<table>
<thead>
<tr>
<th>PREPARED BY :</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPEC No.</td>
<td>LD-20711A</td>
</tr>
<tr>
<td>FILE No.</td>
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<tr>
<td>ISSUE :</td>
<td>July.28.2008</td>
</tr>
<tr>
<td>PAGE :</td>
<td>17 pages</td>
</tr>
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<td>APPLICABLE GROUP</td>
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<tr>
<td>MOBILE LIQUID CRYSTAL DISPLAY GROUP</td>
<td></td>
</tr>
<tr>
<td>SHARP CORPORATION</td>
<td></td>
</tr>
<tr>
<td>SPECIFICATION</td>
<td></td>
</tr>
</tbody>
</table>

**DEVICE SPECIFICATION FOR**

**TFT-LCD Module**

**MODEL No.**

**LQ121S1DG42**

These parts have corresponded with the RoHS directive.

☐ CUSTOMER’S APPROVAL

DATE

PRESENTED

BY (Signature)

K. Shiono
General manager
ENGINEERING DEPARTMENT
MOBILE LIQUID CRYSTAL DISPLAY DIVISION III
MOBILE LIQUID CRYSTAL DISPLAY GROUP
SHARP CORPORATION
1. Application
   This specification applies to color TFT-LCD module, LQ121S1DG42

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In case of using the device for applications such as control and safety equipment for transportation (aircraft, trains, automobiles, etc.), rescue and security equipment and various safety related equipment which require higher reliability and safety, take into consideration that appropriate measures such as fail-safe functions and redundant system design should be taken.

Do not use the device for equipment that requires an extreme level of reliability, such as aerospace applications, telecommunication equipment (trunk lines), nuclear power control equipment and medical or other equipment for life support.

SHARP assumes no responsibility for any damage resulting from the use of the device which does not comply with the instructions and the precautions specified in these specification sheets.

Confirm "12. Handling Precautions " item when you use the device.

Contact and consult with a SHARP sales representative for any questions about this device.

2. Overview
   This module is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver ICs, control circuit and power supply circuit and a backlight unit. Graphics and texts can be displayed on a 800×RGB×600 dots panel with 262,144 colors by supplying 18 bit data signal (6bit/color), four timing signals, +3.3V/5.0V DC supply voltage for TFT-LCD panel driving and supply voltage for backlight.
   Backlight-driving DC/AC inverter is not built in this module.
   Viewing angle is 6 o’clock direction.
3. Outline specification.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specifications</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display size</td>
<td>31 (12.1&quot;) Diagonal</td>
<td>cm</td>
</tr>
<tr>
<td>Active area</td>
<td>246.0(H)×184.5(V)</td>
<td>mm</td>
</tr>
<tr>
<td>Pixel format</td>
<td>800(H)×600(V)</td>
<td>pixel</td>
</tr>
<tr>
<td></td>
<td>(1 pixel=R+G+B dots)</td>
<td>-</td>
</tr>
<tr>
<td>Number of colors</td>
<td>262,144 colors</td>
<td></td>
</tr>
<tr>
<td>(Number of gray scale level)</td>
<td>(64 gray scales per color)</td>
<td></td>
</tr>
<tr>
<td>Pixel pitch</td>
<td>0.3075(H)×0.3075(V)</td>
<td>mm</td>
</tr>
<tr>
<td>Pixel configuration</td>
<td>R,G,B vertical stripe</td>
<td>-</td>
</tr>
<tr>
<td>Display mode</td>
<td>Normally white</td>
<td>-</td>
</tr>
<tr>
<td>Unit outline dimensions *1</td>
<td>276.0(W)×209.0(H)×Max.11.0 (D)</td>
<td>mm</td>
</tr>
<tr>
<td>Mass</td>
<td>Max. 660</td>
<td>g</td>
</tr>
<tr>
<td>Surface treatment</td>
<td>Anti-glare and hard-coating 3H</td>
<td>-</td>
</tr>
</tbody>
</table>

*1: excluding backlight cables.

Outline dimensions is shown in Fig.1
4. Input Terminals

4-1. TFT-LCD panel driving

CN1

Corresponding connector: DF9-41S-1V, DF9A-41S-1V, DF9B-41S-1V, DF9M-41S-1V

(Hirose Electric Co., Ltd.)

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Symbol</th>
<th>Function</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GND</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>CK</td>
<td>Clock signal for sampling each data signal</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Hsync</td>
<td>Horizontal synchronous signal</td>
<td>[Note1]</td>
</tr>
<tr>
<td>5</td>
<td>Vsync</td>
<td>Vertical synchronous signal</td>
<td>[Note1]</td>
</tr>
<tr>
<td>6</td>
<td>GND</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>GND</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>R0</td>
<td>RED data signal (LSB)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>R1</td>
<td>RED data signal</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>R2</td>
<td>RED data signal</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>GND</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>R3</td>
<td>RED data signal</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>R4</td>
<td>RED data signal</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>R5</td>
<td>RED data signal (MSB)</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>GND</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>GND</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>GND</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>G0</td>
<td>GREEN data signal (LSB)</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>G1</td>
<td>GREEN data signal</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>G2</td>
<td>GREEN data signal</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>GND</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>G3</td>
<td>GREEN data signal</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>G4</td>
<td>GREEN data signal</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>G5</td>
<td>GREEN data signal (MSB)</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>GND</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>GND</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>GND</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>B0</td>
<td>BLUE data signal (LSB)</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>B1</td>
<td>BLUE data signal</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>B2</td>
<td>BLUE data signal</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>GND</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>B3</td>
<td>BLUE data signal</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>B4</td>
<td>BLUE data signal</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>B5</td>
<td>BLUE data signal (MSB)</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>GND</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>ENAB</td>
<td>Signal to settle the horizontal display position</td>
<td>[Note2]</td>
</tr>
<tr>
<td>38</td>
<td>R/L</td>
<td>Horizontal display mode select signal</td>
<td>[Note3]</td>
</tr>
<tr>
<td>39</td>
<td>Vcc</td>
<td>+3.3V / +5.0V power supply</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Vcc</td>
<td>+3.3V / +5.0V power supply</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>U/D</td>
<td>Vertical display mode select signal</td>
<td>[Note4]</td>
</tr>
</tbody>
</table>

※The shielding case is connected with GND.

[Note1] The polarity of both synchronous signals are negative.

[Note2] The horizontal display start timing is settled in accordance with a rising timing of ENAB signal. In case ENAB is fixed "Low", the horizontal start timing is determined as described in 7-2. Don’t keep ENAB “High” during operation.
4-2. Backlight driving

CN2 , CN3

Used connector : BHR-03VS-1(JST)
Corresponding connector : SM02(8.0)B-BHS(JST)

<table>
<thead>
<tr>
<th>Pin no.</th>
<th>symbol</th>
<th>function</th>
<th>Color of FL cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VHIGH</td>
<td>Power supply for lamp (High voltage side)</td>
<td>Pink</td>
</tr>
<tr>
<td>2</td>
<td>NC</td>
<td>This is electrically opened.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>VLOW</td>
<td>Power supply for lamp (Low voltage side)</td>
<td>White</td>
</tr>
</tbody>
</table>

5. Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Ratings</th>
<th>Unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage</td>
<td>VI</td>
<td>Ta=25°C</td>
<td>-0.3 to Vcc+0.3</td>
<td>V</td>
<td>[Note1]</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>Vcc</td>
<td>Ta=25°C</td>
<td>0 to +6.0</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Storage temperature</td>
<td>Tstg</td>
<td>-</td>
<td>-30 to +70</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Operating temperature (Ambient)</td>
<td>Topa</td>
<td>-</td>
<td>-10 to +65</td>
<td>°C</td>
<td>[Note2]</td>
</tr>
</tbody>
</table>

[Note1] CK,R0～R5,G0～G5,B0～B5,Hsync,Vsync,ENAB,R/L,U/D

[Note2] Humidity: 95%RH Max. at Ta≤40°C.

Maximum wet-bulb temperature at 39°C or less at Ta>40°C.

No condensation.

[Note3] There is a possibility of causing deterioration in the irregularity and others of the screen and the display fineness when preserving or using it from 60 to 70°C
6. Recommended operation condition

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage</td>
<td>V_i</td>
<td>0</td>
<td>Vcc</td>
<td>V</td>
<td>V</td>
<td>[Note1]</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>V_CC</td>
<td>3.0</td>
<td>3.3/5.0</td>
<td>5.5</td>
<td>V</td>
<td>[Note2]</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>Topa</td>
<td>-10</td>
<td>+65</td>
<td>°C</td>
<td></td>
<td>[Note3]</td>
</tr>
</tbody>
</table>

[Note1] CK,R0～R5,G0～G5,B0～B5,Hsync,Vsync,ENAB,R/L,U/D

[Note2] Vcc-turn-on conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 &lt; t1</td>
<td>15ms</td>
</tr>
<tr>
<td>0 &lt; t2</td>
<td>10ms</td>
</tr>
<tr>
<td>0 &lt; t3</td>
<td>100ms</td>
</tr>
<tr>
<td>0 &lt; t4</td>
<td>1s</td>
</tr>
<tr>
<td>t5</td>
<td>&gt; 200ms</td>
</tr>
</tbody>
</table>

Vcc-dip conditions

1) 2.5V ≤ Vcc
   td ≤ 10ms
2) Vcc < 2.5V

Vcc-dip conditions should also follow the Vcc-turn-on conditions

[Note3] Humidity: 95%RH Max. at Ta ≤ 40°C.
Maximum wet-bulb temperature at 39°C or less at Ta > 40°C.
No condensation.

7. Electrical Characteristics

7-1. TFT-LCD panel driving  Ta=25°C

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current dissipation</td>
<td>Vcc=3.3V</td>
<td>Icc</td>
<td>-</td>
<td>380</td>
<td>480</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>Vcc=5.0V</td>
<td>Icc</td>
<td>-</td>
<td>230</td>
<td>280</td>
<td>mA</td>
</tr>
<tr>
<td>Permissive input</td>
<td>VRP</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>mVp-p</td>
<td></td>
</tr>
<tr>
<td>ripple voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input voltage</td>
<td>Low</td>
<td>VIL</td>
<td>-</td>
<td>-</td>
<td>0.8</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>VIH</td>
<td>2.1</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>Input current 1</td>
<td>Low(VI=0V)</td>
<td>IOL1</td>
<td>-10.0</td>
<td>-</td>
<td>10.0</td>
<td>μA</td>
</tr>
<tr>
<td></td>
<td>Hogh(VI=Vcc)</td>
<td>IOH1</td>
<td>-10.0</td>
<td>-</td>
<td>10.0</td>
<td>μA</td>
</tr>
<tr>
<td>Input current 2</td>
<td>Low(VI=0V)</td>
<td>IOL2</td>
<td>-800</td>
<td>-</td>
<td>-</td>
<td>μA</td>
</tr>
<tr>
<td></td>
<td>Hogh(VI=Vcc)</td>
<td>IOH2</td>
<td>-10.0</td>
<td>-</td>
<td>10.0</td>
<td>μA</td>
</tr>
<tr>
<td>Input current 3</td>
<td>Low(VI=0V)</td>
<td>IOL3</td>
<td>-10.0</td>
<td>-</td>
<td>10.0</td>
<td>μA</td>
</tr>
<tr>
<td></td>
<td>Hogh(VI=Vcc)</td>
<td>IOH3</td>
<td>-</td>
<td>-</td>
<td>800</td>
<td>μA</td>
</tr>
</tbody>
</table>
V<sub>ce</sub>=+3.3V/+5.0V

[Note2] CK,R0–R5,G0–G5,B0–B5,Hsync,Vsync,ENAB,R/L,U/D

[Note3] CK,R0–R5,G0–G5,B0–B5,Hsync,Vsync,ENAB,R/L,U/D

[Note4] R/L
[Note5] U/D
[Note6] See below block diagram of input interface.

---

**Block Diagram of Input Interface**

- **I/F connector**
  - R0~R5
  - G0~G5
  - B0~B5
  - VS
  - HS
  - ENAB
  - CK
  - R/L
  - U/D
  - VCC
  - 100Ω resistors
  - 10KΩ resistors
  - 10μF capacitor

- **Control IC**
  - RGB input pins
  - VCC pin
  - To the inside of a module
7-2. Backlight driving

The backlight system is an edge-lighting type with double CCFT (Cold Cathode Fluorescent Tube).
The characteristics of single lamp are shown in the following table.

(It is usually required to measure under the following condition.

condition:IL=6.0mA, Ta=25°C±2°C, FL=60kHz.)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lamp current</td>
<td>IL</td>
<td>3.0</td>
<td>6.0</td>
<td>6.5</td>
<td>mA rms [Note1]</td>
</tr>
<tr>
<td>Lamp power consumption</td>
<td>PL</td>
<td>-</td>
<td>3.5</td>
<td>-</td>
<td>W [Note2]</td>
</tr>
<tr>
<td>Lamp frequency</td>
<td>FL</td>
<td>35</td>
<td>60</td>
<td>80</td>
<td>kHz [Note3]</td>
</tr>
<tr>
<td>Kick-off voltage</td>
<td>Vs</td>
<td>-</td>
<td>-</td>
<td>1200</td>
<td>V rms Ta=25°C [Note4]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>1400</td>
<td>V rms Ta=0°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>1500</td>
<td>V rms Ta=-10°C</td>
</tr>
</tbody>
</table>

[Note1] Lamp current is measured with current meter for high frequency as shown below.

[Note2] Referential data per one CCFT by calculation. (IL × VL)
The data don’t include loss at inverter. (IL=6.0mA rms)

[Note3] Lamp frequency may produce interference with horizontal synchronous frequency, and this may cause beat on the display. Therefore lamp frequency shall be detached as much as possible from the horizontal synchronous frequency and from the harmonics of horizontal synchronous to avoid interference.

[Note4] The open output voltage of the inverter shall be maintained for more than 1s; otherwise the lamp may not be turned on.

[Note5] Lamp is consumables. In the following condition, the life time is 50,000 hour as the reference value and it is not guaranteed in this technical literature sheet by SHARP.
Above value is applicable when lamp is placed horizontally.

Lamp life time is defined that it applied either ① or ② under this condition

(Continuous turning on at Ta=25°C, IL=6.0mA rms)
① Brightness becomes 50% of the original value under standard condition.
② Kick-off voltage at Ta=−10°C exceeds maximum value, 1500Vrms.
(Lamp life time may vary if lamp is in portrait position due to the change of mercury density inside the lamp.) Lamp life time shortens according to the state of mounting and use.
In case of operating under lower temp environment, the lamp exhaustion is accelerated and the brightness becomes lower. (Continuous operating under for around 1 month under lower temp condition may reduce the brightness to half of the original brightness.)
In case of such usage under lower temp environment, periodical lamp exchange is recommended.

[Note6] The performance of the backlight, for example life time or brightness, is much influenced by the characteristics of the DC-AC inverter for the lamp. When you design or order the inverter, please make sure that a poor lighting caused by the mismatch of the backlight and the inverter (miss-lighting, flicker, etc.) never occur. when you confirm it, the module should be operated in the same condition as it is installed in your instrument.
Be sure to use a back light power supply with the safety protection circuit such as the detection circuit for the excess voltage, excess current and or electric discharge waveform.
Be sure to use the detect circuit by which one side of the CCFT lamps can be controlled independently.
Otherwise, when one side of the CCFT is open, the excess current may possibly be applied to the other side of the lamp. Recommended inverter is “CXA-P1212B-WJL(TDK corporation)”.

[Note7] It is required to have the inverter designed so that to allow the impedance deviation of the two CCFT lamps and the capacity deviation of barast capacitor.

[Note8] Under the environment of 10 lx or less, lamp may not turn on or it may take some time to turn on.
8. Timing Characteristics of input signals

Timing diagrams of input signals are shown in Fig. 2.

8-1. Timing characteristics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clock Frequency</td>
<td>1/Tc</td>
<td>35</td>
<td>40.0</td>
<td>42.0</td>
<td>MHz</td>
<td>-</td>
</tr>
<tr>
<td>High time</td>
<td>Tch</td>
<td>6</td>
<td>-</td>
<td>-</td>
<td>ns</td>
<td>-</td>
</tr>
<tr>
<td>Low time</td>
<td>Tcl</td>
<td>6</td>
<td>-</td>
<td>-</td>
<td>ns</td>
<td>-</td>
</tr>
<tr>
<td>Duty ratio</td>
<td>Th/T</td>
<td>40</td>
<td>50</td>
<td>60</td>
<td>%</td>
<td>-</td>
</tr>
<tr>
<td>Data Setup time</td>
<td>Tds</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>ns</td>
<td>-</td>
</tr>
<tr>
<td>Hold time</td>
<td>Tdh</td>
<td>5</td>
<td>-</td>
<td>-</td>
<td>ns</td>
<td>-</td>
</tr>
<tr>
<td>Horizontal sync. signal Cycle</td>
<td>TH</td>
<td>20.8</td>
<td>26.4</td>
<td>39.9</td>
<td>μs</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>832</td>
<td>1056</td>
<td>1395</td>
<td>clock</td>
<td>-</td>
</tr>
<tr>
<td>Pulse width</td>
<td>THp</td>
<td>2</td>
<td>128</td>
<td>200</td>
<td>clock</td>
<td>-</td>
</tr>
<tr>
<td>Vertical sync. signal Cycle</td>
<td>TV</td>
<td>628</td>
<td>666</td>
<td>798</td>
<td>line</td>
<td>-</td>
</tr>
<tr>
<td>Pulse width</td>
<td>TVp</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>line</td>
<td>-</td>
</tr>
<tr>
<td>Horizontal display period</td>
<td>THd</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>clock</td>
<td>-</td>
</tr>
<tr>
<td>Hsync-Clock phase difference</td>
<td>THc</td>
<td>3</td>
<td>-</td>
<td>Tc-10</td>
<td>ns</td>
<td>-</td>
</tr>
<tr>
<td>Hsync-Vsync phase difference</td>
<td>TVh</td>
<td>1</td>
<td>-</td>
<td>TH-THp</td>
<td>clock</td>
<td>-</td>
</tr>
<tr>
<td>Vertical data start position</td>
<td>TVs</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>line</td>
<td>-</td>
</tr>
</tbody>
</table>

[Note] In case of lower frequency, the deterioration of display quality, flicker etc., may be occurred.

8-2. Horizontal display position

The horizontal display position is determined by ENAB signal and the input data corresponding to the rising edge of ENAB signal is displayed at the left end of the active area.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enable signal Setup time</td>
<td>Tes</td>
<td>5</td>
<td>-</td>
<td>Tc-10</td>
<td>ns</td>
<td>-</td>
</tr>
<tr>
<td>Enable signal Pulse width</td>
<td>Tep</td>
<td>2</td>
<td>800</td>
<td>TH-10</td>
<td>clock</td>
<td>-</td>
</tr>
<tr>
<td>Hsync-Enable signal phase difference</td>
<td>THe</td>
<td>0</td>
<td>-</td>
<td>TH-THp-800</td>
<td>clock</td>
<td>-</td>
</tr>
</tbody>
</table>

[Note] When ENAB is fixed "Low", the display starts from the data of C88(clock) as shown in Fig. 2.

8-3. Vertical display position

The vertical display position, TVs is fixed “23” (line).

8-4. Input Data Signals and Display Position on the screen

Display position of input data
Fig. 2 Input signal waveforms
9. Input Signals, Basic Display Colors and Gray Scale of Each Color

<table>
<thead>
<tr>
<th>Colors &amp; Gray scale</th>
<th>Data signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>G0 G1 G2 G3 G4 G5</td>
</tr>
<tr>
<td>Blue</td>
<td>0 0 0 0 0 0</td>
</tr>
<tr>
<td>Green</td>
<td>0 0 0 0 0 1</td>
</tr>
<tr>
<td>Cyan</td>
<td>0 0 0 0 0 1</td>
</tr>
<tr>
<td>Red</td>
<td>1 1 1 1 1 0</td>
</tr>
<tr>
<td>Magenta</td>
<td>1 1 1 1 1 1</td>
</tr>
<tr>
<td>Yellow</td>
<td>1 1 1 1 1 1</td>
</tr>
<tr>
<td>White</td>
<td>1 1 1 1 1 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gray Scale of Red</th>
<th>Black GS0</th>
<th>GS1</th>
<th>GS2</th>
<th>GS61</th>
<th>GS62</th>
<th>GS63</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 0 0 0 0 0</td>
<td>1 0 0 0 0 0</td>
<td>0 1 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td></td>
</tr>
<tr>
<td>Brighter</td>
<td>0 0 0 0 0 1</td>
<td>0 1 1 1 1 1</td>
<td>0 1 1 1 1 1</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td></td>
</tr>
<tr>
<td>Darker</td>
<td>0 0 0 0 0 0</td>
<td>1 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gray Scale of Green</th>
<th>Black GS0</th>
<th>GS1</th>
<th>GS2</th>
<th>GS61</th>
<th>GS62</th>
<th>GS63</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td></td>
</tr>
<tr>
<td>Brighter</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td></td>
</tr>
<tr>
<td>Darker</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gray Scale of Blue</th>
<th>Black GS0</th>
<th>GS1</th>
<th>GS2</th>
<th>GS61</th>
<th>GS62</th>
<th>GS63</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td></td>
</tr>
<tr>
<td>Brighter</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td></td>
</tr>
<tr>
<td>Darker</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td></td>
</tr>
</tbody>
</table>

0 : Low level voltage, 1 : High level voltage

Each basic color can be displayed in 64 gray scales from 6 bit data signals. According to the combination of total 18 bit data signals, the 262,144-color display can be achieved on the screen.
### 10. Optical Characteristics

Ta=25oC, Vcc=+3.3V / +5.0V

<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>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viewing angle range</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horizontal</td>
<td>$\theta_{21}, \theta_{22}$</td>
<td>CR&gt;10</td>
<td>60</td>
<td>70</td>
<td>-</td>
<td>Deg.</td>
<td>[Note1]</td>
</tr>
<tr>
<td>Vertical</td>
<td>$\theta_{11}$</td>
<td></td>
<td>40</td>
<td>50</td>
<td>-</td>
<td>Deg.</td>
<td>[Note1]</td>
</tr>
<tr>
<td></td>
<td>$\theta_{12}$</td>
<td></td>
<td>50</td>
<td>60</td>
<td>-</td>
<td>Deg.</td>
<td>[Note1]</td>
</tr>
<tr>
<td>Contrast ratio</td>
<td>CRn</td>
<td>$\theta=0^\circ$</td>
<td>150</td>
<td>-</td>
<td>-</td>
<td></td>
<td>[Note2]</td>
</tr>
<tr>
<td></td>
<td>CRo</td>
<td>Optimum viewing angle</td>
<td>-</td>
<td>450</td>
<td>-</td>
<td></td>
<td>[Note2]</td>
</tr>
<tr>
<td>Response time</td>
<td>$\tau_r$</td>
<td></td>
<td>-</td>
<td>10</td>
<td>-</td>
<td>ms</td>
<td>[Note3]</td>
</tr>
<tr>
<td></td>
<td>$\tau_d$</td>
<td></td>
<td>-</td>
<td>25</td>
<td>-</td>
<td>ms</td>
<td>[Note4]</td>
</tr>
<tr>
<td>Chromaticity of white</td>
<td>x</td>
<td>$\theta=0^\circ$</td>
<td>0.263</td>
<td>0.313</td>
<td>0.363</td>
<td></td>
<td>[Note4]</td>
</tr>
<tr>
<td></td>
<td>y</td>
<td></td>
<td>0.279</td>
<td>0.329</td>
<td>0.379</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chromaticity of red</td>
<td>x</td>
<td></td>
<td>0.546</td>
<td>0.596</td>
<td>0.646</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>y</td>
<td></td>
<td>0.279</td>
<td>0.329</td>
<td>0.379</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chromaticity of green</td>
<td>x</td>
<td></td>
<td>0.260</td>
<td>0.310</td>
<td>0.360</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>y</td>
<td></td>
<td>0.502</td>
<td>0.552</td>
<td>0.602</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chromaticity of blue</td>
<td>x</td>
<td></td>
<td>0.098</td>
<td>0.148</td>
<td>0.198</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>y</td>
<td></td>
<td>0.075</td>
<td>0.125</td>
<td>0.175</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Luminance of white</td>
<td>$Y_{1L}$</td>
<td></td>
<td>300</td>
<td>370</td>
<td>-</td>
<td>cd/m²</td>
<td>IL=6.0mA rms f=60kHz</td>
</tr>
<tr>
<td>White Uniformity</td>
<td>$\delta W$</td>
<td></td>
<td>-</td>
<td>-</td>
<td>1.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viewing angle range within</td>
<td>$\theta_{21}, \theta_{22}$</td>
<td>50% of the maximum brightness</td>
<td>-</td>
<td>35</td>
<td>-</td>
<td>Deg.</td>
<td>[Note1]</td>
</tr>
<tr>
<td>defined brightness</td>
<td>$\theta_{11}$</td>
<td></td>
<td>-</td>
<td>25</td>
<td>-</td>
<td>Deg.</td>
<td>[Note1]</td>
</tr>
<tr>
<td></td>
<td>$\theta_{12}$</td>
<td></td>
<td>-</td>
<td>30</td>
<td>-</td>
<td>Deg.</td>
<td>[Note1]</td>
</tr>
</tbody>
</table>

[Note] The measurement shall be executed 30 minutes after lighting at rating. (condition: IL=6.0mA rms)

The optical characteristics shall be measured in a dark room or equivalent state with the method shown in Fig.3 below.

**Photodetector**

Viewing angle/Response time : BM-5A (TOPCON)

Contrast ratio/Luminance of white/Chromaticity : SR-3(TOPCON)

---

**Fig.3 Optical characteristics measurement method**
[Note1] Definitions of viewing angle range:

[Note2] Definition of contrast ratio:
The contrast ratio is defined as the following.

\[
\text{Contrast Ratio (CR)} = \frac{\text{Luminance (brightness) with all pixels white}}{\text{Luminance (brightness) with all pixels black}}
\]

[Note3] Definition of response time:
The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".

[Note4] This shall be measured at center of the screen.

[Note5] Definition of white uniformity:
White uniformity is defined as the following with five measurements (A〜E).

\[
\delta_w = \frac{\text{Maximum Luminance of five points (brightness)}}{\text{Minimum Luminance of five points (brightness)}}
\]
11. Display Quality

The display quality of the color TFT-LCD module shall be in compliance with the Incoming Inspection Standard.

12. Handling Precautions

a) Be sure to turn off the power supply when inserting or disconnecting the cable.

b) Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.

c) Since the front polarizer is easily damaged, pay attention not to scratch it.

   Blow away dust on the polarizer with antistatic \textbf{N} blow. It is undesirable to wipe off because a polarizer is sensitive. It is recommended to peel off softly using the adhesive tape when soil or finger oil is stuck to the polarizer. When unavoidable, wipe off carefully with a cloth for wiping lenses.

d) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.

e) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.

f) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface.

Handle with care.

g) Since CMOS LSI is used in this module, take care of static electricity and injure the human earth when handling. Observe all other precautionary requirements in handling components.

h) Since there is a circuit board in the module back, stress is not added at the time of a design assembly.

   Please make it like. If stress is added, there is a possibility that circuit parts may be damaged.

i) Protection film is attached to the module surface to prevent it from being scratched.

   Peel the film off slowly, just before the use, with strict attention to electrostatic charges.

   Blow off dust on the polarizer by using an ionized nitrogen.

j) The polarizer surface on the panel is treated with Anti-Glare for low reflection. In case of attaching protective board over the LCD, be careful about the optical interface fringe etc. which degrades display quality.

k) Do not expose the LCD panel to direct sunlight. Lightproof shade etc. should be attached when LCD panel is used under such environment.

l) Connect GND to 4 place of mounting holes to stabilize against EMI and external noise.

m) There are high voltage portions on the backlight and very dangerous. Careless touch may lead to electrical shock. When exchange lamps or service, turn off the power without fail.

n) When handling LCD modules and assembling them into cabinets, please avoid that long-term storage in the environment of oxidation or deoxidization gas and the use of such materials as reagent, solvent, adhesive, resin, etc. which generate these gasses, may cause corrosion and discoloration of the LCD modules.

o) Cold cathode fluorescent lamp in LCD panel contains a small amount of mercury, please follow local ordinances or regulations for disposal.

p) Be careful of a back light lead not to pull by force at the time of the wiring to an inverter, or line processing.

q) When install LCD modules in the cabinet, please tighten with “torque=0.294±0.02N•m(3.0±0.2kgf•cm)”.

Be sure to confirm it in the same condition as it is installed in your instrument.

r) Liquid crystal contained in the panel may leak if the LCD is broken. Rinse it as soon as possible if it gets inside your eye or mouth by mistake.

s) Notice : Never dismantle the module, because it will cause failure. Please don't remove the fixed tape, insulateing tape etc that was pasted on the original module. (except for protection film of the panel and the crepe tape(yellow tape) of fixing lamp cable temporarily.)

t) Be careful when using it for long time with fixed pattern display as it may cause afterimage.

   (Please use a screen saver etc., in order to avoid an afterimage.)

u) Adjusting volume have been set optimally before shipment, so do not change any adjusted value.

   If adjusted value is changed, the specification may not be satisfied.

v) If a minute particle enters in the module and adheres to an optical material, it may cause display non-uniformity issue, etc. Therefore, fine-pitch filters have to be installed to cooling and inhalation hole if you intend to install a fan.

w) The lamp used for this product is very sensitive to the temperature.

   Lumiance decreases rapidly when it is used for a long time or repeatedly under the environment of the low temperature or the module is being cooled. Please avoid the continuous or repeating use of it under such an environment. It may decrease up to 50% of the initial luminance in about one month under the low temperature environment. Please consult our company when it is used under the environment like the above mentioned.
13. Packing form

<table>
<thead>
<tr>
<th>Product country</th>
<th>JAPAN</th>
<th>CHINA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piling number of cartons</td>
<td>MAX. 5</td>
<td></td>
</tr>
<tr>
<td>Package quantity in one carton</td>
<td>10pcs</td>
<td></td>
</tr>
<tr>
<td>Carton size</td>
<td>395(W)×275(H)×350(D) mm</td>
<td></td>
</tr>
<tr>
<td>Total mass of one carton filled</td>
<td>8000g</td>
<td></td>
</tr>
<tr>
<td>with full modules</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Packing form is shown</td>
<td>Fig.4</td>
<td></td>
</tr>
</tbody>
</table>

14. Reliability test items

<table>
<thead>
<tr>
<th>No.</th>
<th>Test item</th>
<th>Conditions</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High temperature storage test</td>
<td>Ta = 70°C 240h</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Low temperature storage test</td>
<td>Ta = -30°C 240h</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>High temperature &amp; high humidity operation test</td>
<td>Ta = 40°C; 95%RH 240h (No condensation)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>High temperature operation test</td>
<td>Ta = 65°C 240h</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Low temperature operation test</td>
<td>Ta = -10°C 240h</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Vibration test (non-operating)</td>
<td>Frequency: 10～57Hz/Vibration width (one side):0.076mm 57～500Hz/Gravity:9.8m/s² Sweep time: 11 minutes Test period: 3 hours (1 hour for each direction of X,Y,Z)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Shock test (non-operating)</td>
<td>Max. gravity: 490m/s² Pulse width: 11ms, half sine wave Direction: ±X, ±Y, ±Z once for each direction.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>ESD test</td>
<td>Contact discharge (150pF 330Ω) non-operating = ±10kV, operating = ±8kV Atmospheric discharge (150pF 330Ω) non-operating = ±20kV, operating = ±15kV</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>EMI</td>
<td>Measurement in 10m site Display position on the screen = &quot;H&quot; (full-screen), GND to 4 place = un-connect, Vcc / Vsignal = typ.</td>
<td>VCCI (Class B)</td>
</tr>
</tbody>
</table>

[Result Evaluation Criteria]
Under the display quality test conditions with normal operation state, these shall be no change which may affect practical display function. (normal operation state: Temperature:15～35°C, Humidity:45～75%, Atmospheric pressure:86～106kpa)

15. Others

15-1 Lot No. Label:
15-2 Packing box Label:

\[
\begin{array}{|c|}
\hline
\text{Model number} \\
\hline
\text{Lot number (DATE)} \\
\hline
\text{Quantity of module} \\
\hline
\end{array}
\]

\[
\begin{array}{|c|}
\hline
\text{Barcode} \\
\hline
\text{Lot No. : (1T) 2008. 07. 23} \\
\hline
\text{Quantity (Q) : 10 pcs} \\
\hline
\end{array}
\]

Internal Use Only
R. C.

※R.C.（RoHS Compliance）means these parts have corresponded with the RoHS directive.

15-3 If any problem occurs in relation to the description of this specification, it shall be resolved through discussion with spirit of cooperation.

16. Storage conditions

<Environmental condition range of storage temperature and humidity>

<table>
<thead>
<tr>
<th>Temperature</th>
<th>0 to 40 degrees Celsius</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative humidity</td>
<td>95% and below</td>
</tr>
</tbody>
</table>

(Note) Please refer below as a mean value of the environmental conditions.

- **Summer time**
  - temperature: 20 to 35 degrees Celsius
  - humidity: 85% and below

- **Winter time**
  - temperature: 5 to 15 degrees Celsius
  - humidity: 85% and below

Please maintain within 240 hours of accumulated length of storage time, with conditions of 40 degrees Celsius and room humidity of 95%.

Direct sun light

Please keep the product in a dark room or cover the product to protect from direct sun light.

Atmospheric condition

Please refrain from keeping the product with possible corrosive gas or volatile flux.

Prevention of dew

* Please store the product carton either on a wooden pallet or a stand / rack to prevent dew.
* Do not place directly on the floor. In addition, to obtain moderate ventilation in between the pallet’s top and bottom surfaces, pile the cartons up in a single direction and in order.
* Please place the product cartons away from the storage wall.
* Please maintain the storage area with an appropriate ventilation. It is recommendable to furnish the storage area with equipments such as ventilation systems.
* Please maintain the ambient temperature within the range of natural environmental fluctuation.

Storage period

Within above mentioned conditions, maximum storage period should be one year.
Figure 1. OUTLINE DIMENSIONS (LQ121SIDG42)