FLC51UXC8V-10

Specifications
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1. APPLICATION
   This specification is applied to the 20.1-inch UXGA supported TFT-LCD module.

2. PRODUCT NAME AND MODEL NUMBER
   2–1 Product Name: LCD Module
   2–2 Model Name: FLC51UXC8V-10

3. OVERVIEW
   This LCD module has a TFT active matrix type liquid crystal panel 1600x1200 pixels, and
diagonal size of 51cm(20.1-inch). This LCD has a LVDS dual interface and can display
16,777,216 colors.

   The power supply of this LCD module is +12V DC single.
   This module has the characteristics for applying TCO'99.

4. CONFIGURATION
   This LCD module consists of a color TFT-LCD panel that is mounted with TFT driver ICs, a
cold-cathode fluorescent tube back-light.
   The inverter for the backlight is not included.
   Figure 4-1 shows a block diagram of this LCD module.
5. MECHANICAL SPECIFICATIONS

Table 5-1 shows the mechanical specifications of this LCD module.

Table 5-1 Mechanical Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
<th>Unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>432x331.5x25(TYP.)</td>
<td>mm</td>
<td>Edge type back-light is used. (6 CCFL x 6)</td>
</tr>
<tr>
<td>Display Resolution</td>
<td>(1600x3) x 1200</td>
<td>—</td>
<td>Include inverter.</td>
</tr>
<tr>
<td>Display Dot Area</td>
<td>408.0x306.0</td>
<td>mm</td>
<td>For details on dimensions, See dimensional outline drawing.</td>
</tr>
<tr>
<td>Dot Pitch</td>
<td>(0.085x3)x0.255</td>
<td>mm</td>
<td>(At page 34,35)</td>
</tr>
<tr>
<td>Aspect Ratio</td>
<td>1:1</td>
<td>—</td>
<td>Excluding inverter.</td>
</tr>
<tr>
<td>Weight</td>
<td>3,700 (Typ)</td>
<td>g</td>
<td></td>
</tr>
<tr>
<td>FG-SG</td>
<td>Short circuit</td>
<td>—</td>
<td></td>
</tr>
</tbody>
</table>
6. ABSOLUTE MAXIMUM RATING
Table 6-1 shows the absolute maximum rating of this LCD module.

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Condition</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>Vcc</td>
<td>Ta=25°C</td>
<td>−0.3</td>
<td>—</td>
<td>14.0</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>VINV</td>
<td>Ta=25°C</td>
<td>−0.3</td>
<td>—</td>
<td>14.0</td>
<td>V</td>
</tr>
<tr>
<td>Input Signal Voltage</td>
<td>VIN</td>
<td>Ta=25°C</td>
<td>−0.3</td>
<td>—</td>
<td>3.6</td>
<td>V</td>
</tr>
</tbody>
</table>

7. RECOMMENDED OPERATING CONDITIONS
Table 7-1 shows the recommended operating conditions of this LCD module.

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage (Logic)</td>
<td>Vcc</td>
<td>11.5</td>
<td>12.0</td>
<td>12.5</td>
<td>V</td>
</tr>
<tr>
<td>Ripple Voltage</td>
<td>Vcc</td>
<td>Vrp</td>
<td>—</td>
<td>—</td>
<td>0.1</td>
</tr>
</tbody>
</table>
8. ELECTRICAL SPECIFICATIONS

Table 8-1 shows the electrical specifications of this LCD module. Figure 8-1 shows the measurement circuit. Figure 8-2(A) shows the equivalent circuit of the logic signal input area. Figure 8-2(B) shows the equivalent circuit of the supply voltage Input area.

<table>
<thead>
<tr>
<th>Table 8-1 Electrical Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Item</strong></td>
</tr>
<tr>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Differential-input Voltage (High)</td>
</tr>
<tr>
<td>Differential-input Voltage (Low)</td>
</tr>
<tr>
<td>Supply Current</td>
</tr>
<tr>
<td>Supply Rush Current</td>
</tr>
<tr>
<td>Supply Rush Current (1A excess)</td>
</tr>
<tr>
<td>CCFL Turn on Voltage</td>
</tr>
<tr>
<td><strong>(3)</strong></td>
</tr>
<tr>
<td>Lighting Voltage</td>
</tr>
<tr>
<td>Lighting Frequency</td>
</tr>
<tr>
<td>Tube Current</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

*(1) Typical current situation : Color bar pattern. $V_{cc}=12.0V$

Maximum current situation: 2pixel checker pattern. $V_{cc}=11.5V$

Without rush current.

*(2) These items prescribe the rush current for starting internal DC/DC. Charging current to capacitors of $V_{cc}$ is not prescribed.

*(3) Tube current ($I_{L}$) shows the value of the current that is consumed at one lamp.

This LCD module has 4 lamps. Each 2 lamps are placed at upper side and lower side of the display.

2 lamps are connected in parallel. Each low voltage terminals are connected with separate Cable to Back-light connector.
Measurement circuit is based on Figure 8-1.

![Measurement circuit diagram]

**Figure 8-1** Measurement circuit

**Input signals (LVDS Dual)**
- RX00+  RX00-
- RX01+  RX01-
- RX02+  RX02-
- RX03+  RX03-
- RXOC+  RXOC-
- RXE0+  RXE0-
- RXE1+  RXE1-
- RXE2+  RXE2-
- RXE3+  RXE3-

PD SEL LVDS

LVDS Receiver: DS90CF386 (National Semiconductor) or THC63LVDF84B (Thine Electronics)

**Figure 8-2(A) Equivalent circuit of logic signal Input**

**Fuse**

**EMI Filter**

Ground

**Figure 8-2(B) Equivalent circuit of power supply**
### 9. OPTICAL SPECIFICATIONS

Table 9-1 shows the optical specifications of this LCD module.

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Condition</th>
<th>Specifications</th>
<th>Unit</th>
<th>Remark</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Angle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horizontal</td>
<td>( \theta_{L,R} )</td>
<td>( CR \geq 10 )</td>
<td>( \theta_{L, D}^\circ )</td>
<td>85</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Vertical</td>
<td>( \theta_{U,D} )</td>
<td>( \theta_{U, D}^\circ )</td>
<td>85</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>All Direction</td>
<td>( \theta )</td>
<td></td>
<td>80</td>
<td>—</td>
<td>deg</td>
<td></td>
</tr>
<tr>
<td>Contrast Ratio</td>
<td>CR</td>
<td>( \theta_{L, U,D}^\circ )</td>
<td>400</td>
<td>600</td>
<td>—</td>
<td>White/Black</td>
</tr>
<tr>
<td>Response Time (ON)</td>
<td>( t_{on} )</td>
<td>Ta=25°C</td>
<td>30</td>
<td></td>
<td>ms</td>
<td>(1)(4)</td>
</tr>
<tr>
<td>(B→W)</td>
<td></td>
<td>Ta=0°C</td>
<td>100</td>
<td></td>
<td>ms</td>
<td>(5)</td>
</tr>
<tr>
<td>Response Time (OFF)</td>
<td>( t_{off} )</td>
<td>Ta=25°C</td>
<td>25</td>
<td></td>
<td>ms</td>
<td>(1)(5)</td>
</tr>
<tr>
<td>(W→B)</td>
<td></td>
<td>Ta=0°C</td>
<td>100</td>
<td></td>
<td>ms</td>
<td>(7)</td>
</tr>
<tr>
<td>Brightness</td>
<td>I</td>
<td>( V_{CC}=12.0V )</td>
<td>200</td>
<td>250</td>
<td>cd/m²</td>
<td>White #1</td>
</tr>
<tr>
<td>Brightness Uniformity</td>
<td>( \triangle I )</td>
<td>( V_{INV}=12.0V )</td>
<td>70</td>
<td></td>
<td>%</td>
<td>#1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(At maximum Brightness)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chromaticity</td>
<td>R, G</td>
<td>( x, y )</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Red</td>
<td>(T.B.D.) Typ.</td>
<td></td>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Green</td>
<td>(T.B.D.) Typ.</td>
<td></td>
<td></td>
<td>(5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blue</td>
<td>(T.B.D.) Typ.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LCD Panel Type</td>
<td></td>
<td>TFT Color</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display Mode</td>
<td></td>
<td>Normally Black</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wide Viewing Angle Technology</td>
<td></td>
<td>MVA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optimum Viewing Angle</td>
<td></td>
<td>—</td>
<td>(Symmetry)</td>
<td></td>
<td></td>
<td>(6)</td>
</tr>
<tr>
<td>Display Color</td>
<td></td>
<td>16,777,216</td>
<td>(8-bit color)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Color of non-display area</td>
<td></td>
<td>Black</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface Treatment</td>
<td></td>
<td>Anti-glare</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(*1) Value at 15~20 minutes after lighting on.

(Nota) CS-1000 (MINOLTA Co. Ltd.), BM-5A (Topcon) and the like should be used as a luminance colorimeter.

Field=1°, L=500mm

• Back-light current = 6mA, Dark room condition (1 lux or less)
Note 1) Definition of Viewing Angle (1)
Based on Figure 9-1.

* → \( \theta_1=0^\circ, \theta_2=0^\circ, \theta_3=0^\circ, \theta_4=0^\circ \)

Figure 9-1 Definition of Viewing Angle (1)

Note 2) Definition of Viewing Angle (2)
Based on Figure 9-2.

Figure 9-2 Definition of Viewing Angle (2)

Note 3) Definition of Contrast Ratio (CR)
Determined by Formula (1) based on Figure 9-3 Voltage-Brightness characteristics.

\[
L_w (\text{Brightness at white}) = \frac{L_w - L_B (\text{Brightness at black})}{L_B} \quad \cdots (1)
\]

Figure 9-3 Voltage-Brightness Characteristics
Note 4) Definition of Response Time
Based on Figure 9-4.

Drive signal of LCD panel

ON

OFF

Non-select status  Select status  Non-select status

Relative Brightness

100%

90%

80%

70%

60%

50%

40%

30%

20%

10%

Black

White

Black

ON Response Time

OFF Response Time

Figure 9-4 Definition of Response Time

Note 5) Contrast Ratio and Response Measurement System
Based on Figure 9-5.

Brightness Meter or Luminance colorimeter (with luminosity correction function)

Drive and Measurement System

Figure 9-5 Contrast Ratio and Response Time Measurement System
Note 6) Definition of Optimum Viewing Angle

![Graph showing the contrast ratio with maximum and minimum values.

Figure 9-6 Definition of Viewing Angle

Note 7) Definition of Brightness Uniformity

Brightness uniformity is defined by the following formula.

Brightness (I1~I9) are measured at the following 9 points (①~⑨) on the display area that is shown in Figure 9-7.

\[
\text{Brightness Uniformity (ΔL)} = \frac{|\text{Min. In}|}{|\text{Max. In}|} \times 100 \text{ (%), } n = 1 \text{ to } 9
\]

![Diagram showing measurement points on a grid.

Figure 9-7 Measurement Points

Note) Each measurement point (①~⑨) defines the center spot of view of Brightness Meter. The tolerance of measurement position is ±3mm.
10. INTERFACE SPECIFICATIONS

10-1 Signal descriptions

Table 10-1 shows the description and configuration of interface signals (CN1).

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Symbol</th>
<th>I/O</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Vcc</td>
<td>—</td>
<td>+12V power supply</td>
</tr>
<tr>
<td>2</td>
<td>Vcc</td>
<td>—</td>
<td>+12V power supply</td>
</tr>
<tr>
<td>3</td>
<td>Vcc</td>
<td>—</td>
<td>+12V power supply</td>
</tr>
<tr>
<td>4</td>
<td>TST</td>
<td>—</td>
<td>Test pin *2</td>
</tr>
<tr>
<td>5</td>
<td>PD</td>
<td>I</td>
<td>LVDS Core Power Down</td>
</tr>
<tr>
<td>6</td>
<td>SELL LVDS</td>
<td>I</td>
<td>Select LVDS data order *1</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
<td>—</td>
<td>Ground</td>
</tr>
<tr>
<td>8</td>
<td>RxE3+</td>
<td>I</td>
<td>Positive differential input</td>
</tr>
<tr>
<td>9</td>
<td>RxE3−</td>
<td>I</td>
<td>Negative differential input</td>
</tr>
<tr>
<td>10</td>
<td>RxEC+</td>
<td>I</td>
<td>Positive differential input</td>
</tr>
<tr>
<td>11</td>
<td>RxEC−</td>
<td>I</td>
<td>Negative differential input</td>
</tr>
<tr>
<td>12</td>
<td>RxE2+</td>
<td>I</td>
<td>Positive differential input</td>
</tr>
<tr>
<td>13</td>
<td>RxE2−</td>
<td>I</td>
<td>Negative differential input</td>
</tr>
<tr>
<td>14</td>
<td>GND</td>
<td>—</td>
<td>Ground</td>
</tr>
<tr>
<td>15</td>
<td>RxE1+</td>
<td>I</td>
<td>Positive differential input</td>
</tr>
<tr>
<td>16</td>
<td>RxE1−</td>
<td>I</td>
<td>Negative differential input</td>
</tr>
<tr>
<td>17</td>
<td>GND</td>
<td>—</td>
<td>Ground</td>
</tr>
<tr>
<td>18</td>
<td>RxE0+</td>
<td>I</td>
<td>Positive differential input</td>
</tr>
<tr>
<td>19</td>
<td>RxE0−</td>
<td>I</td>
<td>Negative differential input</td>
</tr>
<tr>
<td>20</td>
<td>RxO3+</td>
<td>I</td>
<td>Positive differential input</td>
</tr>
<tr>
<td>21</td>
<td>RxO3−</td>
<td>I</td>
<td>Negative differential input</td>
</tr>
<tr>
<td>22</td>
<td>RxOC+</td>
<td>I</td>
<td>Positive differential input</td>
</tr>
<tr>
<td>23</td>
<td>RxOC−</td>
<td>I</td>
<td>Negative differential input</td>
</tr>
<tr>
<td>24</td>
<td>GND</td>
<td>—</td>
<td>Ground</td>
</tr>
<tr>
<td>25</td>
<td>RxO2+</td>
<td>I</td>
<td>Positive differential input</td>
</tr>
<tr>
<td>26</td>
<td>RxO2−</td>
<td>I</td>
<td>Negative differential input</td>
</tr>
<tr>
<td>27</td>
<td>RxO1+</td>
<td>I</td>
<td>Positive differential input</td>
</tr>
<tr>
<td>28</td>
<td>RxO1−</td>
<td>I</td>
<td>Negative differential input</td>
</tr>
<tr>
<td>29</td>
<td>RxO0+</td>
<td>I</td>
<td>Positive differential input</td>
</tr>
<tr>
<td>30</td>
<td>RxO0−</td>
<td>I</td>
<td>Negative differential input</td>
</tr>
</tbody>
</table>

Connector : FI-X30S-HF (Japan Aviation Electronics)
User's connector : FI-X30M (Japan Aviation Electronics)
FI-X30H
FI-X30C

*1: 3.3V CMOS Signal input. (High or Low)
*2: Keep open. (Internal test use only.)
# 10-2 LVDS Data Assignment

Table 10-2 shows the LVDS Data Assignment.

<table>
<thead>
<tr>
<th>Input signal #1</th>
<th>Transmitter</th>
<th>Interface connector</th>
<th>Receiver</th>
<th>LCD input (Sel LVDS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEL LVDS</td>
<td></td>
<td>System side</td>
<td>pin</td>
<td>pin OUTPUT</td>
</tr>
<tr>
<td>LVDS Odd</td>
<td></td>
<td>LCD module pin</td>
<td>pin</td>
<td>OUTPUT Low</td>
</tr>
<tr>
<td>Txx</td>
<td></td>
<td>System side</td>
<td>pin</td>
<td>OUTPUT Low</td>
</tr>
<tr>
<td>LVDS Even</td>
<td></td>
<td>LCD module pin</td>
<td>pin</td>
<td>OUTPUT Low</td>
</tr>
</tbody>
</table>

*1 RSVD (reserved) pin on a transmitter should be connected with Ground.

- Input odd or even data depending on the display position of the LCD module.
### Table 10-3 Color Data Assignment

<table>
<thead>
<tr>
<th>Color</th>
<th>Odd R Input data</th>
<th>Even R Input data</th>
<th>G Input data</th>
<th>B Input data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Blue</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Green</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cyan</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Red</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Magenta</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Yellow</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>White</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Note 1:** Definition of gray scale: Color (n)···“n” indicates gray scale level. Larger number means brighter level.

**Note 2:** Data: 1:High, 0:Low

**Note 3:** Color data consist of 8 bit red, green and blue data of odd and even number pixel data. Total data number is 48 signals. This module is able to display 16,777,216 colors because each red, green and blue data is controlled independently.
**10-4 Input Signal Timing**

Table 10-4 and Figure 10-1 shows the Input Signal Timing at LVDS transmitter.

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DCLK signal (Clock)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Period</td>
<td>Tc</td>
<td>11.765</td>
<td>12.345</td>
<td>20.000</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>1/Tc</td>
<td>50.000</td>
<td>81.000</td>
<td>85.000</td>
<td>MHz</td>
<td></td>
</tr>
<tr>
<td>Duty</td>
<td>Tch/Tc</td>
<td>45</td>
<td>50</td>
<td>55</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>High time</td>
<td>TclKH</td>
<td>3.5</td>
<td>—</td>
<td>—</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>Low time</td>
<td>TclKL</td>
<td>3.5</td>
<td>—</td>
<td>—</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td><strong>DCLK-Data Timing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Setup time</td>
<td>Tset</td>
<td>3</td>
<td>—</td>
<td>—</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>Hold time</td>
<td>Thold</td>
<td>2</td>
<td>—</td>
<td>—</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td><strong>ENAB signal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horizontal Period</td>
<td>Th</td>
<td>865°1</td>
<td>1080</td>
<td>1130°1</td>
<td>DCLK</td>
<td></td>
</tr>
<tr>
<td>Hor. Period</td>
<td>Th</td>
<td>13.0</td>
<td>13.3</td>
<td>14.65</td>
<td>µs</td>
<td></td>
</tr>
<tr>
<td>Hor. Display period</td>
<td>Thd</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>DCLK</td>
<td>*2</td>
</tr>
<tr>
<td>Vertical Period</td>
<td>Tv</td>
<td>1207°1</td>
<td>1250</td>
<td>1280°1</td>
<td>Th</td>
<td></td>
</tr>
<tr>
<td>Ver. Frequency</td>
<td>1/Tv</td>
<td>50</td>
<td>60</td>
<td>62</td>
<td>Hz</td>
<td></td>
</tr>
<tr>
<td>Ver. Display period</td>
<td>Tvd</td>
<td>1200</td>
<td>1200</td>
<td>1200</td>
<td>Hz</td>
<td></td>
</tr>
<tr>
<td>Data-ENAB timing</td>
<td>Tdn</td>
<td>—</td>
<td>0</td>
<td>—</td>
<td>DCLK</td>
<td>*3</td>
</tr>
</tbody>
</table>

---

*1)*horizontal display position is specified by the rise of ENAB. The data latched at falling edge of DCLK after rise of ENAB is displayed at the left edge of the display area.

*2)*Vertical display position is specified by the rise of ENAB after low level continuation over 5500 DCLK. The data latched at the rise of ENAB is displayed at the top line of the display area.

*3)*If the “High” level period of ENAB is less than 800 DCLK, black color is displayed at the rest of the display area.

*3)*If ENAB does not synchronize with the effective display data, the display position does not fit to the display area.
Figure 10-1  Input Signal Timing Chart
10-4 Correspondence between Data and Display Position

Figure 10-2 shows the Correspondence between Data and Display Position.

<table>
<thead>
<tr>
<th>S0001</th>
<th>S0002</th>
<th>S0003</th>
<th>S0004</th>
<th>S0005</th>
<th>S0006</th>
<th>S0007</th>
<th>S4799</th>
<th>S4800</th>
</tr>
</thead>
<tbody>
<tr>
<td>RO 0001</td>
<td>GO 0001</td>
<td>BO 0001</td>
<td>RE 0002</td>
<td>GE 0002</td>
<td>BE 0002</td>
<td>RO 0003</td>
<td>GO 0003</td>
<td>GE 1600</td>
</tr>
</tbody>
</table>

Figure 10-2 Correspondence Data and Display Position

10-5 Power Supply Sequence

The sequence of input signals and On/Off of the power supply of this LCD module should be in the specification shown in Figure 10-3 to prevent latch-up of the driver ICs and DC driving of the LCD panel.

![Power Supply Sequence Diagram]

Figure 10-3 Power Supply Sequence (Logic)
11. BACK-LIGHT SPECIFICATION

11-1 Pin configuration for Back-light

Table 11-1 shows the description and Pin assignment of the connectors (CN-A to D) for the Back-light of this LCD module.

Table 11-1 Pin Assignment of CN-A to CN-F

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>CN-A</th>
<th>CN-B</th>
<th>CN-C</th>
<th>CN-D</th>
<th>CN-E</th>
<th>CN-F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>V_{1,1}</td>
<td>V_{1,2}</td>
<td>V_{1,3}</td>
<td>V_{1,4}</td>
<td>V_{1,5}</td>
<td>V_{1,6}</td>
</tr>
<tr>
<td>2</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>GND</td>
<td>GND</td>
<td>GND</td>
<td>GND</td>
<td>GND</td>
</tr>
</tbody>
</table>

Function: Power supply  Color: Pink or Blue

Connector: Housing: BHR-03VS-1
Contact: SBH-001T-P0.5
User’s Connector: Post with base: SM02(8.0)B-BHS-1-TB
Supplier: Japan Solder less Terminal Trading Company LTD. (J.S.T.)

11-2 CCFL

Supplier: Part No.

11-3 Life

The life of the back-light is a minimum of 50,000 hours at the following conditions.

(1) Working conditions
   ① Ambient temperature: 25±5°C
   ② Tube current (I_{L}): (6mA or less)

(2) Definition of life
   ① Brightness becomes 50% or less than the minimum brightness value shown in Table 9-1.
   ② The lamp cannot be lit by the minimum value of the breakdown voltage(1500Vrms) shown in Table 8-1.
   ③ Flashing.

11-4 Lamp assembly set (for replacement)

Lamp assembly set (with charge) is prepared for replacing old lamp to new one. This set consists of an upper lamp assembly and a lower lamp assembly.

Type number:
12. APPEARANCE SPECIFICATIONS

12-1. Appearance

Table 12-1 shows the appearance specifications. In the case of another agreement about Specification arises, that agreement takes priority.

Table 12-1 Appearance Specifications

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Judgment method and standard</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Foreign Particle</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>White and Black points</td>
<td>D \leq 0.5, N \leq 10</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.5 &lt; D, N \leq 0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dark line</td>
<td>W \leq 0.1, L \leq 12.0</td>
<td>N \leq 10</td>
</tr>
<tr>
<td></td>
<td>Fiber</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bright points</td>
<td>D \leq 0.3, N \leq 12</td>
<td>Not count</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.3 &lt; D \leq 0.6, N \leq 8</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>D &gt; 0.6, N \leq 8</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Scratch</td>
<td>Scratch on polarizer film</td>
<td>12.0 &gt; L, N \leq 15</td>
</tr>
<tr>
<td>3</td>
<td>Dent</td>
<td>Dent on polarizer film</td>
<td>D \leq 0.3, N \leq 15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.3 &lt; D \leq 0.4, N \leq 15</td>
<td></td>
</tr>
</tbody>
</table>

Note

*Foreign particle and scratch that do not effect display image, such as foreign particle between glass and polarizer film out of the display area, scratch on metal bezel, backlight module or polarizer film out of the display area are not counted.

*Unwiped dirt out of the display area is not counted.

*These items are applied to the defects in the cell when backlight is on, and defects on the surface of the polarizer film at the display area.

*Must be observed the LCD screen from the normal direction unless specified. The distance between the LCD screen and the observing position should be 35cm or more. One 20W fluorescent lamp is used at 50cm above the worktable. At this time, the luminance at the vertical direction to the fluorescent lamp is 300 to 600 lux (reference value).

*Appearance Specifications are defined under the condition of frame frequency at 60Hz. (include Bright and Dark points specifications)

12-2. Dot defects (Bright spots, Dark spots)

12-2-1. Area to be inspected

   Inside display dot area (408.0 X 306.0mm)
   Display dot area means active area.
   One pixel consists of 3 dots (red, green and blue).

12-2-2. Bright spots definition

   (1) Bright spots are classified as follows. (based on brightness samples)
   
   · Visible through 2% ND filter.............................................. High-bright spot ( R,G )
   · Visible through 5% but invisible through 2% ND filter........ Low-bright spot( R,G,B )
   · Invisible through 5% ND filter........................................ Not counted
12-2-3. Number of bright spot standard

<table>
<thead>
<tr>
<th>Item</th>
<th>Entire Screen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brightness classification</td>
<td>High-bright spots</td>
</tr>
<tr>
<td>Number of defects</td>
<td>15 or less</td>
</tr>
<tr>
<td></td>
<td>High and Low Bright Spots</td>
</tr>
<tr>
<td></td>
<td>22 or less</td>
</tr>
</tbody>
</table>

NOTES:
1. Display should be all black when bright spots are counted.
2. Number of two high Bright spots connections is up to 3.
3. Number of two low Bright spots connections is up to 12.
4. Number of three Bright spots connections and two high Bright spots vertical connections is 0.
5. Number of high Bright spots and low Bright spots connections is up to 5.

12-2-4. Distance between Bright spots

- Distance between Bright spots (not include B)...... 15 mm or more
- Distance between Bright spots (include B).......... 5 mm or more
  (Distance to the third defect should be 20mm or more)

12-2-5. Number of Dark spots standard

<table>
<thead>
<tr>
<th>Item</th>
<th>Entire Screen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of defects</td>
<td>24 or less</td>
</tr>
<tr>
<td>Number of two dark spot connections</td>
<td>(Not include vertical, horizontal and diagonal connections)</td>
</tr>
<tr>
<td>Number of three dark spot connections</td>
<td>3 or less</td>
</tr>
</tbody>
</table>

NOTES:
1. Display should be all white when dark spot is counted.
2. Distance between defects is 5 mm or more.
   (Distance to the third defect should be 20mm or more)
3. If dark spot size is smaller than one dot, convert with following rule and sum up.

   (a) A < 1/3 : Not counted.
   (b) 1/3 ≤ A < 2/3 : Considered as 0.5 dot.
   (c) 2/3 ≤ A : Considered as 1 dot.

(A= Dark spot size / dot size)
13. ENVIRONMENTAL SPECIFICATIONS

Table 13-1 show the environmental specifications.

<table>
<thead>
<tr>
<th>Item</th>
<th>Condition</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>Operation</td>
<td>0~45°C</td>
</tr>
<tr>
<td></td>
<td>Storage</td>
<td>−20~60°C</td>
</tr>
<tr>
<td>Humidity</td>
<td>Operation</td>
<td>20~85%RH</td>
</tr>
<tr>
<td></td>
<td>Storage</td>
<td>5~85%RH</td>
</tr>
<tr>
<td>Vibration</td>
<td>Non-operation</td>
<td>10~500Hz, 1 octave/20 minute, 2G, 1.5mm max, 1 hour each X, Y and Z directions</td>
</tr>
<tr>
<td>Shock</td>
<td>Non-operation</td>
<td>30G, 6ms, 1 time each ±X, ±Y and ±Z directions.</td>
</tr>
</tbody>
</table>

NOTE: Table 13-2 and Figure 13-1 show the shock resistance standard when module is packaged.

<table>
<thead>
<tr>
<th>Dropping location</th>
<th>Dropping height</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>A~J</td>
<td>60cm</td>
<td>1 time</td>
</tr>
</tbody>
</table>
14. INDICATIONS

This module has the following indications.

(1) Product name : LCD unit
(2) Model Number : FLC51UXC8V-10
(3) Product Drawing Number : NA19025-C451
(4) Manufacturing Number : 2900001

- Serial number
  (To be reset every month on 1st.)
- Manufacturing month
- Last digit of manufacturing year.

(5) Version number : 01A (Example)
- 1st 2 digits “01” means operational version.
- 3rd alphabet means functional version.

(6) Manufacturer Country Name : MADE IN JAPAN
(7) Company Name : FUJITSU DISPLAY TECHNOLOGIES CORPORATION
(8) Disposal method of cold-cathode tubes. (See Figure 14-1)
(9) Caution when changing cold-cathode tubes. (See Figure 14-2)

15. PACKAGING

15-1 Packing specifications
(1) 4LCD modules/1package.
(2) Weight: approximately 17kg/1package.
(3) Outline dimensions: 576mm(W)x316mm(D)x508mm(H)

15-2 Packing method

Figure 15-1,2 shows the packing method.
Fig. 15-2 (a) Packaging Method
Label (example)

- Taping
  Top: H or I method
  Bottom: H method
- Top and bottom holders should be anti-electrostatic type.

Fig. 15-2 (b) Packaging Method
Note: 1) 4 boxes × 3 layers (maximum 12 boxes): by ship
   4 boxes × 2 layers (maximum 8 boxes): by airplane
Note:2) This drawing shows marine transportation specification.

Fig.15-2 (c) Packaging Method
Note 1) The carton (A) should be placed in the middle of the container (B) with enough cushioning materials.

Note 2) The figures in ( ) show inside measurements of the container (B).

Figure 15-2 (d) Packing method
16. WARRANTY
The warranty period is one year after shipping. Products which fail during this period are repaired or replaced without charge, unless the failure is caused by user.

17. PRECAUTIONS
Adhere to the following precautions to use this LCD module properly.

(1) Handling of LCD panel

① Do not apply any strong mechanical shock to the LCD panel.
Since the LCD panel is made of glass, excessive shock may damage the panel or cause a malfunction.

② Do not press hard on the LCD panel surface.
In the LCD panel, the gap between two glass plates is kept perfectly even to maintain display properties and reliability. The hard pressure on the LCD panel may cause the following problems.
   ① Ununiformity of color
   ② Disorder of orientation of liquid crystal
Problem ① returns to normal condition after a while. Problem ② returns to normal condition by turning the power off and turning on again.
However these operations should be avoided to insure reliability.

③ Do not scratch the polarizer film on the LCD panel surface.
   • Do not press or rub the display surface with a hard tool, tweezers, etc.
   • For handling, use cotton or conductive gloves so that the display surface is not soiled.
   • If dust or dirt soils the display surface, clean it as follows with a soft cloth (deerskin, etc.)

       [Dust] Wipe off with a soft cloth. (do not rub.)
       [Dirt ] Apply clear water to a soft cloth and squeeze hard out of water drops, then lightly
        wipe off the specified parts. Only if the dirt is hardly wiped off, use isopropyl alcohol
        or ethanol.
        Be careful not to splash the water or the solvents on the edge of polarizer and in the
        LCD unit.
        The polarizer possibly exfoliates due to the solvent and water penetrated between
        the polarizer and the LCD panel.
        Do not use unspecified solvent such as ketone (acetone, etc.) and aromatics (xylene,
        toluene, etc.)
(Caution) Be careful not to allow the water or solvent to enter the module.
   • If saliva or water drops are left for a long period of time, the part may become
    deformed or discolored.
    Wipe off immediately in the same way as for dirt.
   • Do not allow oil to adhere to the module since excessive oil is hard to clean.
④ Do not place or contact objects on the display surface for a long period of time.
This may make some parts of the LCD module distorted and the quality of display may
deteriorate.

(2) Handling of LCD module

① Do not pull the cold-cathode tube cable strongly.
  If the cable is pulled with the strength of 2kg or more, the cable may be damaged or may
  lose reliability.

② Assemble the module into user's system in a dust free environment.
  Conductive foreign matter adheres to the module may cause failures.

③ Take anti-electrostatic measures for assembling the module.
  Since the LCD module contains CMOS-ICs, the following points should be observed.
  · For assembling the module, operator should be grounded and wear cotton or conductive
  gloves.
  · Floor of work area and work table to assemble the LCD module should be covered with
  electrostatic shielding in order to discharge static electricity via an earth wire.
  · If necessary, ground operation tools (soldering iron, radio pliers, tweezers, etc.).
  · Do not take the module out of the conductive bag until the module is assembled.
  · Do not assemble the module under low humidity (50%RH or less).

④ Do not pull the connecting cable on the rear face of the LCD module strongly.

⑤ Do not disassemble or remodel the LCD module.
  Disassembly or remodeling of the LCD module may result in malfunctions or deterioration
  of the display quality and reliability.

(3) Precautions in regards of operating the LCD module

① Adhere to the specified power supply sequence.
  If not followed, the CMOS-IC may cause a latch-up, or DC voltage may be applied to the
  liquid crystal, which cause a failure or serious deterioration in display quality.

② Do not operate the LCD module when condensation occurs.
  If the LCD module is operated when condensation is on the terminals of the LCD panel, the
  terminals cause electrochemical reaction, and may reach disconnection. Condensation
  easily occurs especially when the module is moved from cold environment to warm
  environment.
3) The following troubles occur when the LCD module is not used under recommended temperature.
   - Operation under high temperature (>50°C): Display colors shift to blue.
   - Storage under high temperature (>60°C): The polarizer film deteriorates and contrast decreases.
   - Operation under low temperature (< 0°C): The response speed decreases considerably.
   - Storage under low temperature (< -20°C): The liquid crystal may solidify and become damaged.

4) Be sure to input the control signals at the correct timing.
   If control signals (DCLK, ENAB) are not input, or if the timing is out of the specified timing, DC voltage may be applied to the liquid crystal and, as a result, cause image sticking or deterioration of contrast.

4) Precautions in regards of designing module mounting

1) Excessive force should not be applied to the screen or the rear side of the LCD module.
   Excessive pressure on the screen caused by the installation of the LCD module may deteriorate display quality and reliability.
   Brightness uniformity and the reliability of CCFL may decrease if the pressure is applied to the backlight module.

2) Avoid twisting and bending the LCD module.
   Excessive twist and bend may damage display quality and reliability.

3) Avoid extending the power cable between the LCD module and inverter.
   This may cause the backlight to flicker or not to light.

4) Keep the backlight cable apart from the metal enclosure of the LCD module.
   When frequency current for backlight driving leak to the metal enclosure, the desired brightness may not be assured.

5) When Mounting LCD module with M4 screws (x4), tighten the screws with torque below 5kgf.

5) Storage method

1) Do not store the LCD module in an atmosphere of organic solvent or corrosive gas.
   In an organic solvent atmosphere, the polarizer film discolors and display quality deteriorates.
   In a corrosive gas environment, various parts of the module may corrode or deteriorate.

2) Store the LCD module in a Fujitsu package.
   At storing, Fujitsu packages can be stacked up to 3 boxes.
   The LCD module is in an anti-static bag. Keep the module in that status.
3) The LCD module is recommended to be stored in humidity controlled, cool and dark locations.
   Recommended storage environment
   • Place          : Dark (avoid direct sunlight)
   • Temperature    : 10～35°C
   • Humidity       : 50～60%RH

   Note) If the module is left in an environment of 60°C and above for a long period of time, optical characteristics may deteriorate.

6) Disposal Method
   1) LCD module
      The components of this LCD module can be grouped into metal, resin, glass and so on. As the backlight contains CCFL which includes mercury, it must be disposed according to the local ordinance or regulations.

   2) Package
      All the packages are made of recyclable papers except the anti-ESD bag.

7) Others
   1) If the LCD panel is damaged, do not inhale and do not swallow the liquid crystal.
      If the liquid crystal adhere to the body or cloths, wash it off with soap immediately. Follow regular precautions for electronic components.

   2) Flux residue on the printed circuit board is harmless to the quality and reliability of LCD module.
      Fujitsu has adopted non-wash technology on module assembly process.
(8) Return method of the LCD unit requested for repair or analysis of the problem

- When the LCD unit is packaged and returned, adhere to the following procedures not to damage the LCD panel or the backlight cables. (Fig. 18-1(a)–(b))

When the LCD unit is returned without following the specified packaging procedures, FDTC will not take responsibility for the damages caused by the failure of the packaging method.

① Attach protective sheet.

![Protective sheet diagram](image)

② Put the LCD unit into the anti-electric bag

![Anti-electric bag diagram](image)

Fig. 17-1(a) Packaging method
③ Storage into the container box

- When using the container box manufactured by FDTC

![](holder_top.png)

Holder (top)

* The front side of LCD units should face the direction of the arrowhead on holder (bottom).

![](holder_bottom.png)

Holder (bottom)

* The direction of the arrowhead on holder (top) should face the front side of the LCD units.

**The arrowheads are shown on the holders.**

**Fig. 17-1(b) Packaging method**

- When not using the container box manufactured by FDTC
  Please pack the LCD units one by one and make sure not to damage the LCD unit when transporting.
Specifications of the TFT-LCD panel and other components used in this LCD module are subject to change. Both parties shall discuss together and make the best effort to reach agreement in case of the rising of any doubt to the contents of the specifications. This LCD module is not designed for the purpose where high reliability is required, such as for aero-space equipment, control system of nuclear power and medical life-support equipment.