodes

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

Reverse voltage
Forward current
  d.c.
    peak value; $t_p = 1 \ \mu s; \ f = 300 \ Hz$
    peak value; $t_{on} = 1 \ \text{ms}; \ \delta = 0,01$

Total power dissipation up to $T_{amb} = 35 \ ^\circ C$
Storage temperature
Junction temperature
Lead soldering temperature at $t_{sld} < 7 \ \text{s}$
  $> 1,5 \ \text{mm}$ from the seating plane for COV71A
  $> 5 \ \text{mm}$ from the plastic body for COV71AL

THERMAL RESISTANCE
From junction to ambient when the device is mounted on a p.c. board

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

Forward voltage
  $I_F = 10 \ \text{mA}$
Reverse current
  $V_R = 5 \ \text{V}$
Beamwidth between half-intensity directions in the plane of the leads; $I_F = 10 \ \text{mA}$
Bandwith at half height
Wavelength at peak emission
Luminous intensity
  $I_F = 10 \ \text{mA}$
Diode capacitance
  $V_R = 0; \ f = 1 \ \text{MHz}$

CQV71A
CQV71AL

<table>
<thead>
<tr>
<th></th>
<th>CQV71A</th>
<th>CQV71A(L)</th>
<th>CQV71A(L)-2</th>
<th>CQV71A(L)-3</th>
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</thead>
<tbody>
<tr>
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<td>100 $\mu A$</td>
<td>100 $\mu A$</td>
<td>100 $\mu A$</td>
<td>100 $\mu A$</td>
</tr>
<tr>
<td>$\theta_{1/2}$ typ.</td>
<td>100 $^\circ$</td>
<td>100 $^\circ$</td>
<td>100 $^\circ$</td>
<td>100 $^\circ$</td>
</tr>
<tr>
<td>$\Delta \lambda$ typ.</td>
<td>30 nm</td>
<td>30 nm</td>
<td>30 nm</td>
<td>30 nm</td>
</tr>
<tr>
<td>$\lambda_p$ typ.</td>
<td>565 nm</td>
<td>565 nm</td>
<td>565 nm</td>
<td>565 nm</td>
</tr>
<tr>
<td>$I_V$ min.</td>
<td>0,7 mcd</td>
<td>0,7 mcd</td>
<td>0,7 mcd</td>
<td>0,7 mcd</td>
</tr>
<tr>
<td>$I_V$ max.</td>
<td>1,0 to 2,2 mcd</td>
<td>1,0 to 2,2 mcd</td>
<td>1,0 to 2,2 mcd</td>
<td>1,0 to 2,2 mcd</td>
</tr>
<tr>
<td>$I_V$ max.</td>
<td>1,6 to 3,5 mcd</td>
<td>1,6 to 3,5 mcd</td>
<td>1,6 to 3,5 mcd</td>
<td>1,6 to 3,5 mcd</td>
</tr>
<tr>
<td>$C_d$ typ.</td>
<td>20 pF</td>
<td>20 pF</td>
<td>20 pF</td>
<td>20 pF</td>
</tr>
</tbody>
</table>

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Fig. 2. $P_{\text{tot}}$ vs. $T_{\text{amb}}$.

Fig. 3. $T_{\text{amb}} = 25^\circ\text{C}$; typical values.

Fig. 4. $t_{\text{on}} = 1\text{ ms}$; $\delta = 0.01$; $T_j = 25^\circ\text{C}$; typical values.

Fig. 5. Typical values.

Fig. 6. $I_F = 10\text{ mA}$; typ. values.

Fig. 7. $t_p = 50\mu\text{s}$; typical values.
Fig. 8 Typical values.

Fig. 9 Typical values.
LIGHT EMITTING DIODES

Rectangular light emitting diodes of 5 mm × 3 mm which emit yellow light at a typical wavelength of 590 nm (GaPAs) when forward biased. The CQV72 and CQV72L have a SOD-77 envelope and are encapsulated in a yellow diffusing resin.

The CQV72L is the long lead version (26 mm) and has no seating plane but is in all other respects equal to the CQV72.

When stacked in an array these LEDs can be used as level indicators etc.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$</td>
<td>max. 5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>max. 30 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 65 , ^{\circ}C$</td>
<td>$P_{tot}$</td>
<td>max. 90 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>max. 100 °C</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td>$I_v$</td>
<td>min. 0.7 mcd</td>
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<tr>
<td></td>
<td>CQV72(L)</td>
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<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_p$</td>
<td>typ. 590 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$\theta_{1/2}$</td>
<td>typ. 100 °</td>
</tr>
<tr>
<td>in the plane of the leads; $I_F = 10$ mA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig 1a SOD-77A1.
CQV72.

Fig. 1b SOD-77L.
CQV72L.

Dimensions in mm

Note. Solderability not guaranteed in tie-bar zone.
Light emitting diodes

RATINGS

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

Reverse voltage \( V_R \)  max. 5 V

Forward current

- d.c. peak value; \( t_p = 1 \mu s; f = 300 \text{ Hz} \)
  \( I_F \)  max. 30 mA

- peak value; \( t_{on} = 1 \text{ ms}; \delta = 0.33 \)
  \( I_{FRM} \)  max. 60 mA

Total power dissipation up to \( T_{amb} = 65 \text{ °C} \)

- \( P_{tot} \)  max. 90 mW

Storage temperature \( T_{stg} \)  -55 to +100 °C

Junction temperature \( T_j \)  max. 100 °C

Lead soldering temperature at \( t_{sld} < 7 \text{ s} \)

- 1.5 mm from the seating plane for CQV72
- 5 mm from the plastic body for CQV72L

\( T_{sld} \)  max. 260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board

\( R_{th j-a} \)  max. 350 K/W

CHARACTERISTICS

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

Forward voltage

- \( I_F = 10 \text{ mA} \)
  \( V_F \)  typ. 2.1 V
  max. 3.0 V

Reverse current

- \( V_R = 5 \text{ V} \)
  \( I_R \)  max. 100 \( \mu \text{A} \)

Beamwidth between half-intensity directions in the plane of the leads; \( I_F = 10 \text{ mA} \)

\( \theta_{\frac{1}{2}} \)  typ. 100 °

Bandwidth at half height

\( \Delta \lambda \)  typ. 40 nm

Wavelength at peak emission

- \( I_F = 10 \text{ mA} \)
  \( \lambda_p \)  typ. 590 nm

Luminous intensity

- \( I_F = 10 \text{ mA} \)
  \( CQV72(L) \)
  \( I_V \)  min. 0.7 mcd
  \( CQV72(L)-2 \)
  \( I_V \) 1.0 to 2.2 mcd
  \( CQV72(L)-3 \)
  \( I_V \) 1.6 to 3.5 mcd

Diode capacitance

- \( V_R = 0, f = 1 \text{ MHz} \)
  \( C_d \)  typ. 15 pF

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Fig. 2.

Fig. 3  $T_{amb} = 25 \, ^\circ C$; typ. values.

Fig. 4  $t_{on} = 50 \, \mu s$; $\delta = 0.01$; $T_{amb} = 25 \, ^\circ C$; typ. values.

Fig. 5  Typical values.

Fig. 6  $I_F = 10 \, mA$; typ. values.

Fig. 7  $t_p = 50 \, \mu s$; typical values.
Light emitting diodes

Fig. 8 Typical values.

Fig. 9 Typical values.
LIGHT EMITTING DIODE

Rectangular light emitting diode of 5 mm x 5 mm which emits red light at a typical peak wavelength of 630 nm (GaAsP/GaP; super-red) when forward biased. The CQV80 has a SOD-74L envelope and is encapsulated in a red diffusing resin.

These SOD-74 LEDs are suitable for surface illumination, for example in information boards, score boards, moving advertisement and electronic game applications. The CQV80L has long leads and has no seating plane.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
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<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$ max. 5 V</td>
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<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$ max. 30 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 65 , ^\circ C$</td>
<td>$P_{tot}$ max. 90 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_J$ max. 100 °C</td>
</tr>
<tr>
<td>Luminous intensity $I_F = 10 , mA$</td>
<td>$I_v$ CQV80L min. 0,7 mcd</td>
</tr>
<tr>
<td></td>
<td>CQV80L-2 $I_v$ 1,0 to 2,2 mcd</td>
</tr>
<tr>
<td></td>
<td>CQV80L-3 $I_v$ 1,6 to 3,5 mcd</td>
</tr>
<tr>
<td>Wavelength at peak emission $I_F = 10 , mA$</td>
<td>$\lambda_p$ typ. 630 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$\theta_{1/2}$ typ. 100 °</td>
</tr>
</tbody>
</table>
MECHANICAL DATA
Fig. 1 SOD-74L.

Dimensions in mm

Note. Solderability not guaranteed in tie-bar zone.
RATINGS

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

Reverse voltage  \( V_R \)  max.  5 V

Forward current

\( I_F \)  max.  30 mA
\( I_{FRM} \)  max.  60 mA

Total power dissipation up to \( T_{amb} = 65 \) °C  \( P_{tot} \)  max.  90 mW

Storage temperature  \( T_{stg} \)  --55 to +100 °C

Junction temperature  \( T_j \)  max.  100 °C

Lead soldering temperature

> 5,0 mm from the plastic body; \( t_{sld} < 7 \) s  \( T_{sld} \)  max.  260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board  \( R_{th \ j-a} \)  max.  350 K/W

CHARACTERISTICS

\( T_j = 25 \) °C unless otherwise specified

Forward voltage

\( I_F = 10 \) mA  \( V_F \)  typ.  2.1 V

Reverse current

\( V_R = 5 \) V  \( I_R \)  max.  100 µA

Beamwidth between half-intensity directions

\( I_F = 10 \) mA  \( \theta_{1/2} \)  typ.  100°

Bandwidth at half height  \( \Delta \lambda \)  typ.  45 nm

Wavelength at peak emission

\( I_F = 10 \) mA  \( \lambda_p \)  typ.  630 nm

Luminous intensity

\( I_F = 10 \) mA  \( I_v \)  min.  0.7 mcd
\( CQV80L \)  1.0 to 2.2 mcd
\( CQV80L-2 \)  1.6 to 3.5 mcd
\( CQV80L-3 \)

Diode capacitance

\( V_R = 0, f = 1 \) MHz  \( C_d \)  typ.  10 pF
Fig. 2

Fig. 3  \( T_{\text{amb}} = 25 \, ^\circ\text{C} \); typ. values.

Fig. 4  \( t_{\text{on}} = 50 \, \mu\text{s} \); \( \delta = 0.01 \);  
\( T_{\text{amb}} = 25 \, ^\circ\text{C} \); typ. values.

Fig. 5  Typical values.

Fig. 6  \( I_F = 10 \, \text{mA} \); typ. values.

Fig. 7  \( t_p = 50 \, \mu\text{s} \); typical values.
Fig. 8 Typical values.

Fig. 9 Typical values.
LIGHT EMITTING DIODE

Rectangular light emitting diode of 5 mm x 5 mm which emits red light at a typical peak wavelength of 650 nm (GaAlAs; hyper-red) when forward biased. The CQV80AL has SOD-74L envelope and is encapsulated in a red diffusing resin. The CQV80AL has long leads but no seating plane.

This LED is suitable for surface illumination, for example in information boards, score boards, moving advertisements and electronic games applications. Because of its high light intensity the CQV80AL is also suitable in applications where only very low currents are available and because of its high $I_F\text{max}$ it can be used in high $I_V$ applications.

**QUICK REFERENCE DATA**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Continuous reverse voltage $V_R$</td>
<td>max. 5 V</td>
</tr>
<tr>
<td>Forward current (d.c.) $I_F$</td>
<td>max. 100 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 25 , ^{\circ}C$ $P_{tot}$</td>
<td>max. 215 mW</td>
</tr>
<tr>
<td>Junction temperature $T_j$</td>
<td>max. 100 $^{\circ}C$</td>
</tr>
<tr>
<td>Luminous intensity $I_F = 10 , mA$ $I_V$</td>
<td>min. 0,7 mcd</td>
</tr>
<tr>
<td>$I_F = 10 , mA$ $I_V$</td>
<td>1,6 to 3,5 mcd</td>
</tr>
<tr>
<td>$I_F = 10 , mA$ $I_V$</td>
<td>3,0 to 7,0 mcd</td>
</tr>
<tr>
<td>Wavelength at peak emission $\lambda_p$</td>
<td>typ. 650 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions $I_F = 10 , mA$ $\theta_{1/2}$</td>
<td>typ. 100 $^{\circ}$</td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig. 1 SOD-74L.

Dimensions in mm

Note. Solderability not guaranteed in tie-bar zone.
Light emitting diode

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

Reverse voltage
\[ V_R \] max. 5 V

Forward current
\[ I_F \] max. 100 mA
d.c.
peak value, \( t_p = 1 \mu s; f = 300 \text{ Hz} \)
peak value, \( t_{on} = 20 \mu s; \delta = 0.01 \)
\[ I_{FRM} \] max. 500 mA

Total power dissipation up to \( T_{amb} = 25 \degree C \)
\[ P_{tot} \] max. 215 mW

Storage temperature
\[ T_{stg} \] –55 to +100 \degree C

Junction temperature
\[ T_j \] max. 100 \degree C

Lead soldering temperature
> 5.0 mm from the plastic body; \( t_{sld} < 7 \text{ s} \)
\[ T_{sld} \] max. 260 \degree C

THERMAL RESISTANCE
From junction to ambient when the device is mounted on a p.c. board
\[ R_{th j-a} \] max. 350 K/W

CHARACTERISTICS
\( T_j = 25 \degree C \) unless otherwise specified

Forward voltage
\[ I_F = 10 \text{ mA} \]
\[ V_F \] typ. 1.75 V max. 2.2 V

Reverse current
\[ V_R = 5 \text{ V} \]
\[ I_R \] max. 100 \mu A

Beamwidth between half-intensity directions
\[ I_F = 10 \text{ mA} \]
\[ \theta_{1/2} \] typ. 100 \degree

Bandwidth at half height
\[ \Delta \lambda \] typ. 20 nm

Wavelength at peak emission
\[ I_F = 10 \text{ mA} \]
\[ \lambda_p \] typ. 650 nm

Luminous intensity
\[ I_F = 10 \text{ mA} \]
COV80AL \[ I_V \] min. 1.0 mcd COV80AL-3
COV80AL-4 \[ I_V \] 1.6 to 3.5 mcd

Diode capacitance
\[ V_R = 0; f = 1 \text{ MHz} \]
\[ C_d \] typ. 80 pF

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Fig. 2.  

Fig. 3  $T_{amb} = 25 \, ^{\circ}C$; typ. values.

Fig. 4  $t_{on} = 20 \, \mu s$; $\delta = 0.01$;  
$T_{amb} = 25 \, ^{\circ}C$; typ. values.

Fig. 5  $I_F = 10 \, mA$; typ. values.

Fig. 6  Typical values.

Fig. 7  $t_p = 50 \, \mu s$; typical values.
Fig. 8  $I_F = 10 \text{ mA}; T_{\text{Amb}} = 25 ^\circ \text{C};$ typ. values.

Fig. 9  Typical values.
LIGHT EMITTING DIODES

Rectangular light emitting diode of 5 mm x 5 mm which emits red light at a typical peak wavelength of 700 nm (GaP:ZnO; ultra-red) when forward biased.

The CQV80UL has a SOD-74L outline and is encapsulated in a red diffusing resin.

The CQV80UL has long leads but no seating plane.

**QUICK REFERENCE DATA**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
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<tbody>
<tr>
<td>Reverse voltage</td>
<td>( V_R )</td>
<td>max. 5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>( I_F )</td>
<td>max. 30 mA</td>
</tr>
<tr>
<td>Total power dissipation up to ( T_{amb} = 65 ) °C</td>
<td>( P_{tot} )</td>
<td>max. 90 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>( T_J )</td>
<td>max. 100 °C</td>
</tr>
<tr>
<td>Luminous intensity at ( I_F = 10 ) mA</td>
<td>( I_L )</td>
<td>min. 0.7 mcd</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>( \lambda_p )</td>
<td>typ. 700 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>( \theta_{1/2} )</td>
<td>typ. 100 °</td>
</tr>
</tbody>
</table>

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MECHANICAL DATA

Fig. 1 SOD-74L.

Dimensions in mm

Note: Solderability not guaranteed in tie-bar zone.

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Light emitting diodes

RATINGS

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

Reverse voltage
Forward current
- d.c.
  peak value; \( t_p = 1 \mu s; f = 300 \text{ Hz} \)
  peak value; \( t_{on} = 1 \text{ ms}; \delta = 0.33 \)

Total power dissipation up to \( T_{amb} = 25 \text{ °C} \)
Junction temperature
Storage temperature
Lead soldering temperature

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board

CHARACTERISTICS

\( T_{amb} = 25 \text{ °C} \) unless otherwise specified

Forward voltage
- at \( I_F = 10 \text{ mA} \)
- Reverse current
- at \( V_R = 5 \text{ V} \)
- Beamwidth between half-intensity directions
- at \( I_F = 10 \text{ mA} \)
- Wavelength at peak emission
- at \( I_F = 10 \text{ mA} \)
- Capacitance
- at \( V_R = 0; f = 1 \text{ MHz} \)
- Bandwidth at half height
- Luminous intensity
- at \( I_F = 2 \text{ mA} \)
- Luminous intensity
- at \( I_F = 10 \text{ mA} \)

CQV80UL
CQV80UL-2
CQV80UL-3

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
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<th>CQV80UL</th>
<th>Typical</th>
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<th>Max.</th>
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<td>2.0 V</td>
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<tr>
<td>Reverse current</td>
<td>( I_R )</td>
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<td>100 ( \mu A )</td>
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<tr>
<td>Beamwidth</td>
<td>( \theta_{1/2} )</td>
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<td></td>
<td>100 ( ^\circ )</td>
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<td></td>
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<tr>
<td>Wavelength</td>
<td>( \lambda_p )</td>
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<td>700 ( nm )</td>
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<tr>
<td>Capacitance</td>
<td>( C_d )</td>
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<td>45 ( pF )</td>
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<tr>
<td>Bandwidth</td>
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<td></td>
<td>90 ( nm )</td>
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</tr>
<tr>
<td>Luminous intensity</td>
<td>( I_v )</td>
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<td>0.4 ( \text{ mcd} )</td>
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<tr>
<td>Luminous intensity</td>
<td>( I_v )</td>
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<td></td>
<td>0.7 ( \text{ mcd} )</td>
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<td></td>
<td></td>
<td>CQV80UL-2</td>
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<td>1.0 to 2.2 ( \text{ mcd} )</td>
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<tr>
<td></td>
<td></td>
<td>CQV80UL-3</td>
<td></td>
<td>1.6 to 3.5 ( \text{ mcd} )</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Fig. 2

Fig. 3 Typical values.

Fig. 4 Typical values.

Fig. 5 Typical values.

Fig. 6 Typical values.

Fig. 7 Typical values.
Light emitting diodes

Fig. 8 Typical values.
LIGHT EMITTING DIODE

Rectangular light emitting diode of 5 mm x 5 mm which emits green light at a typical peak wavelength of 565 nm (GaP; super-green) when forward biased. The CQV81L has SOD-74L envelope and is encapsulated in a green diffusing resin.

These SOD-74 LEDs are suitable for surface illumination, for example in information boards, score boards, moving advertisement and electronic game applications.

**QUICK REFERENCE DATA**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Continuous reverse voltage V_R max.</td>
<td>5 V</td>
</tr>
<tr>
<td>Forward current (d.c.) I_F max.</td>
<td>60 mA</td>
</tr>
<tr>
<td>Total power dissipation up to T_amb = 35 °C</td>
<td>P_tot max. 180 mW</td>
</tr>
<tr>
<td>Junction temperature T_j max.</td>
<td>100 °C</td>
</tr>
<tr>
<td>Luminous intensity I_F = 10 mA</td>
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</tr>
<tr>
<td>CQV81L</td>
<td>I_V min. 0.7 mcd</td>
</tr>
<tr>
<td>CQV81L-2</td>
<td>I_V 1.0 to 2.2 mcd</td>
</tr>
<tr>
<td>CQV81L-3</td>
<td>I_V 1.6 to 3.5 mcd</td>
</tr>
<tr>
<td>Wavelength at peak emission I_F = 10 mA</td>
<td>( \lambda_p ) typ. 565 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions I_F = 10 mA</td>
<td>( \theta_{1/2} ) typ. 100 °</td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig. 1 SOD-74L.

Dimensions in mm

Note. Solderability not guaranteed in tie-bar zone.
RATINGS

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

Reverse voltage
Forward current
d.c. peak value, \( t_p = 1 \mu s; f = 300 \text{ Hz} \)
peak value; \( t_{on} = 1 \text{ ms}; \delta = 0.33 \)
Total power dissipation up to \( T_{amb} = 35 \degree \text{C} \)
Storage temperature
Junction temperature
Lead soldering temperature
> 5.0 mm from the plastic body; \( t_{sld} < 7 \text{ s} \)

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board

CHARACTERISTICS

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

Forward voltage
Reverse current
\( \theta_{\frac{1}{2}} \)
Bandwidth at half height
Wavelength at peak emission
Luminous intensity
Diode capacitance

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Fig. 2.

Fig. 3  $T_{\text{amb}} = 25 \, ^\circ\text{C}$; typical values.

Fig. 4  $t_{\text{on}} = 50 \, \mu\text{s}$; $\delta = 0.01$; $T_{\text{amb}} = 25 \, ^\circ\text{C}$; typical values.

Fig. 5  Typical values.

Fig. 6  $I_F = 10 \, \text{mA}$; typical values.

Fig. 7  $t_p = 50 \, \mu\text{s}$; typical values.
Light emitting diode

Fig. 8 Typical values.

Fig. 9 Typical values.
LIGHT EMITTING DIODE

Rectangular light emitting diode of 5 mm x 5 mm which emits yellow light at a typical peak wavelength of 590 nm (GaPAs) when forward biased. The CQV82L has a SOD-74L envelope and is encapsulated in a yellow diffusing resin.

The CQV82L is suitable for surface illumination, for example, information boards, score boards, moving advertisements and electronic game applications.

The CQV82L has long leads and has no seating plane.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Continuous reverse voltage VR max.</td>
<td>5 V</td>
</tr>
<tr>
<td>Forward current (d.c.) IF max.</td>
<td>30 mA</td>
</tr>
<tr>
<td>Total power dissipation up to Tamb = 65 °C</td>
<td>90 mW</td>
</tr>
<tr>
<td>Junction temperature Tj max.</td>
<td>100 °C</td>
</tr>
<tr>
<td>Luminous intensity IF = 10 mA</td>
<td></td>
</tr>
<tr>
<td>CQV82L</td>
<td>IV min. 0,7 mcd</td>
</tr>
<tr>
<td>CQV82L-2</td>
<td>IV 1,0 to 2,2 mcd</td>
</tr>
<tr>
<td>CQV82L-3</td>
<td>IV 1,6 to 3,5 mcd</td>
</tr>
<tr>
<td>Wavelength at peak emission IF = 10 mA</td>
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</tr>
<tr>
<td></td>
<td>λp typ. 590 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions IF = 10 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>θ½ typ. 100 °</td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig. 1 SOD-74L.

Note. Solderability not guaranteed in tie-bar zone.
RATINGS

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

Reverse voltage
Forward current
d.c.
  peak value; \( t_p = 1 \, \mu s \); \( f = 300 \, \text{Hz} \)
  peak value; \( t_{on} = 1 \, \text{ms} \); \( \delta = 0,33 \)
Total power dissipation up to \( T_{amb} = 65 \, ^\circ \text{C} \)
Storage temperature
Junction temperature
Lead soldering temperature
  > 5,0 mm from the plastic body; \( t_{sld} < 7 \, \text{s} \)

THERMAL RESISTANCE

From junction to ambient when the device
  is mounted on a p.c. board

CHARACTERISTICS

\( T_j = 25 \, ^\circ \text{C} \) unless otherwise specified

Forward voltage
Reverse current
  \( V_R = 5 \, \text{V} \)
Beamwidth between half-intensity directions
  \( I_F = 10 \, \text{mA} \)
Bandwidth at half height
Wavelength at peak emission
  \( I_F = 10 \, \text{mA} \)
Luminous intensity
  \( I_F = 10 \, \text{mA} \)
  \( CQV82L \)
  \( CQV82L-2 \)
  \( CQV82L-3 \)
Diode capacitance
  \( V_R = 0; \ f = 1 \, \text{MHz} \)
Fig. 2

Fig. 3 Typical values.

Fig. 4 $t_{on} = 50 \mu s; \delta = 0.01$; $T_{amb} = 25 ^\circ C$; typ. values.

Fig. 5 Typical values.

Fig. 6 $I_F = 10 mA$; typ. values.

Fig. 7 $t_p = 50 \mu s$; typical values.
Fig. 8 Typical values.

Fig. 9 Typical values.
LIGHT EMITTING DIODES

Rectangular light emitting diode of 5 mm x 2,5 mm which emits red light at a typical peak wavelength of 650 nm (GaAlAs; hyper-red) when forward biased.

The CQW10A has a SOD-76 envelope and is encapsulated in a red diffusing resin.

The CQW10AL is the long lead version of the CQW10A without a seating plane but is in all other respects similar to the CQW10A.

When stacked in an array these SOD-76 LEDs can be used, for example, as level indicators. Because of its high light intensity the CQW10A(L) is suitable in applications where only low currents are available and because of its high $I_{F \text{max}}$ it can be used for high $I_V$ applications.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$</td>
<td>max. 5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>max. 100 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{\text{amb}} = 25^\circ C$</td>
<td>$P_{\text{tot}}$</td>
<td>max. 215 mW</td>
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<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>max. 100 $^\circ C$</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td>$I_F = 10$ mA</td>
<td>$I_V$</td>
</tr>
<tr>
<td></td>
<td>CQW10A(L)</td>
<td>$I_V$</td>
</tr>
<tr>
<td></td>
<td>CQW10A(L)-3</td>
<td>$I_V$</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>$I_F = 10$ mA</td>
<td>$\lambda_p$</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$I_F = 10$ mA</td>
<td>$\theta_{1/2}$</td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig. 1 SOD-76A2.
CQW10A

Fig. 1b SOD-76L.
CQW10AL

Note: Solderability not guaranteed in tie-bar zone.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage
- d.c.
  - peak value; $t_p = 1 \mu s; f = 300 \text{ Hz}$
  - peak value; $t_{on} = 20 \mu s; \delta = 0,01$

Total power dissipation up to $T_{amb} = 25 \degree C$

Storage temperature

Junction temperature

Lead soldering temperature; $t_{sld} < 7 \text{ s}$
- $> 1,5 \text{ mm from the seating plane for CQW10A}$
- $> 5 \text{ mm from the plastic body for CQW10AL}$

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board

CHARACTERISTICS

$T_j = 25 \degree C$ unless otherwise specified

Forward voltage
- $I_F = 10 \text{ mA}$

Reverse current
- $V_R = 5 \text{ V}$

Beamwidth between half-intensity directions
- $I_F = 10 \text{ mA}$

Bandwidth at half height

Wavelength at peak emission
- $I_F = 10 \text{ mA}$

Luminous intensity
- $I_F = 10 \text{ mA}$

Diode capacitance
- $V_R = 0, f = 1 \text{ MHz}$
Fig. 2 Typical values.

Fig. 3 $T_{\text{amb}} = 25 \, ^\circ\text{C}$; typ. values.

Fig. 4 $t_{\text{on}} = 20 \, \mu\text{s}; \delta = 0.01$; typ. values.

Fig. 5 $I_F = 10 \, \text{mA}$; typ. values.

Fig. 6 Typical values.

Fig. 7 $t_p = 50 \, \mu\text{s}$; typ. values.
**Light emitting diodes**

Fig. 8  $I_F = 10 \text{ mA}; T_{\text{amb}} = 25 ^\circ \text{C};$ typ. values.

Fig. 9  Typical values.
LIGHT EMITTING DIODES

Rectangular light emitting diode of 5 mm x 2.5 mm which emits red light at a typical peak wavelength of 630 nm (GaAsP/GaP; super-red) when forward biased.

The CQW10B has a SOD-76 envelope and is encapsulated in a red diffusing resin.
The CQW10BL is similar to the CQW10 but has long leads (26 mm) and no seating plane.
When stacked as an array these SOD-76 LEDs can be used, for example, as level indicators.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th></th>
<th>VR</th>
<th>max.</th>
<th>5 V</th>
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<td>Continuous reverse voltage</td>
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</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>IF</td>
<td>max.</td>
<td>30 mA</td>
</tr>
<tr>
<td>Total power dissipation up to T_amb = 65 °C</td>
<td>P_{tot}</td>
<td>max.</td>
<td>90 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>T_j</td>
<td>max.</td>
<td>100 °C</td>
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<tr>
<td>Luminous intensity</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>IF = 10 mA</td>
<td>CQW10B(L)</td>
<td>I_v</td>
<td>min.</td>
</tr>
<tr>
<td></td>
<td>CQW10B(L)-2</td>
<td>I_v</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CQW10B(L)-3</td>
<td>I_v</td>
<td></td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
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<td></td>
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<tr>
<td>IF = 10 mA</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IF = 10 mA</td>
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<td></td>
</tr>
</tbody>
</table>

λ_p | typ. | 630 nm |
θ_{1/2} | typ. | 100 ° |
MECHANICAL DATA

Fig. 1 SOD-76A1.
CQW10B

Note: Solderability not guaranteed in tie-bar zone.
Light emitting diodes

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

Continuous reverse voltage
Forward current
d.c.
peak value; \( t_p = 1 \, \mu s; f = 300 \, Hz \)
peak value; \( t_{on} = 1 \, ms; \delta = 0,33 \)
Total power dissipation up to \( T_{amb} = 65 \, ^o C \)
Storage temperature
Junction temperature
Lead soldering temperature; \( t_{sld} < 7 \, s \)

> 1,5 mm from the seating plane for CQW10B
> 5 mm from the plastic body for CQW10BL

THERMAL RESISTANCE
From junction to ambient when the device is mounted on a p.c. board

CHARACTERISTICS
\( T_j = 25 \, ^o C \) unless otherwise specified
Forward voltage
Reverse current
Beamwidth between half-intensity directions
Bandwidth at half height
Wavelength at peak emission
Luminous intensity
Diode capacitance

\| \begin{align*}
\text{CQW10B} & : & \text{I}_V & : & \text{min.} & : & 0,7 \, \text{mcd} \\
\text{CQW10B(L)-2} & : & \text{I}_V & : & 1,0 \text{ to } 2,2 \, \text{mcd} \\
\text{CQW10B(L)-3} & : & \text{I}_V & : & 1,6 \text{ to } 3,5 \, \text{mcd} \\
\text{Cd} & : & \text{typ.} & : & 10 \, \text{pF} \\
\end{align*} \|
Fig. 2.

Fig. 3  $T_j = 25 \, ^\circ C$; typ. values.

Fig. 4  $t_{on} = 50 \mu s$; $\delta = 0.01$; $T_j = 25 \, ^\circ C$; typ. values.

Fig. 5  Typical values.

Fig. 6  $I_F = 10 \, mA$; typ. values.

Fig. 7  $t_p = 50 \, \mu s$; typ. values.
Light emitting diodes

Fig. 8 $I_F = 10$ mA; typ. values.

Fig. 9 Typical values.
LIGHT EMITTING DIODES

Rectangular light emitting diodes of 2.5 mm x 5 mm which emit red light at a typical peak wavelength of 700 nm (GaP:ZnO; ultra-red) when forward biased.

The CQW10U and CQW10UL have a SOD-76 outline and are encapsulated in a red diffusing resin. The CQW10U and CQW10UL are specially designed for low current applications.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
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<tr>
<td>Reverse voltage</td>
<td>$V_R$</td>
<td>max. 5 V</td>
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<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>max. 30 mA</td>
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<tr>
<td>Total power dissipation up to $T_{amb} = 65 , ^\circ$C</td>
<td>$P_{tot}$</td>
<td>max. 90 mW</td>
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<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>max. 100 , ^\circ$C</td>
</tr>
<tr>
<td>Luminous intensity at $I_F = 10 , mA$</td>
<td>$I_V$</td>
<td>min. 0.7 mcd</td>
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<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_p$</td>
<td>typ. 700 nm</td>
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<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$\theta_{1/2}$</td>
<td>typ. 100 , ^\circ</td>
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</table>

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MECHANICAL DATA

Fig. 1 SOD-76A1.
CQW10U.

Dimensions in mm

Fig. 1b SOD-76L.
CQW10UL

Note: Solderability not guaranteed in tie-bar zone.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage
Forward current
- d.c.
  peak value; \( t_p = 1 \mu s \); \( f = 300 \) Hz
  peak value; \( t_{on} = 1 \) ms; \( \delta = 0,33 \)
Total power dissipation up to \( T_{amb} = 25 \) °C
Junction temperature
Storage temperature
Lead soldering temperature

Lead soldering temperature
- > 1,5 mm from the seating plane; \( t_{sld} < 7 \) s
- > 5 mm from the seating plane; \( t_{sld} < 7 \) s

THERMAL RESISTANCE
From junction to ambient when the device is mounted on a p.c. board

CHARACTERISTICS
\( T_{amb} = 25 \) °C unless otherwise specified

Forward voltage
- at \( I_F = 10 \) mA
Reverse current
- at \( V_R = 5 \) V
Beamwidth between half-intensity directions
- at \( I_F = 10 \) mA
Wavelength at peak emission
- at \( I_F = 10 \) mA
Capacitance
- at \( V_R = 0; f = 1 \) MHz
Bandwidth at half height
Luminous intensity
- at \( I_F = 10 \) mA

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Fig. 2.

Fig. 3 Typical values.

Fig. 4 Typical values.

Fig. 5 Typical values.

Fig. 6 Typical values.

Fig. 7 Typ. values.
Fig. 8 Typical values.
LIGHT EMITTING DIODES

Rectangular light emitting diode of 5 mm x 2.5 mm which emits green light at a typical peak wavelength of 565 nm (GaP; super-green) when forward biased.

The CQW11B has a SOD-76 envelope and is encapsulated in a green diffusing resin.

The CQW11BL is the long lead version of the CQW11B without a seating plane, but in all respects similar to the CQW11B.

When stacked in an array these SOD-76 LEDs can be used, for example, as level indicators. Because of its high light intensity the CQW11B is very suitable in applications where only low currents are available and because of its high $I_F$ max it can be used for high $I_V$ applications.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
<th>Value</th>
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<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$</td>
<td>max.</td>
<td>5 V</td>
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<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>max.</td>
<td>60 mA</td>
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<td>Total power dissipation up to $T_{amb} = 35 , ^\circ C$</td>
<td>$P_{tot}$</td>
<td>max.</td>
<td>180 mW</td>
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<td>Junction temperature</td>
<td>$T_J$</td>
<td>max.</td>
<td>100 , ^\circ C</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td>$I_V$</td>
<td>min.</td>
<td>CQW11B(L) 0.7 mcd</td>
</tr>
<tr>
<td></td>
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<td>CQW11B(L)-2 1.0 to 2.2 mcd</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>CQW11B(L)-3 1.6 to 3.5 mcd</td>
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<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_p$</td>
<td>typ.</td>
<td>565 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$\theta_{1/2}$</td>
<td>typ.</td>
<td>100 , ^\circ</td>
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</tbody>
</table>

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Fig. 1a SOD-76A1. CQW11B

Dimensions in mm

Fig. 1b SOD-76L. CQW11BL

Note: Solderability not guaranteed in tie-bar zone.
**Light emitting diodes**

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### RATINGS

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Condition</th>
<th>Value</th>
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<td>Continuous reverse voltage</td>
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</tr>
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<td>Forward current</td>
<td>d.c. peak value; $t_D = 1 \mu$s; $f = 300$ Hz peak value; $t_{on} = 1$ ms; $\delta = 0.33$</td>
<td>60 mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>150 mA</td>
</tr>
<tr>
<td>Total power dissipation</td>
<td></td>
<td>180 mA</td>
</tr>
<tr>
<td>Storage temperature</td>
<td></td>
<td>-55 to +100 °C</td>
</tr>
<tr>
<td>Junction temperature</td>
<td></td>
<td>100 °C</td>
</tr>
<tr>
<td>Lead soldering temperature</td>
<td>$t_{sld} &lt; 7$ s; $&gt;1.5$ mm from the seating plane CQW11B; $&gt;5$ mm from the plastic body CQW11BL</td>
<td>260 °C</td>
</tr>
<tr>
<td>THERMAL RESISTANCE</td>
<td></td>
<td>350 K/W</td>
</tr>
<tr>
<td>CHARACTERISTICS</td>
<td></td>
<td></td>
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<tr>
<td>$T_j = 25$ °C unless otherwise specified</td>
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</tr>
<tr>
<td>Forward voltage</td>
<td>$I_F = 10$ mA</td>
<td>2.1 V</td>
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<tr>
<td>Reverse current</td>
<td>$V_R = 5$ V</td>
<td>3.0 V</td>
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<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$I_F = 10$ mA</td>
<td>100 °</td>
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<tr>
<td>Bandwidth at half height</td>
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<td>30 nm</td>
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<tr>
<td>Wavelength at peak emission</td>
<td>$I_F = 10$ mA</td>
<td>565 nm</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td>CQW11B(L) $I_V = 10$ mA</td>
<td>0.7 mcd</td>
</tr>
<tr>
<td></td>
<td>CQW11B(L)-2 $I_V = 10$ mA</td>
<td>1.0 to 2.2 mcd</td>
</tr>
<tr>
<td></td>
<td>CQW11B(L)-3 $I_V = 10$ mA</td>
<td>1.6 to 3.5 mcd</td>
</tr>
<tr>
<td>Diode capacitance</td>
<td>$V_R = 0$; $f = 1$ MHz</td>
<td>20 pF</td>
</tr>
</tbody>
</table>

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Fig. 2.

Fig. 3 $T_j = 25$ °C; typ. values.

Fig. 4 $t_{on} = 1$ ms; $\delta = 0.33$; $T_{amb} = 25$ °C; typ. values.

Fig. 5 Typical values.

Fig. 6 $I_F = 10$ mA; typ. values.

Fig. 7 $t_p = 50$ µs; typical values.
Light emitting diodes

Fig. 8 $I_F = 10 \text{ mA}; T_{\text{amb}} = 25 ^\circ \text{C}; \text{typ. values.}$

Fig. 9 Typical values.
LIGHT EMITTING DIODES

Rectangular light emitting diode of 5 mm x 2.5 mm which emits yellow light at a typical peak wavelength of 590 nm (GaPAs) when forward biased.

The CQW12B has a SOD-76 envelope and is encapsulated in a yellow diffusing resin.
The CQW12BL is similar to the CQW12B but has long leads and no seating plane.
When stacked as an array these SOD-76 LEDs can be used, for example, as level indicators.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
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<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
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<td>$V_R$</td>
<td>0 V</td>
<td>5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>0 mA</td>
<td>30 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 65,^\circ{\text{C}}$</td>
<td>$P_{tot}$</td>
<td>0 mW</td>
<td>90 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>0 K</td>
<td>100 K</td>
</tr>
<tr>
<td>Luminous intensity $I_F = 10,\text{mA}$</td>
<td>$I_V$</td>
<td>0.7 mcd</td>
<td>1,0 to 2,2 mcd</td>
</tr>
<tr>
<td></td>
<td>CQW12B(L)</td>
<td>0.7 mcd</td>
<td>1.0 to 2.2 mcd</td>
</tr>
<tr>
<td></td>
<td>CQW12B(L)-2</td>
<td>1.0 to 2.2 mcd</td>
<td>1.6 to 3.5 mcd</td>
</tr>
<tr>
<td>Wavelength at peak emission $I_F = 10,\text{mA}$</td>
<td>$\lambda_p$</td>
<td>590 nm</td>
<td>590 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions $I_F = 10,\text{mA}$; in the plane of the leads</td>
<td>$\theta_{1/2}$</td>
<td>100°</td>
<td>100°</td>
</tr>
</tbody>
</table>
Note: Solderability not guaranteed in tie-bar zone.
RATINGS

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

Continuous reverse voltage

Forward current
d.c.
  peak value; \( t_p = 1 \mu s; f = 300 \text{ Hz} \)
  peak value; \( t_{on} = 1 \text{ ms}; \delta = 0,33 \)

Total power dissipation up to \( T_{amb} = 65 \text{ °C} \)

Storage temperature

Junction temperature

Lead soldering temperature; \( t_{sld} < 7 \text{ s} \)
  \( > 1,5 \text{ mm from the seating plane for CQW12B} \)
  \( > 5 \text{ mm from the plastic body for CQW12BL} \)

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board

CHARACTERISTICS

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

Forward voltage
  \( I_F = 10 \text{ mA} \)

Reverse current
  \( V_R = 5 \text{ V} \)

Beamwidth between half-intensity directions
  \( I_F = 10 \text{ mA} \)

Bandwidth at half height

Wavelength at peak emission
  \( I_F = 10 \text{ mA} \)

Luminous intensity
  \( I_F = 10 \text{ mA} \)

Diode capacitance
  \( V_R = 0; f = 1 \text{ MHz} \)
Fig. 2.

Fig. 3 $T_j = 25^\circ C$; typ. values.

Fig. 4 $t_{\text{on}} = 50 \mu s$; $\delta = 0.01$; $T_j = 25^\circ C$; typ. values.

Fig. 5 Typical values.

Fig. 6 $I_F = 10 \ mA$; typ. values.

Fig. 7 $t_p = 50 \ \mu s$; typical values.
Fig. 8 Typical values.

Fig. 9 Typical values.
LIGHT EMITTING DIODES

Circular light emitting diode with a diameter of 2 mm which emits red light at a typical peak wavelength of 650 nm (GaAlAs; hyper-red) when forward biased.

The CQW20A has a SOD-79 outline and is encapsulated in a red diffusing resin.

This LED is suitable for small indicator functions and in applications where only low currents are available.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$</td>
<td>V</td>
<td>max. 5</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>mA</td>
<td>max. 60</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 25$ °C</td>
<td>$P_{tot}$</td>
<td>mW</td>
<td>max. 150</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>°C</td>
<td>max. 100</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td>$I_V$</td>
<td>mcd</td>
<td>min. 0.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>typ. 2.5</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_p$</td>
<td>nm</td>
<td>typ. 650</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$\theta_\frac{\pi}{2}$</td>
<td>°</td>
<td>typ. 110</td>
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</tbody>
</table>

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MECHANICAL DATA

Fig. 1 SOD-79.

Dimensions in mm
Light emitting diode

RATINGS

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

Reverse voltage

Forward voltage

d.c.
peak value, \( t_p = 1 \mu s; f = 300 \text{ Hz} \)
peak value, \( t_{on} = 20 \mu s; \delta = 0,01 \)

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

Storage temperature

Junction temperature

Lead soldering temperature

> 1,5 mm from the seating plane; \( t_{sld} < 7 \text{ s} \)

THERMAL RESISTANCE

From junction to ambient

when the device is mounted on a p.c. board

CHARACTERISTICS

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

Forward voltage

\( I_F = 4 \text{ mA} \)
\( I_F = 10 \text{ mA} \)

Reverse current

\( V_R = 5 \text{ V} \)

Beamwidth between half-intensity directions

\( I_F = 10 \text{ mA} \)

Bandwidth at half height

Wavelength at peak emission

Luminous intensity

\( I_F = 10 \text{ mA} \)

Diode capacitance

\( V_R = 0; f = 1 \text{ MHz} \)

\( V_F \) typ. 1,65 V
\( V_F \) max. 2,20 V

\( I_R \) max. 100 \( \mu \text{A} \)

\( \theta_{1/2} \) typ. 110 °

\( \Delta \lambda \) typ. 20 nm

\( \lambda_p \) typ. 650 nm

\( I_V \) min. 0,7 mcd
\( I_V \) typ. 2,5 mcd

\( C_d \) typ. 80 pF

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Fig. 2.

Fig. 3 \( T_{\text{amb}} = 25^\circ\text{C} \); typ. values.

Fig. 4 \( t_{\text{on}} = 20\,\mu\text{s}; \delta = 0,01;\)
\( T_{\text{amb}} = 25^\circ\text{C} \); typ. values.

Fig. 5 \( I_F = 10\,\text{mA} \); typ. values.

Fig. 6 Typical values.

Fig. 7 \( t_p = 50\,\mu\text{s} \); typ. values.
Fig. 8  $I_F = 10 \, mA; \, T_{amb} = 25^\circ C; \, typ. \, values.$

Fig. 9  $I_F = 10 \, mA; \, typ. \, values.$
LIGHT Emitting Diodes

Circular light emitting diode with a diameter of 2 mm which emits green light at a typical peak wavelength of 565 nm (GaP; super-green) when forward biased.

The CQW21 has a SOD-79 outline and is encapsulated in a green diffusing resin.

The CQW21 is suitable for small indicator functions and can resist higher forward currents when a higher luminosity is required.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$ max. 5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$ max. 60 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 25 , ^\circ C$</td>
<td>$P_{tot}$ max. 150 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$ max. 100 °C</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td>$I_V$ min. 0.7 mcd</td>
</tr>
<tr>
<td>$I_F = 10 , mA$</td>
<td>typ. 1.5 mcd</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_p$ typ. 565 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$\theta_{1/2}$ typ. 110 °</td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig. 1 SOD-79.

Dimensions in mm

3.3
2.9
2.0
1.8

2.54
0.56
0.45

k (-)

0.56
0.45

1.0 min
16.0 min
7.8
7.2
5.1
4.6
2.7
2.5

18.0 min

unflat base plane

0.56
0.45

7Z89912.2

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

Reverse voltage
\[ V_R \text{ max.} = 5 \text{ V} \]

Forward current
\[ I_F \text{ max.} = 60 \text{ mA} \]
\[ I_{FRM} \text{ max.} = 1 \text{ A} \]
\[ P_{tot} \text{ max.} = 150 \text{ mW} \]

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

Storage temperature
\[ T_{stg} \text{ max.} = -55 \text{ to } +100 \text{ °C} \]

Junction temperature
\[ T_j \text{ max.} = 100 \text{ °C} \]

Lead soldering temperature
\[ T_{sld} \text{ max.} = 260 \text{ °C} \]

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board
\[ R_{th j-a} \text{ max.} = 500 \text{ K/W} \]

CHARACTERISTICS

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

Forward voltage
\[ I_F = 10 \text{ mA} \]
\[ V_F \text{ typ.} = 2,1 \text{ V} \]
\[ V_F \text{ max.} = 3,0 \text{ V} \]

Reverse current
\[ I_R \text{ max.} = 100 \text{ µA} \]

Beamwidth between half-intensity directions
\[ \theta_{1/2} \text{ typ.} = 110 \text{ °} \]

Bandwidth at half height
\[ \Delta \lambda \text{ typ.} = 30 \text{ nm} \]

Wavelength at peak emission
\[ \lambda_p \text{ typ.} = 565 \text{ nm} \]

Luminous intensity
\[ I_v \text{ min.} = 0,7 \text{ mcd} \]
\[ I_v \text{ typ.} = 1,5 \text{ mcd} \]

Diode capacitance
\[ V_R = 0; f = 1 \text{ MHz} \]
\[ C_d \text{ typ.} = 20 \text{ pF} \]
Fig. 2. $P_{\text{tot}}$ (mW) vs. $T_{\text{amb}}$ (°C).

Fig. 3. $I_F$ (mA) vs. $V_F$ (V).

Fig. 4. $t_{\text{on}} = 1$ ms; $\delta = 0.33$; $T_{\text{amb}} = 25$ °C; typ. values.

Fig. 5. Typical values.

Fig. 6. Typical values.

Fig. 7. $t_p = 50$ µs; typical values.
Fig. 8 $I_F = 10 \text{ mA}$; typ. values.

Fig. 9 Typical values.
LIGHT EMITTING DIODE

Circular light emitting diode with a diameter of 2 mm which emits yellow light at a typical peak wavelength of 590 nm (GaPAs) when forward biased. The CQW22 has a SOD-79 outline and is encapsulated in a yellow diffusing resin. The CQW21 is suitable for small indicator functions.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
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<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$</td>
<td>max. 5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>max. 30 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 55 , ^\circ C$</td>
<td>$P_{tot}$</td>
<td>max. 90 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>max. 100 $^\circ C$</td>
</tr>
<tr>
<td>Luminous intensity $I_F = 20 , mA$</td>
<td>$I_V$</td>
<td>min. 0.7 mcd</td>
</tr>
<tr>
<td></td>
<td></td>
<td>typ. 1.5 mcd</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_p$</td>
<td>typ. 590 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$\theta_{1/2}$</td>
<td>typ. 110 $^\circ$</td>
</tr>
</tbody>
</table>
MECHANICAL DATA
Fig. 1 SOD-79.

Dimensions in mm

unflat base plane

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RATINGS

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

Reverse voltage
Forward current
d.c.
peak value; $t_p = 1$ $\mu$s; $f = 300$ Hz
peak value; $t_{on} = 1$ ms; $\delta = 0.33$
Total power dissipation up to $T_{amb} = 55$ $^\circ$C
Storage temperature
Junction temperature
Lead soldering temperature
$>1.5$ mm from the seating plane; $t_{slid} < 7$ s

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board

CHARACTERISTICS

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

Forward voltage
Forward current
$V_R = 5$ V
Reverse current
Diode capacitance
Beamwidth between half-intensity directions
Bandwidth at half height
Wavelength at peak emission
Luminous intensity
$I_F = 20$ mA

$I_F$ max. $30$ mA
$I_F$ max. $1$ A
$I_{FRM}$ max. $60$ mA
$P_{tot}$ max. $90$ mW
$T_{stg}$ $-55$ to $+100$ $^\circ$C
$T_j$ max. $100$ $^\circ$C
$T_{slid}$ max. $260$ $^\circ$C
$R_{thja}$ max. $500$ K/W

$V_F$ typ. $2.1$ V
$max.$
$V_F$ typ. $3.0$ V
$min.$
$min.$
$15$ pF
$110$ $^\circ$
$40$ nm
$590$ nm
$0.7$ mcd
$1.5$ mcd

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Fig. 2.

Fig. 3 $T_{\text{amb}} = 25 \, ^\circ\text{C}$; typ. values.

Fig. 4 $t_{\text{on}} = 1 \, \text{ms}; \delta = 0.33$; $T_{\text{amb}} = 25 \, ^\circ\text{C}$; typical values.

Fig. 5 $I_F = 10 \, \text{mA}$; typical values.

Fig. 6 Typical values.

Fig. 7 $t_p = 50 \, \mu\text{s}$; typical values.
Fig. 8 Typical values.

Fig. 9 Typical values.
LIGHT EMITTING DIODES

Circular light emitting diodes with a diameter of 5 mm which emit red light at a typical peak wavelength of 650 nm (GaAlAs; hyper-red) when forward biased.

The CQW24 and CQW24L have a SOD-63 outline and are encapsulated in a red diffusing resin.

The CQW24L is the long-lead version of the CQW24 and has no seating plane but is in all other respects similar to the CQW24.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<td>Continuous reverse voltage</td>
<td>$V_R$ max. 5 V</td>
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<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$ max. 100 mA</td>
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<td>Total power dissipation up to $T_{amb} = 25 ^\circ C$</td>
<td>$P_{tot}$ max. 215 mW</td>
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<tr>
<td>Junction temperature</td>
<td>$T_j$ max. 100 ^\circ C</td>
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<tr>
<td>Luminous intensity</td>
<td>$I_V$ min. 3 mcd</td>
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<tr>
<td>$I_F = 10 \text{ mA}$</td>
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</tr>
<tr>
<td>CQW24(L)</td>
<td></td>
</tr>
<tr>
<td>CQW24(L)-4</td>
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</tr>
<tr>
<td>CQW24(L)-5</td>
<td></td>
</tr>
<tr>
<td>CQW24(L)-6</td>
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<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_p$ typ. 650 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$\theta_{1/2}$ typ. 100 °</td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig. 1a SOD-63A2.
CQW24

Fig. 1b SOD-63L

Note.: Solderability not guaranteed in tie-bar zone.
RATINGS

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

Reverse voltage
Forward current
d.c.
Forward current
peak value, \( t_p = 1 \mu s; f = 300 \text{ Hz} \)
peak value; \( t_{on} = 20 \mu s; \delta = 0,01 \)
Total power dissipation up to \( T_{amb} = 25 \text{ °C} \)
Storage temperature
Junction temperature
Lead soldering temperature; \( t_{sld} < 7 \text{ s} \)

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board

CHARACTERISTICS

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

Forward voltage
Reverse current
Bandwidth between half-intensity directions
Bandwidth at half height
Wavelength at peak emission
Luminous intensity
Diode capacitance

$$V_R = 0; f = 1 \text{ MHz}$$

### Fig. 2

<table>
<thead>
<tr>
<th>$P_{\text{tot}}$ (mW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
</tr>
<tr>
<td>100</td>
</tr>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$T_{\text{amb}}$ (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
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<td>75</td>
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<tr>
<td>50</td>
</tr>
<tr>
<td>25</td>
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<tr>
<td>0</td>
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### Fig. 3

<table>
<thead>
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<th>$C_d$</th>
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<tr>
<td>typ.</td>
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<td>80 pF</td>
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<table>
<thead>
<tr>
<th>$I_F$ (mA)</th>
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<tbody>
<tr>
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<tr>
<td>40</td>
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<tr>
<td>20</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$V_F$ (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.9</td>
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<td>1.8</td>
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<tr>
<td>1.7</td>
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<td>1.6</td>
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<td>1.5</td>
</tr>
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<td>1.4</td>
</tr>
<tr>
<td>1.3</td>
</tr>
<tr>
<td>1.2</td>
</tr>
<tr>
<td>1.1</td>
</tr>
<tr>
<td>1.0</td>
</tr>
</tbody>
</table>

### Fig. 4

| $t_{\text{ON}}$ = 20 µs; $\delta = 0.01$; $T_{\text{amb}} = 25$ °C; typ. values.

<table>
<thead>
<tr>
<th>$I_{\text{FM}}$ (mA)</th>
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</thead>
<tbody>
<tr>
<td>500</td>
</tr>
<tr>
<td>400</td>
</tr>
<tr>
<td>300</td>
</tr>
<tr>
<td>200</td>
</tr>
<tr>
<td>100</td>
</tr>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$V_{\text{FM}}$ (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
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<tr>
<td>3</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>0</td>
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</tbody>
</table>

### Fig. 5

| $I_F = 10$ mA; typ. values.

<table>
<thead>
<tr>
<th>$T_{\text{amb}}$ (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
</tr>
<tr>
<td>75</td>
</tr>
<tr>
<td>50</td>
</tr>
<tr>
<td>25</td>
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<td>0</td>
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</tbody>
</table>

### Fig. 6

<table>
<thead>
<tr>
<th>$I_V$ (% )</th>
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<tbody>
<tr>
<td>200</td>
</tr>
<tr>
<td>100</td>
</tr>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$T_{\text{j}}$ (°C)</th>
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</thead>
<tbody>
<tr>
<td>100</td>
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<tr>
<td>75</td>
</tr>
<tr>
<td>50</td>
</tr>
<tr>
<td>25</td>
</tr>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

### Fig. 7

| $t_p = 50$ µs; typ. values.

<table>
<thead>
<tr>
<th>$I_F$ (mA)</th>
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<tbody>
<tr>
<td>100</td>
</tr>
<tr>
<td>80</td>
</tr>
<tr>
<td>60</td>
</tr>
<tr>
<td>40</td>
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<tr>
<td>20</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>5</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>$I_v$ (mCd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
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<tr>
<td>80</td>
</tr>
<tr>
<td>60</td>
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<tr>
<td>40</td>
</tr>
<tr>
<td>20</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>5</td>
</tr>
</tbody>
</table>

---

Figure 2, Figure 3, Figure 4, Figure 5, Figure 6, Figure 7
Light emitting diodes

Fig. 8  $I_F = 10 \text{ mA}; T_{\text{amb}} = 25 \degree \text{C};$ typ. values.

Fig. 9 Typical values.
Circular light emitting diode with a diameter of 3 mm which emits red light at a typical peak wavelength of 650 nm (GaAlAs; hyper-red) when forward biased.

The CQW54 has a SOD-53 outline and is encapsulated in a red coloured diffusing resin.

The high light intensity of the CQW54 makes it suitable for applications where only low currents are available.

**QUICK REFERENCE DATA**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>( V_R )</td>
<td>max. 5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>( I_F )</td>
<td>max. 60 mA</td>
</tr>
<tr>
<td>Total power dissipation up to ( T_{amb} = 25 , ^\circ C )</td>
<td>( P_{tot} )</td>
<td>max. 150 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>( T_j )</td>
<td>max. 100 °C</td>
</tr>
<tr>
<td>Luminous intensity ( I_F = 10 , mA )</td>
<td>( I_v )</td>
<td>min. 3 mcd</td>
</tr>
<tr>
<td>CQW54</td>
<td>( I_v )</td>
<td>5 to 12 mcd</td>
</tr>
<tr>
<td>CQW54-5</td>
<td>( I_v )</td>
<td>10 to 22 mcd</td>
</tr>
<tr>
<td>CQW54-6</td>
<td>( I_v )</td>
<td>min. 16 mcd</td>
</tr>
<tr>
<td>CQW54-7</td>
<td>( I_v )</td>
<td></td>
</tr>
<tr>
<td>Wavelength at peak emission ( I_F = 10 , mA )</td>
<td>( \lambda_p )</td>
<td>typ. 650 nm</td>
</tr>
<tr>
<td>Beamwidth at half-intensity directions</td>
<td>( \theta_{\frac{1}{2}} )</td>
<td>typ. 100 °</td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig. 1 SOD-53E.

Dimensions in mm

2,54

0,56

0,45

unflat base plane

45°
Light emitting diode

CQW54

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

Reverse voltage
Forward current
d.c.
peak value; \( t_p = 1 \mu s; f = 300 \text{ Hz} \)
peak value; \( t_{on} = 20 \mu s; \delta = 0,01 \)
Total power dissipation up to \( T_{amb} = 25 \degree C \)
Storage temperature
Junction temperature
Lead soldering temperature

THERMAL RESISTANCE
From junction to ambient
when the device is mounted on a p.c. board

CHARACTERISTICS
\( T_j = 25 \degree C \) unless otherwise specified

Forward voltage
Reverse current
\( V_R = 5 \text{ V} \)
Beamwidth between half-intensity directions
\( \theta_{1/2} \)
Bandwidth at half height
Wavelength at peak emission
Luminous intensity

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Diode capacitance

\[ V_R = 0; \; f = 1 \text{ MHz} \]

\[ P_{\text{tot}} \text{ (mW)} \]

\[ R_{\text{load}} = 800 \Omega \text{ measured on f.c.h.} \]

\[ C_d \text{ typ. } 80 \text{ pF} \]

\[ I_F \text{ (mA)} \]

\[ V_F \text{ (V)} \]

\[ T_{\text{amb}} = 25 \text{ °C} \; \text{typ. values.} \]

\[ I_F = 10 \text{ mA} \; \text{typ. values.} \]

\[ t_p = 50 \mu s \; \text{typ. values.} \]

Fig. 2

Fig. 3

Fig. 4

\[ t_{\text{on}} = 20 \mu s; \; \delta = 0.01; \]
\[ T_{\text{amb}} = 25 \text{ °C} \; \text{typ. values.} \]

Fig. 5

Fig. 6

Fig. 7
Fig. 8  $I_F = 10$ mA; $T_{amb} = 25$ °C; typ. values.

Fig. 9  Typical values.
LIGHT EMITTING DIODES

Rectangular light emitting diodes of 5 mm x 1 mm which emit red light at a typical peak wavelength of 630 nm (GaAsP/GaP; super-red) when forward biased.

The CQW60 and CQW60L have a SOD-75 outline and are encapsulated in a red diffusing resin. These LEDs when stacked in an array (in combination with other SOD-75 LEDs) can be used, for example, as level indicators.

The CQW60L is equal to the CQW60 but has long leads and no seating plane.

**QUICK REFERENCE DATA**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>( V_R )</td>
<td>max.</td>
<td>5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>( I_F )</td>
<td>max.</td>
<td>30 mA</td>
</tr>
<tr>
<td>Total power dissipation up to ( T_{amb} = 65 , ^\circ C )</td>
<td>( P_{tot} )</td>
<td>max.</td>
<td>90 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>( T_J )</td>
<td>max.</td>
<td>100 °C</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( I_F = 10 , mA )</td>
<td>( I_V )</td>
<td>min.</td>
<td>0.7 mcd</td>
</tr>
<tr>
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<td></td>
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<tr>
<td>CQW60(L)-2</td>
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<td>CQW60(L)-3</td>
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<td>Wavelength at peak emission</td>
<td>( \lambda_p )</td>
<td>typ.</td>
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<tr>
<td>( I_F = 10 , mA )</td>
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<tr>
<td>Beamwidth between half-intensity directions</td>
<td>( \theta_{1/2} )</td>
<td>typ.</td>
<td>110 °</td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig. 1a SOD-75B1.
CQW60

Fig. 1b SOD-75BL.
CQW60L.

Dimensions in mm

Note: Solderability not guaranteed in tie-bar zone.
Light emitting diodes

CQW60
CQW60L

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

Reverse voltage
Forward current
   d.c.
      peak value; $t_p = 1 \mu s$; $f = 300$ Hz
      peak value; $t_{on} = 1$ ms; $\delta = 0,33$
Total power dissipation up to $T_{amb} = 65$ °C
Storage temperature
Junction temperature
Lead soldering temperature at $t_{sld} < 7$ s
   $> 1,5$ mm from the seating plane for CQW60
   $> 5$ mm from the plastic body for CQW60L

THERMAL RESISTANCE
From junction to ambient when the device is mounted on a p.c. board.

CHARACTERISTICS
$T_j = 25$ °C unless otherwise specified

Forward voltage
Reverse current
Beamwidth between half-intensity directions in the plane of the leads
Bandwidth at half height
Wavelength at peak emission
Luminous intensity
Diode capacitance

<table>
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<tr>
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<th>CQW60</th>
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<th>CQW60(L)-3</th>
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<td>30 mA</td>
<td>100 µA</td>
<td>100 µA</td>
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<td>1 A</td>
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<td>3,0 V</td>
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<td>350 K/W</td>
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<td>2,1 V</td>
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<td>110 o</td>
<td>110 o</td>
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<td>630 nm</td>
<td>630 nm</td>
<td>630 nm</td>
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<tr>
<td>$I_F = 10$ mA</td>
<td>0,7 mcd</td>
<td>0,7 mcd</td>
<td>0,7 mcd</td>
<td>0,7 mcd</td>
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<tr>
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<td>1,0 to 2,2 mcd</td>
<td>1,0 to 2,2 mcd</td>
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<td>630 nm</td>
<td>630 nm</td>
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</tbody>
</table>

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Fig. 8 Typical values.

Fig. 9 Typical values.
Rectangular light emitting diodes of 5 mm x 1 mm which emit red light at a typical peak wavelength of 650 nm (GaAlAs; hyper-red) when forward biased.

The CQW60A and CQW60AL have a SOD-75 outline and are encapsulated in a red diffusing resin. These LEDs when stacked in an array (in combination with other SOD-75 LEDs) can be used, for example, as level indicators.

The CQW60AL is equal to the CQW60A but has long leads and no seating plane.

### QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
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<td>Continuous reverse voltage</td>
<td>$V_R$</td>
<td>V</td>
<td>5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>mA</td>
<td>100 mA</td>
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<tr>
<td>Total power dissipation up to $T_{amb} = 25 , ^\circ C$</td>
<td>$P_{tot}$</td>
<td>mW</td>
<td>215 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>°C</td>
<td>100 °C</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td>$I_V$</td>
<td>mcd</td>
<td>0.7 mcd, 1.6 to 3.5 mcd, 3.0 mcd</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_p$</td>
<td>nm</td>
<td>650 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions in the plane of the leads</td>
<td>$\theta_{1/2}$</td>
<td>°</td>
<td>110 °</td>
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</table>
MECHANICAL DATA

Fig. 1a SOD-75B2. CQW60A

Dimensions in mm

Fig. 1b SOD-75BL. CQW60AL

Note: Solderability not guaranteed in tie-bar zone.
**RATINGS**

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

Reverse voltage

<table>
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<tr>
<td>VR max.</td>
<td>max.</td>
<td>5 V</td>
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Forward current

d.c.
- peak value; $t_p = 1 \mu s$; $f = 300$ Hz
- peak value; $t_{on} = 20 \mu s$; $\delta = 0,01$

<table>
<thead>
<tr>
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Total power dissipation up to $T_{amb} = 25$ °C

<table>
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<th>Parameter</th>
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</thead>
<tbody>
<tr>
<td>P_{tot} max.</td>
<td>max.</td>
<td>215 mW</td>
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Storage temperature

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Junction temperature

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<td>$T_j$ max.</td>
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Lead soldering temperature at $t_{sld} < 7$ s

<table>
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<th>Parameter</th>
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<tr>
<td>&gt; 1,5 mm from the seating plane for CQW60A</td>
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</tr>
<tr>
<td>&gt; 5 mm from the plastic body for CQW60AL</td>
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**THERMAL RESISTANCE**

From junction to ambient when the device is mounted on a p.c. board

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<td>$R_{th j-a}$ max.</td>
<td>max.</td>
<td>350 K/W</td>
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**CHARACTERISTICS**

$T_j = 25$ °C unless otherwise specified

Forward voltage

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Reverse current

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Beamwidth between half-intensity directions in the plane of the leads

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<td>typ.</td>
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Bandwidth at half height

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<td>typ.</td>
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Wavelength at peak emission

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<td>$\lambda_p$ typ.</td>
<td>typ.</td>
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Luminous intensity

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<td>$I_v$ min.</td>
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<tr>
<td>$I_v$ 1,6 to 3,5 mcd</td>
<td>1,6 to 3,5 mcd</td>
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<table>
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<tbody>
<tr>
<td>$I_v$ 3,0 mcd</td>
<td>3,0 mcd</td>
<td></td>
</tr>
</tbody>
</table>

Diode capacitance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_d$ typ.</td>
<td>typ.</td>
<td>80 pF</td>
</tr>
</tbody>
</table>

$V_R = 0$, $f = 1$ MHz
Fig. 2

Fig. 3 \( T_{\text{Amb}} = 25 \, ^\circ\text{C} \); typ. values.

Fig. 4 \( t_{\text{on}} = 20 \, \mu\text{s}; \, \delta = 0.01; \, T_{\text{Amb}} = 25 \, ^\circ\text{C} \); typ. values.

Fig. 5 \( I_F = 10 \, \text{mA}; \) typical values.

Fig. 6 Typical values.

Fig. 7 \( t_D = 50 \, \mu\text{s}; \) typical values.
Fig. 8 IF = 10 mA; T_{amb} = 25°C; typ. values.

Fig. 9 Typical values.
LIGHT EMITTING DIODES

Rectangular light emitting diodes of 5 mm x 1 mm which emit red light at a typical peak wavelength of 700 nm (GaAsP; standard red) when forward biased.

The CQW60U and CQW60UL have a SOD-75 outline and are encapsulated in a red diffusing resin.

The CQW60U and CQW60UL are specially designed for low current applications.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th></th>
<th>VR max.</th>
<th>IF max.</th>
<th>Ptot max.</th>
<th>Tj max.</th>
<th>Iv min.</th>
<th>( \lambda_p ) typ.</th>
<th>( \theta_{1/2} ) typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse voltage</td>
<td>5 V</td>
<td>30 mA</td>
<td>90 mW</td>
<td>100 °C</td>
<td>0,7 mcd</td>
<td>700 nm</td>
<td>110 °</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Total power dissipation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>up to ( T_{amb} = 65 , ^{\circ}C )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junction temperature</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Luminous intensity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>at ( I_F = 10 , mA )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig. 1 SOD-75B1.

CQW60U

Dimensions in mm

Fig. 1b SOD-75BL.

CQW60UL

Note: Solderability not guaranteed in tie-bar zone.
### RATINGS

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse voltage</td>
<td>( V_R )</td>
<td>max.</td>
<td>5 V</td>
</tr>
<tr>
<td>Forward current</td>
<td>( I_F )</td>
<td>max.</td>
<td>30 mA</td>
</tr>
<tr>
<td>D.C. peak value; ( t_0 = 1 , \mu s ); ( f = 300 , \text{Hz} )</td>
<td>( I_{FRM} )</td>
<td>max.</td>
<td>1 A</td>
</tr>
<tr>
<td>Peak value; ( t_{on} = 1 , \text{ms} ); ( \delta = 0.33 )</td>
<td>( I_{FRM} )</td>
<td>max.</td>
<td>60 mA</td>
</tr>
<tr>
<td>Total power dissipation up to ( T_{amb} = 25 , ^\circ \text{C} )</td>
<td>( P_{tot} )</td>
<td>max.</td>
<td>90 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>( T_j )</td>
<td>max.</td>
<td>100 °C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>( T_{stg} )</td>
<td>max.</td>
<td>-55 to +100 °C</td>
</tr>
<tr>
<td>Lead soldering temperature</td>
<td>CQW60U</td>
<td>( T_{sld} )</td>
<td>max. 260 °C</td>
</tr>
<tr>
<td></td>
<td>CQW60UL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal resistance</td>
<td>( R_{th , j-a} )</td>
<td>max.</td>
<td>350 K/W</td>
</tr>
</tbody>
</table>

### CHARACTERISTICS

\( T_{amb} = 25 \, ^\circ \text{C} \) unless otherwise specified

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Typ.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward voltage at ( I_F = 10 , \text{mA} )</td>
<td>( V_F )</td>
<td></td>
<td>2.0 V</td>
</tr>
<tr>
<td>Reverse current at ( V_R = 5 , \text{V} )</td>
<td>( I_R )</td>
<td>max.</td>
<td>100 , \mu A</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions at ( I_F = 10 , \text{mA} )</td>
<td>( \theta_{1/2} )</td>
<td>typ.</td>
<td>110 °</td>
</tr>
<tr>
<td>Wavelength at peak emission at ( I_F = 10 , \text{mA} )</td>
<td>( \lambda_p )</td>
<td>typ.</td>
<td>700 nm</td>
</tr>
<tr>
<td>Capacitance at ( V_R = 0 ); ( f = 1 , \text{MHz} )</td>
<td>( C_d )</td>
<td>typ.</td>
<td>45 pF</td>
</tr>
<tr>
<td>Bandwidth at half height</td>
<td>( \Delta \lambda )</td>
<td>typ.</td>
<td>90 nm</td>
</tr>
<tr>
<td>Luminous intensity at ( I_F = 10 , \text{mA} )</td>
<td>( I_V )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CQW60U(L)-2</td>
<td>min.</td>
<td>0.7 mcd</td>
<td></td>
</tr>
<tr>
<td>CQW60U(L)-2</td>
<td>min.</td>
<td>1.0 mcd</td>
<td></td>
</tr>
<tr>
<td>CQW60U(L)-3</td>
<td>max.</td>
<td>2.2 mcd</td>
<td></td>
</tr>
<tr>
<td>CQW60U(L)-3</td>
<td>max.</td>
<td>1.6 mcd</td>
<td></td>
</tr>
</tbody>
</table>
Fig. 8 Typical values.
Rectangular light emitting diodes of 5 mm x 1 mm which emit green light at a typical peak wavelength of 565 nm (GaP; super-green) when forward biased.

The CQW61 and CQW61L have a SOD-75 outline and are encapsulated in a green diffusing resin. These LEDs when stacked in an array (in combination with other SOD-75 LEDs) can be used, for example, as level indicators.

The CQW61L is equal to the CQW61 but has long leads and no seating plane.

<table>
<thead>
<tr>
<th>QUICK REFERENCE DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 35^\circ$C</td>
</tr>
<tr>
<td>Junction temperature</td>
</tr>
<tr>
<td>Luminous intensity</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions in the plane of the leads</td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig. 1a SOD-75B1.
CQW61

Fig. 1b SOD-75BL.
CQW61L

Note: Solderability not guaranteed in tie-bar zone.
Light emitting diodes

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

Reverse voltage
Forward current
d.c.
peak value; \( t_p = 1 \mu s; f = 300 \text{ Hz} \)
peak value; \( t_{on} = 1 \text{ ms}; \delta = 0,33 \)
Total power dissipation up to \( T_{amb} = 35 \text{ °C} \)
Storage temperature
Junction temperature
Lead soldering temperature at \( t_{sld} < 7 \text{ s} \)
> 1,5 mm from the seating plane for CQW61
> 5 mm from the plastic body for CQW61 L

THERMAL RESISTANCE
From junction to ambient when the device is mounted on a p.c. board

CHARACTERISTICS
\( T_j = 25 \text{ °C unless otherwise specified} \)
Forward voltage
Reverse current
Beamwidth between half-intensity directions in the plane of the leads; \( I_F = 10 \text{ mA} \)
Bandwidth at half height
Wavelength at peak emission
Luminous intensity
Diode capacitance

\( V_R \max. \quad 5 \text{ V} \)
\( I_F \max. \quad 60 \text{ mA} \)
\( I_{FRM} \max. \quad 1 \text{ A} \)
\( I_{FRM} \max. \quad 150 \text{ mA} \)
\( P_{tot} \max. \quad 180 \text{ mW} \)
\( T_{j} \max. \quad 100 \text{ °C} \)
\( T_{sld} \max. \quad 260 \text{ °C} \)

\( R_{th j-a} \max. \quad 350 \text{ K/W} \)

\( V_F \typ. \quad 2,1 \text{ V} \)
\( V_F \max. \quad 3,0 \text{ V} \)
\( I_R \max. \quad 100 \mu \text{A} \)
\( \theta_{1/2} \typ. \quad 110 \text{ °} \)
\( \Delta \lambda \typ. \quad 30 \text{ nm} \)
\( \lambda_p \typ. \quad 565 \text{ nm} \)
\( I_F = 10 \text{ mA} \)

\( C_D \typ. \quad 20 \text{ pF} \)

CQW61
CQW61L
CQW61
CQW61L

Fig. 2.

Fig. 3 \( T_{\text{amb}} = 25 \, ^{\circ}\text{C} \); typ. values.

Fig. 4 \( t_{\text{on}} = 50 \, \mu\text{s}; \delta = 0.01; \)
\( T_{\text{amb}} = 25 \, ^{\circ}\text{C} \); typ. values.

Fig. 5 Typical values.

Fig. 6 Typical values.

Fig. 7 \( t_{p} = 50 \, \mu\text{s} \); typical values.
Fig. 8  $I_F = 10 \text{ mA}$; typical values.

Fig. 9  Typical values.
LIGHT EMITTING DIODES

Rectangular light emitting diodes of 5 mm x 1 mm which emit yellow light at a typical peak wavelength of 590 nm (GaPAs) when forward biased.

The CQW62 and CQW62L have a SOD-75 outline and are encapsulated in a yellow diffusing resin. These LEDs when stacked in an array (in combination with other SOD-75 LEDs) can be used, for example, as level indicators.

The CQW62L is equal to the CQW62 but has long leads and no seating plane.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$</td>
<td>max.</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>max.</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 65,\degree C$</td>
<td>$P_{tot}$</td>
<td>max.</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>max.</td>
</tr>
<tr>
<td>Luminous intensity at $I_F = 10, mA$</td>
<td>$I_V$</td>
<td>min.</td>
</tr>
<tr>
<td>CQW62(L)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CQW62(L)-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CQW62(L)-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wavelength at peak emission at $I_F = 10, mA$</td>
<td>$\lambda_p$</td>
<td>typ.</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions in the plane of the leads</td>
<td>$\theta_{1/2}$</td>
<td>typ.</td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig. 1a SOD-75B1.
CQW62

Note: Solderability not guaranteed in tie-bar zone.
Light emitting diodes

RATINGS

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

Reverse voltage
Forward current
d.c.
peak value; \( t_p = 1 \mu s; f = 300 \text{ Hz} \)
peak value; \( t_{on} = 1 \text{ ms}; \delta = 0,33 \)
Total power dissipation up to \( T_{amb} = 65 ^\circ \text{C} \)
Storage temperature
Junction temperature
Lead soldering temperature at \( t_{sld} < 7 \text{ s} \)

> 1,5 mm from the seating plane for CQW62
> 5 mm from the plastic body for CQW62L

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board

CHARACTERISTICS

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

Forward voltage
Forward current

VR \quad \text{max.} \quad 5 \text{ V}
IF \quad \text{max.} \quad 30 \text{ mA}
IFRM \quad \text{max.} \quad 1 \text{ A}
P_{tot} \quad \text{max.} \quad 90 \text{ mW}

T_{stg} \quad \text{–55 to +100 \text{ C}}
T_{j} \quad \text{max.} \quad 100 \text{ \text{C}}
T_{sld} \quad \text{max.} \quad 260 \text{ \text{C}}

R_{th j-a} \quad \text{max.} \quad 350 \text{ K/W}

Forward voltage
Forward current

c. \quad \text{max.} \quad 2,1 \text{ V}
max. \quad 3,0 \text{ V}

Reverse current

VR \quad \text{max.} \quad 5 \text{ V}
IR \quad \text{max.} \quad 100 \mu\text{A}

Beamwidth between half-intensity directions in the plane of the leads; \( IF = 10 \text{ mA} \)

Bandwidth at half height

\( \theta_{1/2} \quad \text{typ.} \quad 110 ^\circ \)
\( \Delta \lambda \quad \text{typ.} \quad 40 \text{ nm} \)

Wavelength at peak emission \( IF = 10 \text{ mA} \)

\( \lambda_p \quad \text{typ.} \quad 590 \text{ nm} \)

Luminous intensity \( IF = 10 \text{ mA} \)

CQW62(L) \qquad I_v \quad \text{min.} \quad 0,7 \text{ mcd}
CQW62(L)-2 \qquad I_v \quad \text{min.} \quad 1,0 \text{ to } 2,2 \text{ mcd}
CQW62(L)-3 \qquad I_v \quad \text{min.} \quad 1,6 \text{ mcd}

Diode capacitance \( VR = 0; f = 1 \text{ MHz} \)

C_d \quad \text{typ.} \quad 15 \text{ pF}
Fig. 2. $P_{\text{tot}}$ vs. $T_{\text{amb}}$ (°C).

Fig. 3. $T_{\text{amb}} = 25$ °C; typ. values.

Fig. 4. $t_{\text{on}} = 50$ µs; $\delta = 0.01$; $T_{\text{amb}} = 25$ °C; typ. values.

Fig. 5. Typical values.

Fig. 6. $I_F = 10$ mA; typ. values.

Fig. 7. $t_p = 50$ µs; typical values.
Fig. 8 Typical values.

Fig. 9 Typical values.
HIGH-SPEED INFRARED EMITTING DIODE

Circular infrared emitting diode with diameter of 5 mm which emits infrared light at a typical peak wavelength of 830 nm (GaAlAs; infrared) when forward biased.

The CQW89A has a SOD-63 outline and is moulded in a light blue encapsulation with long leads. It is intended for remote control applications using carrier frequencies up to 1 MHz.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$</td>
<td>max. 5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>max. 130 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 25 \degree C$</td>
<td>$P_{tot}$</td>
<td>max. 300 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_J$</td>
<td>max. 100 \degree C</td>
</tr>
<tr>
<td>Radiant intensity (on axis)</td>
<td>$I_F = 100 \ mA$</td>
<td>$I_e$ min. 9 mW/sr</td>
</tr>
<tr>
<td></td>
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<td>CQW89A</td>
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<td></td>
<td></td>
<td>CQW89A-1</td>
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<tr>
<td></td>
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<td>CQW89A-2</td>
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<tr>
<td>Switching times (see Figs 2 and 3)</td>
<td></td>
<td>$t_r$ typ. 30 ns</td>
</tr>
<tr>
<td>$I_F = 100 \ mA$</td>
<td></td>
<td>$t_f$ typ. 30 ns</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td></td>
<td>$\lambda_p$ typ. 830 nm</td>
</tr>
<tr>
<td>Beamwidth at half-intensity directions</td>
<td></td>
<td>$\theta_{1/2}$ typ. 40 \degree</td>
</tr>
</tbody>
</table>
MECHANICAL DATA
Fig. 1 SOD-63D2.

Dimensions in mm
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)
Continuous reverse voltage
Forward current
d.c.
peak value; \( t_p = 10 \, \mu s; \delta = 0,01 \)
peak value; \( t_p = 50 \, \mu s; \delta = 0,01 \)
Total power dissipation up to
Storage temperature
Junction temperature
Lead soldering temperature
THERMAL RESISTANCE
From junction to ambient
when the device is mounted on a printed circuit board
CHARACTERISTICS
T\( _j \) = 25 °C unless otherwise specified
Forward voltage
Forward voltage
Reverse current
Diode capacitance at \( f = 1 \, \text{MHz} \)
Total radiant power
Radiant intensity (on axis)
Radiant power temperature coefficient
Wavelength at peak emission
Spectral line half width
Beamwidth at half-intensity direction
Switching times (see Figs 2 and 3)

\[ \begin{array}{lcl}
V_R & \text{max.} & 5 \, \text{V} \\
I_F & \text{max.} & 130 \, \text{mA} \\
I_{FM} & \text{max.} & 2500 \, \text{mA} \\
I_{FM} & \text{max.} & 1500 \, \text{mA} \\
P_{tot} & \text{max.} & 300 \, \text{mW} \\
T_{stg} & \text{max.} & -55 \text{ to } +100 \, \text{°C} \\
T_j & \text{max.} & 100 \, \text{°C} \\
T_{sld} & \text{max.} & 260 \, \text{°C} \\
V_F & \text{typ.} & 3,7 \, \text{V} \\
V_F & \text{max.} & 2,2 \, \text{V} \\
I_R & \text{max.} & 100 \, \mu \text{A} \\
C_d & \text{typ.} & 200 \, \text{pF} \\
\phi_e & \text{typ.} & 8 \, \text{mW} \\
I_e & \text{min.} & 9 \, \text{mW/sr} \\
I_e & \text{min.} & 12 \, \text{mW/sr} \\
I_e & \text{min.} & 15 \, \text{mW/sr} \\
k_{\phi e} & \text{typ.} & -0,6 \, \%/\text{K} \\
\lambda_p & \text{typ.} & 830 \, \text{nm} \\
\Delta \lambda & \text{typ.} & 35 \, \text{nm} \\
\theta_{\pi} & \text{min.} & 28 \, \text{o} \\
\theta_{\pi} & \text{typ.} & 40 \, \text{o} \\
tr & \text{typ.} & 30 \, \text{ns} \\
tf & \text{typ.} & 30 \, \text{ns} \\
\end{array} \]
Fig. 2 Measuring circuit.

Fig. 3 Waveforms.

Fig. 4 Typical values.

Fig. 5 $t_{on} = 10 \mu s$; $\delta = 0.01$; $T_{amb} = 25 ^\circ C$; typical values.

Fig. 6 $T_{amb} = 25 ^\circ C$; typical values.

Fig. 7 $t_{on} = 10 \mu s$; $T_{amb} = 25 ^\circ C$; typical values.
High-speed infrared emitting diode

Fig. 8 $I_F = 100 \text{ mA}$; typical values.

Fig. 9 Typical values.

Fig. 10 Spectral response; typical values.

Fig. 11 Typical values.

Fig. 12 Typical values.
**LIGHT EMITTING DIODE**

Circular light emitting diode with a diameter of 3 mm which emits red light at a typical peak wavelength of 650 nm (GaAlAs; hyper-red) when forward biased. The CQW93 has a SOD-53 outline and is encapsulated in a red non-diffusing resin.

**Note:** This device has to be used behind a diffusing screen.

### QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$</td>
<td>max. 5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>max. 60 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 25 , ^{\circ}C$</td>
<td>$P_{tot}$</td>
<td>max. 150 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>max. 100 , ^{\circ}C</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td>$I_V$</td>
<td>min. 5 mcd</td>
</tr>
<tr>
<td>$I_F = 10 , mA$</td>
<td>CQW93</td>
<td>$\lambda_p$</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>$\theta_{1/2}$</td>
<td>typ. 60 , ^{\circ}</td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig. 1 SOD-53E.

Dimensions in mm

CQW93
### 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>Continuous reverse voltage</td>
<td>$V_R$</td>
<td>max. 5 V</td>
</tr>
<tr>
<td>Forward current</td>
<td>$I_F$</td>
<td>max. 60 mA</td>
</tr>
<tr>
<td>d.c. peak value; $t_p = 1 \mu s$; $f =$ 300 Hz</td>
<td>$I_{FRM}$</td>
<td>max. 1 A</td>
</tr>
<tr>
<td>peak value; $t_{on} = 20 \mu s$; $\delta =$ 0,01</td>
<td>$I_{FRM}$</td>
<td>max. 500 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} =$ 25 °C</td>
<td>$P_{tot}$</td>
<td>max. 150 mW</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>$T_{stg}$</td>
<td>-55 to +100 °C</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>max. 100 °C</td>
</tr>
<tr>
<td>Lead soldering temperature</td>
<td>$T_{sld}$</td>
<td>max. 260 °C</td>
</tr>
<tr>
<td>$&gt; 1,5$ mm from the seating plane; $t_{sld} &lt;$ 7 s</td>
<td>$T_{sld}$</td>
<td>max. 260 °C</td>
</tr>
</tbody>
</table>

### THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board $R_{th j-a}$ max. 500 K/W

### CHARACTERISTICS

$T_j =$ 25 °C unless otherwise specified

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward voltage</td>
<td>$I_F$</td>
<td>10 mA</td>
</tr>
<tr>
<td>$V_F$ max. 1,75 V</td>
<td>max. 2,2 V</td>
<td></td>
</tr>
<tr>
<td>Reverse current</td>
<td>$V_R = 5$ V</td>
<td>$I_R$ max. 100 µA</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$\theta_{1/2}$</td>
<td>typ. 60 °</td>
</tr>
<tr>
<td>Bandwidth at half height</td>
<td>$\Delta \lambda$</td>
<td>typ. 20 nm</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_p$</td>
<td>typ. 650 nm</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td>$I_F = 10$ mA</td>
<td>$I_v$ min. 5 mcd</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CQW93-5 $I_v$ min. 5 mcd</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CQW93-6 $I_v$ max. 12 mcd</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CQW93-7 $I_v$ min. 10 mcd</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CQW93-8 $I_v$ max. 22 mcd</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CQW93-9 $I_v$ min. 16 mcd</td>
</tr>
<tr>
<td>Diode capacitance</td>
<td>$V_R = 0$; $f =$ 1 MHz</td>
<td>$C_d$ typ. 80 pF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CQW93-5 $C_d$ typ. 80 pF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CQW93-6 $C_d$ typ. 80 pF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CQW93-7 $C_d$ typ. 80 pF</td>
</tr>
</tbody>
</table>
LIGHT EMITTING DIODE WITH HIGH LUMINOSITY

Circular light emitting diode with a diameter of 3 mm which emits green light at a typical peak wavelength of 565 nm (GaP; super-green) when forward biased.

The CQW95 has a SOD-53 outline and is encapsulated in a green non-diffusing resin.

The CQW95 can resist higher forward currents when high luminosity is required. An appropriate device, for example, for the backlighting of push buttons.

Note: This device has to be used behind a diffusing screen.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$ max. 5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$ max. 60 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 25 ^\circ C$</td>
<td>$P_{tot}$ max. 150 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$ max. 100 °C</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td></td>
</tr>
<tr>
<td>$I_F = 10$ mA</td>
<td>$I_V$ min. 3 mcd</td>
</tr>
<tr>
<td>CQW95</td>
<td>$I_V$ 5 to 12 mcd</td>
</tr>
<tr>
<td>CQW95-5</td>
<td>$I_V$ 10 to 22 mcd</td>
</tr>
<tr>
<td>CQW95-6</td>
<td>$I_V$ min. 16 mcd</td>
</tr>
<tr>
<td>CQW95-7</td>
<td>$I_V$</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_p$ typ. 565 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$\theta_{1/2}$ typ. 60 °</td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig. 1 SOD-53E.

Dimensions in mm

unflat base plane

45°
RATINGS

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

Continuous reverse voltage
Forward current
d.c.
peak value; \( t_p = 1 \mu s; f = 300 \text{ Hz} \)
peak value; \( t_{on} = 1 \text{ ms}; \delta = 0.33 \)
Total power dissipation up to \( T_{amb} = 25^\circ \text{C} \)
Storage temperature
Junction temperature
Lead soldering temperature

\[
\begin{align*}
V_R & \quad \text{max.} \quad 5 \text{ V} \\
I_F & \quad \text{max.} \quad 60 \text{ mA} \\
I_{FRM} & \quad \text{max.} \quad 1 \text{ A} \\
P_{tot} & \quad \text{max.} \quad 150 \text{ mA} \\
T_{df} & \quad \text{max.} \quad 100 \text{ °C} \\
T_{sld} & \quad \text{max.} \quad 260 \text{ °C}
\end{align*}
\]

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board

\[
R_{th j-a} \quad \text{max.} \quad 500 \text{ K/W}
\]

CHARACTERISTICS

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

Forward voltage
Reverse current
\( V_R = 5 \text{ V} \)
Beamwidth between half-intensity directions
Bandwidth at half height
Wavelength at peak emission
Luminous intensity
Diode capacitance

\[
\begin{align*}
I_F = 10 \text{ mA} & \quad V_F \quad \text{typ.} \quad 2.1 \text{ V} \\
I_R & \quad \text{max.} \quad 100 \mu \text{A} \\
\theta_{1/2} & \quad \text{typ.} \quad 60 \text{ °} \\
\Delta \lambda & \quad \text{typ.} \quad 30 \text{ nm} \\
\lambda_p & \quad \text{typ.} \quad 565 \text{ nm} \\
I_F = 10 \text{ mA} & \quad C_{QW95} \quad I_v \quad \text{min.} \quad 3 \text{ mcd} \\
& \quad C_{QW95-5} \quad I_v \quad 5 \text{ to} 12 \text{ mcd} \\
& \quad C_{QW95-6} \quad I_v \quad 10 \text{ to} 22 \text{ mcd} \\
& \quad C_{QW95-7} \quad I_v \quad \text{min.} \quad 16 \text{ mcd} \\
V_R = 0; f = 1 \text{ MHz} & \quad C_d \quad \text{typ.} \quad 20 \text{ pF}
\end{align*}
\]
Fig. 2

Fig. 3 \( T_{\text{amb}} = 25 \, ^{\circ}\text{C} \); typ. values.

Fig. 4 \( t_{\text{on}} = 1 \, \text{ms}; \delta = 0.33; \) \( T_{\text{amb}} = 25 \, ^{\circ}\text{C} \); typ. values.

Fig. 5 Typical values.

Fig. 6 Typical values.

Fig. 7 \( t_{\text{p}} = 50 \, \mu\text{s} \); typ. values.
Fig. 8 $I_F = 10$ mA; typ. values.

Fig. 9 Typical values.
CQW97

LIGHT EMITTING DIODE WITH HIGH LUMINOSITY

Circular light emitting diode with a diameter of 3 mm which emits yellow light at a typical peak wavelength of 590 nm (GaPAs) when forward biased.

The CQW97 has a SOD-53 outline and is mounted in a yellow non-diffusing resin. An appropriate device, for example, backlighting push button indicators.

Note: This device has to be used behind a diffusing screen.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Continuous reverse voltage</th>
<th>$V_R$</th>
<th>max.</th>
<th>5 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>max.</td>
<td>30 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 55 , ^\circ C$</td>
<td>$P_{tot}$</td>
<td>max.</td>
<td>90 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>max.</td>
<td>100 $^\circ C$</td>
</tr>
<tr>
<td>Luminous intensity $I_F = 10 , mA$</td>
<td>$l_v$</td>
<td>min.</td>
<td>3 mcd</td>
</tr>
<tr>
<td>CQW97A</td>
<td>$l_v$</td>
<td>5 to 12 mcd</td>
<td></td>
</tr>
<tr>
<td>CQW97A-5</td>
<td>$l_v$</td>
<td>10 to 22 mcd</td>
<td></td>
</tr>
<tr>
<td>CQW97A-6</td>
<td>$l_v$</td>
<td>min.</td>
<td>16 mcd</td>
</tr>
<tr>
<td>CQW97A-7</td>
<td>$l_v$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_p$</td>
<td>typ.</td>
<td>590 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$\theta_{1/2}$</td>
<td>typ.</td>
<td>60 $^\circ$</td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig. 1 SOD-53E.

Dimensions in mm

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>3,5</td>
</tr>
<tr>
<td>Depth</td>
<td>3,1</td>
</tr>
<tr>
<td>Height</td>
<td>3,1</td>
</tr>
<tr>
<td>Length</td>
<td>2,9</td>
</tr>
<tr>
<td>Width</td>
<td>2,54</td>
</tr>
<tr>
<td>Depth</td>
<td>0,56</td>
</tr>
<tr>
<td>Height</td>
<td>0,45</td>
</tr>
</tbody>
</table>

unflat base plane

45°
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage
- \( V_R \), max. 5 V

Forward current
- d.c.
  - peak value; \( t_p = 1 \mu s; f = 300 \text{ Hz} \)
  - peak value; \( t_{on} = 1 \text{ ms}; \delta = 0.33 \)

- \( I_F \), max. 30 mA

- \( I_{FRM} \), max. 60 mA

Total power dissipation up to \( T_{amb} = 55 ^\circ C \)
- \( P_{tot} \), max. 90 mW

Storage temperature
- \( T_{stg} \), -55 to 100 \(^\circ C\)

Junction temperature
- \( T_j \), max. 100 \(^\circ C\)

Lead soldering temperature
- > 1.5 mm from the seating plane; \( t_{sld} < 7 \text{ s} \)
- \( T_{sld} \), max. 260 \(^\circ C\)

THERMAL RESISTANCE
From junction to ambient when the device is mounted on a p.c. board
- \( R_{th j-a} \), max. 500 K/W

CHARACTERISTICS
\( T_j = 25 ^\circ C \) unless otherwise specified

Forward voltage
- \( I_F = 10 \text{ mA} \)
  - \( V_F \), typ. 2.1 V
  - max. 3.0 V

Reverse current
- \( V_R = 5 \text{ V} \)
  - \( I_R \), max. 100 \( \mu A \)

Beamwidth between half-intensity directions
- \( I_F = 10 \text{ mA} \)
  - \( \theta_{1/2} \), typ. 60 \(^\circ\)

Bandwidth at half height
- \( \Delta \lambda \), typ. 40 nm

Wavelength at peak emission
- \( I_F = 10 \text{ mA} \)
  - \( \lambda_p \), typ. 590 nm

Luminous intensity
- \( I_F = 10 \text{ mA} \)
  - \( CQW97A \)
    - \( I_v \), min. 3 mcd
  - \( CQW97A-5 \)
    - \( I_v \), 5 to 12 mcd
  - \( CQW97A-6 \)
    - \( I_v \), 10 to 22 mcd
  - \( CQW97A-7 \)
    - \( I_v \), min. 16 mcd

Diode capacitance
- \( V_R = 0; f = 1 \text{ MHz} \)
  - \( C_d \), typ. 15 pF
**Fig. 2.**

- $P_{\text{tot}}$ (mW)
- $T_{\text{amb}}$ (°C)

**Fig. 3** $T_j = 25$ °C; typ. values.

**Fig. 4** $t_p = 50$ µs; $\delta = 0.01$; $T_{\text{amb}} = 25$ °C; typ. values.

**Fig. 5** Typical values.

**Fig. 6** Typical values.

**Fig. 7** $T_j = 25$ °C; typ. values.
Fig. 8 Typical values.

Fig. 9 Typical values.
LIGHT EMITTING DIODES

Circular light emitting diodes with a diameter of 3 mm which emit a narrow beam of red light at a typical peak wavelength of 650 nm (GaAlAs; hyper-red) when forward biased.

The CQX24 and CQX24L have a SOD-63 outline and are encapsulated in a clear colourless resin.

The very high light intensity of the CQX24 and COX24L make them suitable for applications where only low currents are available. They are also suited for very high luminous intensity applications because of their ability to withstand high forward currents.

The CQX24L is the long-lead version of the CQX24 and has no seating plane but is in all other respects equal to the COX24.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>COX24(L)</th>
<th>COX24(L)-8</th>
<th>COX24(L)-9</th>
<th>COX24(L)-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>V_R</td>
<td>max.</td>
<td>5 V</td>
<td></td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>I_F</td>
<td>max.</td>
<td>100 mA</td>
<td></td>
</tr>
<tr>
<td>Total power dissipation up to T_amb = 25 °C</td>
<td>P_tot</td>
<td>max.</td>
<td>215 mW</td>
<td></td>
</tr>
<tr>
<td>Junction temperature</td>
<td>T_j</td>
<td>max.</td>
<td>100 °C</td>
<td></td>
</tr>
<tr>
<td>Luminous intensity</td>
<td><em>I_F = 10 mA</em></td>
<td><em>I_V</em></td>
<td>min. 16 mcd</td>
<td>30 to 70 mcd</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50 to 120 mcd</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100 mcd</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td><em>l_p</em></td>
<td>typ.</td>
<td>650 nm</td>
<td></td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>_θ_1/2</td>
<td>typ.</td>
<td>20 °</td>
<td></td>
</tr>
</tbody>
</table>

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MECHANICAL DATA

Fig. 1a SOD-63D2. CQX24

Fig. 1b SOD-63L. CQX24L

Note. Solderability not guaranteed in tie-bar zone.
**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>Reverse voltage</td>
<td>$V_R$</td>
<td>max. 5 V</td>
</tr>
<tr>
<td>Forward current</td>
<td>$I_F$</td>
<td>max. 100 mA</td>
</tr>
<tr>
<td>Forward current, peak value, $t_p$</td>
<td>1 µs; $f = 300$ Hz</td>
<td></td>
</tr>
<tr>
<td>Forward current, peak value, $t_{on}$</td>
<td>20 µs; $\delta = 0.01$</td>
<td></td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 25$ °C</td>
<td>$P_{tot}$</td>
<td>max. 215 mW</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>$T_{stg}$</td>
<td>-55 to +100 °C</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>max. 100 °C</td>
</tr>
<tr>
<td>Lead soldering temperature; $t_{sld} &lt; 7$ s</td>
<td>$T_{sld}$</td>
<td>max. 260 °C</td>
</tr>
</tbody>
</table>

**THERMAL RESISTANCE**

From junction to ambient when the device is mounted on a p.c. board

$R_{th j-a}$ max. 350 K/W

**CHARACTERISTICS**

$T_j = 25$ °C unless otherwise specified

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward voltage, $I_F = 10$ mA</td>
<td>$V_F$</td>
<td>max. 2.2 V</td>
</tr>
<tr>
<td>Forward voltage, $I_F = 50$ mA</td>
<td>$V_F$</td>
<td>typ. 1.75 V</td>
</tr>
<tr>
<td>Reverse current</td>
<td>$I_R$</td>
<td>max. 100 µA</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$\theta_{1/2}$</td>
<td>typ. 20 °</td>
</tr>
<tr>
<td>Bandwidth at half height</td>
<td>$\Delta \lambda$</td>
<td>typ. 20 nm</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_p$</td>
<td>typ. 650 nm</td>
</tr>
<tr>
<td>Luminous intensity, $I_F = 4$ mA</td>
<td>$I_v$</td>
<td>typ. 16 mcd</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td></td>
<td>CQX24(L)-8</td>
<td>$I_v$</td>
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<tr>
<td></td>
<td>CQX24(L)-9</td>
<td>$I_v$</td>
</tr>
<tr>
<td></td>
<td>CQX24(L)-10</td>
<td>$I_v$</td>
</tr>
<tr>
<td></td>
<td>CQX24(L)</td>
<td>$I_v$</td>
</tr>
<tr>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>CQX24(L)-8</td>
<td>$I_v$</td>
</tr>
<tr>
<td></td>
<td>CQX24(L)-9</td>
<td>$I_v$</td>
</tr>
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<td>CQX24(L)-10</td>
<td>$I_v$</td>
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<td>CQX24(L)-8</td>
<td>$I_v$</td>
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<td></td>
<td>CQX24(L)-10</td>
<td>$I_v$</td>
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<td></td>
<td>CQX24(L)-8</td>
<td>$I_v$</td>
</tr>
<tr>
<td></td>
<td>CQX24(L)-9</td>
<td>$I_v$</td>
</tr>
<tr>
<td></td>
<td>CQX24(L)-10</td>
<td>$I_v$</td>
</tr>
</tbody>
</table>

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- Diode capacitance

\[ V_R = 0; f = 1 \text{ MHz} \]

![Graph showing diode capacitance](image)

Fig. 2

\[ I_{FM} (\text{mA}) \]

\[ V_{FM} (\text{V}) \]

Fig. 3 Typical values; \( T_{amb} = 25 \degree C \)

\[ I_F = 10 \text{ mA}; \text{typ. values.} \]

Fig. 5

\[ I_v (\%) \]

\[ T_j (\degree C) \]

Fig. 6 Typical values.

\[ I_F (\text{mA}) \]

\[ I_v (\text{mCd}) \]

Fig. 7 \( t_p = 50 \mu s \); typ. values.
Fig. 8  $I_F = 10$ mA; $T_{amb} = 25$ °C; typ. values.

Fig. 9.
Circular light emitting diode with a diameter of 5 mm which emits red light at a typical peak wavelength of 630 nm (GaAsP/GaP; super-red) when forward biased.

The CQX51 and CQX51L have a SOD-63 outline and are encapsulated in a red diffusing resin.

### QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>( V_{R \text{ max.}} )</td>
<td>5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>( I_{F \text{ max.}} )</td>
<td>30 mA</td>
</tr>
<tr>
<td>Total power dissipation up to ( T_{\text{amb}} = 65 , ^\circ \text{C} )</td>
<td>( P_{\text{tot \ max.}} )</td>
<td>90 mW</td>
</tr>
<tr>
<td>Luminous intensity at ( I_{F} = 10 , \text{mA} )</td>
<td>( I_{V \text{ min.}} )</td>
<td>1.6 mcd</td>
</tr>
<tr>
<td>CQX51-4</td>
<td>( I_{V \text{ min.}} )</td>
<td>3 to 7 mcd</td>
</tr>
<tr>
<td>CQX51-5</td>
<td>( I_{V \text{ min.}} )</td>
<td>5 to 12 mcd</td>
</tr>
<tr>
<td>CQX51-6</td>
<td>( I_{V \text{ min.}} )</td>
<td>10 mcd</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>( \lambda_{p \text{ typ.}} )</td>
<td>630 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>( \theta_{1/2 \text{ typ.}} )</td>
<td>70°</td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig. 1 SOD-63A1.
CQX51

Fig. 1b SOD-63L.
CQX51L

Note: Solderability not guaranteed in tie-bar zone.
Light emitting diodes

RATINGS

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

Continuous reverse voltage \( V_R \) max. 5 V
Forward current (d.c.) \( I_F \) max. 30 mA
Forward current
peak value; \( t_{on} = 1 \) ms; \( \delta = 0.33 \)
peak value; \( t_p = 1 \) µs; \( f = 300 \) Hz
\( I_{FRM} \) max. 60 mA
\( I_{pRM} \) max. 1 A
Total power dissipation up to \( T_{amb} = 65 \) °C
\( P_{tot} \) max. 90 mW
Storage temperature \( T_{stg} \) –55 to +100 °C
Junction temperature \( T_J \) max. 100 °C
Lead soldering temperature
> 1,5 mm from the seating plane; \( t_{slid} < 7 \) s
\( T_{slid} \) max. 230 °C

THERMAL RESISTANCE

From junction to ambient mounted on a printed-circuit board
\( R_{th \ j-a} \) min. 350 K/W

CHARACTERISTICS

\( T_J = 25 \) °C unless otherwise specified

Forward voltage
\( I_F = 10 \) mA \( V_F \) typ. 2.1 V 5 V
Reverse current
\( V_R = 5 \) V \( I_R \) max. 100 µA
Diode capacitance
\( V_R = 0; f = 1 \) MHz
\( C_d \) typ. 10 pF
Luminous intensity (on-axis)
\( I_F = 10 \) mA
\( CQX51 \) \( I_V \) min. 1.6 mcd
\( CQX51-4 \) \( I_V \) 3 to 7 mcd
\( CQX51-5 \) \( I_V \) 5 to 12 mcd
\( CQX51-6 \) \( I_V \) min. 10 mcd
Wavelength at peak emission
\( \lambda_p \) typ. 630 nm
Beamwidth between half-intensity directions
\( \theta_{1/2} \) typ. 70 °
Fig. 2: $I_F = 10 \text{ mA}$.

Fig. 3: $T_j = 25 \degree \text{C}$.

Fig. 4: $t_p = 50 \mu \text{s}; T = 5 \text{ ms}; T_j = 25 \degree \text{C}$.

Fig. 5: Typical values.
Light emitting diodes

Fig. 6

Fig. 7 Tamb = 25 °C.

Fig. 8 Typical values.
Fig. 9 Typical values.
LIGHT EMITTING DIODES

Circular light emitting diodes with a diameter of 5 mm which emit a narrow beam of red light at a typical peak wavelength of 630 nm (GaAsP/GaP; super-red) when forward biased.

The CQX54 and CQX54L have a SOD-63 outline and are encapsulated in a clear diffusing resin.

The CQX54L is the long-lead version of the CQX54 and has no seating plane but is in all other respects equal to the CQX54.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$</td>
<td>V</td>
<td>max. 5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>mA</td>
<td>max. 30 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 65 \degree C$</td>
<td>$P_{tot}$</td>
<td>mW</td>
<td>max. 90 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_J$</td>
<td>°C</td>
<td>max. 100 °C</td>
</tr>
</tbody>
</table>
| Luminous intensity $I_F = 10$ mA       | $I_V$  | mcd | min. 10 mcd    | COX54(L)
|                                        |        | mcd  | 16 to 35 mcd   | COX54(L)-7
|                                        |        | mcd  | 30 to 70 mcd   | COX54(L)-8
|                                        |        | mcd  | min. 50 mcd    | COX54(L)-9
| Wavelength at peak emission            | $\lambda_p$ | nm | typ. 630 nm    |
| Beamwidth between half-intensity directions | $\theta_{1/2}$ | °  | typ. 20 °      |
Note: Solderability not guaranteed in tie-bar zone.
**RATINGS**

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

Reverse voltage

\[ V_R \] max. 5 V

Forward current

d.c.

\[ I_F \] max. 30 mA

Forward current

peak value; \( t_p = 1 \mu s; f = 300 \text{ Hz} \)

\[ I_{FRM} \] max. 1 A

pan value; \( t_{on} = 1 \text{ ms}; \delta = 0.33 \)

\[ I_{FRM} \] max. 60 mA

Total power dissipation up to \( T_{amb} = 65 \text{ °C} \)

\[ P_{tot} \] max. 90 mW

Storage temperature

\[ T_{stg} \] -55 to +100 °C

Junction temperature

\[ T_j \] max. 100 °C

Lead soldering temperature; \( t_{sld} < 7 \text{ s} \)

> 1,5 mm from the seating plane for CQX54

> 5 mm from the plastic body for CQX54L

\[ T_{sld} \] max. 260 °C

**THERMAL RESISTANCE**

From junction to ambient

when the device is mounted on a p.c. board

\[ R_{th j-a} \] max. 350 K/W

**CHARACTERISTICS**

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

Forward voltage

\[ I_F = 10 \text{ mA} \]

\[ V_F \] typ. 2,1 V

\[ V_F \] max. 3,0 V

Reverse current

\[ V_R = 5 \text{ V} \]

\[ I_R \] max. 100 \( \mu \text{A} \)

Beamwidth between half-intensity directions

\( \theta_{1/2} \) typ. 20 °

Bandwidth at half height

\( \Delta\lambda \) typ. 45 nm

Wavelength at peak emission

\( \lambda_p \) typ. 630 nm

Luminous intensity

\[ I_F = 10 \text{ mA} \]

COX54(L) \[ I_v \] min. 10 mcd

COX54(L)-7 \[ I_v \] 16 to 35 mcd

COX54(L)-8 \[ I_v \] 30 to 70 mcd

COX54(L)-9 \[ I_v \] min. 50 mcd

Diode capacitance

\[ V_R = 0; f = 1 \text{ MHz} \]

\[ C_d \] typ. 10 pF
Fig. 2. 

Fig. 3 \( T_{\text{amb}} = 25^\circ\text{C} \); typ. values.

Fig. 4 \( t_{\text{on}} = 50 \mu\text{s}; \delta = 0.01; \)
\( T_{\text{amb}} = 25^\circ\text{C} \); typ. values.

Fig. 5 Typical values.

Fig. 6 Typical values.

Fig. 7 \( t_p = 50 \mu\text{s} \); typ. values.
Fig. 8 Typical values.

Fig. 9 IF = 10 mA; typ. values.
**LIGHT EMITTING DIODE**

Circular light emitting diode with a diameter of 5 mm which emits red light at a typical peak wavelength of 630 nm (GaPAs; super-red) when forward biased.

The CQX54D has a SOD-63 outline and is encapsulated in a clear diffusing resin.

### QUICK REFERENCE DATA

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<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse voltage</td>
<td>$V_R$</td>
<td>max. 5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>max. 30 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 65 \degree C$</td>
<td>$P_{tot}$</td>
<td>max. 50 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>max. 100 \degree C</td>
</tr>
<tr>
<td>Luminous intensity at $I_F = 10$ mA</td>
<td>$I_v$</td>
<td>min. 3 mcd</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_p$</td>
<td>typ. 630 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$\theta_{1/2}$</td>
<td>typ. 30°</td>
</tr>
</tbody>
</table>
CQX54D

MECHANICAL DATA

Fig. 1 SOD-63D1. Dimensions in mm

[Diagram with dimensions labeled in mm]
Light emitting diode

CQX54D

RATINGS

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

Reverse voltage
Forward current
d.c. peak value; \( t_p = 1 \mu s; f = 300 \text{ Hz} \)
peak value; \( t_{on} = 1 \text{ ms}; \delta = 0,33 \)
Total power dissipation up to \( T_{amb} = 65 \text{ °C} \)
Junction temperature
Storage temperature
Lead soldering temperature

\[
\begin{align*}
V_R & \text{ max.} \quad 5 \text{ V} \\
I_F & \text{ max.} \quad 30 \text{ mA} \\
I_{FRM} & \text{ max.} \quad 1 \text{ A} \\
P_{tot} & \text{ max.} \quad 90 \text{ mW} \\
T_j & \text{ max.} \quad 100 \text{ °C} \\
T_{stg} & \text{ from} -55 \text{ to} +100 \text{ °C} \\
T_{sld} & \text{ max.} \quad 260 \text{ °C} \\
\end{align*}
\]

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board

\[
R_{th \ j-a} \text{ max.} \quad 350 \text{ K/W}
\]

CHARACTERISTICS

\( T_{amb} = 25 \text{ °C} \) unless otherwise specified

Forward voltage at \( I_F = 10 \text{ mA} \)
Reverse current \( \quad V_R = 5 \text{ V} \)
Beamwidth between half-intensity directions at \( I_F = 10 \text{ mA} \)
Bandwidth at half height
Wavelength at peak emission at \( I_F = 10 \text{ mA} \)
Capacitance at \( V_R = 0; f = 1 \text{ MHz} \)
Luminous intensity at \( I_F = 10 \text{ mA} \)

\[
\begin{align*}
V_F & \text{ typ.} \quad 2,1 \text{ V} \\
max. \quad 3,0 \text{ V} \\
I_R & \text{ max.} \quad 100 \text{ µA} \\
\theta_{1/2} & \text{ typ.} \quad 30 \text{ °} \\
\Delta \lambda & \text{ typ.} \quad 45 \text{ nm} \\
\lambda_p & \text{ typ.} \quad 630 \text{ nm} \\
C_d & \text{ typ.} \quad 35 \text{ pF} \\
I_v & \text{ min.} \quad 3 \text{ mcd} \\
CQX54D & \quad I_v \quad \text{ min.} \quad 5 \text{ mcd} \\
CQX54D-5 & \quad I_v \quad \text{ max.} \quad 12 \text{ mcd} \\
CQX54D-6 & \quad I_v \quad \text{ min.} \quad 10 \text{ mcd} \\
CQX54D-7 & \quad I_v \quad \text{ min.} \quad 22 \text{ mcd} \\
\end{align*}
\]

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Circular light emitting diodes with a diameter of 5 mm which emit a narrow beam of green light at a typical peak wavelength of 565 nm (GaP, super-green) when forward biased.

The CQX64 and CQX64L have a SOD-63 outline and are encapsulated in a clear resin. Because of their resistance to high forward currents, the CQX64 and CQX64L are suitable for applications where high luminous intensity is required and applications where only low currents are available.

The CQX64L is the long-lead version of the CQX64 and has no seating plane but is in all other respects equal to the CQX64.

### QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>CQX64(L)</th>
<th>CQX64(L)-7</th>
<th>CQX64(L)-8</th>
<th>CQX64(L)-9</th>
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<tbody>
<tr>
<td>Continuous reverse voltage</td>
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<td></td>
</tr>
<tr>
<td>$V_R$ max.</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>$I_F$ max.</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 35 ^\circ C$</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$P_\text{tot}$ max.</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junction temperature</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$T_j$ max.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Luminous intensity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_F = 10 \text{ mA}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_v$ min.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\lambda_p$ typ.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\theta_{1/2}$ typ.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- $V_R$ max. = 5 V
- $I_F$ max. = 60 mA
- $P_\text{tot}$ max. = 180 mW
- $T_j$ max. = 100 °C
- $I_v$ min. = 10 mcd
- $\lambda_p$ typ. = 565 nm
- $\theta_{1/2}$ typ. = 20 °
MECHANICAL DATA

Fig. 1 SOD-63L.

Dimensions in mm

---

Fig. 1b SOD-63L.

CQX64L

---

Note: Solderability not guaranteed in tie-bar zone.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse voltage</td>
<td>$V_R$</td>
<td></td>
<td>5 V</td>
</tr>
<tr>
<td>Forward current, d.c.</td>
<td>$I_F$</td>
<td></td>
<td>60 mA</td>
</tr>
<tr>
<td>Forward current, peak value, $t_D = 1 \mu s$; $f = 300 \text{ Hz}$</td>
<td>$I_{FRM}$</td>
<td></td>
<td>1 A</td>
</tr>
<tr>
<td>Forward current, peak value, $t_{ON} = 1 \text{ ms}$; $\delta = 0.33$</td>
<td>$I_{FRM}$</td>
<td></td>
<td>150 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{Amb} = 35 \degree C$</td>
<td>$P_{tot}$</td>
<td></td>
<td>180 mW</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>$T_{Stg}$</td>
<td>-55 to +100 °C</td>
<td></td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td></td>
<td>100 °C</td>
</tr>
<tr>
<td>Lead soldering temperature, $t_{sld} &lt; 7 \text{ s}$</td>
<td>$T_{sld}$</td>
<td></td>
<td>260 °C</td>
</tr>
</tbody>
</table>

> 1.5 mm from the seating plane for CQX64
> 5 mm from the plastic body for CQX64L

THERMAL RESISTANCE
From junction to ambient
when the device is mounted on a p.c. board

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{th j-a}$</td>
<td>max.</td>
<td>350 K/W</td>
</tr>
</tbody>
</table>

CHARACTERISTICS
$T_j = 25 \degree C$ unless otherwise specified

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward voltage, $I_F = 10 \text{ mA}$</td>
<td>$V_F$</td>
<td>typ.</td>
</tr>
<tr>
<td>Reverse current</td>
<td>$I_R$</td>
<td>max.</td>
</tr>
<tr>
<td>$V_R = 5 \text{ V}$</td>
<td>$\theta_1/2$</td>
<td>typ.</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$\Delta \lambda$</td>
<td>typ.</td>
</tr>
<tr>
<td>Bandwidth at half height</td>
<td>$\lambda_p$</td>
<td>typ.</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>$I_F = 10 \text{ mA}$</td>
<td>$I_v$</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td>CQX64(L)</td>
<td>$I_v$</td>
</tr>
<tr>
<td>CQX64(L)-7</td>
<td>$I_v$</td>
<td>30 to 70 mcd</td>
</tr>
<tr>
<td>CQX64(L)-8</td>
<td>$I_v$</td>
<td>50 mcd</td>
</tr>
<tr>
<td>CQX64(L)-9</td>
<td>$I_v$</td>
<td>50 mcd</td>
</tr>
<tr>
<td>Diode capacitance</td>
<td>$V_R = 0$; $f = 1 \text{ MHz}$</td>
<td>$C_d$</td>
</tr>
</tbody>
</table>

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Fig. 2.

Fig. 3  $T_{\text{amb}} = 25 \, ^\circ\text{C}$; typ. values.

Fig. 4  $t_{\text{on}} = 1 \, \text{ms}; \, \delta = 0,33; \, T_{\text{amb}} = 25 \, ^\circ\text{C};$ typ. values.

Fig. 5  Typical values.

Fig. 6  Typical values.

Fig. 7  $t_{\text{p}} = 50 \, \mu\text{s};$ typ. values.
Light emitting diodes

Fig. 8 $I_F = 10$ mA; typ. values.

Fig. 9 $I_F = 10$ mA; typ. values.
LIGHT EMITTING DIODE

Circular light emitting diode with a diameter of 5 mm which emits green light at a typical peak wavelength of 565 nm (GaP) when forward biased. The CQX64D has a SOD-63 outline and is encapsulated in a green diffusing resin.

**QUICK REFERENCE DATA**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>Reverse voltage</td>
<td>$V_R$</td>
<td>max. 5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>max. 60 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 35 \degree C$</td>
<td>$P_{tot}$</td>
<td>max. 180 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>max. 100 \degree C</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td>$I_v$</td>
<td>min. 3 mcd</td>
</tr>
<tr>
<td>at $I_F = 10$ mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_p$</td>
<td>typ. 565 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$\theta_{1/2}$</td>
<td>typ. 30 \degree</td>
</tr>
</tbody>
</table>

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MECHANICAL DATA

→ Fig. 1 SOD-63D1.

Dimensions in mm

![Diagram of mechanical data with dimensions in mm.](image-url)
Light emitting diode

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

Reverse voltage
\[ V_R \text{ max.} = 5 \text{ V} \]

Forward current
- d.c.
  \[ I_F \text{ max.} = 60 \text{ mA} \]
  \[ I_{FRM} \text{ max.} = 1 \text{ A} \]
  \[ I_{FRM} \text{ max.} = 150 \text{ mA} \]

Total power dissipation up to \( T_{amb} = 35 \text{ °C} \)
\[ P_{tot} \text{ max.} = 180 \text{ mW} \]

Junction temperature
\[ T_j \text{ max.} = 100 \text{ °C} \]

Storage temperature
\[ T_{stg} \text{ max.} = -55 \text{ to } +100 \text{ °C} \]

Lead soldering temperature
\[ T_{sld} \text{ max.} = 260 \text{ °C} \]

THERMAL RESISTANCE
From junction to ambient when the device is mounted on a p.c. board
\[ R_{thj-a} \text{ max.} = 350 \text{ K/W} \]

CHARACTERISTICS
For \( T_{amb} = 25 \text{ °C} \) unless otherwise specified

Forward voltage
\[ V_F \text{ typ.} = 2.1 \text{ V} \]
\[ V_F \text{ max.} = 3 \text{ V} \]

Reverse current
\[ I_R \text{ max.} = 100 \mu\text{A} \]

Beamwidth between half-intensity directions
\[ \theta_{1/2} \text{ typ.} = 30 \text{ °} \]

Bandwidth at half height
\[ \Delta \lambda \text{ typ.} = 30 \text{ nm} \]

Wavelength at peak emission
\[ \lambda_p \text{ typ.} = 565 \text{ nm} \]

Capacitance
\[ C_d \text{ typ.} = 35 \text{ pF} \]

Luminous intensity
\[ CQX54D \text{ min.} = 3 \text{ mcd} \]
\[ CQX54D-5 \text{ min.} = 5 \text{ mcd} \]
\[ CQX54D-6 \text{ min.} = 12 \text{ mcd} \]
\[ CQX54D-7 \text{ min.} = 10 \text{ mcd} \]
\[ CQX54D \text{ min.} = 22 \text{ mcd} \]
\[ CQX54D-7 \text{ min.} = 16 \text{ mcd} \]

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LIGHT EMITTING DIODES

Circular light emitting diodes with a diameter of 5 mm which emit a narrow beam of yellow light at a typical peak wavelength of 590 nm (GaPAs) when forward biased.

The CQX74 and CQX74L have a SOD-63 outline and are encapsulated in a clear resin.

The CQX74L is the long-lead version of the CQX74 and has no seating plane but is in all other respects equal to the CQX74.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$</td>
<td>max.</td>
<td>5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>max.</td>
<td>30 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb}$ = 65°C</td>
<td>$P_{tot}$</td>
<td>max.</td>
<td>90 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_J$</td>
<td>max.</td>
<td>100 °C</td>
</tr>
<tr>
<td>Luminous intensity, $I_F = 10$ mA</td>
<td>$I_V$</td>
<td>min.</td>
<td>10 mcd</td>
</tr>
<tr>
<td></td>
<td>CQX74(L)</td>
<td></td>
<td>16 to 35 mcd</td>
</tr>
<tr>
<td></td>
<td>CQX74(L)-7</td>
<td></td>
<td>30 to 70 mcd</td>
</tr>
<tr>
<td></td>
<td>CQX74(L)-8</td>
<td></td>
<td>50 mcd</td>
</tr>
<tr>
<td></td>
<td>CQX74(L)-9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_p$</td>
<td></td>
<td>590 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$\theta_{1/2}$</td>
<td>typ.</td>
<td>20 °</td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig. 1a SOD-63D1.
CQX74

Fig. 1b SOD-63L.
CQX74L

Note: Solderability not guaranteed in tie-bar zone.
RATINGS

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

Reverse voltage
Forward current d.c.
Forward current peak value; \( t_p = 1 \mu s; f = 300 \) Hz
peak value; \( t_{on} = 1 \) ms; \( \delta = 0.33 \)
Total power dissipation up to \( T_{amb} = 65 \) °C
Storage temperature
Junction temperature
Lead soldering temperature; \( t_{sld} < 7 \) s
\( > 1.5 \) mm from the seating plane for COX74
\( > 5 \) mm from the plastic body for COX74L

THERMAL RESISTANCE
From junction to ambient

CHARACTERISTICS

\( T_j = 25 \) °C unless otherwise specified
Forward voltage
Reverse current
Forward current peak value; \( t_{on} = 1 \) ms; \( \delta = 0.33 \)
Total power dissipation up to \( T_{amb} = 65 \) °C
Storage temperature
Junction temperature
Lead soldering temperature; \( t_{sld} < 7 \) s
\( > 1.5 \) mm from the seating plane for COX74
\( > 5 \) mm from the plastic body for COX74L

CHARACTERISTICS

\( T_j = 25 \) °C unless otherwise specified
Forward voltage
Reverse current
Beamwidth between half-intensity directions
Bandwidth at half height
Wavelength at peak emission
Luminous intensity
Diode capacitance

Diode capacitance
\( V_R = 0; f = 1 \) MHz
Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7
Light emitting diodes

Fig. 8 Typical values.

Fig. 9 Typical values.
LIGHT EMITTING DIODE

Circular light emitting diode with a diameter of 5 mm which emits yellow light at a typical peak wavelength of 590 nm (GaPAs) when forward biased.

The CQX74D has a SOD-63 outline and is encapsulated in a yellow diffusing resin.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse voltage</td>
<td>$V_R$</td>
<td>max. 5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>max. 30 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 65 , ^\circ\text{C}$</td>
<td>$P_{tot}$</td>
<td>max. 90 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_J$</td>
<td>max. 100 $^\circ\text{C}$</td>
</tr>
<tr>
<td>Luminous intensity</td>
<td>$I_V$</td>
<td>min. 3 mcd</td>
</tr>
<tr>
<td>at $I_F = 10 , \text{mA}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_p$</td>
<td>typ. 590 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$\theta_{\frac{\pi}{2}}$</td>
<td>typ. 30 $^\circ$</td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig. 1 SOD-63D1.

Dimensions in mm

1.0 min - 12.7 min - 13.4
12.6
9.3
8.8
8.4
8.1

2.54
0.56
0.45
1.30
1.10
0.56
0.45
0.2
0.1

unflat base plane
RATINGS

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

Reverse voltage

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_R$</td>
<td></td>
<td>max. 5 V</td>
</tr>
</tbody>
</table>

Forward current

d.c.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_F$</td>
<td></td>
<td>max. 30 mA</td>
</tr>
<tr>
<td>$I_{frm}$</td>
<td></td>
<td>max. 1 A</td>
</tr>
</tbody>
</table>

peak value, $t_p = 1 \mu s; f = 300$ Hz

peak value; $t_{on} = 1$ ms; $\delta = 0.33$

Total power dissipation up to $T_{amb} = 65$ °C

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$P_{tot}$</td>
<td></td>
<td>max. 90 mW</td>
</tr>
</tbody>
</table>

Junction temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_J$</td>
<td></td>
<td>max. 100 °C</td>
</tr>
</tbody>
</table>

Storage temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_{stg}$</td>
<td></td>
<td>-55 to +100 °C</td>
</tr>
</tbody>
</table>

Lead soldering temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_{sld}$</td>
<td>max. 260 °C</td>
</tr>
</tbody>
</table>

Lead soldering temperature:

> 1,5 mm from the seating plane; $t_{sld} < 7$ s

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{th j-a}$</td>
<td></td>
<td>max. 350 K/W</td>
</tr>
</tbody>
</table>

CHARACTERISTICS

$T_{amb} = 25$ °C unless otherwise specified

Forward voltage

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_F$</td>
<td>typ.</td>
<td>2.1 V</td>
</tr>
<tr>
<td>$V_F$</td>
<td>max.</td>
<td>3 V</td>
</tr>
</tbody>
</table>

Reverse current

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_R$</td>
<td>max.</td>
<td>100 $\mu$A</td>
</tr>
</tbody>
</table>

Beamwidth between half-intensity directions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\theta_{1/2}$</td>
<td>typ.</td>
<td>30 °</td>
</tr>
</tbody>
</table>

Bandwidth at half height

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta \lambda$</td>
<td>typ.</td>
<td>40 nm</td>
</tr>
</tbody>
</table>

Wavelength at peak emission

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\lambda_p$</td>
<td>typ.</td>
<td>590 nm</td>
</tr>
</tbody>
</table>

Capacitance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_d$</td>
<td>typ.</td>
<td>35 pF</td>
</tr>
</tbody>
</table>

Luminous intensity

<table>
<thead>
<tr>
<th>Device</th>
<th>Parameter</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>COX54D</td>
<td>$I_v$</td>
<td>min.</td>
<td>3 mcd</td>
</tr>
<tr>
<td>COX54D-5</td>
<td>$I_v$</td>
<td>min.</td>
<td>5 mcd</td>
</tr>
<tr>
<td>COX54D-6</td>
<td>$I_v$</td>
<td>max.</td>
<td>12 mcd</td>
</tr>
<tr>
<td>COX54D-7</td>
<td>$I_v$</td>
<td>min.</td>
<td>10 mcd</td>
</tr>
<tr>
<td></td>
<td>$I_v$</td>
<td>min.</td>
<td>22 mcd</td>
</tr>
<tr>
<td></td>
<td>$I_v$</td>
<td>min.</td>
<td>16 mcd</td>
</tr>
</tbody>
</table>

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LIGHT EMITTING DIODES

Circular light emitting diodes with a diameter of 5 mm which emit red light at a typical peak wavelength of 650 nm (GaAsP; standard-red) when forward biased.

The CQY24B and CQY24BL have a SOD-63 outline and are encapsulated in a red diffusing resin. Together with types CQY94B(L) and CQY96(L) they form one family.

The CQY24BL is the long-lead version of the CQY24B and has no seating plane but is in all other respects equal to the CQY24B.

QUICK REFERENCE DATA

| Continuous reverse voltage | $V_R$ | max. | 5 V |
| Forward current (d.c.) | $I_F$ | max. | 50 mA |
| Total power dissipation up to $T_{amb} = 65 \degree$C | $P_{tot}$ | max. | 100 mW |
| Junction temperature | $T_j$ | max. | 100 $\degree$C |
| Luminous intensity | $I_F = 20$ mA |
| COY24B(L) | $I_V$ | min. | 0.7 mcd |
| COY24B(L)-2 | $I_V$ | 1.0 to 2.2 mcd |
| COY24B(L)-3 | $I_V$ | 1.6 to 3.5 mcd |
| COY24B(L)-4 | $I_V$ | min. | 3.0 mcd |
| Wavelength at peak emission | $\lambda_p$ | typ. | 650 nm |
| Beamwidth between half-intensity directions | $\theta_{1/2}$ | typ. | 70 $\degree$ |

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MECHANICAL DATA

Fig. 1a SOD-63AI.
CQY24B

Fig. 1b SOD-63L.
CQY24BL

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Note: Solderability not guaranteed in tie-bar zone.

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Dimensions in mm

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### 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>Continuous reverse voltage $V_R$</td>
<td>max. 5 V</td>
</tr>
<tr>
<td>Forward current $I_F$ max.</td>
<td>50 mA</td>
</tr>
<tr>
<td>Forward current $I_{FRM}$ max.</td>
<td>1 A</td>
</tr>
<tr>
<td>Forward current peak value; $t_p = 1 \mu s; f = 300$ Hz</td>
<td>500 mA</td>
</tr>
<tr>
<td>Forward current peak value; $t_p = 10 \mu s; \delta = 0.01$</td>
<td></td>
</tr>
<tr>
<td>Total power dissipation $P_{tot}$</td>
<td>max. 100 mW</td>
</tr>
<tr>
<td>Storage temperature $T_{stg}$</td>
<td>-55 to +100 °C</td>
</tr>
<tr>
<td>Junction temperature $T_j$</td>
<td>max. 100 °C</td>
</tr>
<tr>
<td>Lead soldering temperature $T_{sld}$</td>
<td>max. 260 °C</td>
</tr>
</tbody>
</table>

#### THERMAL RESISTANCE

From junction to ambient mounted on a p.c. board $R_{th j-a}$ max. 350 K/W

#### CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward voltage $I_F = 10$ mA $V_F$</td>
<td>typ. 1.7 V max. 2.0 V</td>
</tr>
<tr>
<td>Reverse current $V_R = 5$ V $I_R$</td>
<td>max. 100 µA</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions $I_F = 10$ mA $\theta_{1/2}$</td>
<td>typ. 70 °</td>
</tr>
<tr>
<td>Bandwidth at half height $\Delta\lambda$</td>
<td>typ. 20 nm</td>
</tr>
<tr>
<td>Wavelength at peak emission $I_F = 20$ mA $\lambda_p$</td>
<td>typ. 650 nm</td>
</tr>
<tr>
<td>Luminous intensity (on axis) $I_F = 20$ mA</td>
<td>CQY24B(L) $I_V$ min. 0.7 mcd</td>
</tr>
<tr>
<td></td>
<td>CQY24B(L)-2 $I_V$ 1.0 to 2.2 mcd</td>
</tr>
<tr>
<td></td>
<td>CQY24B(L)-3 $I_V$ 1.6 to 3.5 mcd</td>
</tr>
<tr>
<td></td>
<td>CQY24B(L)-4 $I_V$ min. 3.0 mcd</td>
</tr>
<tr>
<td>Diode capacitance $V_R = 0; f = 1$ MHz</td>
<td>$C_d$ typ. 45 pF</td>
</tr>
</tbody>
</table>
Fig. 2.

$P_{\text{tot}}$ (mW)

$T_{\text{amb}}$ (°C)

Fig. 3.

$I_F$ (mA)

$T_j = 25^\circ C$

Fig. 4.

$I_{\text{FM}}$ (mA)

$T_j = 25^\circ C$

$\tau_p = 10 \mu s$

$T = 1 \text{ ms}$

Fig. 5.

$I_F = 20 \text{ mA}$

$I_V$ (%)

$T_j$ (°C)
Light emitting diodes

Fig. 6 Typical values.

Fig. 7

Fig. 8

Fig. 9
Fig. 10 Typical values.
LIGHT EMITTING DIODE

Circular light emitting diode with a diameter of 3 mm which emits red light at a typical peak wavelength of 650 nm (GaAsP; standard-red) when forward biased.

The CQY54A has a SOD-53 outline and is encapsulated in a red diffusing resin.

Together with the CQY95B and the CQY97A the CQY54A forms one LED family.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>CQY54A</th>
<th>CQY54A-2</th>
<th>CQY54A-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>( V_R )</td>
<td>max.</td>
<td>5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>( I_F )</td>
<td>max.</td>
<td>50 mA</td>
</tr>
<tr>
<td>Total power dissipation up to ( T_{amb} = 40 , ^{\circ}C )</td>
<td>( P_{tot} )</td>
<td>max.</td>
<td>120 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>( T_j )</td>
<td>max.</td>
<td>100 , ^{\circ}C</td>
</tr>
<tr>
<td>Luminous intensity ( I_F = 20 , mA )</td>
<td>( I_V )</td>
<td>min.</td>
<td>0.7 mcd</td>
</tr>
<tr>
<td></td>
<td>CQY54A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CQY54A-2</td>
<td>1,0 to 2,2 mcd</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CQY54A-3</td>
<td>min.</td>
<td>1,6 mcd</td>
</tr>
<tr>
<td>Wavelength at peak emission ( I_F = 20 , mA )</td>
<td>( \lambda_p )</td>
<td>typ.</td>
<td>650 nm</td>
</tr>
<tr>
<td>Beamwidth at half-intensity directions ( I_F = 20 , mA )</td>
<td>( \theta_{1/2} )</td>
<td>typ.</td>
<td>70 , ^{\circ}</td>
</tr>
</tbody>
</table>

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MECHANICAL DATA

Fig. 1 SOD-53E.

Dimensions in mm

- 3.5 mm minimum
- 3.1 mm maximum
- 2.9 mm maximum
- 1.0 mm minimum
- 16.0 mm minimum
- 6.6 mm maximum
- 6.2 mm maximum
- 5.4 mm maximum
- 4.9 mm maximum
- 3.4 mm minimum
- 3.1 mm minimum
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage
Forward current
d.c.
  peak value, \( t_p = 1 \, \mu s \); \( f = 300 \, \text{Hz} \)
Total power dissipation up to \( T_{amb} = 40 \, ^\circ \text{C} \)
Storage temperature
Junction temperature
Lead soldering temperature
  \( > 1.5 \, \text{mm from the seating plane; } t_{slid} < 7 \, \text{s} \)

Storage temperature
\( T_{stg} = -55 \, \text{to} +100 \, ^\circ \text{C} \)
Junction temperature
\( T_j = 100 \, ^\circ \text{C} \)
Lead soldering temperature
\( T_{slid} = 260 \, ^\circ \text{C} \)

THERMAL RESISTANCE
From junction to ambient
  when the device is mounted on a p.c. board

CHARACTERISTICS
\( T_j = 25 \, ^\circ \text{C} \) unless otherwise specified

Forward voltage
\( I_F = 20 \, \text{mA} \)
Reverse current
\( V_R = 5 \, \text{V} \)
Beamwidth between half-intensity directions
\( I_F = 20 \, \text{mA} \)
Bandwidth at half height
Wavelength at peak emission
Luminous intensity
\( I_F = 20 \, \text{mA} \)
Diode capacitance
\( V_R = 0; \ f = 1 \, \text{MHz} \)

\[ V_R \] max. \( 5 \, \text{V} \)
\[ I_F \] max. \( 50 \, \text{mA} \)
\[ I_{FRM} \] max. \( 1 \, \text{A} \)
\[ P_{tot} \] max. \( 120 \, \text{mW} \)
\[ T_{stg} \] max. \( -55 \, \text{to} +100 \, ^\circ \text{C} \)
\[ T_j \] max. \( 100 \, ^\circ \text{C} \)
\[ T_{slid} \] max. \( 260 \, ^\circ \text{C} \)

\[ R_{th \ j-a} \] max. \( 500 \, \text{K/W} \)

\[ V_F \] typ. \( 1.7 \, \text{V} \)
\[ V_F \] max. \( 2.0 \, \text{V} \)
\[ I_R \] max. \( 100 \, \mu \text{A} \)
\[ \theta_{1/2} \] typ. \( 70 \, ^\circ \text{o} \)
\[ \Delta \lambda \] typ. \( 20 \, \text{nm} \)
\[ \lambda_\text{p} \] typ. \( 650 \, \text{nm} \)
\[ I_V \] min. \( 0.7 \, \text{mcd} \)
\[ I_V \] 1.0 to 2.2 \, \text{mcd} \)
\[ I_V \] min. \( 1.6 \, \text{mcd} \)
\[ C_d \] typ. \( 45 \, \text{pF} \)
Fig. 2. 

$P_{\text{tot}}$ (mW) vs $T_{\text{amb}}$ (°C).

Fig. 3. $T_{\text{amb}} = 25$ °C.

Fig. 4. Typical values.

$V_F$ (V) vs $T_{\text{j}}$ (°C).

Fig. 5. $I_F = 20$ mA; typ. values.

Fig. 6. $I_F = 20$ mA; typ. values.

Fig. 7. $t_p = 50$ µs; $T_j = 25$ °C.
Fig. 8 Typical values.

Fig. 9 Typical values.
LIGHT EmitTING DIODE

Diffused planar light emitting diode intended for optical coupling and encoding. It emits radiation in the near infrared when forward biased. Infrared translucent epoxy encapsulation (dark blue). Combination with phototransistor BPW22A is recommended.

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$</td>
<td>max. 5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>max. 50 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 25 ^\circ$C</td>
<td>$P_{tot}$</td>
<td>max. 100 mW</td>
</tr>
<tr>
<td>Radiant intensity (on-axis) at $I_F = 20$ mA</td>
<td>$I_e$</td>
<td>typ. 2 mW/sr</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>(\lambda)</td>
<td>typ. 930 nm</td>
</tr>
</tbody>
</table>

MECHANICAL DATA

Fig. 1 SOD-53F.

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

Continuous reverse voltage
Forward current
d.c.
(peak value); \( t_p = 10 \mu s; \delta = 0.01 \)
Total power dissipation up to \( T_{\text{amb}} = 25 \, ^\circ\text{C} \) (see Fig. 2)
Storage temperature
Junction temperature
Lead soldering temperature

<table>
<thead>
<tr>
<th>( V_R ) max.</th>
<th>5 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>( I_F ) max.</td>
<td>50 mA</td>
</tr>
<tr>
<td>( I_{FRM} ) max.</td>
<td>200 mA</td>
</tr>
<tr>
<td>( P_{\text{tot}} ) max.</td>
<td>100 mW</td>
</tr>
<tr>
<td>( T_{\text{stg}} )</td>
<td>-55 to +100 °C</td>
</tr>
<tr>
<td>( T_j ) max.</td>
<td>100 °C</td>
</tr>
<tr>
<td>( T_{\text{slid}} ) max.</td>
<td>260 °C</td>
</tr>
</tbody>
</table>

THERMAL RESISTANCE
From junction to ambient,

\[ R_{\text{th}j-a} = 750 \, \text{K/W} \]

Fig. 2 Power derating curve versus ambient temperature.
CHARACTERISTICS

$T_j = 25\, ^\circ C$

Forward voltage
$V_F = 20\, mA$

Forward voltage typ. $V_F = 1.2\, V$

$V_F$ max. $1.5\, V$

Reverse current
$V_R = 5\, V$

Reverse current max. $I_R = 100\, \mu A$

Diode capacitance
$V_R = 0, f = 1\, MHz$

Diode capacitance typ. $C_d = 40\, \mathrm{pF}$

Total radiant power
$V_F = 20\, mA$

Total radiant power typ. $\phi_e = 1\, \mathrm{mW}$

Radiant intensity (on-axis)
$V_F = 20\, mA$

Radiant intensity (on-axis) CQY58A typ. $I_e = 2\, \mathrm{mW/sr}$

CQY58A-1 max. $5\, \mathrm{mW/sr}$

CQY58A-2 min. $3\, \mathrm{mW/sr}$

Wavelength at peak emission

Bandwidth at half height

Beamwidth between half-intensity directions
$V_F = 20\, mA$

Switching times
$I_{\text{on}} = 20\, mA$

Light rise time

Light fall time

$t_r$ typ. $3\, \mu s$

$t_f$ typ. $3\, \mu s$
Fig. 3  $T_{\text{amb}} = 25 \, ^\circ\text{C}$.

Fig. 4  $t_d = 10 \, \mu\text{s}; T = 1 \, \text{ms}; T_{\text{amb}} = 25 \, ^\circ\text{C}$.

Fig. 5  Typical values.
Light emitting diode

**Graph 1:**
- **Figure 6** $T_{amb} = 25°C$.
- **Figure 7** $t_p = 10\,\mu s$; $T = 1\,ms$; $T_{amb} = 25°C$.

**Graph 2:**
- **Figure 8** $V_{CE} = 5\,V$; $d^* = 10\,mm$; typical values.
- **Figure 9** $V_{CE} = 5\,V$; $d^* = 10\,mm$; typical values.

* $d =$ shortest free distance of mechanical on-axis when BPW22A is coupled with CQY58A.
Fig. 10 Spectral response.

Fig. 11 Typical values.
GaAs LIGHT EMITTING DIODE

Epitaxial gallium arsenide light emitting diode intended for remote-control applications. It emits radiation in the near infrared when forward biased. Infrared translucent epoxy encapsulation (dark blue).

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$</td>
<td>max.</td>
<td>5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>max.</td>
<td>130 mA</td>
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<tr>
<td>Total power dissipation up to $T_{amb} = 25 , ^\circ C$</td>
<td>$P_{tot}$</td>
<td>max.</td>
<td>215 mW</td>
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<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>max.</td>
<td>100 , ^\circ C</td>
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<tr>
<td>Radiant intensity (on-axis) at $I_F = 100 , mA$</td>
<td>$I_e$</td>
<td>min.</td>
<td>9 mW/sr</td>
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<tr>
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<td>COY89A</td>
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<td>COY89A-1</td>
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<td>15 mW/sr</td>
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<td>COY89A-2</td>
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<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_p$</td>
<td>typ.</td>
<td>930 nm</td>
</tr>
</tbody>
</table>
MECHANICAL DATA

Fig. 1 SOD-63B2.

Dimensions in mm

unflat base plane
GaAs light emitting diode

RATINGS

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

Continuous reverse voltage
Forward current (d.c.)
Forward current (peak value)
Non-repetitive peak forward current (tp ≤ 10 µs)
Total power dissipation up to T_{amb} = 25 °C
Storage temperature
Junction temperature
Lead soldering temperature

THERMAL RESISTANCE

From junction to ambient
mounted on a printed-circuit board

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage
Reverse current
Diode capacitance
Total radiant power
Decrease of radiant power with temperature
Radiant intensity (on-axis)
Wavelength at peak emission
Spectral line half width
Beamwidth between half-intensity directions

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Fig. 2. \( T_{\text{amb}} = 25 \, {^\circ}\text{C}; T_j \text{ peak} = 100 \, {^\circ}\text{C}. \)

Fig. 3.

Fig. 4.
GaAs light emitting diode

Fig. 5.

Fig. 6  $T_j = 25 \, ^\circ\text{C}$.

Fig. 7.

Fig. 8  $T_{\text{amb}} = 25 \, ^\circ\text{C}; \, t_p = 10 \, \mu\text{s}; \, T = 1 \, \text{ms}$.
Fig. 9.

Fig. 10.
CQY94B
CQY94BL

LIGHT EMITTING DIODES

Circular light emitting diodes with a diameter of 5 mm which emit green light at a typical peak wavelength of 565 nm (GaP; super-green) when forward biased.

The CQY94B and CQY94BL have a SOD-63 outline and are encapsulated in a green diffusing resin. Because of their resistance to high forward currents, the CQY94B and CQY94BL are suitable for those applications where high luminosity is required. The CQY94BL is the long-lead version of the CQY94B and has no seating plane but is in all other respects equal to the CQY94B.

QUICK REFERENCE DATA

| Continuous reverse voltage | \( V_R \) | max. | 5 V |
| Forward current (d.c.) | \( I_F \) | max. | 60 mA |
| Total power dissipation up to \( T_{amb} = 35 \, ^\circ C \) | \( P_{tot} \) | max. | 180 mW |
| Junction temperature | \( T_j \) | max. | 100 \, ^\circ C |
| Luminous intensity \( I_F = 10 \, mA \) | CQY94B(L) | \( I_V \) | min. | 0.7 mcd |
| | CQY94B(L)-3 | \( I_V \) | 1.6 to 3.5 mcd |
| | CQY94B(L)-4 | \( I_V \) | 3.0 to 7.0 mcd |
| | CQY94B(L)-5 | \( I_V \) | min. | 5.0 mcd |
| Wavelength at peak emission | \( \lambda_p \) | typ. | 565 nm |
| Beamwidth between half-intensity directions | \( \theta_{1/2} \) | typ. | 70 ° |
MECHANICAL DATA

Fig 1a SOD-63AI.

CQY94B

CQY94BL

Fig. 1b SOD-63L.

CQY94BL

Dimensions in mm

Note: Solderability not guaranteed in tie-bar zone.

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

Reverse voltage
Forward current
Forward current
peak value; $t_p = 1 \mu s; f = 300$ Hz
peak value; $t_p = 1$ ms; $\delta = 0.33$
Total power dissipation up to $T_{amb} = 35 ^\circ C$
Storage temperature
Junction temperature
Lead soldering temperature at $t_{sld} < 7$ s
$> 1.5$ mm from the seating plane for CQY94B
$> 5$ mm from the plastic body for CQY94BL

THERMAL RESISTANCE
From junction to ambient
when the device is mounted on a p.c. board

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

Forward voltage
Reverse current
Beamwidth between half-intensity directions
Bandwidth at half height
Wavelength at peak emission
Luminous intensity
Diode capacitance

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Fig. 2 Typical values.

Fig. 3 $T_{\text{amb}} = 25^\circ C$; typ. values.

Fig. 4 $t_{\text{on}} = 1 \text{ ms}; \delta = 0,33$; $T_{\text{amb}} = 25^\circ C$; typ. values.

Fig. 5 Typical values.

Fig. 6 Typical values.

Fig. 7 $t_p = 50 \mu s$. 

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Light emitting diodes

Fig. 8  $I_F = 10 \text{mA}$; typ. values.

Fig. 9  Typical values.
LIGHT EMITTING DIODE

Circular light emitting diode with a diameter of 3 mm which emits green light at a typical peak wavelength of 565 nm (GaP; super-green) when forward biased.

The CQY95B has a SOD-53 outline and is encapsulated in a green diffusing resin.

This LED can resist higher forward currents when a higher luminosity is required. Because the CQY95B is available in high \( I_V \) classes, it is suitable for those applications where only low currents are available.

**QUICK REFERENCE DATA**

<table>
<thead>
<tr>
<th>Continuous reverse voltage</th>
<th>( V_R )</th>
<th>max.</th>
<th>5 V</th>
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</thead>
<tbody>
<tr>
<td>Forward current (d.c.)</td>
<td>( I_F )</td>
<td>max.</td>
<td>60 mA</td>
</tr>
<tr>
<td>Total power dissipation up to ( T_{amb} = 25 , ^\circ\text{C} )</td>
<td>( P_{tot} )</td>
<td>max.</td>
<td>150 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>( T_j )</td>
<td>max.</td>
<td>100 , ^\circ\text{C}</td>
</tr>
</tbody>
</table>

**Luminous intensity**

\( I_F = 10 \, \text{mA} \)
- CQY95B: \( I_V \) min. 0,7 mcd
- CQY95B-3: \( I_V \) 1,6 to 3,5 mcd
- CQY95B-4: \( I_V \) 3,0 to 7,0 mcd
- CQY95B-5: \( I_V \) min. 5,0 mcd

**Wavelength at peak emission**
- \( \lambda_p \) typ. 565 nm

**Beamwidth between half-intensity directions**
- \( \theta_{1/2} \) typ. 70 °
MECHANICAL DATA

Fig. 1 SOD-53E.

Dimensions in mm
RATINGS

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

Reverse voltage
\[ V_R \text{ max. } 5 \text{ V} \]

Forward current
\[ I_F \text{ max. } 60 \text{ mA} \]
\[ I_{\text{FRM}} \text{ max. } 1 \text{ A} \]
\[ P_{\text{tot}} \text{ max. } 150 \text{ mW} \]

Total power dissipation up to \( T_{\text{amb}} = 25 \text{ °C} \)
\[ P_{\text{tot}} \text{ max. } 150 \text{ mW} \]

Storage temperature
\[ T_{\text{stg}} \text{ -55 to +100 °C} \]

Junction temperature
\[ T_j \text{ max. } 100 \text{ °C} \]

Lead soldering temperature
\[ T_{\text{sld}} \text{ max. } 260 \text{ °C} \]

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board
\[ R_{\text{th j-a}} \text{ max. } 500 \text{ K/W} \]

CHARACTERISTICS

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

Forward voltage
\[ I_F = 10 \text{ mA} \]
\[ V_F \text{ typ. } 2,1 \text{ V} \]
\[ V_F \text{ max. } 3,0 \text{ V} \]

Reverse current
\[ V_R = 5 \text{ V} \]
\[ I_R \text{ max. } 100 \mu \text{A} \]

Beamwidth between half-intensity directions
\[ \theta_{\frac{1}{2}} \text{ typ. } 70 \text{ °} \]

Bandwidth at half height
\[ \Delta \lambda \text{ typ. } 30 \text{ nm} \]

Wavelength at peak emission
\[ \lambda_p \text{ typ. } 565 \text{ nm} \]

Luminous intensity
\[ I_F = 10 \text{ mA} \]
\[ I_V \text{ min. } 0,7 \text{ mcd} \]
\[ I_V \text{ min. } 1,6 \text{ to } 3,5 \text{ mcd} \]
\[ I_V \text{ min. } 3,0 \text{ to } 7,0 \text{ mcd} \]
\[ I_V \text{ min. } 5,0 \text{ mcd} \]

Diode capacitance
\[ V_R = 0; f = 1 \text{ MHz} \]
\[ C_d \text{ typ. } 20 \text{ pF} \]
Fig. 2.

Fig. 3 $T_{amb} = 25 \, ^\circ\text{C}$; typ. values.

Fig. 4 $t_{on} = 1 \, \text{ms}$; $\delta = 0,33$; $T_{amb} = 25 \, ^\circ\text{C}$; typ. values.

Fig. 5 Typical values.

Fig. 6 Typical values.

Fig. 7 $t_p = 50 \, \mu\text{s}$; typ. values.
Fig. 8 $I_F = 10 \, \text{mA}$; typ. values.

Fig. 9 Typical values.
Circular light emitting diodes with a diameter of 5 mm which emit yellow light at a typical peak wavelength of 590 nm (GaPAs) when forward biased.

The CQY96 and CQY96L have a SOD-63 outline and are encapsulated in a yellow diffusing resin. The CQY96L is the long-lead version of the CQY96 and has no seating plane but is in all other respects equal to the CQY96.

**QUICK REFERENCE DATA**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>( V_R )</td>
<td>max.</td>
<td>5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>( I_F )</td>
<td>max.</td>
<td>30 mA</td>
</tr>
<tr>
<td>Total power dissipation up to ( T_{amb} = 65 , ^\circ C )</td>
<td>( P_{tot} )</td>
<td>max.</td>
<td>90 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>( T_j )</td>
<td>max.</td>
<td>100 , ^\circ C</td>
</tr>
<tr>
<td>Luminous intensity (on-axis) ( I_F = 10 , mA )</td>
<td>( I_V )</td>
<td>min.</td>
<td>0.7 mcd</td>
</tr>
<tr>
<td>CQY96(L)</td>
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<tr>
<td>CQY96(L)-3</td>
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</tr>
<tr>
<td>CQY96(L)-4</td>
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</tr>
<tr>
<td>CQY96(L)-5</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>( \lambda_p )</td>
<td>typ.</td>
<td>590 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>( \theta_{1/2} )</td>
<td>typ.</td>
<td>70 , ^\circ</td>
</tr>
</tbody>
</table>

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MECHANICAL DATA

Fig. 1a SOD-63A1.
CQY96

Dimensions in mm

Fig. 1b SOD-63L.
CQY96L

Note: Solderability not guaranteed in tie-bar zone.
RATINGS
Limiting values in accordance with the Absolute Maximum System (IEC 134)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
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<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$</td>
<td>max. 5 V</td>
</tr>
<tr>
<td>Forward current d.c.</td>
<td>$I_F$</td>
<td>max. 30 mA</td>
</tr>
<tr>
<td>Forward current peak value; $t_p = 1 \mu s$; $f = 300$ Hz</td>
<td>$I_{FRM}$</td>
<td>max. 1 A</td>
</tr>
<tr>
<td>peak value; $t_{on} = 1$ ms; $\delta = 0.33$</td>
<td>$P_{tot}$</td>
<td>max. 60 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 65$ °C</td>
<td>$P_{tot}$</td>
<td>max. 90 mW</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>$T_{stg}$</td>
<td>--55 to +100 °C</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>max. 100 °C</td>
</tr>
<tr>
<td>Lead soldering temperature at $t_{sld} &lt; 7$ s</td>
<td>$T_{sld}$</td>
<td>max. 260 °C</td>
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</table>

$T_j = 25$ °C unless otherwise specified

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward voltage</td>
<td>$V_F$</td>
<td>typ. 2.1 V max. 3 V</td>
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<tr>
<td>Reverse current</td>
<td>$I_R$</td>
<td>max. 100 $\mu$A</td>
</tr>
<tr>
<td>Diode capacitance</td>
<td>$C_d$</td>
<td>typ. 15 pF</td>
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<tr>
<td>Luminous intensity (on-axis)</td>
<td>$I_F = 10$ mA</td>
<td>$I_V$ min. 0.7 mcd</td>
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<tr>
<td></td>
<td>CQY96(L)</td>
<td>$I_V$ 1.6 to 3.5 mcd</td>
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<tr>
<td></td>
<td>CQY96(L)-3</td>
<td>$I_V$ 3.0 to 7.0 mcd</td>
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<td></td>
<td>CQY96(L)-4</td>
<td>$I_V$ 5.0 to 12 mcd</td>
</tr>
<tr>
<td>Wavelength at peak emission</td>
<td>$\lambda_p$</td>
<td>typ. 590 nm</td>
</tr>
<tr>
<td>Bandwidth at half height</td>
<td>$\theta_{1/2}$</td>
<td>typ. 40 nm</td>
</tr>
<tr>
<td>Beamwidth between half-intensity directions</td>
<td>$\Delta\lambda$</td>
<td>typ. 70 °</td>
</tr>
</tbody>
</table>

THERMAL RESISTANCE
From junction to ambient mounted on a printed board

$R_{th j-a} = 350$ K/W
Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7
Fig. 8 Typical values.

Fig. 9 Typical values.
LIGHT EMITTING DIODE

Circular light emitting diode with a diameter of 3 mm which emits yellow light at a typical peak wavelength of 590 nm (GaPAs) when forward biased.

The CQY97A has a SOD-53 envelope and is encapsulated in a yellow coloured resin.

**QUICK REFERENCE DATA**

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Unit</th>
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<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$</td>
<td>max. 5 V</td>
</tr>
<tr>
<td>Forward current (d.c.)</td>
<td>$I_F$</td>
<td>max. 30 mA</td>
</tr>
<tr>
<td>Total power dissipation up to $T_{amb} = 55 , ^\circ C$</td>
<td>$P_{tot}$</td>
<td>max. 90 mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>max. 100 , ^\circ C</td>
</tr>
<tr>
<td>Luminous intensity $I_F = 10 , mA$</td>
<td>$I_v$</td>
<td>min. 0.7 mcd</td>
</tr>
<tr>
<td>CQY97A</td>
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</tr>
<tr>
<td>CQY97A-3</td>
<td></td>
<td>1.6 to 3.5 mcd</td>
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<tr>
<td>CQY97A-4</td>
<td></td>
<td>3.0 to 7.0 mcd</td>
</tr>
<tr>
<td>CQY97A-5</td>
<td></td>
<td>min. 5.0 mcd</td>
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<tr>
<td>Wavelength at peak emission $I_F = 10 , mA$</td>
<td>$\lambda_p$</td>
<td>typ. 590 nm</td>
</tr>
<tr>
<td>Beamwidth at half-intensity directions</td>
<td>$\theta_{1/2}$</td>
<td>typ. 70 , ^\circ</td>
</tr>
</tbody>
</table>
MECHANICAL DATA
Fig. 1 SOD-53E.

Dimensions in mm

unflat base plane

45°
Light emitting diode.

RATINGS

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

Reverse voltage
Forward current
d.c.
peak value, \( t_D = 1 \mu s; f = 300 \text{ Hz} \)
peak value; \( t_{on} = 1 \text{ ms}; \delta = 0,33 \)
Total power dissipation up to \( T_{amb} = 55 \text{ °C} \)
Storage temperature
 Junction temperature
Lead soldering temperature

\( > 1,5 \text{ mm from the seating plane; } t_{sld} < 7 \text{ s} \)

THERMAL RESISTANCE

From junction to ambient
when the device is mounted on a p.c. board

CHARACTERISTICS

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

Forward voltage
Reverse current
Beamwidth between half-intensity directions
Bandwidth at half height
Wavelength at peak emission
Luminous intensity (class division)
Diode capacitance

\( V_R \) max. 5 V
\( I_F \) max. 30 mA
\( I_{FRM} \) max. 1 A
\( P_{tot} \) max. 90 mW
\( T_{stg} \) max. 100 °C
\( I_{FRM} \) max. 1 A
\( I_{F} \) typ. 2,1 V
\( I_R \) max. 100 µA
\( \theta_{1/2} \) typ. 70 °
\( \Delta \lambda \) typ. 40 nm
\( \lambda_p \) typ. 590 nm
\( I_v \) min. 0,7 mcd
\( I_v \) 1,6 to 3,5 mcd
\( I_v \) 3,0 to 7,0 mcd
\( I_v \) min. 5,0 mcd
\( C_d \) typ. 15 pF

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Fig. 2

Fig. 3 \( T_j = 25 \, ^\circ C \); typ. values.

Fig. 4 \( t_p = 50 \, \mu s; \delta = 0.01; \)
\( T_{amb} = 25 \, ^\circ C \); typ. values.

Fig. 5 Typical values.

Fig. 6 Typical values.

Fig. 7 \( T_j = 25 \, ^\circ C \), typ. values.
Fig. 8 Typical values.

Fig. 9 Typical values.
INDEX OF TYPE NUMBERS

The inclusion of a type number in this publication does not necessarily imply its availability.

<table>
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<tr>
<th>type no.</th>
<th>book</th>
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<td>BAS29</td>
<td>S7/S1</td>
<td>Mm/SD</td>
<td>BAV101</td>
<td>S7/S1</td>
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<td>SD</td>
<td>BAS31</td>
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<td>Mm/SD</td>
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<td>T</td>
<td>BAS32</td>
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<td>Mm/SD</td>
<td>BAV103</td>
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Mm = Microminiature semiconductors for hybrid circuits  
SD = Small-signal diodes  
Sm = Small-signal transistors  
Sp = Special diodes  
T = Tuner diodes  
Vrg = Voltage regulator diodes

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* = series
FET = Field-effect transistors
Mm = Microminiature semiconductors
Sm = Small-signal transistors
P = Low-frequency power transistors

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FET = Field-effect transistors  
P = Low-frequency power transistors  
HVP = High-voltage power transistors  
Sm = Small-signal transistors  
WBT = Wideband transistors  
Mm = Microminiature semiconductors for hybrid circuits
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* = series
FET = Field-effect transistors
Mm = Microminiature semiconductors for hybrid circuits
RFP = R.F. power transistors and modules
RT = Tripler
Sm = Small-signal transistors
WBM = Wideband hybrid IC modules
WBT = Wideband transistors

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RFP = R.F. power transistors and modules
ThM = Thyristor modules
WBM = Wideband hybrid IC modules
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RFP = R.F. power transistors and modules  
Mm = Microminiature semiconductors for hybrid circuits  
Sm = Small-signal transistors  
DPT = Photodiodes or transistors  
Th = Thyristors
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* = series
FET = Field-effect transistors
Mm = Microminiature semiconductors for hybrid circuits
PM = Power MOS transistors
Sm = Small-signal transistors
SP = Low-frequency switching power transistors
Th = Thyristors
Tri = Triacs

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* = series  
PM = Power MOS transistors  
R = Rectified diodes
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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  
LED = Light-emitting diodes  
M = Microwave transistors  
SEN = Sensors  
WBM = Wideband hybrid IC modules  
I = Infrared devices  
PhC = Photocouplers
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* = series  
FET = Field-effect transistors  
I = Infrared devices  
M = Microwave transistors  
Mm = Microminiature semiconductors  
for hybrid circuits  
P = Low-frequency power transistors  
PhC = Photocouplers  
R = Rectifier 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
FET = Field-effect transistors
SD = Small-signal diodes
P = Low-frequency power transistors
Sm = Small-signal transistors
R = Rectifier diodes
Vrf = Voltage reference diodes
RFP = R.F. power transistors and modules
WBT = Wideband transistors

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A = Accessories
FET = Field-effect transistors
Ph = Photoconductive devices
PhC = Photocouplers
RFP = R.F. power transistors and modules
Sm = Small-signal transistors
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