DEVICE SPECIFICATION

TFT-LCD Module
MODEL No.
LQ150X1DWF1
(FLC38XGC6V-06P)

CUSTOMER:

☐ CUSTOMER’S APPROVAL

DATE

BY

PRESENTED

BY

T. Yatsui
Department general manager
Product Quality Assurance DEPT. III
Mobile Liquid Crystal Display Group
SHARP Corporation

BY

T. Naka
Division deputy general manager of
Mobile LCD Design Center III
Engineering Department II
Mobile Liquid Crystal Display Group
SHARP Corporation
### REVISION HISTORY

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Prepared</th>
<th>Checked</th>
<th>Approved</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>01A</td>
<td>Jun.21,2004</td>
<td>M.Nishido</td>
<td>Y.Furukoshi</td>
<td>F.Yamada</td>
<td>1st issue</td>
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<td>02A</td>
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<td>M.Nishido</td>
<td>T. Ito</td>
<td>F. Yamada</td>
<td>Change manufacture to SHARP.</td>
</tr>
</tbody>
</table>
# TABLE OF CONTENTS

1. APPLICATIONS .................................................................................................................. 3

2. PRODUCT NAME AND MODEL NUMBER
   2-1. Product Name .................................................................................................................. 3  
   2-2. Model Name .................................................................................................................. 3

3. OVERVIEW .......................................................................................................................... 3

4. CONFIGURATION .................................................................................................................. 3

5. MECHANICAL SPECIFICATIONS ....................................................................................... 4

6. ABSOLUTE MAXIMUM RATINGS ...................................................................................... 5

7. RECOMMENDED OPERATING CONDITIONS ....................................................................... 5

8. ELECTRICAL SPECIFICATIONS ....................................................................................... 6

9. OPTICAL SPECIFICATIONS ............................................................................................... 8

10. INTERFACE SPECIFICATIONS
    10-1. Signal descriptions ....................................................................................................... 13  
    10-2. Color Data Assignment ............................................................................................... 14
    10-3. Input Signal Timing ..................................................................................................... 15
    10-4. Correspondence between Data and Display Position .................................................. 17
    10-5. Power Supply Sequence ............................................................................................. 17

11. BACKLIGHT SPECIFICATIONS
    11-1. Pin Configuration for Backlight .................................................................................. 18
    11-2. CCFL .......................................................................................................................... 18
    11-3. Life ............................................................................................................................ 18
    11-4. Lamp Assembly Set (for Replacement) ..................................................................... 18

12. APPEARANCE SPECIFICATIONS
    12-1. Zone .......................................................................................................................... 19
    12-2. Bright Spot .................................................................................................................. 19
    12-3. Test Condition ............................................................................................................ 19
    12-4. Standard .................................................................................................................... 19

13. ENVIRONMENTAL SPECIFICATIONS ............................................................................. 21

14. INDICATIONS ..................................................................................................................... 22

15. PACKAGING
    15-1. Packaging Specifications ............................................................................................ 22
    15-2. Packaging Method ...................................................................................................... 22

16. WARRANTY .......................................................................................................................... 27

17. PRECAUTIONS ................................................................................................................... 27

18. PRECAUTIONS FOR USE ................................................................................................. 33

19. MISCELLANEOUS ................................................................................................................. 33
1. APPLICATIONS
This specification is applied to the 15.0 in. XGA supported TFT-LCD module.

2. PRODUCT NAME AND MODEL NUMBER
2-1. Product Name : LCD Module
2-2. SHARP Model Name : LQ150X1DWF1
2-3. Model Name : FLC38XGC6V-06P

3. OVERVIEW
This LCD module has a TFT active matrix type liquid crystal panel 1024×768 pixels, and diagonal size of 38cm (15.0-inch). This module supports 1024×768 XGA mode (Non-interlace). This LCD has a digital RGB interface and can display 262,144 colors.
Timing control signal is “Data enable signal : ENAB” only. (Data enable mode)
Even and odd data are transmitted at the same timing in the interface, so data lines are 36. (R, G, B each 6 bit ×2) The signal level of this interface is +3.3V CMOS level or 5V TTL level.
The power supply of this LCD module is +5v DC single.

4. CONFIGURATION
This LCD module consists of a LCD panel, LCD driving circuit, control circuit, interface circuit and backlight unit.
The LCD panel is active matrix TFT type. The LCD driving circuit is integrated in IC chips, which are bonded on plastic wiring film (hereinafter TAB driver-IC), and the output terminals of the IC chips are connected to the LCD panel. The control circuit and the interface circuit are mounted on three kinds of printed circuit board (hereinafter PCB) and the input of the TAB driver-ICs are connected to the PCBs.
With such circuit construction, the image data received by the interface circuit is forwarded to the control circuit and the control circuit modulates the image data to LCD driving signals. The TAB driver ICs buffer the LCD driving signals and output driving voltages to the LCD panel.
These LCD parts such as the LCD panel, the TAB-ICs and the PCBs are assembled together with the backlight module in a plastic case and a metal frame.
Fig.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>347.3×263.5×15.8 (TYP.)</td>
<td>mm</td>
<td>Edge type backlight is used. (φ2.6 CCFL×4)</td>
</tr>
<tr>
<td>Display Resolution</td>
<td>(1024×3) ×768</td>
<td>—</td>
<td>Outward Appearance is shown at page 34 and 35.</td>
</tr>
<tr>
<td>Display Dot Area</td>
<td>304.1×228.1</td>
<td>mm</td>
<td></td>
</tr>
<tr>
<td>Dot Pitch</td>
<td>(0.099×3) ×0.297</td>
<td>mm</td>
<td></td>
</tr>
<tr>
<td>Aspect Ratio</td>
<td>1 : 1</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>1,600max</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 RATINGS

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>V_{CC}</td>
<td>Ta=25°C</td>
<td>-0.3</td>
<td>—</td>
<td>6.0</td>
<td>V</td>
</tr>
<tr>
<td>Input Voltage</td>
<td>V_{IN}</td>
<td>Ta=25°C</td>
<td>-0.3</td>
<td>—</td>
<td>V_{CC}+0.3</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>V_{CC}</td>
<td>4.75</td>
<td>5.0</td>
<td>5.25</td>
<td>V</td>
</tr>
<tr>
<td>Ripple Voltage</td>
<td>V_{CC}</td>
<td>V_{RP}</td>
<td>—</td>
<td>—</td>
<td>100</td>
</tr>
</tbody>
</table>
8. ELECTRICAL SPECIFICATIONS

Table 8-1 shows the electrical specifications 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>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Current</td>
<td>( I_{CC} )</td>
<td>( V_{CC}=+5.0\pm0.25V ) ( V_{SS}=0V )</td>
<td>—</td>
<td>380</td>
<td>800</td>
<td>mA</td>
<td>*1</td>
</tr>
<tr>
<td>“H” Level Logic Input Voltage</td>
<td>( V_{IH} )</td>
<td>( DCLK=32.505MHz )</td>
<td>2.3</td>
<td>—</td>
<td>( V_{CC} )</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>“L” Level Logic Input Voltage</td>
<td>( V_{IL} )</td>
<td>( V_{SS} )</td>
<td>—</td>
<td>—</td>
<td>0.9</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Leak Current (Logic Input)</td>
<td>( I_{IL} )</td>
<td>–</td>
<td>5</td>
<td>—</td>
<td>+5</td>
<td>( \mu A )</td>
<td></td>
</tr>
<tr>
<td>Supply Rush Current</td>
<td>( I_{SCC} )</td>
<td>–</td>
<td>—</td>
<td>—</td>
<td>5.5</td>
<td>A</td>
<td>*2</td>
</tr>
<tr>
<td>Supply Rush Current Duration (1A excess)</td>
<td>( T_{SCC} )</td>
<td>–</td>
<td>—</td>
<td>—</td>
<td>0.4</td>
<td>ms</td>
<td></td>
</tr>
<tr>
<td>CCFL Turn on Voltage</td>
<td>( V_{s} )</td>
<td>( f=50kHz, Ta=25^\circ C )</td>
<td>—</td>
<td>1324</td>
<td>1500</td>
<td>Vrms</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( f=50kHz, Ta=0^\circ C )</td>
<td>—</td>
<td>—</td>
<td>1500</td>
<td>Vrms</td>
<td></td>
</tr>
<tr>
<td>Lighting Voltage</td>
<td>( V_{L} )</td>
<td>( V_{L}=580V_{rms} )</td>
<td>550</td>
<td>580</td>
<td>610</td>
<td>Vrms</td>
<td></td>
</tr>
<tr>
<td>Lighting Frequency</td>
<td>( f_{L} )</td>
<td>( V_{L}=580V_{rms} )</td>
<td>40</td>
<td>50</td>
<td>60</td>
<td>kHz</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( f=50kHz )</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>mA</td>
<td>*4</td>
</tr>
</tbody>
</table>

(*1) Typical current value is measured when color bar pattern is displayed at \( V_{CC}=5.0V \).
Maximum current value is measured when 55/63 and 63/63 gray scale pattern every 2 pixel is displayed at \( V_{CC}=4.75V \).
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) Backlight specifications are valid when using a suitable inverter such as the “LQ0DDJ5004 (FLC0V-07)” of Sharp.

(*4) 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 and lower side of the display.
2 lamps are connected in parallel. Each low voltage terminals are bound into 1 line cable, which connected to the backlight connector.

(FLC38XGC6V-06P)
Note 1) Measurement Circuit
   Based on Fig.8-1.

Fig.8-1. Measurement Circuit

Note 2) Equivalent Circuit
   Based on Fig.8-2 (a), (b).

EMI Filter

Fig.8-2 (a) Equivalent Circuit of Logic Signal Input

Fig.8-2 (b) Equivalent Circuit of Power Supply

Fuse .................. KAB2402202NA (Matsuo Electric Co., LTD.)
EMI Filter ........... SGM20C1E332-2A (Sumitomo Metals)
## 9. OPTICAL SPECIFICATIONS

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

### Table 9-1. Optical Specifications

<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>Vertical Visual Angle</td>
<td>( \theta_L,R )</td>
<td>( \theta_U,D=0^\circ )</td>
<td>80</td>
<td>—</td>
<td>—</td>
<td>deg</td>
</tr>
<tr>
<td>Vertical Visual Angle</td>
<td>( \theta_U,D )</td>
<td>( \theta_L,R=0^\circ )</td>
<td>80</td>
<td>—</td>
<td>—</td>
<td>deg</td>
</tr>
<tr>
<td>Contrast Ratio</td>
<td>CR</td>
<td>( \theta_L,R,U,D=0^\circ )</td>
<td>210</td>
<td>400</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Response Time (ON) (Black→White)</td>
<td></td>
<td></td>
<td>—</td>
<td>15</td>
<td>30</td>
<td>ms</td>
</tr>
<tr>
<td>Response Time (OFF) (White→Black)</td>
<td></td>
<td></td>
<td>—</td>
<td>10</td>
<td>25</td>
<td>ms</td>
</tr>
<tr>
<td>Brightness</td>
<td>I</td>
<td>( \theta_L,R,U,D=0^\circ )</td>
<td>200</td>
<td>250</td>
<td>—</td>
<td>cd/m^2</td>
</tr>
<tr>
<td>Brightness Uniformity</td>
<td>( \Delta I )</td>
<td></td>
<td>80</td>
<td>—</td>
<td>—</td>
<td>%</td>
</tr>
<tr>
<td>Chromaticity</td>
<td>R, G, B</td>
<td></td>
<td>0.283</td>
<td>0.313</td>
<td>0.343</td>
<td>—</td>
</tr>
<tr>
<td>LCD Panel Type</td>
<td></td>
<td></td>
<td>0.299</td>
<td>0.329</td>
<td>0.359</td>
<td>—</td>
</tr>
<tr>
<td>Display Mode</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wide Viewing Angle Technology</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optimum Viewing Angle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(symmetry)</td>
</tr>
<tr>
<td>Display Color</td>
<td></td>
<td></td>
<td>262,144</td>
<td></td>
<td></td>
<td>(6-bit color)</td>
</tr>
<tr>
<td>Color of non-display area</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Black</td>
</tr>
<tr>
<td>Surface Treatment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Anti-glare (Haze value: 25%,2H)</td>
</tr>
</tbody>
</table>

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

(Note) CS-1000 (MINOLTA Co., Ltd.) Field=1°, L=500mm

Back-light current = 7mA, Dark room condition (1 lux or less)

Be carefull that the luminance meter, which you use, may not be able to get correct brightness if it's not set correctly.
Fig.9-1. $\gamma$ - Curve (Reference Value)

$\gamma = 2.40$ (TYP.)
Note 1) Definition of Viewing Angle (1)
   Based on Fig.9-2.

   \[ \theta_L, \theta_U, \theta_D, \theta_R \]  

   Top (12 o'clock Direction)  
   Left (9 o'clock Direction)  
   Right (3 o'clock Direction)  
   Bottom (6 o'clock Direction)

   \[ *0^\circ (\text{Front}) \]

   \[ * \rightarrow \theta_U=0^\circ, \theta_R=0^\circ, \theta_L=0^\circ, \theta_R=0^\circ \]

   Fig.9-2. Definition of Viewing Angle (1)

Note 2) Definition of Viewing Angle (2)
   Based on Fig.9-3.

   Display Surface

   Display Surface

   \[ \theta_{\text{MAX}}, \theta_{\text{TYP}}, \theta_{\text{MIN}} \]

   \[ \theta_{L,R,U,D} = 0^\circ \]

   Fig.9-3. Definition of Viewing Angle (2)

Note 3) Definition of Contrast Ratio (CR)
   Determined by Formula (1) based on Fig.9-4. Voltage-Brightness Characteristics.

   \[ L_w (\text{Brightness at white}) \]

   \[ L_b (\text{Brightness at black}) \]

   \[ L_w = \frac{L_w}{L_b} \]

   \[ L_w = \frac{L_w}{L_b} \]

   (1)

   Fig.9-4. Voltage-Brightness Characteristics
Note 4) Definition of Response Time
Based on Fig.9-5.

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%

0%

Black

White

Black

ON Response Time

OFF Response Time

Fig.9-5. Definition of Response Time

Note 5) Contrast Ratio and Response Measurement System
Based on Fig.9-6.

Drive and Measurement System

Brightness Meter or Luminance Colorimeter (with luminosity correction function)

Fig.9-6. Contrast Ratio and Response Time Measurement System
Note 6) Definition of Optimum Viewing Angle
   Based on Fig.9-7.

   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 shown in Fig.9-8.

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

   Note) Each measurement point (1 ~ 9) defines the center spot of Brightness Meter view.
   The tolerance of measurement position is ±5mm.

   Fig.9-8, Measurement Points
10. INTERFACE SPECIFICATIONS

10-1. Signal descriptions

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

Table 10-1. Interface signals (CN1)

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Symbol</th>
<th>I/O</th>
<th>Function</th>
<th>Pin No.</th>
<th>Symbol</th>
<th>I/O</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GND</td>
<td>—</td>
<td>Ground</td>
<td>31</td>
<td>G01</td>
<td>I</td>
<td>Green odd data 1</td>
</tr>
<tr>
<td>2</td>
<td>RE0</td>
<td>I</td>
<td>Red even data 0</td>
<td>32</td>
<td>G02</td>
<td>I</td>
<td>Green odd data 2</td>
</tr>
<tr>
<td>3</td>
<td>RE1</td>
<td>I</td>
<td>Red even data 1</td>
<td>33</td>
<td>G03</td>
<td>I</td>
<td>Green odd data 3</td>
</tr>
<tr>
<td>4</td>
<td>RE2</td>
<td>I</td>
<td>Red even data 2</td>
<td>34</td>
<td>G04</td>
<td>I</td>
<td>Green odd data 4</td>
</tr>
<tr>
<td>5</td>
<td>RE3</td>
<td>I</td>
<td>Red even data 3</td>
<td>35</td>
<td>G05</td>
<td>I</td>
<td>Green odd data 5</td>
</tr>
<tr>
<td>6</td>
<td>RE4</td>
<td>I</td>
<td>Red even data 4</td>
<td>36</td>
<td>GND</td>
<td>—</td>
<td>Ground</td>
</tr>
<tr>
<td>7</td>
<td>RE5</td>
<td>I</td>
<td>Red even data 5</td>
<td>37</td>
<td>BO0</td>
<td>I</td>
<td>Blue odd data 0</td>
</tr>
<tr>
<td>8</td>
<td>GND</td>
<td>—</td>
<td>Ground</td>
<td>38</td>
<td>BO1</td>
<td>I</td>
<td>Blue odd data 1</td>
</tr>
<tr>
<td>9</td>
<td>GE0</td>
<td>I</td>
<td>Green even data 0</td>
<td>39</td>
<td>BO2</td>
<td>I</td>
<td>Blue odd data 2</td>
</tr>
<tr>
<td>10</td>
<td>GE1</td>
<td>I</td>
<td>Green even data 1</td>
<td>40</td>
<td>BO3</td>
<td>I</td>
<td>Blue odd data 3</td>
</tr>
<tr>
<td>11</td>
<td>GE2</td>
<td>I</td>
<td>Green even data 2</td>
<td>41</td>
<td>BO4</td>
<td>I</td>
<td>Blue odd data 4</td>
</tr>
<tr>
<td>12</td>
<td>GE3</td>
<td>I</td>
<td>Green even data 3</td>
<td>42</td>
<td>BO5</td>
<td>I</td>
<td>Blue odd data 5</td>
</tr>
<tr>
<td>13</td>
<td>GE4</td>
<td>I</td>
<td>Green even data 4</td>
<td>43</td>
<td>GND</td>
<td>—</td>
<td>Ground</td>
</tr>
<tr>
<td>14</td>
<td>GE5</td>
<td>I</td>
<td>Green even data 5</td>
<td>44</td>
<td>PULL</td>
<td>I</td>
<td>(*2)</td>
</tr>
<tr>
<td>15</td>
<td>GND</td>
<td>—</td>
<td>Ground</td>
<td>45</td>
<td>PULL</td>
<td>I</td>
<td>(*2)</td>
</tr>
<tr>
<td>16</td>
<td>BE0</td>
<td>I</td>
<td>Blue even data 0</td>
<td>46</td>
<td>ENAB</td>
<td>I</td>
<td>Data enable signal</td>
</tr>
<tr>
<td>17</td>
<td>BE1</td>
<td>I</td>
<td>Blue even data 1</td>
<td>47</td>
<td>GND</td>
<td>—</td>
<td>Ground</td>
</tr>
<tr>
<td>18</td>
<td>BE2</td>
<td>I</td>
<td>Blue even data 2</td>
<td>48</td>
<td>GND</td>
<td>—</td>
<td>Ground</td>
</tr>
<tr>
<td>19</td>
<td>BE3</td>
<td>I</td>
<td>Blue even data 3</td>
<td>49</td>
<td>DCLK</td>
<td>I</td>
<td>Dot clock signal</td>
</tr>
<tr>
<td>20</td>
<td>BE4</td>
<td>I</td>
<td>Blue even data 4</td>
<td>50</td>
<td>GND</td>
<td>—</td>
<td>Ground</td>
</tr>
<tr>
<td>21</td>
<td>BE5</td>
<td>I</td>
<td>Blue even data 5</td>
<td>51</td>
<td>GND</td>
<td>—</td>
<td>Ground</td>
</tr>
<tr>
<td>22</td>
<td>GND</td>
<td>—</td>
<td>Ground</td>
<td>52</td>
<td>SS</td>
<td>—</td>
<td>SS function ON/OFF (*1)</td>
</tr>
<tr>
<td>23</td>
<td>RO0</td>
<td>I</td>
<td>Red odd data 0</td>
<td>53</td>
<td>N.C.</td>
<td>—</td>
<td>——</td>
</tr>
<tr>
<td>24</td>
<td>RO1</td>
<td>I</td>
<td>Red odd data 1</td>
<td>54</td>
<td>GND</td>
<td>—</td>
<td>Ground</td>
</tr>
<tr>
<td>25</td>
<td>RO2</td>
<td>I</td>
<td>Red odd data 2</td>
<td>55</td>
<td>GND</td>
<td>—</td>
<td>Ground</td>
</tr>
<tr>
<td>26</td>
<td>RO3</td>
<td>I</td>
<td>Red odd data 3</td>
<td>56</td>
<td>GND</td>
<td>—</td>
<td>Ground</td>
</tr>
<tr>
<td>27</td>
<td>RO4</td>
<td>I</td>
<td>Red odd data 4</td>
<td>57</td>
<td>VDD</td>
<td>—</td>
<td>+5V Power supply</td>
</tr>
<tr>
<td>28</td>
<td>RO5</td>
<td>I</td>
<td>Red odd data 5</td>
<td>58</td>
<td>VDD</td>
<td>—</td>
<td>+5V Power supply</td>
</tr>
<tr>
<td>29</td>
<td>GND</td>
<td>—</td>
<td>Ground</td>
<td>59</td>
<td>VDD</td>
<td>—</td>
<td>+5V Power supply</td>
</tr>
<tr>
<td>30</td>
<td>G00</td>
<td>I</td>
<td>Green odd data 0</td>
<td>60</td>
<td>VDD</td>
<td>—</td>
<td>+5V Power supply</td>
</tr>
</tbody>
</table>

(*1) SS (Spread Spectrum): SS function is ON when signal level is high or N.C. (generally set up N.C.)
SS function is OFF when signal level is low.

(*2) Connect it to GND for the protection of internal circuit.

(*3) When using a connector other than the recommended one, a defect in the initial stage
or a problem concerning long term reliability may occur.
10-2. Color Data Assignment

Table 10-2 shows the color data assignment.

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

<table>
<thead>
<tr>
<th>Color</th>
<th>R Input data</th>
<th>G Input data</th>
<th>B Input data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>0 0 0 0 0 0 0</td>
<td>0 0 0 0 0 0 0</td>
<td>0 0 0 0 0 0 0</td>
</tr>
<tr>
<td></td>
<td>1 0 0 0 0 0 1</td>
<td>0 0 0 0 0 0 0</td>
<td>0 0 0 0 0 0 0</td>
</tr>
<tr>
<td></td>
<td>0 0 0 0 0 0 0</td>
<td>0 0 0 0 0 0 0</td>
<td>0 0 0 0 0 0 0</td>
</tr>
<tr>
<td></td>
<td>1 1 1 1 1 0 1</td>
<td>0 0 0 0 0 0 0</td>
<td>0 0 0 0 0 0 0</td>
</tr>
<tr>
<td></td>
<td>1 1 1 1 1 0 0</td>
<td>0 0 0 0 0 0 0</td>
<td>0 0 0 0 0 0 0</td>
</tr>
<tr>
<td></td>
<td>1 1 1 1 1 1 1</td>
<td>0 0 0 0 0 0 0</td>
<td>0 0 0 0 0 0 0</td>
</tr>
</tbody>
</table>

Note 1) Definition of gray scale: Color (n) -"n" indicates gray scale level. The gray scale is brighter as the number is larger.

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

Note 3) Color data consist of 36 bits, namely, 6-bit odd and even data for each red, green and blue. Optional data can be set to red, green and blue independently. Therefore, the module is able to display 262,144 colors.
10-3. Input Signal Timing

Table 10-3 and Fig.10-3 shows the input signal timing.

### Table 10-3. Timing Characteristics

<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</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Clock)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Period</td>
<td>Tc</td>
<td>25.000</td>
<td>30.764</td>
<td>40.000</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>fc</td>
<td>25.000</td>
<td>30.764</td>
<td>40.000</td>
<td>MHz</td>
<td>fc=1/Tc</td>
</tr>
<tr>
<td>Duty</td>
<td>Tch/Tc</td>
<td>45</td>
<td>50</td>
<td>55</td>
<td>%</td>
<td>*1</td>
</tr>
<tr>
<td>High time</td>
<td>TelkH</td>
<td>5.0</td>
<td>—</td>
<td>—</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>Low time</td>
<td>TelkL</td>
<td>5.0</td>
<td>—</td>
<td>—</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>Rise time</td>
<td>Telkr</td>
<td>—</td>
<td>—</td>
<td>5.0</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>Fall time</td>
<td>Telkf</td>
<td>—</td>
<td>—</td>
<td>5.0</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>4.5</td>
<td>—</td>
<td>—</td>
<td>ns</td>
<td>40MHz</td>
</tr>
<tr>
<td>Hold time</td>
<td>Thold</td>
<td>6.5</td>
<td>—</td>
<td>—</td>
<td>ns</td>
<td>40MHz</td>
</tr>
<tr>
<td><strong>Horizontal Display period</strong></td>
<td>Th</td>
<td>565</td>
<td>672</td>
<td>1566</td>
<td>DCLK</td>
<td>fh=1/Th</td>
</tr>
<tr>
<td>Frequency</td>
<td>fh</td>
<td>38.6</td>
<td>48</td>
<td>60</td>
<td>kHz</td>
<td></td>
</tr>
<tr>
<td><strong>Vertical Display period</strong></td>
<td>Thd</td>
<td>—</td>
<td>512</td>
<td>—</td>
<td>DCLK*2,3</td>
<td></td>
</tr>
<tr>
<td><strong>Data-ENAB 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>—</td>
<td>—</td>
<td>0</td>
<td>DCLK*4</td>
<td></td>
</tr>
</tbody>
</table>

*1) DCLK signal input must be valid while power supply is applied.

*2) Display position is specified by the ENAB signal.
   - Horizontal display position is specified by the rise of ENAB signal. The data of a horizontal line, which is latched by the falling edge of 1st DCLK right after the rise of ENAB, is displayed on the left edge of the screen.
   - Vertical display position is specified by the rise of ENAB after a “Low” level period equivalent to eight times of horizontal period. The 1st data corresponding to one horizontal line after the rise of ENAB is displayed at the top line of screen.

*3) If a period of ENAB “High” is less than 512 DCLK or less than 768 lines, the rest of the screen displays black.

*4) The display position does not fit to the screen if the ENAB period and the effective data period do not synchronize with each other.
Fig. 10.3. Input Signal Timing Chart

DCLK

ENAB
RO5-0, RE5-0
GO5-0, GE5-0
BO5-0, BE5-0

RO5-0, RE5-0
GO5-0, GE5-0
BO5-0, BE5-0

ENAB

RO5-0, RE5-0
GO5-0, GE5-0
BO5-0, BE5-0

ENAB

DCLK

RO5-0, RE5-0
GO5-0, GE5-0
BO5-0, BE5-0

ENAB

RO5-0, RE5-0
GO5-0, GE5-0
BO5-0, BE5-0

ENAB

DCLK

RO5-0, RE5-0
GO5-0, GE5-0
BO5-0, BE5-0

ENAB
10-4. Correspondence between Data and Display Position

Fig. 10-3 shows the Correspondence between Data and Display Position.

<table>
<thead>
<tr>
<th>C001</th>
<th>RO 0001</th>
<th>GO 0001</th>
<th>BO 0001</th>
<th>RE 0002</th>
<th>GE 0002</th>
<th>BE 0002</th>
<th>RO 0003</th>
<th>GO 0003</th>
<th>GE 1024</th>
<th>BE 1024</th>
</tr>
</thead>
<tbody>
<tr>
<td>C768</td>
<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 1024</td>
<td>BE 1024</td>
</tr>
</tbody>
</table>

Fig. 10-4. 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 Fig. 10-4 to prevent latch-up of the driver ICs and DC driving of the LCD panel.

Fig. 10-5. Power Supply Sequence
11. BACKLIGHT SPECIFICATIONS

11-1. Pin Configuration for Backlight

Table 11-1(a) and 11-1(b) shows the description and pin assignment of the connectors (CN-A and B) for the Backlight of this LCD module.

Table 11-1(a) Pin Assignment of CN-A

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>V_{L1}</td>
<td>Power supply for CCFL 1</td>
</tr>
<tr>
<td>2</td>
<td>V_{L2}</td>
<td>Power supply for CCFL 2</td>
</tr>
<tr>
<td>3</td>
<td>NC</td>
<td>——</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td>Ground (for V_{L1}, 2)</td>
</tr>
</tbody>
</table>

Table 11-1(b) Pin Assignment of CN-B

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>V_{L3}</td>
<td>Power supply for CCFL 3</td>
</tr>
<tr>
<td>2</td>
<td>V_{L4}</td>
<td>Power supply for CCFL 4</td>
</tr>
<tr>
<td>3</td>
<td>NC</td>
<td>——</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td>Ground (for V_{L3}, 4)</td>
</tr>
</tbody>
</table>

Cable color (CN-A and B): White at GND, Pink at V_{L1}, V_{L2}, and V_{L3}

Connector
- Housing: BHR-04VS-1
- Contact: SBH-001T-P0.5
- User's Connector: Post with base: SM04(4.0)B-BHS-1-TB
- Supplier: Japan Solderless Terminal Trading Company LTD. (J.S.T.)

11-2. CCFL

Supplier: SANKEN ELECTRIC CO., LTD Part No. KFN8319F315296Z

11-3. Life

The life of the backlight 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}): (7mA or less)

2. Definition of life
   1. Brightness becomes 50% or below 50% of the minimum brightness value shown in Table 9-1.
   2. The lamp cannot be lit by the breakdown voltage of 1500Vvms.
   3. Lamp is flashing.

11-4. Lamp Assembly set (for replacement)

Lamp Assembly set (with charge) is prepared for maintenance. This set consists of an upper lamp assembly and a lower lamp assembly.

Type number: LQ0DDB5462 (FLC1-16S) for upper and lower
12. APPEARANCE SPECIFICATIONS

12-1. Zone
- Inside display dot area (304.1×228.1mm)
- Display dot area means active area.
- One pixel consists of 3 dots (red, green and blue).
- Foreign particle and scratch unharmful to display image, such as the foreign particle under polarizer film but outside of the display area and scratch or stain on metal bezel, backlight module, aluminum chassis or polarizer film out of the display area, etc., are not counted.

12-2. Bright spots
(1) Bright spots by the defect of TFT.
   • Visible under bias of 2% ND filter .................................................. High bright spot R•G
   • Visible under 5% but invisible under 2% ND filter .... Low bright spot R•G•B
   • Invisible under bias of 5% ND filter .................................................. Not counted
(2) Bright spots by the light passing through tears, breaks, etc in color filter.
   • Exceed size of a half dot ......................................................... High bright spot
   • A half dot or less ................................................................. Not counted
(3) Bright spots by the light passing through tears, breaks, etc in chromium mask.
   • Exceed 50μm ................................................................. High bright spot
   • 50μm or less ................................................................. Not counted

12-3. Test condition
- Inspector must observe the LCD screen from the normal direction under the illumination by a single 20W fluorescent lamp. The distance between the LCD screen and the inspector should be a height of 50cm above the worktable.
- The vertical illuminance is 300 to 600lux (reference value).
- Bright spot should be counted under entire black screen.
- Dark spot should be counted under entire white screen.
- Frame frequency should be 60Hz.

12-4. Specifications
Table 12-4 shows the appearance standard.

(Note1) Please do not mistake a single bright spot for a bright spot connection due to Cs(supplemental capacitance) line at the center of each dot.
(Note2) If a pixel is dark partially, it connects into the number of dark spots in accordance with following rule.
   (a) S<1/3 : Not count. Only one of 4 dark connection is allowed.
   (b) 1/3≤S<2/3 : Considered as 0.5 dot.
   (c) 2/3≤S : Considered as 1 dot.

(S=Dark spot size/dot size)
Table 12-4. Appearance specifications

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Judgment method and standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bright spot (high and Low)</td>
<td>≤3 dots (Note 1)</td>
</tr>
<tr>
<td>2</td>
<td>Bright spot connection (high and low)</td>
<td>≤1 pair (2 dot connection in horizontal only)</td>
</tr>
<tr>
<td>3</td>
<td>Total of bright spot</td>
<td>≤3 dots</td>
</tr>
<tr>
<td>4</td>
<td>Dark spot</td>
<td>≤6 dots (Note 2)</td>
</tr>
<tr>
<td>5</td>
<td>Dark spot connection</td>
<td>≤3 pairs (2 dot connection in horizontal only)</td>
</tr>
<tr>
<td>6</td>
<td>Total of dark spot</td>
<td>≤6 dots (Note 2)</td>
</tr>
<tr>
<td>7</td>
<td>Total of dot defect (bright and dark)</td>
<td>≤6 dots</td>
</tr>
<tr>
<td>8</td>
<td>Distance of bright spot high-high</td>
<td>≥15mm</td>
</tr>
<tr>
<td>9</td>
<td>Distance of dark spot</td>
<td>≥5mm</td>
</tr>
<tr>
<td>10</td>
<td>Scratch on polarizer, line shape</td>
<td>W≤0.03: Ignore</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.03&lt;W≤0.05: L≤6; 6&lt;L≤12: &lt;3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.03&lt;W≤0.05: 12&lt;L; 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.05&lt;W≤0.15: L≤0.6; 0.6&lt;L≤5: ≤2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.05&lt;W≤0.15: 5&lt;L; 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.15&lt;W≤0.3: W×L≤0.4; 0.4&lt;W×L ≤1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.3&lt;W</td>
</tr>
<tr>
<td>11</td>
<td>Dent on polarizer, dot shape</td>
<td>D≤0.2: Ignore</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.2&lt;D≤0.4: ≤4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.4&lt;D</td>
</tr>
<tr>
<td>12</td>
<td>Bubble in polarizer</td>
<td>D≤0.4: ≤4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.4&lt;D</td>
</tr>
<tr>
<td>13</td>
<td>Black white spot (Foreign circular matter)</td>
<td>D≤0.5: ≤4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.5&lt;D</td>
</tr>
<tr>
<td>14</td>
<td>Light leakage by foreign articles</td>
<td>S&lt;1/3: Ignore</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1-dot: ignore</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Consecutive 2~3 dots ≤3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Consecutive 4~5 dots ≤2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Consecutive 6 dots 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1/3≤S&lt;2/3: Dot defect +0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2/3≤S: Dot defect +1</td>
</tr>
<tr>
<td>15</td>
<td>Lints, black/white line</td>
<td>W≤0.03: Ignore</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.03&lt;W≤0.05: L≤6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.03&lt;W≤0.05: 6&lt;L≤12: ≤3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.03&lt;W≤0.05: 12&lt;L; 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.05&lt;W≤0.1: L≤0.6: ≤2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.05&lt;W≤0.1: 5&lt;L; 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.15&lt;W (W+L)/2=D: Conform to No.13</td>
</tr>
</tbody>
</table>

D: Average diameter [mm], W: Width [mm], L: Length [mm], S=(bright spot size)/(dot size)
13. ENVIRONMENTAL SPECIFICATIONS

Table 13-1 shows the environmental specifications.

<table>
<thead>
<tr>
<th>Item</th>
<th>Condition</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Temperature</strong></td>
<td><strong>Operation</strong></td>
<td>0~50°C</td>
</tr>
<tr>
<td></td>
<td><strong>Storage</strong></td>
<td>-20~60°C</td>
</tr>
<tr>
<td><strong>Humidity</strong></td>
<td><strong>Operation</strong></td>
<td>20~85%RH</td>
</tr>
<tr>
<td></td>
<td><strong>Storage</strong></td>
<td>5~85%RH</td>
</tr>
<tr>
<td><strong>Vibration</strong></td>
<td>Non-operation</td>
<td>10~500Hz, 1 cycle/20 minute, 2G, 1.5mm max, 2 hour each X, Y and Z directions</td>
</tr>
<tr>
<td><strong>Shock</strong></td>
<td>Non-operation</td>
<td>50G, 6ms, 1 time each ±X, ±Y and ±Z directions.</td>
</tr>
</tbody>
</table>

NOTE: Table 13-2 and Fig. 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>

Fig.13-1. Direction to apply shock to package
14. INDICATIONS

This module has the following indications.

Product label:

(1) SHARP Model number : LQ150X1DWF1
(2) Model number : FLC38XGC6V-06P
(3) Version number : 02A (Example)
  - 1st 2 digits “01” means operational version.
  - 3rd alphabet means functional version.
(4) Company name : SHARP
(5) Manufacturing number : 46 XXX 0 0 0 0 1
  - Serial number
    (To be reset every month on 1st.)
  - Manufacturing code
    (For internal use)
  - Manufacturing month
  - Last digit of manufacturing year.
(6) Country of origin : MADE IN JAPAN
(7) Disposal method of cold-cathode tubes. (See Fig.14-1)
(8) Caution when changing cold-cathode tubes. (See Fig. 14-2)

- FLUORESCENT LAMPS IN THIS PRODUCT CONTAIN MERCURY AND MUST BE DISPOSED OF ACCORDING TO LOCAL ORDINANCE, STATE OR FEDERAL LAWS.
- この製品の内部の蛍光管には水銀
  が含まれていますので、地方自治体
  の条例、州法または連邦法に従って
  廃業してください。

- WHEN CHANGING COLD CATHODE FLUORESCENT LAMPS, FOLLOW OPERATING SPECIFICATIONS, ESPECIALLY BE CAREFUL ABOUT THE LAMPS SIDE-EDGE.
- 壁面の交換は作業仕様書に従っ
  て行って下さい。特に蛍光管ホル
  デ側面のエッジに気をつけて下
  さい。

Fig.14-1  Fig.14-2

SHARP Model No.
Bar Code(Lot No.)
Model No.
XX XXXXXX
FLC38XGC6V-06P 02A
MADE IN JAPAN

Fig.14-3 Product label (example)
15. PACKAGING

Separately specified in packaging specifications.

15-1. Packaging specifications

(1) 5 LCD modules / 1 package.
(2) Weight: approximately 10kg / 1 package.
(3) Outline dimensions : 353mm (W)×268mm (D) ×462mm (H)

15-2. Packaging method

Fig.15-2 (a),(b),(c),(d) show the packing method.

Fig.15-2(a) Packaging Method
Carton Label 1 (example)

Carton Label 2 (example) : 5 pcs

Label format is same as product label. The number of label attachment depends on module quantity.

Fig.15-2(b) Packaging Method
Note: 1) 8 boxes×4 layers (maximum 32 boxes) : by ship
     8 boxes×3 layers (maximum 24 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) Packaging Method
16. WARRANTY
The warranty period is one year after manufacturing. 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 properly use this LCD module.

(1) Fail safe design
LCD module has an inherent chance of failure. Customers must protect against injury, damage or loss from such failures by incorporating safety design measures into your facility and equipment such as redundancy, fire protection, and prevention of over-current levels and other abnormal operating conditions.

(2) 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. If the pressure is over 2kg/cm², the problem don't return to normal condition.
   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, pincet, etc.
   • For handling, use cotton or conductive gloves so that the display surface is not stained.
   • For If the display surface is stained by dust or dirt, clean it as follows with a soft cloth (deer skin, etc.)
   [Dust] Wipe off with a soft cloth. (do not rub.)
   [Dirt] Wipe off lightly with a soft cloth after soaking in the clear water and squeezing hard out of water drops. Only if the dirt is hardly wiped off, use isopropyl alcohol or ethanol.
   Be careful not to splash the water or the solvent and water penetrated between the polarizer and the LCD panel.
   Do not use solvents such as ketone (acetone, etc.) and aromatics (xylene, toluene, etc.)
   • If saliva or water drops are left for long time, it may deform partial deformation or discolored. Wipe off immediately in the same way as for dirt.
   • Do not allow oil to adhere to the module, since the cleaning of oil is difficult.

④ Do not place or contact objects on the display surface for a long period of time.
   That's because this may make some parts of the LCD module distorted and the display quality may decline.
(3) Handling of LCD module

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

② Assemble the module into user’s system in a dust free environment.
   If conductive foreign matter adheres to the module, failures may occur.

③ Take anti-static measures for assembling the module.
   Since the LCD module contains CMOS-ICs, the following considerations are necessary.
   • 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, pincet, etc.).
   • Do not take the module out of the conductive bag until the time when the module is assembled.
   • 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.
   If this LCD module is disassembled or remodeled, it may have some trouble, or the display quality and reliability may not be assured.

(4) Precautions for operating the LCD module

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

② Do not operate the LCD module when condensation is present.
   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 a cold environment to a warm environment.

③ Trouble that occurs when the LCD module is used at not recommended temperature.
   • Operation at high temperature (＞50°C) : Display colors shift to blue.
   • Storage at high temperature (＞60°C) : The polarizer film deteriorates and contrast decreases.
   • Operation at low temperature (＜0°C) : The response speed decreases considerably.
   • Storage at low temperature (＜-20°C) : The liquid crystal may solidify and become damaged.

④ Always input the control signals at the correct timing.
   If control signals (DCLK, or 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.
(5) Precautions on designing module mounting

1. **Do not press the display surface and bottom face of the LCD module.**
   Display quality or reliability may be deteriorated if the installation of the LCD module is inappropriate and, as a result, excessive pressure is applied to the surface of LCD screen.
   Brightness uniformity or the reliability of CCFL may decrease if the pressure is applied to the backlight module.

2. **Consider the module mounting design, so that twisting and bending do not occur to the LCD module.**
   Excessive twisting and bending may damage display quality and reliability.

3. **The power cable length between the LCD module and inverter should not be extended.**
   Otherwise the backlight may not light or flickering may occur.

4. **Do not make the power cable of the backlight clung to a metal plate, etc.**
   Backlight frequency current for backlight driving may leak to the metal and desired brightness may not be assured.

5. **When Mounting LCD module with M4 screw (x4) should be screw up under 5.75kgf torque.**

(6) 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 problems may occur.

2. **Store the LCD module in a SHARP package.**
   At storing, SHARP packages can be stacked up to 4 boxes.
   The LCD module is in an anti-static bag. Keep the module in that status.

3. **It is recommended that the storage environment should be humidity controlled, cool and dark.**
   Recommended storage environment
   • Place : Dark (avoid direct sunlight)
   • Temperature : 10~35ºC
   • Humidity : 50~60%RH
   Note) If the module is left in an environment of 60ºC or more for a long period of time, optical characteristics may deteriorate.

(7) 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.
(8) CAUTION IN DESIGNING INVERTER

Fluorescent lamps driven by high voltage are included in this LCD module. Please stand to the instructions below when designing inverter that lights the fluorescent lamps. Otherwise it may lead to FATAL FAILURE, such as SMOKING or FIRING.

① APPLY PROTECTIVE CIRCUIT in preparation for lamp breaking, wire breaking and short circuit. The protective circuit should also detect half open circuit and wire breaking in narrow gap etc.. Otherwise it may lead to fatal failure.

② KEEP ENOUGH CURRENT CAPACITY of inverter output for leakage current, which leaks from lamps and wire to surrounding metal material. Usually output current of about 1.5 times as same as the lamp current is necessary. But it sometimes varies due to characteristics of the inverter itself. So before determining design, please check characteristics of the inverter by connecting it to the LCD module.

③ KEEP ENOUGH TEMPERATURE MARGIN for each parts mounted on inverter. Temperature of the parts becomes higher when they are mounted in the final products due to heating inside. The temperature of each parts MUST NOT increase over the guaranteed temperature.
(9) **Return method of the LCD module requested for repair or analysis of the problem**

* When returning the LCD modules, adhere to the following procedures not to damage the LCD panel or the backlight cables. (Fig. 17-1(a)~(b))

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

① Attach protective sheet.

![Diagram of protective sheet attachment](image)

② Hook the backlight cables.

![Diagram of backlight cable hooking](image)

* If the cables are not fixed, the connectors may scratch the LCD panel surface or the cables may be damaged.

③ Put the LCD module into the anti-electrostatic bag

(Please do not use torn anti-electrostatic bags)

![Diagram of anti-electrostatic bag packaging](image)

*Fig. 17-1(a) Packaging method*
Storage into the carton box

- When using the carton box manufactured by SHARP
  (Please use carton boxes and arrowheads that are not collapsed)

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

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

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

Fig. 17-1(b) Packaging method

- When not using the carton box manufactured by SHARP
  Please pack the LCD modules one by one and make sure not to damage the LCD modules when transporting.
(10) 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.
SHARP has adopted non-wash technology on module assembly process.

18. PRECAUTIONS FOR USE

This Product is designed, developed and manufactured as contemplated for general use, including without limitation, general office use, personal use, household use, and ordinary industrial use, but is not designed, developed and manufactured as contemplated for use accompanying fatal risks or dangers that, unless extremely high safety is secured, could lead directly to death, personal injury, severe physical damage or other loss (hereinafter “High Safety Required Use”), including without limitation, nuclear reaction control in nuclear facility, aircraft flight control, air traffic control, mass transport control, medical life support system, missile launch control in weapon system. If customer’s product possibly falls under the category of High Safety Required Use, please consult with our sales representatives in charge before such use. In addition, SHARP shall not be liable against the Customer and/or any third party for any claims or damages arising in connection with the High Safety Required Use of the Product without permission.

19. MISCELLANEOUS

Specifications of the TFT-LCD panel and other components used in the LCD module are subject to change. Both parties shall discuss together before change.
If any doubt is raised in the content of the specifications, both parties shall discuss and make best effort for the agreement.
Front View

Bezel is in contact with PCB-5G at the tilt B. Plt A, C, D are insulated with PCB-5G.