TECHNICAL LITERATURE

FOR

TFT - LCD module

MODEL No. LQ084S3LG12

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DISPLAY DEVICE BUSINESS GROUP
SHARP CORPORATION
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<td>19</td>
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<tr>
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<td>20</td>
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1. Application

This technical literature applies to the color TFT-LCD module LQ084S3LG12.

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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, power supply circuit and a White-LED Backlight unit. Graphics and texts can be displayed on a 800 × RGB × 600 dots panel with about 16 million colors by using LVDS (Low Voltage Differential Signaling) and supplying +3.3V DC supply voltages for TFT-LCD panel driving and supply voltage for backlight.

The TFT-LCD panel used for this module is a low-reflection and higher-color-saturation type. Therefore, this module is also suitable for the multimedia use.

The maximum viewing angle is in the 6 o’clock direction. The 12 o’clock direction is difficult to reverse the grayscale.

The LED driver circuit and the PWM circuit to drive the backlight are built into the module.

3. Mechanical technical literatures

<table>
<thead>
<tr>
<th>Parameter</th>
<th>technical literatures</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display size</td>
<td>21 (8.4inch) Diagonal</td>
<td>cm</td>
</tr>
<tr>
<td>Active area</td>
<td>170.4 (H) × 127.8 (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>(1pixel=R+G+B dot)</td>
<td></td>
</tr>
<tr>
<td>Aspect ratio</td>
<td>4:3</td>
<td></td>
</tr>
<tr>
<td>Pixel pitch</td>
<td>0.213 (H) × 0.213 (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</td>
<td>200.0 (W) × 152.0 (H) × 11.6 (D)</td>
<td>mm</td>
</tr>
<tr>
<td>Mass</td>
<td>TBD (Max.)</td>
<td>g</td>
</tr>
<tr>
<td>Surface treatment</td>
<td>Anti-glare and hard-coating 2H</td>
<td></td>
</tr>
</tbody>
</table>

*1 Note: excluding back light connector.

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

4-1. TFT-LCD panel driving

CN1 (Interface signals and +3.3V power supply)

Corresponding connectors: FI-SE20M or FI-S20S(conector) (JAE)

(※) Please do not use it besides corresponding connector

<table>
<thead>
<tr>
<th>Pin</th>
<th>Symbol</th>
<th>Function</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RxIN3+</td>
<td>LVDS receiver signal CH3 (+)</td>
<td>[*4-1,4-5]</td>
</tr>
<tr>
<td>2</td>
<td>RxIN3−</td>
<td>LVDS receiver signal CH3 (−)</td>
<td>[*4-1,4-5]</td>
</tr>
<tr>
<td>3</td>
<td>REV</td>
<td>Horizontal/Vertical display mode select signal</td>
<td>[*4-3]</td>
</tr>
<tr>
<td>4</td>
<td>8/6Bit</td>
<td>8Bit/6Bit select terminal</td>
<td>[*4-4]</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>GND</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>CK IN+</td>
<td>LVDS receiver signal CK (+)</td>
<td>[*4-1]</td>
</tr>
<tr>
<td>7</td>
<td>CK IN−</td>
<td>LVDS receiver signal CK (−)</td>
<td>[*4-1]</td>
</tr>
<tr>
<td>8</td>
<td>GND</td>
<td>GND</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>RxIN2+</td>
<td>LVDS receiver signal CH2 (+)</td>
<td>[*4-1]</td>
</tr>
<tr>
<td>10</td>
<td>RxIN2−</td>
<td>LVDS receiver signal CH2 (−)</td>
<td>[*4-1]</td>
</tr>
<tr>
<td>11</td>
<td>GND</td>
<td>GND</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>RxIN1+</td>
<td>LVDS receiver signal CH1 (+)</td>
<td>[*4-1]</td>
</tr>
<tr>
<td>13</td>
<td>RxIN1−</td>
<td>LVDS receiver signal CH1 (−)</td>
<td>[*4-1]</td>
</tr>
<tr>
<td>14</td>
<td>GND</td>
<td>GND</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>RxIN0+</td>
<td>LVDS receiver signal CH0 (+)</td>
<td>[*4-1]</td>
</tr>
<tr>
<td>16</td>
<td>RxIN0−</td>
<td>LVDS receiver signal CH0 (−)</td>
<td>[*4-1]</td>
</tr>
<tr>
<td>17</td>
<td>GND</td>
<td>GND</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>LVDS_SET</td>
<td>LVDS_SET</td>
<td>[*4-6]</td>
</tr>
<tr>
<td>19</td>
<td>VCC</td>
<td>+3.3V Power supply</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>VCC</td>
<td>+3.3V Power supply</td>
<td></td>
</tr>
</tbody>
</table>

[*4-1] Please refer to 4-2 and 7-2 for correspondence of RxINi (i=0,1,2,3) and actual display-data.

[*4-2] The shielding case is connected with GND-line in the module.

[*4-3] REV = LOW or OPEN        REV = HIGH

<table>
<thead>
<tr>
<th>REV = LOW or OPEN</th>
<th>REV = HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>“L” or Open</td>
<td>6Bit input mode</td>
</tr>
</tbody>
</table>

[*4-5] When use 6Bit input mode, please connects RxIN3+/− and GND-line.
## 4-2. Data Mapping

pin assignment ex) (THC63LVDM83R/D (Thine electronics) or Compatible product)

<table>
<thead>
<tr>
<th>Transmitter</th>
<th>8/6Bit=H</th>
<th>8/6Bit=L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin No</td>
<td>Data</td>
<td>LVDS_SET=L</td>
</tr>
<tr>
<td>51</td>
<td>TA0</td>
<td>R2</td>
</tr>
<tr>
<td>52</td>
<td>TA1</td>
<td>R3</td>
</tr>
<tr>
<td>54</td>
<td>TA2</td>
<td>R4</td>
</tr>
<tr>
<td>55</td>
<td>TA3</td>
<td>R5</td>
</tr>
<tr>
<td>56</td>
<td>TA4</td>
<td>R6</td>
</tr>
<tr>
<td>3</td>
<td>TA5</td>
<td>R7(MSB)</td>
</tr>
<tr>
<td>4</td>
<td>TA6</td>
<td>G2</td>
</tr>
<tr>
<td>6</td>
<td>TB0</td>
<td>G3</td>
</tr>
<tr>
<td>7</td>
<td>TB1</td>
<td>G4</td>
</tr>
<tr>
<td>11</td>
<td>TB2</td>
<td>G5</td>
</tr>
<tr>
<td>12</td>
<td>TB3</td>
<td>G6</td>
</tr>
<tr>
<td>14</td>
<td>TB4</td>
<td>G7 (MSB)</td>
</tr>
<tr>
<td>15</td>
<td>TB5</td>
<td>B2</td>
</tr>
<tr>
<td>19</td>
<td>TB6</td>
<td>B3</td>
</tr>
<tr>
<td>20</td>
<td>TC0</td>
<td>B4</td>
</tr>
<tr>
<td>22</td>
<td>TC1</td>
<td>B5</td>
</tr>
<tr>
<td>23</td>
<td>TC2</td>
<td>B6</td>
</tr>
<tr>
<td>24</td>
<td>TC3</td>
<td>B7 (MSB)</td>
</tr>
<tr>
<td>27</td>
<td>TC4</td>
<td>(NA)</td>
</tr>
<tr>
<td>28</td>
<td>TC5</td>
<td>(NA)</td>
</tr>
<tr>
<td>30</td>
<td>TC6</td>
<td>DE</td>
</tr>
<tr>
<td>50</td>
<td>TD0</td>
<td>R0(LSB)</td>
</tr>
<tr>
<td>2</td>
<td>TD1</td>
<td>R1</td>
</tr>
<tr>
<td>8</td>
<td>TD2</td>
<td>G0(LSB)</td>
</tr>
<tr>
<td>10</td>
<td>TD3</td>
<td>G1</td>
</tr>
<tr>
<td>16</td>
<td>TD4</td>
<td>B0(LSB)</td>
</tr>
<tr>
<td>18</td>
<td>TD5</td>
<td>B1</td>
</tr>
<tr>
<td>25</td>
<td>TD6</td>
<td>(NA)</td>
</tr>
</tbody>
</table>
4-3. Interface block diagram

Using LVDS receiver: Building into control IC (THC63LVDF84B (Thine electronics) or Compatible product)

Corresponding LVDS transmitter: THC63LVDM83R/D (Thine electronics) or Compatible product

<8/6Bit=H, LVDS_SET=L>

RCLK+

RCLK-

RA+

RA-

RB+

RB-

RC+

RC-

DE: Display Enable
NA: Not Available

* When use 6Bit input mode, please connects RxlN3+/− and GND line.
When using 6Bit input mode, please connect RxIN3+/− and GND line.
<8/6Bit=L, LVDS_SET=L>

1 CYCLE

RCLK+

RCLK−

RA+

RA−

RB+

RB−

RC+

RC−

DE: Display Enable
NA: Not Available

* When use 6Bit input mode, please connects RxIN3+/− and GND−line.
4-4. LED backlight

LED backlight connector(CN2)

<table>
<thead>
<tr>
<th>Connector No.</th>
<th>Pin No.</th>
<th>symbol</th>
<th>function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VLED</td>
<td></td>
<td>+12V power supply</td>
</tr>
<tr>
<td>2</td>
<td>VLED</td>
<td></td>
<td>+12V power supply</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td></td>
<td>GND</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td></td>
<td>GND</td>
</tr>
<tr>
<td>5</td>
<td>BL_EN</td>
<td></td>
<td>Low:OFF,Hign:ON</td>
</tr>
<tr>
<td>6</td>
<td>BRTI</td>
<td></td>
<td>Luminance control(Note1)</td>
</tr>
<tr>
<td>7</td>
<td>BRTH</td>
<td></td>
<td>GND</td>
</tr>
<tr>
<td>8</td>
<td>NC</td>
<td></td>
<td>Keep this pin OPEN</td>
</tr>
</tbody>
</table>

(Note1)

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>Supply voltage</td>
<td>Vcc</td>
<td>Ta=25℃</td>
<td>0 ~ +4.0</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>VLED</td>
<td>Ta=25℃</td>
<td>0 ~ +15</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Input voltage</td>
<td>VIN</td>
<td>Ta=25℃</td>
<td>-0.3 ~ +Vcc+0.3</td>
<td>V</td>
<td>【*5-1】</td>
</tr>
<tr>
<td></td>
<td>BRTI</td>
<td>Ta=25℃</td>
<td>-0.3~+2.5</td>
<td>V</td>
<td>【*5-2】</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>Tstg</td>
<td>—</td>
<td>-30 ~ +80</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Tope</td>
<td>—</td>
<td>-30 ~ +80 (Panel surface (display area))</td>
<td>°C</td>
<td>【*5-3,5-4,5-6】</td>
</tr>
</tbody>
</table>

【*5-1】 RxINi−/+(i=0,1,2), CK IN−/+, REV, 8/6Bit.SET_LVDS
【*5-2】 BRTI
【*5-3】 Humidity:95%RH Max.(Ta≦40℃) Note static electricity. Maximum wet-bulb temperature at 39℃ or less. (Ta>40℃) No condensation.
【*5-4】 The operating temperature only guarantees operation of the circuit. For contrast, speed response, and other factors related to display quality, judgment is done using the ambient temperature Ta =+25℃.
【*5-5】 Use over the absolute maximum rating might affect reliability and might cause malfunction.
【*5-6】 There is a possibility of causing deterioration in the irregularity and others of the screen and the display fineness though the liquid crystal module doesn’t arrive at destruction when using it at 65～80℃.
### 6. Electrical Characteristics

#### 6-1. TFT-LCD panel driving

<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>$V_{CC}$</td>
<td>+3.0</td>
<td>+3.3</td>
<td>+3.6</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Current dissipation</td>
<td>$I_{CC}$</td>
<td>-</td>
<td>(300)</td>
<td>TBD</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>Permissible input ripple voltage</td>
<td>$V_{RP}$</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>mV</td>
<td>$V_{CC}=+3.3V$</td>
</tr>
<tr>
<td>Input voltage width for LVDS receiver</td>
<td>$V_1$</td>
<td>0</td>
<td>-</td>
<td>2.4</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Differential input Threshold voltage</td>
<td>High</td>
<td>$V_{TH}$</td>
<td>-</td>
<td>-</td>
<td>+100</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>$V_{TL}$</td>
<td>-100</td>
<td>-</td>
<td>-</td>
<td>mV</td>
</tr>
<tr>
<td>Input leak current (High)</td>
<td>$I_{OH1}$</td>
<td>-</td>
<td>-</td>
<td>±10</td>
<td>μA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$I_{OH2}$</td>
<td>-</td>
<td>-</td>
<td>±500</td>
<td>μA</td>
<td>$V_{CC}=+3.6V$</td>
</tr>
<tr>
<td>Input leak current (Low)</td>
<td>$I_{OL1}$</td>
<td>-</td>
<td>-</td>
<td>±10</td>
<td>μA</td>
<td>$V_{CC}=+3.6V$</td>
</tr>
<tr>
<td></td>
<td>$I_{OL2}$</td>
<td>-</td>
<td>-</td>
<td>±500</td>
<td>μA</td>
<td></td>
</tr>
<tr>
<td>Terminal resistor</td>
<td>$R_T$</td>
<td>-</td>
<td>100</td>
<td>-</td>
<td>Ω</td>
<td>Differential input</td>
</tr>
</tbody>
</table>

**[6-1]** VCM: LVDS common mode voltage

**[6-2]** REV, 8/6bit

**[6-3]** On-off conditions for supply voltage

---

![Backlight Timing Diagram](image)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Min.</th>
<th>Max.</th>
<th>Unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>t1</td>
<td>0</td>
<td>25</td>
<td>ms</td>
<td></td>
</tr>
<tr>
<td>t2</td>
<td>0</td>
<td>100</td>
<td>ms</td>
<td></td>
</tr>
<tr>
<td>t3</td>
<td>0</td>
<td>1</td>
<td>s</td>
<td></td>
</tr>
<tr>
<td>t4</td>
<td>0</td>
<td>400</td>
<td>ms</td>
<td></td>
</tr>
<tr>
<td>t5</td>
<td>200</td>
<td>-</td>
<td>ms</td>
<td></td>
</tr>
<tr>
<td>t6</td>
<td>180</td>
<td>-</td>
<td>ms</td>
<td>*1</td>
</tr>
<tr>
<td>t7</td>
<td>5</td>
<td>-</td>
<td>ms</td>
<td>*1</td>
</tr>
</tbody>
</table>

*1: As for the power sequence for backlight, it is recommended to apply above mentioned input timing. If the backlight is lit on and off at a timing other than shown above, displaying image may get disturbed. This is due to variation of output signal from timing generator when LVDS signal is changed from on to off or vice versa, but

**Note:** Please do not put the input signal into the state of the High impedance for power ON period, and do not input the abnormal signal.
Vcc-dip conditions

\[ V_{th} = 2.5V \]
\[ V_{min} = 3V \]

1) \( +2.5 \, V \leq Vcc < +3.0 \, V, \, t_d \leq 10 \, ms \)

Under above condition, the display image should return to an appropriate figure after Vcc voltage recovers.

2) \( Vcc < +2.5 \, V \)

Vcc-dip conditions should also follow the On-off conditions for supply voltage

【*6-4】 Current dissipation

Typical current situation : 16-gray-scale-bar pattern
\( (Vcc=+3.3V, \, gray-scale: \, GS(4n)) \)

However, assume \( n \) to be a natural number from 0 to 15, and refer to Chapter 8 for gray scale of RGB.

Maximum current situation : \( Vcc=+3.0V \)

6-2. LED backlight

<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>Supply voltage</td>
<td>( V_{LED} )</td>
<td>11.2</td>
<td>12.0</td>
<td>12.6</td>
<td>V</td>
<td>—</td>
</tr>
<tr>
<td>Current dissipation</td>
<td>( I_{LED} )</td>
<td>—</td>
<td>(375)</td>
<td>TBD</td>
<td>mA</td>
<td>( V_{LED}=12.0V )</td>
</tr>
<tr>
<td>BL_EN signal Low voltage</td>
<td>V BL_EN</td>
<td>—</td>
<td>—</td>
<td>0.4</td>
<td>V</td>
<td>( V_{LED}=12.0V )</td>
</tr>
<tr>
<td>BL_EN signal High voltage</td>
<td>V BL_EN</td>
<td>2.1</td>
<td>—</td>
<td>12</td>
<td>V</td>
<td>( V_{LED}=12.0V )</td>
</tr>
<tr>
<td>BRTI voltage</td>
<td>BRTI</td>
<td>—</td>
<td>—</td>
<td>70,000</td>
<td>Hz</td>
<td>—</td>
</tr>
<tr>
<td>Life time</td>
<td>h</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>hours</td>
<td>—</td>
</tr>
</tbody>
</table>

【*6-5】 Luminance becomes 50% of the original value under standard condition.
7. Timing characteristics of input signals

7-1. Timing characteristics

In case of using the long vertical period, the deterioration of display quality, flicker etc. may occur.

<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>35.0</td>
<td>40</td>
<td>42.0</td>
<td>MHz</td>
<td></td>
</tr>
<tr>
<td>Horizontal period</td>
<td>TH</td>
<td>832</td>
<td>1056</td>
<td>1395</td>
<td>clock</td>
<td></td>
</tr>
<tr>
<td>Horizontal period (High)</td>
<td>THd</td>
<td>20.8</td>
<td>26.4</td>
<td>39.9</td>
<td>μs</td>
<td></td>
</tr>
<tr>
<td>Vertical Frequency</td>
<td>TV</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>clock</td>
<td></td>
</tr>
<tr>
<td>Vertical period (High)</td>
<td>TVd</td>
<td>666</td>
<td>666</td>
<td>798</td>
<td>line</td>
<td></td>
</tr>
</tbody>
</table>

【*7-1】 In case of using the long vertical period, the deterioration of display quality, flicker etc. may occur.

7-2. Input Data Signals and Display Position on the screen

R (1,1) G (1,1) B (1,1) R (2,1) G (2,1) B (2,1)
### 8. Input Signals, Basic Display Colors and Gray Scale of Each Color

#### 8-1. 8 bit input

<table>
<thead>
<tr>
<th>Basic Color</th>
<th>Data signal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Black</strong></td>
<td>R0 R1 R2 R3 R4 R5 R6 R7 G0 G1 G2 G3 G4 G5 G6 G7 B0 B1 B2 B3 B4 B5 B6 B7</td>
</tr>
<tr>
<td><strong>Blue</strong></td>
<td>R0 R1 R2 R3 R4 R5 R6 R7 G0 G1 G2 G3 G4 G5 G6 G7 B0 B1 B2 B3 B4 B5 B6 B7</td>
</tr>
<tr>
<td><strong>Green</strong></td>
<td>R0 R1 R2 R3 R4 R5 R6 R7 G0 G1 G2 G3 G4 G5 G6 G7 B0 B1 B2 B3 B4 B5 B6 B7</td>
</tr>
<tr>
<td><strong>Cyan</strong></td>
<td>R0 R1 R2 R3 R4 R5 R6 R7 G0 G1 G2 G3 G4 G5 G6 G7 B0 B1 B2 B3 B4 B5 B6 B7</td>
</tr>
<tr>
<td><strong>Red</strong></td>
<td>R0 R1 R2 R3 R4 R5 R6 R7 G0 G1 G2 G3 G4 G5 G6 G7 B0 B1 B2 B3 B4 B5 B6 B7</td>
</tr>
<tr>
<td><strong>Magenta</strong></td>
<td>R0 R1 R2 R3 R4 R5 R6 R7 G0 G1 G2 G3 G4 G5 G6 G7 B0 B1 B2 B3 B4 B5 B6 B7</td>
</tr>
<tr>
<td><strong>Yellow</strong></td>
<td>R0 R1 R2 R3 R4 R5 R6 R7 G0 G1 G2 G3 G4 G5 G6 G7 B0 B1 B2 B3 B4 B5 B6 B7</td>
</tr>
<tr>
<td><strong>White</strong></td>
<td>R0 R1 R2 R3 R4 R5 R6 R7 G0 G1 G2 G3 G4 G5 G6 G7 B0 B1 B2 B3 B4 B5 B6 B7</td>
</tr>
</tbody>
</table>

Each basic color can be displayed in 253 gray scales from 8 bit data signals. According to the combination of total 24 bit data signals, the 16-million-color display can be achieved on the screen.
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.
9. Optical Characteristics

Ta=+25℃, Vcc=+3.3V

<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>θ 21, θ 22</td>
<td>CR&gt;10</td>
<td>70</td>
<td>80</td>
<td>–</td>
<td>Deg.</td>
<td></td>
</tr>
<tr>
<td>Vertical</td>
<td>θ 11</td>
<td></td>
<td>45</td>
<td>80</td>
<td>–</td>
<td>Deg.</td>
<td>【*9-1,9-2,9-4】</td>
</tr>
<tr>
<td></td>
<td>θ 12</td>
<td></td>
<td>70</td>
<td>80</td>
<td>–</td>
<td>Deg.</td>
<td></td>
</tr>
<tr>
<td>Contrast ratio</td>
<td>CR</td>
<td>optimized</td>
<td>300</td>
<td>600</td>
<td>–</td>
<td>Deg.</td>
<td>【*9-2,9-4】</td>
</tr>
<tr>
<td>Response Time White Black</td>
<td>τr + τd</td>
<td></td>
<td>–</td>
<td>35</td>
<td>–</td>
<td>ms</td>
<td>【*9-3,9-4】</td>
</tr>
<tr>
<td>Chromaticity of White</td>
<td>Wx</td>
<td>θ =0°</td>
<td>–</td>
<td>TBD</td>
<td>–</td>
<td></td>
<td>【*9-4】</td>
</tr>
<tr>
<td></td>
<td>Wy</td>
<td></td>
<td>–</td>
<td>TBD</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Luminance of white</td>
<td>YL1</td>
<td></td>
<td>–</td>
<td>400</td>
<td>–</td>
<td>cd/m²</td>
<td>【*9-4】</td>
</tr>
<tr>
<td>White Uniformity</td>
<td>δw</td>
<td></td>
<td>–</td>
<td>–</td>
<td>1.33</td>
<td></td>
<td>【*9-5】</td>
</tr>
</tbody>
</table>

※The measurement shall be executed 30 minutes after lighting at rating.

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

Fig.3 Optical characteristics measurement method
**9-2** Definition of contrast ratio:

The contrast ratio is defined as the following.

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

**9-3** 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”.

\[
\theta_1 \quad \theta_2 \quad \theta_2
\]

**9-4** This shall be measured at the center of the screen.

**9-5** Definition of white uniformity:

White uniformity is defined as the following with five measurements. (①～⑤)

\[
\delta_w = \frac{\text{Maximum luminance of 5 points (①～⑤)}}{\text{Minimum luminance of 5 points (①～⑤)}}
\]

10. Display quality

The display quality of the color TFT-LCD module shall be in compliance with the Incoming Inspection Standard.
11. 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.
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 flame of module to stabilize against EMI and external noise.
m) If stored at the temperatures lower than the rated storage temperature, the LC may freeze and it may cause LCD panel damage. If storage temperature exceeds the specified rating, the molecular orientation of the LC may change to that of a liquid, and they may not revert to their original state. Store the module in normal room temperature.

n) When handling LCD modules and assembling them into cabinets, please avoid that long-terms 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 modules. Do not use the LCD module under such environment.
o) Be careful of a back light FPC not to pull by force at the time of the connecting to a W-LED driver, or FPC processing.
p) When install LCD modules in the cabinet, please tighten with \( "\text{torque}=0.294\pm0.02\text{N} \cdot \text{m}(3.0\pm0.2\text{kgf} \cdot \text{cm})" \). Be sure to confirm it in the same condition as it is installed in your instrument.
q) 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.
r) Notice: Never take to pieces the module, because it will cause failure. Please don't remove the fixed tape, insulating tape etc. that was pasted on the original module. (except for protection film of the panel)
s) Be careful when using it for long time with fixed pattern display as it may cause accidental image. (Please use a screen saver etc., in order to avoid an afterimage.)
t) Adjusting volume have been set optimally before shipment, so do not change any adjusted value.

u) 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.
v) An abnormal display by changing in quality of the polarizing plate might occur regardless of contact or no contact to the polarizing plate, because of epoxy resin (amine system curing agent) that comes out from the material and the packaging material used for the set side, the silicon adhesive (dealcoholization system and oxime system), and the tray blowing agents (azo–compound), etc. Please confirm adaptability with your employed material.
12. Packing form

a) Piling number of cartons : MAX. TBD
b) Package quantity in one carton: TBDpcs
c) Carton size(TYP): TBDmm(W) × TBDmm(D) × TBDmm(H)
d) Total mass of one carton filled with full modules(TBDpcs) TBDkg
e) Packing form are shown in Fig -.

13. Reliability test items

<table>
<thead>
<tr>
<th>No.</th>
<th>Test item</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High temperature storage test</td>
<td>Ambient temperature +80℃ 240H</td>
</tr>
<tr>
<td>2</td>
<td>Low temperature strage test</td>
<td>Ambient temperature -30℃ 240H</td>
</tr>
<tr>
<td>3</td>
<td>High temperature &amp; high humidity operation test</td>
<td>Ambient temperature 40℃, Humidity 95% RH 240H (No condensation.)</td>
</tr>
<tr>
<td>4</td>
<td>High temperature operation test</td>
<td>Panel surface 80℃ 240H</td>
</tr>
<tr>
<td>5</td>
<td>Low temperature operation test</td>
<td>Ambient temperature -30℃ 240H</td>
</tr>
</tbody>
</table>
| 6   | Vibration test                     | <Sin wave>
                      | Frequency :10～57Hz/Vibration width (one side) : 0.075mm
                      | 57～500Hz/Gravity:9.8m/s²
                      | Sweep time:11minutes |
| 7   | Shock test                         | Max. gravity:490m/s² Pulse width:11ms
                      | Direction:±X,±Y,±Z Test period :1time/1direction |
| 8   | ESD test                           | Contact discharge (150pF 330Ω)
                      | non-operating = ±10kV, operating = ±8kV
                      | Atmospheric discharge (150pF 330Ω)
                      | non-operating = ±20kV, operating = ±15kV |

[*] 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℃, Humidity:45〜75%, Atmospheric pressure:86〜106kpa)
14. Others

14-1. Lot No. Label:

TBD

14-2. Packing box Label:

The label that displays ① Model number (LQ084S3LG12) ② Lot number ③ Quantity of module is stuck on the packing box. Moreover, the display of bar code also applies to this.

A right picture is written to the packing box of module for the RoHS restriction.
※ R.C. (RoHs Compliance) means these parts have corresponded with the RoHs directive.
This module corresponds from the first sample to RoHS Directive.

14-3. The ozone-depleting substances is not used.

through discussion with spirit of cooperation.
15. Storage conditions

Environmental condition range of storage temperature and humidity

Temperature 0 to 40 degrees Celsius
Relative humidity 95% and below

[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.

Storage period
Within above mentioned conditions, maximum storage period should be one year.