LQ065T9BR51
Color TFT LCD Module
(Model Number: LQ065T9BR51)

Specifications

Spec No.: LCY–00065
Dated: May 31. 2002
DEVICE SPECIFICATION FOR

TFT-LCD module

MODEL No. LQ065T9BR51

☐ CUSTOMER'S APPROVAL

DATA

PRESENTED

BY

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(1) Summary
The SHARP color TFT-LCD module is an active matrix LCD (Liquid Crystal Display) produced by making the most of Sharp’s expertise in liquid-crystal and semiconductor technologies. The active device is amorphous silicon TFT (Thin Film Transistor). The module has a 16:9 aspect ratio and accepts full color video signal conforming to the NTSC and PAL systems. An outline of the module is shown in Table 1.

(2) Features
- 16:9 aspect ratio suitable for the wide-screen systems.
- A variety of display modes can be selected without any loss of wide-screen characteristics.
- The 6.5 screen produces a high resolution image that is composed of 96,000 pixel elements in a stripe arrangement.
- Wide viewing angle technology is adopted. (The most suitable viewing angle is in the 6 o'clock direction.)
- External clock synchronization allows an extremely clear image to be displayed.
- TFT-active matrix-LCD drive system with high contrast.
- Dual mode type [NTSC (M) and PAL(B・G) standards]
- MBK-PAL which enables the 240-scanning lines panel to display a picture with virtually 274-scanning lines.
- Reduced reflection as a result of low reflectance black matrix and an antiglare (AG) and anti-reflection (AR) polarizer being adopted.
- A thin, lightweight and compact
  1. Effective area/Outline area = 82%
  2. Thickness = 12.5 mm
  3. Mass = 205 g
- Multi scene display which is able to display high-quality color image in all lighting condition.
- Through the use of TN-normally white mode, an image with highly natural color reproduction is realized.
- It is possible to reverse the display direction (right/left and up/down).
- Self-heating Backlight that is excellent of brightness rising characteristics at low temperature in consideration of automotive application.

(3) Construction and Outline
Outline dimension of TFT-LCD module : Fig. 1 (and the structure of the module is shown in Fig. 2).
The module consists of the TFT-LCD panel, driver ICs, control PWB mounted with electronic circuits, self heating backlight, frame, backlight, front and rear shielding cases.

(4) Mechanical specifications

<table>
<thead>
<tr>
<th>Table 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter</td>
</tr>
<tr>
<td>Display format</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Active area</td>
</tr>
<tr>
<td>Screen size (Diagonal)</td>
</tr>
<tr>
<td>Dot pitch</td>
</tr>
<tr>
<td>Pixel configuration</td>
</tr>
<tr>
<td>Outline dimension</td>
</tr>
<tr>
<td>Mass</td>
</tr>
</tbody>
</table>

[Note1-1] This measurement is typical, and see Fig. 1 for details.
[Note1-2] Maximum values are given.
### 5-1) TFT-LCD panel driving section

#### Table 2

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Symbol</th>
<th>i/o</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HSY</td>
<td>i/o</td>
<td>Input/Output horizontal sync. signal (low active)</td>
<td>[Note2-1]</td>
</tr>
<tr>
<td>2</td>
<td>FRPT</td>
<td>o</td>
<td>Polarity alternating signal for common signal</td>
<td>[Note2-2]</td>
</tr>
<tr>
<td>3</td>
<td>SYN</td>
<td>i</td>
<td>Composite sync. signal (high active)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>VGH</td>
<td>i</td>
<td>Power supply for gate driver (high level)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>FRPV</td>
<td>o</td>
<td>Polarity alternating signal for video signal</td>
<td>[Note2-3]</td>
</tr>
<tr>
<td>6</td>
<td>VB</td>
<td>i</td>
<td>Color video signal (Blue)</td>
<td>[Note2-4]</td>
</tr>
<tr>
<td>7</td>
<td>VR</td>
<td>i</td>
<td>Color video signal (Red)</td>
<td>[Note2-4]</td>
</tr>
<tr>
<td>8</td>
<td>VG</td>
<td>i</td>
<td>Color video signal (Green)</td>
<td>[Note2-4]</td>
</tr>
<tr>
<td>9</td>
<td>GND</td>
<td>i</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>VSH</td>
<td>i</td>
<td>Positive power supply voltage</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>VGL</td>
<td>i</td>
<td>Power supply for gate driver (low level)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>COM</td>
<td>i</td>
<td>Common electrode driving signal</td>
<td>[Note2-5]</td>
</tr>
<tr>
<td>13</td>
<td>NTP</td>
<td>i</td>
<td>Selection for NTSC or PAL</td>
<td>[Note2-6]</td>
</tr>
<tr>
<td>14</td>
<td>VSY</td>
<td>i/o</td>
<td>Input/Output vertical sync. signal (low active)</td>
<td>[Note2-7]</td>
</tr>
<tr>
<td>15</td>
<td>HRV</td>
<td>i</td>
<td>Selection for horizontal scanning direction</td>
<td>[Note2-8]</td>
</tr>
<tr>
<td>16</td>
<td>VRV</td>
<td>i</td>
<td>Selection for vertical scanning direction</td>
<td>[Note2-9]</td>
</tr>
<tr>
<td>17</td>
<td>CLKC</td>
<td>i</td>
<td>Selection for input/output direction of CLK, HSY, VSY</td>
<td>[Note2-10]</td>
</tr>
<tr>
<td>18</td>
<td>PWM</td>
<td>o</td>
<td>Timing signal for PWM dimming of backlight</td>
<td>[Note2-11]</td>
</tr>
<tr>
<td>19</td>
<td>VMSW</td>
<td>I</td>
<td>Selection for number of vertical line</td>
<td>[Note2-12]</td>
</tr>
<tr>
<td>20</td>
<td>CLK</td>
<td>i/o</td>
<td>Input/output clock signal</td>
<td>[Note2-13]</td>
</tr>
<tr>
<td>21</td>
<td>MODS</td>
<td>i</td>
<td>Selection for display mode</td>
<td>[Note2-14]</td>
</tr>
<tr>
<td>22</td>
<td>MODW</td>
<td>i</td>
<td>Selection for display mode</td>
<td>[Note2-14]</td>
</tr>
<tr>
<td>23</td>
<td>MODN</td>
<td>i</td>
<td>Selection for display mode</td>
<td>[Note2-14]</td>
</tr>
<tr>
<td>24</td>
<td>VCS</td>
<td>o</td>
<td>Video selection timing signal</td>
<td>[Note2-15]</td>
</tr>
</tbody>
</table>

**[Note2-1]** If CLKC="Hi", this terminal outputs horizontal sync. signal synchronized with the SYN signal. If CLKC="Lo", this terminal will be external horizontal sync. input terminal.

**[Note2-2]** This terminal is to reverse the polarity of common electrode driving signal (COM).

**[Note2-3]** This terminal is to reverse the polarity of video signal. Use of a dedicated video signal polarity reversing IC should be used. Recommended interface ICs to be reversed the polarity of video signal are the IR3Y26A (analog RGB input type) and IR3Y29BM (composite video type) manufactured by Sharp.

**[Note2-4]** This terminal is to be input the video signal which whose polarity is reversed in compliance with the FRPV inverse timing signal.

**[Note2-5]** This terminal is to be input the common electrode driving signal (COM) whose polarity is reversed in compliance with the FRPV inverse timing signal. Brightness is adjusted through a change of the COM signal amplitude, and the center position of the COM input signal (VCDC) is adjusted, maximum contrast for a module’s display screen should be achieved.

**[Note2-6]** NTP = "Hi": NTSC system  
NTP = "Lo": PAL system

**[Note2-7]** When CLKC="Hi", this terminal outputs vertical sync. signal synchronized with the SYN signal. When CLKC="Lo", this terminal will be external horizontal sync. input terminal.

**[Note2-8]** HRV = "Hi": Normal video  
HRV = "Lo": Reversed video on horizontal direction

**[Note2-9]** VRV = "Hi": Normal video  
VRV = "Lo": Reversed video on vertical direction

**[Note2-10]** CLCK = "Hi": CLK, HSY and VSY terminals are the output mode.  
CLCK = "Lo": CLK, HSY and VSY terminals are the input mode.
**Note2-11**  PWM signal is used for the PWM dimming frequency and it is possible to control the PWM signal dimming by combining both HSY and PWM signal. But, please use this PWM signal just in case of inputting standard NTSC or PAL signal. (See Fig. 4-1)

**Note2-12**  VMSW = “Hi”: Vertical 240 line display  
VMSW = ‘Lo”: Vertical 234 line display  
Masking signal for upper 1 line and bottom 5 line is output with VCS signal.

**Note2-13**  When CLKC=“Hi”, this terminal outputs low level.  
When CLKC=“Lo”, this terminal will be external clock input terminal.  
This signal should correspond to sampling timing of the horizontal direction image. NTP, MODS, MODW, and MODN should be "Hi" when CLKC="Lo".

**Note2-14**  Display mode settings are shown in Table 3.

**Note2-15**  In case of normal mode (MODS="Hi", MODW="Lo", MODN="Hi"), it is possible to get an excellent display by masking of video signal based on the VCS output signal. The video signal is masked when VCS is "Hi" (the two edges of the screen). (In case of black masking display, it is possible to easily get the normal screen (full frame) by inputting the VCS signal at the system switching terminal of the video interface IC, inputting the field signal into another video input and inputting a signal for black into the other video input.  
And also, in case of vertical 234 lines, the masking signal of upper 1 line and bottom 5 lines is output regardless of display mode.  
In case of the other condition except above, the output of VCS becomes “Lo”.  
In case of the module test mode, the test signal is output.
<table>
<thead>
<tr>
<th>MODS</th>
<th>MODW</th>
<th>MODN</th>
<th>Display mode</th>
<th>Characteristics</th>
<th>Source</th>
<th>example</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>H</td>
<td>H</td>
<td>Full mode</td>
<td>The picture is displayed with uniform enlargement in the horizontal direction, and the horizontal retrace line of the input signal cannot be seen. If the video sampling frequency of the image is fixed and a 4:3 video signal is displayed, the picture will be prominently oblong.</td>
<td>4:3 signal, Navigation signal</td>
<td>Fig.3-1</td>
</tr>
<tr>
<td>H</td>
<td>H</td>
<td>L</td>
<td>Wide 1 mode</td>
<td>A 4:3 video signal is displayed with less feeling of incongruity than that in the full screen mode. Since the video horizontal sampling frequency is modulated in the horizontal direction, the degree of perfect roundness in the center of the screen is improved over that of the full screen mode.</td>
<td>4:3 signal</td>
<td>Fig.3-2</td>
</tr>
<tr>
<td>H</td>
<td>L</td>
<td>H</td>
<td>Normal mode</td>
<td>When displaying a 4:3 video signal, the displayed image is slightly less than perfectly round and the horizontal retrace line period is displayed at the two edges of the screen. With respect to the video horizontal sampling frequency, the center portion of the screen is slightly lower and the two edges become slightly higher. With respect to the horizontal retrace line period, a far better display is achieved than that of masking of the video signal by the VCS signal timing.</td>
<td>4:3 signal</td>
<td>Fig.3-3</td>
</tr>
<tr>
<td>H</td>
<td>L</td>
<td>L</td>
<td>Cinema mode</td>
<td>A letter-box type image (16:9 signal) is displayed over the central width of the screen. In the horizontal direction, full screen display is utilized. Due to the display being extended in the vertical direction, a slightly less than perfectly round image is displayed.</td>
<td>letter box type wide signal (16:9 signal)</td>
<td>Fig.3-4</td>
</tr>
<tr>
<td>L</td>
<td>H</td>
<td>H</td>
<td>Wide 2 mode</td>
<td>In the horizontal direction, the Wide 1 display mode is employed. Due to the display being extended in the vertical direction, the portion of the picture in the center of the screen is slightly less than perfectly round. Also due to extending in the vertical direction, the upper and lower potions of the image are not displayed.</td>
<td>4:3 signal</td>
<td>Fig.3-5</td>
</tr>
<tr>
<td>L</td>
<td>H</td>
<td>L</td>
<td>test</td>
<td>This mode is unusable as it is the test mode.</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>L</td>
<td>L</td>
<td>H</td>
<td>test</td>
<td>This mode is unusable as it is the test mode.</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>L</td>
<td>L</td>
<td>L</td>
<td>test</td>
<td>This mode is unusable as it is the test mode.</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>
Fig. 3-1  Full mode

Fig. 3-2  Wide 1 mode

Fig. 3-3  Normal mode

Fig. 3-4  Cinema mode

Fig. 3-5  Wide 2 mode
### 5-2) Functions, Modes and Terminals (Table 4)

<table>
<thead>
<tr>
<th>Mode terminals</th>
<th>Sync, signal I/O terminals</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CLRC</strong></td>
<td><strong>HSY</strong></td>
<td><strong>VSY</strong></td>
</tr>
<tr>
<td>H</td>
<td>H or L</td>
<td>L</td>
</tr>
<tr>
<td>H</td>
<td>H or L</td>
<td>H</td>
</tr>
<tr>
<td>H</td>
<td>H or L</td>
<td>other H or L settings</td>
</tr>
<tr>
<td>L</td>
<td>H</td>
<td>H</td>
</tr>
</tbody>
</table>

### 5-3) Backlight fluorescent tube driving part

#### Table 5-1 Lamp

<table>
<thead>
<tr>
<th>terminal</th>
<th>No.</th>
<th>symbol</th>
<th>function</th>
<th>remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN2</td>
<td>1</td>
<td>VL1A</td>
<td>i input terminal (hi voltage side)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>NC</td>
<td>– non connection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>VL2A</td>
<td>i input terminal (low voltage side)</td>
<td></td>
</tr>
</tbody>
</table>

#### Table 5-2 Thermistor

<table>
<thead>
<tr>
<th>terminal</th>
<th>No.</th>
<th>symbol</th>
<th>remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN3</td>
<td>1</td>
<td>TH1</td>
<td>Thermistor</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>TH2</td>
<td>Thermistor</td>
</tr>
</tbody>
</table>

Caution:
- Please use this thermistor in order to check the lamp temperature
- Model number of Thermistor: 203GT-1 made by Ishizuka Electronics
- Zero load resistance value at 25 °C: 20.0kΩ ± 3%
### Absolute maximum ratings

Table 6  
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>MIN</th>
<th>MAX</th>
<th>Unit</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive power supply voltage</td>
<td>VSH</td>
<td>-0.3</td>
<td>+6.0</td>
<td>V</td>
<td>Ta = 25 °C</td>
</tr>
<tr>
<td>Power supply for gate driver</td>
<td>VGH</td>
<td>-0.3</td>
<td>+33.0</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>VGL</td>
<td>VGH-33.0</td>
<td>VGH+0.3</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Input signals [terminal 4-1]</td>
<td>VIA</td>
<td>-0.3</td>
<td>VSH+0.3</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Input signals [terminal 4-2]</td>
<td>VID</td>
<td>-0.3</td>
<td>VSH+0.3</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Output signals [terminal 4-3]</td>
<td>VOD</td>
<td>-0.3</td>
<td>VSH+0.3</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>DC bias voltage of common electrode</td>
<td>VDC</td>
<td>-4</td>
<td>+6</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Storage temperature</td>
<td>Tstg</td>
<td>-30</td>
<td>85</td>
<td>°C</td>
<td>[Note 4-1,2]</td>
</tr>
<tr>
<td>Operating temperature (panel surface)</td>
<td>Topr1</td>
<td>-30</td>
<td>85</td>
<td>°C</td>
<td>[Note 4-2,3,4]</td>
</tr>
<tr>
<td>Operating temperature (Ambient temperature)</td>
<td>Topr2</td>
<td>-30</td>
<td>65</td>
<td>°C</td>
<td>[Note 4-4,5]</td>
</tr>
</tbody>
</table>

[terminal 4-1] V R, V G, V B  

[Note 4-1] This rating is applied to all parts of the module and should not be exceeded.  
[Note 4-2] Maximum wet-bulb temperature is less than 58°C. Condensation of dew must be avoided as electrical current leaks will occur, causing a degradation of performance specifications.  
[Note 4-3] Please measure in the effective display area only.  
[Note 4-4] The operating temperature only guarantees operation of the circuit. For contrast, speed response, and other factors related to display quality, determine operating temperature using the formula Ta = +25°C  
[Note 4-5] Ambient temperature when the backlight is lit (reference value).
(7) Electrical characteristics

7-1) Recommended operating conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive power supply voltage</td>
<td>VSH</td>
<td>+4.75</td>
<td>+5.0</td>
<td>+5.5</td>
<td>V</td>
<td>[Note 5-1]</td>
</tr>
<tr>
<td>Power supply for gate driver</td>
<td>VGH</td>
<td>+12.5</td>
<td>+13.0</td>
<td>+13.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Gate driver Lo voltage</td>
<td>VGL</td>
<td>-15.5</td>
<td>-16.0</td>
<td>-16.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>AC component</td>
<td>VIAC</td>
<td>+2.0</td>
<td>-</td>
<td>±2.0</td>
<td>V</td>
<td>[Note 5-2]</td>
</tr>
<tr>
<td>DC component</td>
<td>VIDC</td>
<td>VSM-0.1</td>
<td>VSM</td>
<td>VSM+0.1</td>
<td>V</td>
<td>[Note 5-3]</td>
</tr>
<tr>
<td>Input voltage [terminal 5-1]</td>
<td>VID</td>
<td>0</td>
<td>-</td>
<td>VSH</td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>
| Input voltage [terminal 5-2] | frequency NTSC | fH(N) | 15.13 | 15.73 | 16.33 | kHz | CLKC='Hi'
| | PAL | fH(P) | 15.03 | 15.63 | 16.23 | kHz | |
| Input horizontal sync. signal [terminal 5-3] | pulse width NTSC | τ HI(N) | 4.2 | 4.7 | 5.2 | μs | |
| | PAL | τ HI(P) | 4.2 | 4.7 | 5.2 | μs | |
| Input vertical sync. signal [terminal 5-4] | pulse width NTSC | τ VI(N) | - | 3H | - | μs | |
| | PAL | τ VI(P) | - | 2.5H | - | μs | |
| Input clock [terminal 5-5] | frequency | fCLI | 7.2 | 8.0 | 8.8 | MHz | CLKC='Lo'
| Hi pulse width | τ WH | 20.0 | - | - | ns | |
| Lo pulse width | τ WL | 20.0 | - | - | ns | |
| rising time | τ rCLI | - | - | 10.0 | ns | |
| falling time | τ fCLI | - | - | 10.0 | ns | |
| Input horizontal sync. signal [terminal 5-6] | pulse width | τ HI | 1 | 5 | 9 | μs | |
| rising time | τ rHI2 | - | - | 0.05 | μs | |
| falling time | τ fHI2 | - | - | 0.05 | μs | |
| Input vertical sync. signal [terminal 5-7] | frequency | fVI | 50 | fHI/262 | fHI/258 | Hz | CLKC='Lo'
| pulse width | τ VI | 1H | 3H | 5H | μs | |
| Data setup time [terminal 5-5,6] | tSU1 | 25 | - | - | ns | CLKC='Lo'
| Data hold time [terminal 5-5,6] | tHO1 | 25 | - | - | ns | [Note 5-4] |
| Data setup time [terminal 5-5,7] | tSU2 | 1.0 | - | - | μs | CLKC='Lo'
| Data hold time [terminal 5-5,7] | tHO2 | 1.0 | - | - | μs | [Note 5-5] |
| Polarity alternating delay time (FRPV-VRGB) | τ DV | - | - | 4 | μs | |
| Polarity alternating delay time (FRPT-COM) | τ DC | - | - | 4 | μs | |
| Common electrode driving signal AC component | VCAC | ±0.5 | ±3.9 | ±5.0 | V | [Note 5-2] |
| DC component | VCDC | +0.0 | +1.6 | +3.0 | V | [Note 5-6] |

Caution:

Power switch on (or off) must be done with all power supplies. And, the signals must input after power has been turned on.
[terminal 5-1] VR, VG, VB
[terminal 5-2] HSY, SYN, NTP, VSY, HRV, VRV, CLK, VMSW, MODS, CLK, MODW, MODN
[terminal 5-3] SYN (horizontal sync. component)
[terminal 5-4] SYN (vertical sync. component)
[terminal 5-5] CLK
[terminal 5-6] HSY
[terminal 5-7] VSY

【Note 5-1】 Any change in voltage after adjusting VCDC should be less than 0.1 V.
【Note 5-2】 Positive and negative amplitudes should be equal. When the AC input voltage is $-\pi/+\pi$, FRPV and T are in phase. When the AC input voltage is $+\pi/-\pi$, FRPV and T are $180^\circ$ out of phase. The MIN value produces a white display, and the MAX value produces a black display.
【Note 5-3】 VSM=VSH/2. Any change in voltage after adjusting VCDC should be less than 0.1 V.
【Note 5-4】 During the clock input mode, CLK and the HSY input signal are out of phase. In this mode, the HSY input signal is effected by the rise time of the CLK input signal.
【Note 5-5】 During the clock input mode, HSY and the VSY input signal are out of phase. In this mode, the VSY input signal is effected by the rise time of the HSY input signal.
【Note 5-6】 To obtain the maximum value of contrast, each module must be adjusted to an optimum voltage.

B) Backlight driving section

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>lamp voltage</td>
<td>VL 7</td>
<td>630</td>
<td>700</td>
<td>770</td>
<td>Vrms</td>
<td>I L = 6.5mA RMS</td>
</tr>
<tr>
<td>lamp current</td>
<td>I L</td>
<td>6.0</td>
<td>6.5</td>
<td>7.0</td>
<td>MA RMS</td>
<td>at Normal Operation</td>
</tr>
<tr>
<td></td>
<td>I L B</td>
<td>-</td>
<td>-</td>
<td>9.0</td>
<td>MA RMS</td>
<td>at PWM Dimming</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lamp frequency</td>
<td>f L</td>
<td>35</td>
<td>-</td>
<td>60</td>
<td>kHz</td>
<td></td>
</tr>
<tr>
<td>kick-off voltage</td>
<td>VS</td>
<td>-</td>
<td>-</td>
<td>3000</td>
<td>Vrms</td>
<td>Ta=+25°C [Note 6-2]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>3000</td>
<td>Vrms</td>
<td>Ta=-30°C [Note 6-2]</td>
</tr>
</tbody>
</table>


【Note 6-1】 The sin wave which is symmetrical wave of both positive and negative without spike wave shall be used for inverter.
【Note 6-2】 The metal shield case of the module shall be connected to GND of the inverter circuit.
【Note 6-3】 Usable area for backlight lighting

![Dimming Diagram]
7-2) Electrical characteristics

**Table 9**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>input voltage</td>
<td>Hi</td>
<td>VIT+</td>
<td>-</td>
<td>-</td>
<td>+3.7</td>
<td>V</td>
</tr>
<tr>
<td>[terminal 7-1]</td>
<td>Lo</td>
<td>VIT-</td>
<td>1.0</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>V+ - V-</td>
<td>+0.2</td>
<td>-</td>
<td>-</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>input voltage</td>
<td>Hi</td>
<td>VIDH</td>
<td>+3.5</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>[terminal 7-2]</td>
<td>Lo</td>
<td>VIDL</td>
<td>-</td>
<td>-</td>
<td>+1.5</td>
<td>V</td>
</tr>
<tr>
<td>output voltage</td>
<td>Hi</td>
<td>VOH1</td>
<td>+4.0</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>[terminal 7-3]</td>
<td>Lo</td>
<td>VOL1</td>
<td>-</td>
<td>-</td>
<td>+0.4</td>
<td>V</td>
</tr>
<tr>
<td>output voltage</td>
<td>Hi</td>
<td>VOH2</td>
<td>+4.0</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>[terminal 7-4]</td>
<td>Lo</td>
<td>VOL2</td>
<td>-</td>
<td>-</td>
<td>+0.4</td>
<td>V</td>
</tr>
<tr>
<td>input current</td>
<td>Hi</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[terminal 7-5]</td>
<td>IIH1</td>
<td>-</td>
<td>-</td>
<td>+1</td>
<td>μA</td>
<td>VID=VSH</td>
</tr>
<tr>
<td>Lo</td>
<td>IIL1</td>
<td>-</td>
<td>-</td>
<td>+1</td>
<td>μA</td>
<td>VID=0V</td>
</tr>
<tr>
<td>input current</td>
<td>Hi</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[terminal 7-6]</td>
<td>IIH2</td>
<td>-</td>
<td>-</td>
<td>+2</td>
<td>μA</td>
<td>VID=VSH</td>
</tr>
<tr>
<td>Lo</td>
<td>IIL2</td>
<td>5.0</td>
<td>-</td>
<td>+75</td>
<td>μA</td>
<td>VID=0V</td>
</tr>
<tr>
<td>input capacity (reference)</td>
<td>CIA</td>
<td>-</td>
<td>160</td>
<td>-</td>
<td>pF</td>
<td>f=1MHz</td>
</tr>
<tr>
<td>[terminal 7-7]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>input capacity (reference)</td>
<td>CID</td>
<td>-</td>
<td>20</td>
<td>-</td>
<td>pF</td>
<td>f=1MHz</td>
</tr>
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</table>

7-3) Power consumption

**Table 10**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sym</th>
<th>Conditions</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCD panel</td>
<td>Source</td>
<td>ISH</td>
<td>VSH=+5.0V</td>
<td>-</td>
<td>60</td>
<td>75</td>
<td>mA</td>
</tr>
<tr>
<td>Driving power</td>
<td>gate high</td>
<td>IGH</td>
<td>VGH=+13.0V</td>
<td>-</td>
<td>1.3</td>
<td>2.0</td>
<td>mA</td>
</tr>
<tr>
<td>Consumption</td>
<td>gate low</td>
<td>IGL</td>
<td>VGL=16.0V</td>
<td>-</td>
<td>3.0</td>
<td>5.5</td>
<td>mA</td>
</tr>
<tr>
<td>Total</td>
<td>WS</td>
<td>-</td>
<td>365</td>
<td>489</td>
<td>mW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lamp power consumption</td>
<td>WL</td>
<td>Normal driving</td>
<td>-</td>
<td>4.55</td>
<td>-</td>
<td>W</td>
<td></td>
</tr>
</tbody>
</table>

【Note 7-8】excluding backlight section

7-4) Input/output signal waveforms

Refer to Fig.4-A,B,C,D,E,F,G,H

Caution:
In case of NTSC or PAL mode, please input standard composite video (or sync.) signal, NTSC(M) or PAL(B,G).
If the non-standard sync. signal would be input for a long time, it may cause flicker or decline in the display quality.
In the case of external clock mode, the signal shall be input under the condition shown in Table. 7.
### Input/Output signal timing chart

**Table 11**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal sync. frequency</td>
<td>fHO</td>
<td>-</td>
<td>fH</td>
<td>-</td>
<td>kHz</td>
<td></td>
</tr>
<tr>
<td>pulse width</td>
<td>τHO</td>
<td>2.0</td>
<td>4.6</td>
<td>8.0</td>
<td>μs</td>
<td>[Note 9-1]</td>
</tr>
<tr>
<td>rising time</td>
<td>τrHO</td>
<td>-</td>
<td>-</td>
<td>0.5</td>
<td>μs</td>
<td>CL=10pF</td>
</tr>
<tr>
<td>falling time</td>
<td>τfHO</td>
<td>-</td>
<td>-</td>
<td>0.5</td>
<td>μs</td>
<td>CL=10pF</td>
</tr>
<tr>
<td>Horizontal sync. phase difference</td>
<td>τpd1</td>
<td>0.5</td>
<td>1.1</td>
<td>3.0</td>
<td>μs</td>
<td>[Note 9-2]</td>
</tr>
<tr>
<td>Vertical sync. output</td>
<td>fVO</td>
<td>-</td>
<td>fV</td>
<td>-</td>
<td>Hz</td>
<td></td>
</tr>
<tr>
<td>pulse width</td>
<td>τVO</td>
<td>-</td>
<td>4H</td>
<td>-</td>
<td>μs</td>
<td>1H=1/fH</td>
</tr>
<tr>
<td>sync. output difference</td>
<td>τVHO</td>
<td>-</td>
<td>11</td>
<td>29</td>
<td>μs</td>
<td></td>
</tr>
<tr>
<td>rising time</td>
<td>τrVO</td>
<td>-</td>
<td>-</td>
<td>2.0</td>
<td>μs</td>
<td>CL=10pF</td>
</tr>
<tr>
<td>falling time</td>
<td>τfVO</td>
<td>-</td>
<td>-</td>
<td>2.0</td>
<td>μs</td>
<td>CL=10pF</td>
</tr>
<tr>
<td>Vertical sync. phase difference</td>
<td>τDV1</td>
<td>-</td>
<td>1H</td>
<td>-</td>
<td>μs</td>
<td></td>
</tr>
<tr>
<td>even field</td>
<td>τDV2</td>
<td>-</td>
<td>0.5H</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polarity alternating output signal</td>
<td>τrFR</td>
<td>-</td>
<td>-</td>
<td>0.5</td>
<td>μs</td>
<td>CL=10pF</td>
</tr>
<tr>
<td>falling time</td>
<td>τfFR</td>
<td>-</td>
<td>-</td>
<td>0.5</td>
<td>μs</td>
<td>CL=10pF</td>
</tr>
</tbody>
</table>

[Note 7-1] This is changed by the value of τpd1

[Note 7-2] Center position: τpd1=1.1±0.5 μs (NTSC mode)
7-6) Display time range

(1) NTSC(M) mode (NTP='Hi',CLKC='Hi')
   (a1) Horizontal Direction (full,wide1,2,cinema)
       13.1 ~ 63.2 μs from the falling edge of HSY.
   (a2) Horizontal Direction (normal)
       7.9 ~ 68.4 μs from the falling edge of HSY
   (b1) Vertical Direction (full,wide1,normal)
       1) VMSW="Hi": 19 ~ 258 H from the falling edge of VSY
       2) VMSW="Lo": 20 ~ 253 H from the falling edge of VSY
   (b2) Vertical Direction (Cinema)
       1) VMSW="Hi": 48 ~ 228 H from the falling edge of VSY
       2) VMSW="Lo": 49 ~ 224 H from the falling edge of VSY
   (b3) Vertical Direction (Wide2)
       1) VMSW="Hi": 41 ~ 232 H from the falling edge of VSY
       2) VMSW="Lo": 42 ~ 228 H from the falling edge of VSY

(2) PAL(B·G) mode (NTP='Lo',CLKC='Hi')
   (a1) Horizontal Direction (full,wide1,2,cinema)
       13.1 ~ 63.2 μs from the falling edge of HSY
   (a2) Horizontal Direction (normal)
       7.9 ~ 68.4 μs from the falling edge of HSY. (Normal)
   (b1) Vertical Direction (full,wide1,normal)
       1) VMSW="Hi": 25 ~ 304 H from the falling edge of VSY
       2) VMSW="Lo": 26 ~ 298 H from the falling edge of VSY
       However, the video signals of (14n+12)H,(14n+20)H/Even field.
       (14n+17)H,(14n+23)H/Odd field (n=1,2····, 20)
       are not displayed on the module.
   (b2) Vertical Direction (cinema)
       1) VMSW="Hi": 48 ~ 287 H from the falling edge of VSY
       2) VMSW="Lo": 49 ~ 282 H from the falling edge of VSY
   (b3) Vertical Direction (wide2)
       1) VMSW="Hi": 34 ~ 297 H from the falling edge of VSY
       2) VMSW="Lo": 35 ~ 291 H from the falling edge of VSY
       However, the video signals of (22n+14)H,(22n+21)H/Even field.
       (22n+25)H,(22n+32)H/Odd field (n=1,2····, 12)
       are not displayed on the module.

(3) External clock mode (NTP='Hi',CLKC='Lo')
   Displaying the following range within video signals.
   (a) Horizontal Direction :  86 ~ 485 clk from the falling edge of HSY.
       (clk means input external clock.)
   (b) Vertical Direction :  19 ~ 258 H from the falling edge of VSY.
### Table 12: Optical Characteristics at $T_a=25^\circ C$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viewing angle</td>
<td>$\triangle \theta_1$</td>
<td>CR$\geq 5$</td>
<td>40</td>
<td>50</td>
<td>-</td>
<td>°</td>
<td>(degree)</td>
</tr>
<tr>
<td></td>
<td>$\triangle \theta_2$</td>
<td></td>
<td>30</td>
<td>40</td>
<td>-</td>
<td>°</td>
<td>(degree)</td>
</tr>
<tr>
<td>Contrast ratio</td>
<td>CRmax</td>
<td>Optimal</td>
<td>60</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response time</td>
<td>Rise</td>
<td>$\tau_r$</td>
<td>-</td>
<td>15</td>
<td>30</td>
<td>ms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fall</td>
<td>$\tau_d$</td>
<td>-</td>
<td>35</td>
<td>70</td>
<td>ms</td>
<td></td>
</tr>
<tr>
<td>Luminance</td>
<td>Y</td>
<td>$\text{IL}=6.5\text{mA rms}$</td>
<td>160</td>
<td>220</td>
<td>-</td>
<td>cd/m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>YLOW</td>
<td>$\text{IL}=9\text{mA rms}$</td>
<td>60</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White chromaticity</td>
<td>x</td>
<td>$\text{IL}=6.5\text{mA rms}$</td>
<td>0.263</td>
<td>0.313</td>
<td>0.363</td>
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<td>[Note10-1,6]</td>
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<tr>
<td></td>
<td>y</td>
<td>$\text{IL}=6.5\text{mA rms}$</td>
<td>0.279</td>
<td>0.329</td>
<td>0.379</td>
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<td>Lamp life time</td>
<td>$+25^\circ C$</td>
<td>-</td>
<td>10,000</td>
<td>-</td>
<td>-</td>
<td>hour</td>
<td>[Note10-1,8]</td>
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<tr>
<td></td>
<td>$-30^\circ C$</td>
<td>-</td>
<td>2,000</td>
<td>-</td>
<td>-</td>
<td>time</td>
<td>[Note10-1,9]</td>
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<tr>
<td>Reflectivity</td>
<td>Rf</td>
<td>30° in/10°</td>
<td>-</td>
<td>10</td>
<td>-</td>
<td>%</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Integrating sphere</td>
<td>(3.8)</td>
<td></td>
<td></td>
<td>Reference</td>
<td>[Note10-11]</td>
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<tr>
<td>Viewing angle</td>
<td>$\triangle \theta_{1/2}$</td>
<td>CR$\geq 2$</td>
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<td>45</td>
<td>-</td>
<td>°</td>
<td>(degree)</td>
</tr>
<tr>
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<td>$\triangle \theta_2$</td>
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<td>45</td>
<td>50</td>
<td>-</td>
<td>°</td>
<td>(degree)</td>
</tr>
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<td>Contrast ratio</td>
<td>CR</td>
<td>$\theta = 0^\circ$</td>
<td>5</td>
<td>7</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response time</td>
<td>Rise</td>
<td>$\tau_r$</td>
<td>-</td>
<td>15</td>
<td>30</td>
<td>ms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fall</td>
<td>$\tau_d$</td>
<td>-</td>
<td>35</td>
<td>70</td>
<td>ms</td>
<td></td>
</tr>
<tr>
<td>White chromaticity</td>
<td>x</td>
<td>$\theta = 0^\circ$</td>
<td>0.269</td>
<td>0.319</td>
<td>0.369</td>
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<td>[Note10-12,15]</td>
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<tr>
<td></td>
<td>y</td>
<td>$\theta = 0^\circ$</td>
<td>0.299</td>
<td>0.349</td>
<td>0.399</td>
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</tbody>
</table>

[Note10-1] Refer the measurement method as shown in Fig.4
Just for evaluation, the following inverter can be used.
Harison Co.: HIU-359A-W2
To be measured after 30 minutes of lamp lighting
Please make sure enough with an actual model for unevenness arises in luminance, at
the reason of installation states of the module, the leading line of taking around for
the lamp and matching with the inverter.
Viewing angle range is defined as follows.

6 o'clock direction

\[
\theta_1, \theta_2, \theta_{11}, \theta_{12}
\]

Note 10-3: Applied voltage condition for the measurement of transmissive mode:
1) VCDC is adjusted so as to attain maximum contrast ratio.
2) Input \( \pm 1.90 \) V at VIAC.
When \( \text{VI}_{50} \) = transmission is 50% at Voltage-Transmission curve,
Black level : \( \text{VI}_{50} = \pm 2.5 \) V, White level : \( \text{VI}_{50} = \pm 1.5 \) V

Contrast ratio is defined as follows:

\[
\text{Contrast ratio (CR)} = \frac{\text{Photodetector output with LCD being "white"}}{\text{Photodetector output with LCD being "black"}}
\]

Response time is obtained by measuring the transition time of photodetector output, when input signals are applied so as to make the area "black" to and from "white".
【Note 10-6】 Measured on the center area of the panel at a viewing cone 1° by TOPCON luminance meter BM-7. (After 30 minutes operation) DC/AC inverter driving frequency: 49kHz

【Note 10-7】 Ambient temperature: -20°C
Measured luminance on the panel after 2 minutes operation.

【Note 10-8】 Lamp life time is defined as the time when either or occurs in the continuous operation under the condition of lamp current IL=3.0~7.0mArms and (Lighting Condition) Electric Current dimming: Continuous lighting at IL=6.0~7.0mArms PWM Dimming: Continuous lighting at IL=9mArms, Duty=80%~5%

【Note 10-9】 The intermittent cycles is defined as a time when brightness not to become under 50% of the original value under the condition of following cycle.

Ambient temperature: -30°C

【Note 10-10】 The optical measurement A for reflective mode is defined in Fig.6(a).

【Note 10-11】 Reflectivity is defined as follow:
The intermittent cycles is defined as a time when brightness not to become under 50% of the original value under the condition of following cycle.
Reflectivity (Rf) = Reflective intensity at non-operating Reflective intensity with LCD being "White"

【Note 10-12】 The optical measurement B for reflective mode is defined in Fig.6(b).

【Note 10-13】 Applied voltage condition for the measurement of reflective mode
1) VCDC is adjusted so as to attain maximum contrast ratio.
2) Input ±1.90V at VIAC.
When VI50= transmission is 50% at Voltage-Transmission curve,
Black level : Vi50 = ±2.5V, White level : Vi50 = ±1.5V

【Note 10-14】 Contrast ratio on reflective mode is defined as follows:
Contrast ratio (CR) = Reflectivity in the center of screen with LCD being "white" Reflectivity in the center of screen with LCD being "black"

【Note 10-15】 Measured by Minoruta’s spectrophotometer CM-2002.
White chromaticity with LCD being “White” based on Lighting source (D65)
(Assumption of chromaticity of lighting source: X=0.313, Y=0.329)
(9) Mechanical characteristics
9-1) External appearance
   Extreme defects should not exist.  (See Fig. 1)

9-2) Panel toughness
   The panel shall not be broken, when 19N is pressed on the center of the panel by a
   smooth sphere having 15 mm diameter.
   Caution: In spite of very soft toughness, if, in the long-term, add pressure on the
   active area, it is possible to occur the functional damage.
9-3) Input/output connector performance

A) Input/output connectors for the operation of LCD module

1) Applicable FPC: refer the below figure

2) Terminal holding force: More than 0.9N/pin; Thickness of FPC is t=0.33mm.
   (Each terminal is pulled out at a rate of 25 ±3mm/min.)

3) Insertion/pulling; contact resistance is not twice larger than the durability initial value
   after applicable FPC is inserted and pulled out 20 times

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Base material</td>
<td>Polyimide or equivalent material (25 μm thick)</td>
</tr>
<tr>
<td>2</td>
<td>Copper foil</td>
<td>Copper foil (35 μm thick) Solder plated over 2 μm</td>
</tr>
<tr>
<td>3</td>
<td>Cover lay</td>
<td>Polyimide or equivalent material</td>
</tr>
<tr>
<td>4</td>
<td>Reinforcing plate</td>
<td>Polyester polyimide or equivalent material (188 μm thick)</td>
</tr>
</tbody>
</table>

FPC applied to input/output connector (0.8mm pitch)

B) I/O connector of backlight driving circuit

Lamp Connector (JST)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Used Connector</th>
<th>Corresponding connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN2</td>
<td>BHR-02(8.0)VS-1N</td>
<td>SM02(8.0)B-HS-TB(assembled on PWB)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SM02(8.0)B-HS-1N(assembled on PWB)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BHMR-03V (inter connector)</td>
</tr>
</tbody>
</table>

Thermistor Connector (Molex)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Used Connector</th>
<th>Corresponding connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN3</td>
<td>51021-0200</td>
<td>53047-0210 (assembled on PWB: Straight type)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>53048-0210 (assembled on PWB: Right angle type)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>51047-0200 (inter connector)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>53398-0210 (assembled on PWB surface: Straight type)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>53261-0210 (assembled on PWB surface: Right angle type)</td>
</tr>
</tbody>
</table>
(10) Display quality
The display quality of the color TFT-LCD module shall be in compliance with the Delivery Inspection Standard.

(11) Handling instructions
11-1) Mounting of module
The TFT-LCD module is designed to be mounted on equipment using the mounting tabs in the four corners of the module at the rear side.
On mounting the module, as the M2.6 tapping screw fastening torque is 0.3 through 0.5N·m (7mm length) is recommended, be sure to fix the module on the same plane, taking care not to wrap or twist the module.
Don’t reach the pressure of touch-switches of the set side to a module directly, because images may be disturbed.
Please power off the module when you connect the input/output connector.
Please connect the metallic shielding cases of the module and the ground pattern of the inverter circuit surely. If that connection is not perfect, there may be a possibility that the following problems happen.
a). The noise from the backlight unit will increase.
b). The output from inverter circuit will be unstable. Then, there may be a possibility that some problems happen.
c). In some cases, a part of module will heat.

11-2) Precautions in mounting
Polarizer which is made of soft material and susceptible to flaw must be handled carefully. Protective film (Laminator) is applied on the surface to protect it against scratches and dirts. It is recommended to peel off the laminator immediately before the use, taking care of static electricity.
Precautions in peeling off the laminator
A) Working environment
When the laminator is peeled off, static electricity may cause dust to stick to the polarizer surface. To avoid this, the following working environment is desirable.
a) Floor: Conductive treatment of 1MΩ or more on the tile
   (conductive mat or conductive paint on the tile)
b) Clean room free form dust and with an adhesive mat on the doorway
c) Advisable humidity: 50%~70%  Advisable temperature: 15℃~27℃
d) Workers shall wear conductive shoes, conductive work clothes, conductive gloves and an earth band.

B) Working procedures
a) Direct the wind of discharging blower somewhat downward to ensure that module is blown sufficiently. Keep the distance between module and discharging blower within 20 cm.
b) Attach adhesive tape to the laminator part near discharging blower so as to protect polarizer against flaw.
c) Peel off laminator, pulling adhesive tape slowly to your side taking 5 or more second.
d) On peeling off the laminator, pass the module to the next work process to prevent the module to get dust.
e) Method of removing dust from polarizer

- Blow off dust with N2 blower for which static electricity preventive measure has been taken. Ionized air gun (Hugle Electronics Co.) is recommended.
- Since polarizer is vulnerable, wiping should be avoided. But when the panel has stain or grease, we recommend to use adhesive tape to softly remove them from the panel.

When metal part of the TFT-LCD module (shielding lid and rear case) is soiled, wipe it with soft dry cloth. For stubborn dirt, wipe the part, breathing on it.
Wipe off water drop or finger grease immediately. Long contact with water may cause discoloration or spots.
TFT-LCD module uses glass which breaks or cracks easily if dropped or bumped on hard surface. Handle with care.
Since CMOS LSI is used in this module, take care of static electricity and earth your body when handling.

11-3) Precautions in adjusting module

Adjusting volumes on the rear face of the module have been set optimally before shipment. Therefore, do not change any adjusted values. If adjusted values are changed, the specifications described here may not be satisfied.

11-4) Caution of product design

The LCD module shall be protected against water salt-water by the waterproof cover.
Please take measures to interferential radiation from module, to do not interfere surrounding appliances.

11-5) Others

Do not expose the module to direct sunlight or intensive ultraviolet rays for many hours; liquid crystal is deteriorated by ultraviolet rays.
Store the module at a temperature near the room temperature. At lower than the rated storage temperature, liquid crystal solidifies, causing the panel to be damaged. At higher than the rated storage temperature, liquid crystal turns into isotropic liquid and may not recover.
The voltage of beginning electric discharge may over the normal voltage because of leakage current from approach conductor by to draw lump read lead line around.
If LCD panel breaks, there may be a possibility that the liquid crystal escapes from the panel. Since the liquid crystal is injurious, do not put it into the eyes or mouth. When liquid crystal sticks to hands, feet or clothes, wash it out immediately with soap.
Observe all other precautionary requirements in handling general electronic components.
(12) Forwarding form

12-1) Fig.3 shows packing form.

12-2) Conditions for storage.

① Piling number of cartons : 10

② Environment

Temperature : 0～40℃
Humidity : 60%RH or less(at 40℃)
Atmosphere : Harmful gas, such as acid or alkali which bites electronic components and/or wires, must not be detected.
Period : About 3 months
Opening of the package : In order to prevent the LCD module from breakdown by electrostatic charges, please control the room humidity over 50%RH and open the package taking sufficient countermeasures against electrostatic charges, such as earth, etc.

(13) Reliability test conditions

Reliability test conditions for the TFT-LCD module are shown in Table 13.

(14) Others

14-1) Indication of lot number

The lot number is shown on a label. Attached location is shown in Fig.1(Outline Dimensions).

Indicated contents of the label

```
LQ065T9BR51  ○○○○○○○○○
```

model No.      lot No.

Contents of lot No.  the 1st figure  production year (ex.2000 : 0)
the 2nd figure  production month  1,2,3,……,9,X,Y,Z
the 3rd～7th figure  serial No.  00001～
the 8th figure  revision marks  blank or A,B,C …
the 9th figure  production factory code blank or A,B,C …
Reliability test conditions for TFT-LCD module

Table 13

Remark)
Temperature condition is based on operating temperature conditions on (6)-Table 6.

<table>
<thead>
<tr>
<th>No.</th>
<th>Test items</th>
<th>Test conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High temperature storage test</td>
<td>Ta=+85°C, 240H</td>
</tr>
<tr>
<td>2</td>
<td>Low temperature storage test</td>
<td>Ta=-30°C, 240H</td>
</tr>
<tr>
<td>3</td>
<td>High temperature And high humidity operating test</td>
<td>Tp=+50°C, 90~95%RH, 240H</td>
</tr>
<tr>
<td>4</td>
<td>High temperature operating test</td>
<td>Tp=+85°C, 240H</td>
</tr>
<tr>
<td>5</td>
<td>Low temperature operating test</td>
<td>Tp=-30°C, 240H</td>
</tr>
<tr>
<td>6</td>
<td>Electro static discharge test</td>
<td>±200V, 200pF(0Ω), 1 times for each terminals</td>
</tr>
<tr>
<td>7</td>
<td>Shock test</td>
<td>980m/s², 6ms, ±X, ±Y, ±Z, 3 times for each direction (JIS C0041, A-7 condition C)</td>
</tr>
<tr>
<td>8</td>
<td>Vibration test</td>
<td>· Frequency range 8<del>33.3Hz, Stroke: 1.3mm, Sweep: 33.3Hz</del>400Hz, Acceleration: 28.4 m/s², Cycle: 15 minutes, X, Z 2 hours for each directions, 4 hours for Y direction (total 8 hours) (caution) (JIS D1601)</td>
</tr>
<tr>
<td>9</td>
<td>Heat shock test</td>
<td>Tp=-30~+85°C / 200cycles (0.5H) (0.5H)</td>
</tr>
</tbody>
</table>

【Note】Ta=Ambient temperature, Tp=Panel temperature
【Check items】In the standard condition, there shall be no practical problems that may affect the display function.
【Caution】X,Y,Z directions are shown as follows
Fig1. Outline dimension of TFT-LCD module
Fig2. Construction of TFT-LCD module
Fig3. Packing form
Fig. 4 – A  Input-output signal waveform (NTSC, PAL system CLKC=Hi)
Fig 4. - B  Input-output signal waveform (External clock input synchronized system  NTPC=Hi, CLKC=Lo, MODS=MODW=MODN=Hi)
Fig. 4 – C Input–output signal waveform
Fig 4. Input-output signal waveform (NTSC system NTPC=Hi, CLKC=Hi)
Fig 4. -E Input-output signal waveform (PAL system  NTPC=Lo, CLKC=Hi)
Fig. 4 — G Input-output signal waveform (Normal mode, NTSC, PAL system CLKC=Hi, MODS=Hi, MODW=Lo, MODN=Hi)
Fig. 4. Input–output signal waveform (Vertical mask mode, NTSC, PAL system VMSW=Lo)
Fig. 4-1 PWM light-adjustment timing chart
Fig. 5. Measurement method of optical characteristics (Transmissive mode)
Fig. 6 (a). Measurement method of optical characteristic (Reflective mode) A

Fig. 6 (b). Measurement method of optical characteristic (Reflective mode) B
Adjusting Method of Optimum Common electrode DC Bias Voltage

To obtain optimum DC bias Voltage of common electrode driving signal, photo-electric devices are very effective, and the accuracy is within 0.1V. (In visual examination method, the accuracy is about 0.5V because of the difference among individuals.)

To obtain optimum common electrode DC bias voltage, there is a measurement method as follows:

Measurement of flicker method
DC bias voltage is adjusted so as to minimize NTSC: 60Hz(30Hz)/PAL: 50Hz(25Hz) flicker.

Photo-electric output voltage is measured by an oscilloscope at a system shown in Fig.A. DC bias voltage must be adjusted so as to minimize the 60Hz(30Hz)[NTSC]/50Hz(25Hz)[PAL] flicker with DC bias voltage changing slowly. (Fig. B)

Fig. A Measurement system

Fig. B Waveforms of flickers
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