Specification

7.6cm (3.0") transflective TFT

L5S30878

Version June 2009

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<th>Date</th>
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## REVISION HISTORY

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<td>⋯⋯p31</td>
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<td>⋯⋯p11</td>
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QA STD Number: QSME01E
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OUTWARD DRAWINGS (P065982-11-00) ................................................. Attached sheet
## 1. BASIC SPECIFICATIONS

### 1.1 STRUCTURES

<table>
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<th>PARAMETER</th>
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<td>TFT LCD</td>
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<tr>
<td>2</td>
<td>Outward</td>
<td>45.15(W) x 76.6(H) x 2.62(D)mm (excluding part of protruding) *1)</td>
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<tr>
<td>3</td>
<td>Weight</td>
<td>Approx. 17 g (excluding protective film)</td>
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<tr>
<td>4</td>
<td>Screen Size</td>
<td>39.24(W) x 65.4(H)mm</td>
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<tr>
<td>5</td>
<td>Number of Dots</td>
<td>720(240 x RGB)(W) x 400(H)</td>
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<tr>
<td>6</td>
<td>Dot Pitch</td>
<td>0.0545(W) x 0.1635(H)mm</td>
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<tr>
<td>7</td>
<td>Color Layout</td>
<td>Stripe</td>
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<td>8</td>
<td>Viewing Direction</td>
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<td>9</td>
<td>LCD Optical Mode</td>
<td>Transflective with High-Reflectance display, ECB mode</td>
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<td>10</td>
<td>Polarizer Type</td>
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<td>Number of Colors</td>
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*1) See attached drawing for details
1.2 BLOCK DIAGRAM

Back Light Unit

240 Pixels

240 x 3 (RGB) = 720 dots

Driver IC

400 Pixels
### 1.3 I/O PINS

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<thead>
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<th>PIN</th>
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<th>REMARKS</th>
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<td></td>
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<td>LED anode2</td>
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<td>Ground</td>
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<td>7</td>
<td>D0</td>
<td>(RGB-IF) Data</td>
<td>I</td>
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<td>“L” active</td>
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<td>26</td>
<td>ENABLE</td>
<td>(RGB-IF) Display Data enable</td>
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<td>27</td>
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<td></td>
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<td>31</td>
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<td>(RGB-IF) Vertical synchronous signal</td>
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<td>-</td>
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<td>34</td>
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<td>Chip select signal</td>
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<td>“H” SDI = Hi-z</td>
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<td>35</td>
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<td>(MPU-Serial-IF) Serial clock</td>
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<td>Rising edge operation</td>
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<td>VDD</td>
<td>Power supply for system</td>
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<td>VDD</td>
<td>Power supply for system</td>
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<td>Not connect</td>
<td>-</td>
<td>Open</td>
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<td>Not connect</td>
<td>-</td>
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<td>45</td>
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<td>-</td>
<td>Open</td>
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P : power supply  I : Input
2. FUNCTIONS

2.1 OVERVIEW

This LCD module is equipped with two kind of Interface used for transferring of command data and pixel data.

1) MPU Serial Interface
   Serial bus with MPU control for transferring commands

2) RGB interface
   RGB data (R: 6bit, G: 6bit, B: 6bit) and HSYNC, VSYNC, PCLK, ENABLE for transferring display-contents

ID[7:0] and IB[7:0:] are joined and defined as "Command" in this document.
See 2.2.1 Command List for details.

2.1.1 MPU Serial Interface

MPU serial interface is performed by three signal lines.

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<th>XCS</th>
<th>Chip select signal</th>
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<tr>
<td>SCL</td>
<td>Serial transfer clock signal</td>
</tr>
<tr>
<td>SDI</td>
<td>Serial input data signal (latched by rising edge of SCL)</td>
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![Diagram of MPU Serial Interface]

D/CX

<table>
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<tr>
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<tbody>
<tr>
<td>1</td>
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2.1.2. RGB Interface

The display data is input synchronizing with HSYNC, VSYNC, ENABLE and PCLK.

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<tr>
<td>VS</td>
<td>Vertical Sync Time (VSYNC=L)</td>
</tr>
<tr>
<td>VBP</td>
<td>Vertical Back Porch</td>
</tr>
<tr>
<td>VDISP</td>
<td>Vertical Display Active Time</td>
</tr>
<tr>
<td>VFP</td>
<td>Vertical Front Porch</td>
</tr>
<tr>
<td>HS</td>
<td>Horizontal Sync Time (HSYNC=L)</td>
</tr>
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<td>Horizontal Back Porch</td>
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<td>HFP</td>
<td>Horizontal Front Porch</td>
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### 2.1.3. Display Format

18bit RGB interface

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<th>240</th>
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<td>3R4</td>
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### 2.2 COMMANDS

#### 2.2.1 Command List

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<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>No</td>
</tr>
<tr>
<td>5</td>
<td>DISON</td>
<td></td>
<td>29h</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>No</td>
</tr>
<tr>
<td>6</td>
<td>CASET</td>
<td></td>
<td>2Ah</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Yes (4Byte)</td>
</tr>
<tr>
<td>7</td>
<td>PASET</td>
<td></td>
<td>2Bh</td>
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<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>Yes (4Byte)</td>
</tr>
<tr>
<td>8</td>
<td>MADCTL</td>
<td></td>
<td>36h</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Yes (1Byte)</td>
</tr>
<tr>
<td>9</td>
<td>COLMOD</td>
<td></td>
<td>3Ah</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>Yes (1Byte)</td>
</tr>
<tr>
<td>10</td>
<td>ADCCTL</td>
<td></td>
<td>5Bh</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>Yes (1Byte)</td>
</tr>
<tr>
<td>11</td>
<td>SSLCTL</td>
<td></td>
<td>7Oh</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Yes (1Byte)</td>
</tr>
<tr>
<td>12</td>
<td>PWMENB</td>
<td></td>
<td>8Ah</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Yes (1Byte)</td>
</tr>
<tr>
<td>13</td>
<td>DISCTL</td>
<td></td>
<td>B0h</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Yes (20Byte)</td>
</tr>
<tr>
<td>14</td>
<td>PWRCCTL</td>
<td></td>
<td>B1h</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>Yes (19Byte)</td>
</tr>
<tr>
<td>15</td>
<td>RGBIF</td>
<td>Level2</td>
<td>B2h</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>Yes (6Byte)</td>
</tr>
<tr>
<td>16</td>
<td>MADDEF</td>
<td></td>
<td>B8h</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Yes (3Byte)</td>
</tr>
<tr>
<td>17</td>
<td>GAMMSET P0</td>
<td></td>
<td>C0h</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Yes (13Byte)</td>
</tr>
<tr>
<td>18</td>
<td>GAMMSET N0</td>
<td></td>
<td>C1h</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>Yes (13Byte)</td>
</tr>
<tr>
<td>19</td>
<td>AMPCTL</td>
<td></td>
<td>CCh</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Yes (1Byte)</td>
</tr>
<tr>
<td>20</td>
<td>DLS</td>
<td></td>
<td>CDh</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>Yes (1Byte)</td>
</tr>
<tr>
<td>21</td>
<td>RGBDN</td>
<td></td>
<td>CEh</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Yes (1Byte)</td>
</tr>
<tr>
<td>22</td>
<td>MTPCTL</td>
<td></td>
<td>D0h</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Yes (1Byte)</td>
</tr>
<tr>
<td>23</td>
<td>EXTCMMOD1</td>
<td></td>
<td>F0h</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Yes (1Byte)</td>
</tr>
<tr>
<td>24</td>
<td>EXTCMMOD2</td>
<td></td>
<td>F1h</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>Yes (1Byte)</td>
</tr>
</tbody>
</table>

The command which has a parameter must not enter a data more than necessity.
As for the necessary number of parameters, refer to above table.
2.2.2 Command Details

See 4.4 RECOMMENDED SEQUENCE to design a command sequence and intervals.

(1) SLPIN
This command is used to set TFTLCD module to the sleep state.
When in sleep state, the oscillating circuit and the power circuit are suspended.
After using this command, the power supply voltage (VDD, VDDI) must be maintained for more than 200ms.
This command should be entered after DISOFF.

<table>
<thead>
<tr>
<th>Hex</th>
<th>ID7</th>
<th>ID6</th>
<th>ID5</th>
<th>ID4</th>
<th>ID3</th>
<th>ID2</th>
<th>ID1</th>
<th>ID0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>10h</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

The default setting is SLPIN state.

(2) SLPOUT
This command is used to set TFTLCD module to quit the sleep state.
By entering this command, the oscillating circuit and the power circuit start to operation.
Output voltages of the power circuit are stabilized after 200ms or less from this command.

<table>
<thead>
<tr>
<th>Hex</th>
<th>ID7</th>
<th>ID6</th>
<th>ID5</th>
<th>ID4</th>
<th>ID3</th>
<th>ID2</th>
<th>ID1</th>
<th>ID0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>11h</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

The default setting is SLPIN state.

(3) GAMSET
This command is used to setting Gamma curve.

<table>
<thead>
<tr>
<th>Hex</th>
<th>ID7</th>
<th>ID6</th>
<th>ID5</th>
<th>ID4</th>
<th>ID3</th>
<th>ID2</th>
<th>ID1</th>
<th>ID0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>26h</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hex</th>
<th>IP7</th>
<th>IP6</th>
<th>IP5</th>
<th>IP4</th>
<th>IP3</th>
<th>IP2</th>
<th>IP1</th>
<th>IP0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>01h</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Be sure to use the value specified on this table.
(4) DISOFF
This command is used to forcibly control the display to OFF state.

<command>

<table>
<thead>
<tr>
<th>Hex</th>
<th>ID7</th>
<th>ID6</th>
<th>ID5</th>
<th>ID4</th>
<th>ID3</th>
<th>ID2</th>
<th>ID1</th>
<th>ID0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>28h</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

The default setting is DISOFF state.

(5) DISON
This command is used to control the display to the operative state. This command should be entered after SLPOUT.

<command>

<table>
<thead>
<tr>
<th>Hex</th>
<th>ID7</th>
<th>ID6</th>
<th>ID5</th>
<th>ID4</th>
<th>ID3</th>
<th>ID2</th>
<th>ID1</th>
<th>ID0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>29h</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

The default setting is DISOFF state.

(6) CASET
CASET and the subsequent parameters are used to set the column address limits of RAM. When column address is incremented to the end column, the column address returns to the start column and the page address is incremented. After page address is incremented to the end page, the page address returns to the start page. The start column value must be less than the end column value.

<command>

<table>
<thead>
<tr>
<th>Hex</th>
<th>ID7</th>
<th>ID6</th>
<th>ID5</th>
<th>ID4</th>
<th>ID3</th>
<th>ID2</th>
<th>ID1</th>
<th>ID0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>2Ah</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

<parameter>

<table>
<thead>
<tr>
<th>Hex</th>
<th>IP7</th>
<th>IP6</th>
<th>IP5</th>
<th>IP4</th>
<th>IP3</th>
<th>IP2</th>
<th>IP1</th>
<th>IP0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>00h</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Start column -upper</td>
</tr>
<tr>
<td>P2</td>
<td>00h</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Start column -lower</td>
</tr>
<tr>
<td>P3</td>
<td>00h</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>End column -upper</td>
</tr>
<tr>
<td>P4</td>
<td>EFh</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>End column -lower</td>
</tr>
</tbody>
</table>

The default setting of Start column is 0000h, End column is 00EFh.
(7) PASET

PASET and the subsequent parameters are used to set the page address limits of display RAM. When column address is incremented to the end column, the column address returns to the start column and the page address is incremented. After page address is incremented to the end page, the page address returns to the start page. The start page value must be less than the end page value.

<command>

<table>
<thead>
<tr>
<th>Hex</th>
<th>ID7</th>
<th>ID6</th>
<th>ID5</th>
<th>ID4</th>
<th>ID3</th>
<th>ID2</th>
<th>ID1</th>
<th>ID0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>2Bh</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

<parameter>

<table>
<thead>
<tr>
<th>Hex</th>
<th>IP7</th>
<th>IP6</th>
<th>IP5</th>
<th>IP4</th>
<th>IP3</th>
<th>IP2</th>
<th>IP1</th>
<th>IP0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>00h</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Start page -upper</td>
</tr>
<tr>
<td>P2</td>
<td>00h</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Start page -lower</td>
</tr>
<tr>
<td>P3</td>
<td>01h</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>End page -upper</td>
</tr>
<tr>
<td>P4</td>
<td>8Fh</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>End page -lower</td>
</tr>
</tbody>
</table>

The default setting of Start page is 0000h, End page is 01AFh.
(8) MADCTL

This command and the subsequent parameter are used to set the accessing direction of VRAM. It represents the position of Driver IC.

<command>

<table>
<thead>
<tr>
<th>Hex</th>
<th>ID7</th>
<th>ID6</th>
<th>ID5</th>
<th>ID4</th>
<th>ID3</th>
<th>ID2</th>
<th>ID1</th>
<th>ID0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>36h</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

<parameter>

<table>
<thead>
<tr>
<th>Hex</th>
<th>IP7</th>
<th>IP6</th>
<th>IP5</th>
<th>IP4</th>
<th>IP3</th>
<th>IP2</th>
<th>IP1</th>
<th>IP0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>-</td>
<td>P17</td>
<td>P16</td>
<td>0</td>
<td>P14</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Be sure to use the value specified on this table for IP5, IP3, IP2, IP1 and IP0 of P1.

<Settings for Each Position of the Driver IC>

<table>
<thead>
<tr>
<th></th>
<th>P17</th>
<th>P16</th>
<th>P14</th>
<th>CASET parameters</th>
<th>PASET parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Driver IC on</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>P1P2=0000h</td>
<td>P1P2=0000h</td>
</tr>
<tr>
<td>the Bottom</td>
<td></td>
<td></td>
<td></td>
<td>P3P4=00EFh</td>
<td>P3P4=018Fh</td>
</tr>
<tr>
<td>2. Driver IC on</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>the Top</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Specified parameters of MADCTL are at the case of MADDEF:P1 = 00h.
Specified parameters of CASET and PASET are at the case of all area display.

At the case of MADDEF:P1=00h

- → LCD Gate scanning direction
- → RAM writing direction by interface
- → RAM reading direction by LCD
(9) COLMOD
This command and the subsequent parameter are used to set the color mode.

<command>

<table>
<thead>
<tr>
<th>Hex</th>
<th>ID7</th>
<th>ID6</th>
<th>ID5</th>
<th>ID4</th>
<th>ID3</th>
<th>ID2</th>
<th>ID1</th>
<th>ID0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>3Ah</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

<parameter>

<table>
<thead>
<tr>
<th>Hex</th>
<th>IP7</th>
<th>IP6</th>
<th>IP5</th>
<th>IP4</th>
<th>IP3</th>
<th>IP2</th>
<th>IP1</th>
<th>IP0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>06h</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>color mode setting</td>
</tr>
</tbody>
</table>

Be sure to use the value specified on this table.

(10) ADCCTL
This command and the subsequent parameters are stopped the test signal.

<command>

<table>
<thead>
<tr>
<th>Hex</th>
<th>ID7</th>
<th>ID6</th>
<th>ID5</th>
<th>ID4</th>
<th>ID3</th>
<th>ID2</th>
<th>ID1</th>
<th>ID0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>5Bh</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

<parameter>

<table>
<thead>
<tr>
<th>Hex</th>
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<th>IP6</th>
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Be sure to use the value specified on this table.
(11) SSLCTL
This command and the subsequent parameters are stopped the test signal.

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Be sure to use the value specified on this table.

(12) PWMENB
This command and the subsequent parameters are stopped the test signal.

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Be sure to use the value specified on this table.
This command and the subsequent parameters are used to set timings for display. These command and parameters should be entered before SLPOUT.

### Command Table

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### Parameter Table

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(14) PWRCTL

This command and the subsequent parameters are used to set output voltages for display. These command and parameters should be entered before SLPOUT.

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(15) RGBIF

This command and the subsequent parameters are used to set RGB timing setting. These command and parameters should be entered before SLPOUT.

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Be sure to use the value specified on this table.

(16) MADDEF

This command and the subsequent parameters are used to define the pre-calculation of MADCTL parameter and setting of sync signal polarity.

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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Sync signal polarity</td>
</tr>
</tbody>
</table>

Be sure to use the value specified on this table.
(17) GAMMSET P0

This command and the subsequent parameters are used to set timings for display. These command and parameters should be entered before SLPOUT.

<command>

<table>
<thead>
<tr>
<th>Hex</th>
<th>ID7</th>
<th>ID6</th>
<th>ID5</th>
<th>ID4</th>
<th>ID3</th>
<th>ID2</th>
<th>ID1</th>
<th>ID0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>C0h</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Gamma Curve0 Positive Set</td>
</tr>
</tbody>
</table>

<parameter>

<table>
<thead>
<tr>
<th>Hex</th>
<th>IP7</th>
<th>IP6</th>
<th>IP5</th>
<th>IP4</th>
<th>IP3</th>
<th>IP2</th>
<th>IP1</th>
<th>IP0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>00h</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>P2</td>
<td>00h</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>P3</td>
<td>05h</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>P4</td>
<td>0Eh</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>P5</td>
<td>19h</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>P6</td>
<td>24h</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>P7</td>
<td>2Dh</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>P8</td>
<td>3Ah</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>P9</td>
<td>41h</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>P10</td>
<td>41h</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>P11</td>
<td>44h</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>P12</td>
<td>4Bh</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>P13</td>
<td>33h</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
(18) GAMMSET NO

This command and the subsequent parameters are used to set timings for display. These command and parameters should be entered before SLPOUT.

<command>

<table>
<thead>
<tr>
<th>Hex</th>
<th>ID7</th>
<th>ID6</th>
<th>ID5</th>
<th>ID4</th>
<th>ID3</th>
<th>ID2</th>
<th>ID1</th>
<th>ID0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1h</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>Gamma Curve0 Negative Set</td>
</tr>
</tbody>
</table>

<parameter>

<table>
<thead>
<tr>
<th>Hex</th>
<th>IP7</th>
<th>IP6</th>
<th>IP5</th>
<th>IP4</th>
<th>IP3</th>
<th>IP2</th>
<th>IP1</th>
<th>IP0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>03h</td>
<td>00h</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Gamma Curve0 Negative Set</td>
</tr>
<tr>
<td>P2</td>
<td>03h</td>
<td>00h</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Gamma Curve0 Negative Set</td>
</tr>
<tr>
<td>P3</td>
<td>00h</td>
<td>05h</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Gamma Curve0 Negative Set</td>
</tr>
<tr>
<td>P4</td>
<td>00h</td>
<td>00h</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>Gamma Curve0 Negative Set</td>
</tr>
<tr>
<td>P5</td>
<td>18h</td>
<td>19h</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Gamma Curve0 Negative Set</td>
</tr>
<tr>
<td>P6</td>
<td>2Ah</td>
<td>19h</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Gamma Curve0 Negative Set</td>
</tr>
<tr>
<td>P7</td>
<td>33h</td>
<td>2Dh</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Gamma Curve0 Negative Set</td>
</tr>
<tr>
<td>P8</td>
<td>42h</td>
<td>3Ah</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Gamma Curve0 Negative Set</td>
</tr>
<tr>
<td>P9</td>
<td>4Ah</td>
<td>41h</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Gamma Curve0 Negative Set</td>
</tr>
<tr>
<td>P10</td>
<td>48h</td>
<td>4Ah</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Gamma Curve0 Negative Set</td>
</tr>
<tr>
<td>P11</td>
<td>48h</td>
<td>4Ah</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Gamma Curve0 Negative Set</td>
</tr>
<tr>
<td>P12</td>
<td>54h</td>
<td>48h</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Gamma Curve0 Negative Set</td>
</tr>
<tr>
<td>P13</td>
<td>3Ah</td>
<td>4Ah</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Gamma Curve0 Negative Set</td>
</tr>
</tbody>
</table>

(19) AMPCTL

This command and the subsequent parameter are used to set AMP of VCI1.

<command>

<table>
<thead>
<tr>
<th>Hex</th>
<th>ID7</th>
<th>ID6</th>
<th>ID5</th>
<th>ID4</th>
<th>ID3</th>
<th>ID2</th>
<th>ID1</th>
<th>ID0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCh</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>AMP of VCI1 setting</td>
</tr>
</tbody>
</table>

<parameter>

<table>
<thead>
<tr>
<th>Hex</th>
<th>IP7</th>
<th>IP6</th>
<th>IP5</th>
<th>IP4</th>
<th>IP3</th>
<th>IP2</th>
<th>IP1</th>
<th>IP0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>00h</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>AMP of VCI1 setting</td>
</tr>
</tbody>
</table>

Be sure to use the value specified on this table.
(20) DLS
This command and the subsequent parameter are used to set Source, VCOM and Gate level when display off.

<command>

<table>
<thead>
<tr>
<th>Hex</th>
<th>ID7</th>
<th>ID6</th>
<th>ID5</th>
<th>ID4</th>
<th>ID3</th>
<th>ID2</th>
<th>ID1</th>
<th>ID0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDh</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

<parameter>

<table>
<thead>
<tr>
<th>Hex</th>
<th>IP7</th>
<th>IP6</th>
<th>IP5</th>
<th>IP4</th>
<th>IP3</th>
<th>IP2</th>
<th>IP1</th>
<th>IP0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>P11 P10</td>
<td></td>
</tr>
</tbody>
</table>

< Settings for each position of Driver IC >

<table>
<thead>
<tr>
<th>P11</th>
<th>P10</th>
<th>Source</th>
<th>VCOM</th>
<th>Gate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>GND</td>
<td>level</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>Undefined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>OFF</td>
<td>level</td>
<td>Operation</td>
</tr>
</tbody>
</table>

(21) RGBDN
This command and the subsequent parameter are used to set disable VSYNC, HSYNC, ENABLE and PCLK when SLEEP IN state.

<command>

<table>
<thead>
<tr>
<th>Hex</th>
<th>ID7</th>
<th>ID6</th>
<th>ID5</th>
<th>ID4</th>
<th>ID3</th>
<th>ID2</th>
<th>ID1</th>
<th>ID0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEh</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

<parameter>

<table>
<thead>
<tr>
<th>Hex</th>
<th>IP7</th>
<th>IP6</th>
<th>IP5</th>
<th>IP4</th>
<th>IP3</th>
<th>IP2</th>
<th>IP1</th>
<th>IP0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>P10</td>
<td>VSYSNC, HSYNC, ENABLE and PCLK disable setting</td>
</tr>
</tbody>
</table>

< Settings for each position of Driver IC >

<table>
<thead>
<tr>
<th>P10</th>
<th>Disable or enable setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>VSYSNC, HSYNC, ENABLE and PCLK disable</td>
</tr>
<tr>
<td>1</td>
<td>VSYSNC, HSYNC, ENABLE and PCLK enable</td>
</tr>
</tbody>
</table>
(22) MTPCTL

This command and the subsequent parameter are used to MTP control.

<command>

<table>
<thead>
<tr>
<th>Hex</th>
<th>ID7</th>
<th>ID6</th>
<th>ID5</th>
<th>ID4</th>
<th>ID3</th>
<th>ID2</th>
<th>ID1</th>
<th>ID0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>D0h</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

<parameter>

<table>
<thead>
<tr>
<th>Hex</th>
<th>IP7</th>
<th>IP6</th>
<th>IP5</th>
<th>IP4</th>
<th>IP3</th>
<th>IP2</th>
<th>IP1</th>
<th>IP0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>02h</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>MTP control</td>
</tr>
</tbody>
</table>

Be sure to use the value specified on this table.

(23) EXTCMMOD1

EXTCMMOD1 and EXTCMMOD2 commands and the subsequent parameters are the commands to access level 2 command.

<command>

<table>
<thead>
<tr>
<th>Hex</th>
<th>ID7</th>
<th>ID6</th>
<th>ID5</th>
<th>ID4</th>
<th>ID3</th>
<th>ID2</th>
<th>ID1</th>
<th>ID0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>F0h</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

<parameter>

<table>
<thead>
<tr>
<th>Hex</th>
<th>IP7</th>
<th>IP6</th>
<th>IP5</th>
<th>IP4</th>
<th>IP3</th>
<th>IP2</th>
<th>IP1</th>
<th>IP0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>5Ah</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Be sure to use the value specified on this table.

(24) EXTCMMOD2

EXTCMMOD1 and EXTCMMOD2 commands and the subsequent parameters are the commands to access level 2 command.

<command>

<table>
<thead>
<tr>
<th>Hex</th>
<th>ID7</th>
<th>ID6</th>
<th>ID5</th>
<th>ID4</th>
<th>ID3</th>
<th>ID2</th>
<th>ID1</th>
<th>ID0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1h</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

<parameter>

<table>
<thead>
<tr>
<th>Hex</th>
<th>IP7</th>
<th>IP6</th>
<th>IP5</th>
<th>IP4</th>
<th>IP3</th>
<th>IP2</th>
<th>IP1</th>
<th>IP0</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>5Ah</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Be sure to use the value specified on this table.
3. ABSOLUTE MAXIMUM RATINGS

3.1 ABSOLUTE MAXIMUM RATING

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>RATINGS</th>
<th>UNIT</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply Voltage</td>
<td>VDD</td>
<td>0.0 ~ 4.6 V</td>
<td>V</td>
<td>*1)</td>
</tr>
<tr>
<td></td>
<td>VDDI</td>
<td>0.0 ~ 4.6 V</td>
<td>V</td>
<td>*1)</td>
</tr>
<tr>
<td>Input Voltage</td>
<td>VIN</td>
<td>0.0 ~ VDDI + 0.3 V</td>
<td>V</td>
<td>*1)</td>
</tr>
<tr>
<td>Storage Temperature Range (Ambient Temperature)</td>
<td>TST</td>
<td>-20 ~ 70 °C</td>
<td>°C</td>
<td>no dew condition</td>
</tr>
<tr>
<td>Operating Temperature Range (Ambient Temperature)</td>
<td>TOP</td>
<td>-10 ~ 60 °C</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>LED Forward Current</td>
<td>IF</td>
<td>30 mA</td>
<td>mA</td>
<td>per chip at 25°C *2)</td>
</tr>
</tbody>
</table>

*1: On the other hand, For normal operations, it is desirable to use this module under the conditions according to 4. ELECTRICAL SPECIFICATIONS. If LCD modules uses beyond those conditions, malfunctioning of the module can occur and the reliability of the module may deteriorate.

*2: The rating of maximum LED forward current is decreased along the ambient temperature as the following scheme.

![Graph showing the maximum forward current in one LED chip in LED back vs. temperature.](image)

Stress beyond those listed under "ABSOLUTE MAXIMUM RATINGS" may cause permanent damage to the device.
4. ELECTRICAL SPECIFICATION

4.1 DC SPECIFICATIONS

4.1.1 DC Specifications of General Pins

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
<th>Pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply Voltage *1)</td>
<td>VDD</td>
<td></td>
<td>2.7</td>
<td>3.0</td>
<td>3.3 V</td>
</tr>
<tr>
<td></td>
<td>VDDI</td>
<td></td>
<td>2.7</td>
<td>3.0</td>
<td>3.3 V</td>
</tr>
<tr>
<td>Low-level input voltage</td>
<td>VIL</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>0.2 x VDDI V</td>
</tr>
<tr>
<td>High-level input voltage</td>
<td>VIH</td>
<td>0.8 x VDDI</td>
<td>-</td>
<td>VDDI</td>
<td>V</td>
</tr>
<tr>
<td>Input leak current</td>
<td>ILI</td>
<td></td>
<td>-</td>
<td>-</td>
<td>1.0 µA</td>
</tr>
<tr>
<td>Power supply current (RMS)</td>
<td>IDD</td>
<td></td>
<td>-</td>
<td>11.5</td>
<td>17.5 mA</td>
</tr>
<tr>
<td></td>
<td>IDDI</td>
<td></td>
<td>-</td>
<td>1.4</td>
<td>2.5 mA</td>
</tr>
</tbody>
</table>

*1: Rated values indicate operating range of electrical functions.
*2: Typ. values are at the condition of power supply voltage is Typ., the ambient temperature is 25°C, full screen color bar which was written according to the timing of "4.3 DISPLAY SIGNAL INPUT TIMING". Max. values are at the condition of power supply voltage is in a range of "DC specification", ambient temperature is in a range of operating temperature, full screen color bar which was written according to the timing of "4.3 DISPLAY SIGNAL INPUT TIMING".

< Color Bar Display >

4.1.2 DC Specifications of Back Light

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
<th>Pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>forward current / circuit</td>
<td>IF</td>
<td>Ta=25°C</td>
<td>-</td>
<td>20</td>
<td>- mA</td>
</tr>
<tr>
<td>forward voltage / circuit</td>
<td>VF</td>
<td>IF=20mA</td>
<td>-</td>
<td>9.6</td>
<td>10.5 V</td>
</tr>
</tbody>
</table>

* Epson Imaging Devices Corporation doesn’t specify these ratings.

LED forward voltage and current condition
### 4.2 AC SPECIFICATIONS

#### 4.2.1 Serial Interface Timing

<table>
<thead>
<tr>
<th>Signal</th>
<th>Symbol</th>
<th>Parameter</th>
<th>Min.</th>
<th>Max.</th>
<th>Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCL</td>
<td>tSCYCW</td>
<td>Serial Clock Cycle</td>
<td>200</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tSHW</td>
<td>SCL &quot;H&quot; Pulse Width</td>
<td>85</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tSLW</td>
<td>SCL &quot;L&quot; Pulse Width</td>
<td>85</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tSCC</td>
<td>SCL falling &lt;--&gt; XCS</td>
<td>35</td>
<td></td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>SDI</td>
<td>tSDS</td>
<td>Data Setup Time</td>
<td>70</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tSDH</td>
<td>Data Hold Time</td>
<td>70</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>XCS</td>
<td>tCHW</td>
<td>XCS &quot;H&quot; Pulse Width</td>
<td>100</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tCSS</td>
<td>XCS-SCL Time</td>
<td>100</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tCSH</td>
<td></td>
<td>120</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
</tbody>
</table>

Voltage of VDDI is in ranges of 4.1 DC SPECIFICATIONS, ambient temperature is in a range of operating temperature.

*: When both the rising time (tr) and the falling time (tf) of input signals are less than 15 ns.

*: Ratings are specified as intervals by the voltage of 20% and 80% of VDDI-GND.
4.2.2 Reset Timing

Voltage of VDDI is in ranges of 4.1. DC SPECIFICATIONS, ambient temperature is in a range of operating temperature.

*: Ratings are specified as intervals by at the voltage of 20% and 80% of VDDI-GND.

*: Follow it about regulations of 4.4. RECOMMENDED SEQUENCE about reset "L" pulse width when Start to supply system power.
4.2.3 RGB Interface Timing

<table>
<thead>
<tr>
<th>Signal</th>
<th>Symbol</th>
<th>Parameter</th>
<th>Min.</th>
<th>Max.</th>
<th>Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSYNC</td>
<td>tDSYN</td>
<td>SYNC setup time</td>
<td>40</td>
<td></td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>HSYNC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENABLE</td>
<td>tDCSS</td>
<td>ENABLE setup time</td>
<td>45</td>
<td></td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tDCSH</td>
<td>ENABLE hold time</td>
<td>45</td>
<td></td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>PCLK</td>
<td>tDCYC</td>
<td>Pixel clock cycle</td>
<td>120</td>
<td></td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tDLW</td>
<td>Pixel clock low time</td>
<td>45</td>
<td></td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tDHW</td>
<td>Pixel clock High time</td>
<td>45</td>
<td></td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>D[17:0]</td>
<td>tDDS</td>
<td>Data setup time</td>
<td>45</td>
<td></td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tDDH</td>
<td>Data hold time</td>
<td>45</td>
<td></td>
<td>ns</td>
<td></td>
</tr>
</tbody>
</table>

Voltage of VDDI is in ranges of 4.1 DC SPECIFICATIONS, ambient temperature is in a range of operating temperature.

*: When both the rising time (tr) and the falling time (tf) of input signals are less than 15 ns.
*: Ratings are specified as intervals by at the voltage of 20% and 80% of VDDI-GND.
4.3 DISPLAY SIGNAL INPUT TIMING

1) Horizontal Timing

Parameter | Symbol | Min. | Typ. | Max. | Unit | Remarks
--- | --- | --- | --- | --- | --- | ---
HS cycle | HP | - | 264 | - | CLK | 
HS low pulse width | HS | - | 8 | - | CLK | 
Horizontal back porch | HBP | - | 8 | - | CLK | 
HS + HBP | HS+HBP | - | 16 | - | CLK | 
Horizontal front porch | HFP | - | 8 | - | CLK | 
Horizontal active area | HDisp | - | 240 | - | CLK | 
Frame cycle | - | - | 60 | - | Hz | 
Pixel clock Frequency | DCKP | - | 6.4 | - | MHz | 

2) Vertical Timing

Parameter | Symbol | Min. | Typ. | Max. | Unit | Remarks
--- | --- | --- | --- | --- | --- | ---
Vertical cycle | VP | - | 404 | - | H | 
Vertical Low pulse width | VS | - | 1 | - | H | 
Vertical back porch | VBP | - | 1 | - | H | 
VS + VBP | VS+VBP | - | 2 | - | H | 
Vertical front porch | VFP | - | 2 | - | H | 
Vertical active area | VDisp | - | 400 | - | H | 

EPSON IMAGING DEVICES CORP.
### 4.4 RECOMMENDED SEQUENCE

1. Start to supply system power.
2. Make a device reset after starting to supply the system power.
   (XRES must be kept "L" for more than 2ms.)
3. Wait more than 200ms after releasing the system reset *1)
4. Transfer commands for initial setting and turning on.
   (See 4.4.1  Power ON Sequence)
5. Transfer commands to turn off.  (See 4.4.2  Power OFF Sequence)
6. Stop to supply system power.

Required intervals are described in the following chart and the table of "4.4.1" to "4.4.2".

---

**Notes**

* XRES must be maintained to "LOW" more than 2ms after turning on the system power (VDD, VDDI).
* The rising speed of VDD or VDDI should be less than 2V/100μs.
* VDD (min.) and VDDI (min.) are minimum voltage of VDD and VDDI. Please refer to 4.1 DC SPECIFICATIONS.
### 4.4.1 Power ON Sequence

<table>
<thead>
<tr>
<th>Power Supply</th>
<th>VDDI=3.0V</th>
<th>VDD=3.0V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard Reset</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RGB data, VSYNC, HSYNC, ENABLE and PCLK start</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wait</td>
<td>More than 200ms</td>
<td></td>
</tr>
<tr>
<td>EXTCMMOD1</td>
<td>CMD F0h</td>
<td></td>
</tr>
<tr>
<td>PRM1</td>
<td>5Ah</td>
<td></td>
</tr>
<tr>
<td>EXTCMMOD2</td>
<td>CMD F1h</td>
<td></td>
</tr>
<tr>
<td>PRM1</td>
<td>5Ah</td>
<td></td>
</tr>
<tr>
<td>DISCTL</td>
<td>CMD B0h</td>
<td></td>
</tr>
<tr>
<td>PRM1</td>
<td>29h</td>
<td></td>
</tr>
<tr>
<td>PRM2</td>
<td>23h</td>
<td></td>
</tr>
<tr>
<td>PRM3</td>
<td>23h</td>
<td></td>
</tr>
<tr>
<td>PRM4</td>
<td>23h</td>
<td></td>
</tr>
<tr>
<td>PRM5</td>
<td>02h</td>
<td></td>
</tr>
<tr>
<td>PRM6</td>
<td>2Ah</td>
<td></td>
</tr>
<tr>
<td>PRM7</td>
<td>2Ah</td>
<td></td>
</tr>
<tr>
<td>PRM8</td>
<td>2Ah</td>
<td></td>
</tr>
<tr>
<td>PRM9</td>
<td>02h</td>
<td></td>
</tr>
<tr>
<td>PRM10</td>
<td>26h</td>
<td></td>
</tr>
<tr>
<td>PRM11</td>
<td>26h</td>
<td></td>
</tr>
<tr>
<td>PRM12</td>
<td>26h</td>
<td></td>
</tr>
<tr>
<td>PRM13</td>
<td>2Ah</td>
<td></td>
</tr>
<tr>
<td>PRM14</td>
<td>3Fh</td>
<td></td>
</tr>
<tr>
<td>PRM15</td>
<td>55h</td>
<td></td>
</tr>
<tr>
<td>PRM16</td>
<td>07h</td>
<td></td>
</tr>
<tr>
<td>PRM17</td>
<td>0Fh</td>
<td></td>
</tr>
<tr>
<td>PRM18</td>
<td>0Ch</td>
<td></td>
</tr>
<tr>
<td>PRM19</td>
<td>CCh</td>
<td></td>
</tr>
<tr>
<td>PRM20</td>
<td>CCh</td>
<td></td>
</tr>
<tr>
<td>PWRCTL</td>
<td>CMD B1h</td>
<td></td>
</tr>
<tr>
<td>PRM1</td>
<td>2Bh</td>
<td></td>
</tr>
<tr>
<td>PRM2</td>
<td>00h</td>
<td></td>
</tr>
<tr>
<td>PRM3</td>
<td>3Eh</td>
<td></td>
</tr>
<tr>
<td>PRM4</td>
<td>5Ah</td>
<td></td>
</tr>
<tr>
<td>PRM5</td>
<td>0Eh</td>
<td></td>
</tr>
<tr>
<td>PRM6</td>
<td>02h</td>
<td></td>
</tr>
<tr>
<td>PRM7</td>
<td>CDh</td>
<td></td>
</tr>
<tr>
<td>PRM8</td>
<td>00h</td>
<td></td>
</tr>
<tr>
<td>PRM9</td>
<td>00h</td>
<td></td>
</tr>
<tr>
<td>PRM10</td>
<td>02h</td>
<td></td>
</tr>
<tr>
<td>PRM11</td>
<td>08h</td>
<td></td>
</tr>
<tr>
<td>PRM12</td>
<td>00h</td>
<td></td>
</tr>
<tr>
<td>PRM13</td>
<td>00h</td>
<td></td>
</tr>
<tr>
<td>PRM14</td>
<td>02h</td>
<td></td>
</tr>
<tr>
<td>PRM15</td>
<td>00h</td>
<td></td>
</tr>
<tr>
<td>PRM16</td>
<td>00h</td>
<td></td>
</tr>
<tr>
<td>PRM17</td>
<td>02h</td>
<td></td>
</tr>
<tr>
<td>PRM18</td>
<td>00h</td>
<td></td>
</tr>
<tr>
<td>PRM19</td>
<td>00h</td>
<td></td>
</tr>
<tr>
<td>APMCTL</td>
<td>CMD CCc</td>
<td></td>
</tr>
<tr>
<td>PRM1</td>
<td>00h</td>
<td></td>
</tr>
<tr>
<td>MTPCTL</td>
<td>CMD D0h</td>
<td></td>
</tr>
<tr>
<td>PRM1</td>
<td>02h</td>
<td></td>
</tr>
<tr>
<td>RGBIF</td>
<td>CMD B2h</td>
<td></td>
</tr>
<tr>
<td>PRM1</td>
<td>90h</td>
<td></td>
</tr>
<tr>
<td>PRM2</td>
<td>00h</td>
<td></td>
</tr>
<tr>
<td>PRM3</td>
<td>02h</td>
<td></td>
</tr>
<tr>
<td>PRM4</td>
<td>02h</td>
<td></td>
</tr>
<tr>
<td>PRM5</td>
<td>10h</td>
<td></td>
</tr>
<tr>
<td>PRM6</td>
<td>08h</td>
<td></td>
</tr>
<tr>
<td>COLMOD</td>
<td>CMD 3Ah</td>
<td></td>
</tr>
<tr>
<td>PRM1</td>
<td>06h</td>
<td></td>
</tr>
<tr>
<td>GAMSET</td>
<td>CMD 26h</td>
<td></td>
</tr>
<tr>
<td>PRM1</td>
<td>01h</td>
<td></td>
</tr>
</tbody>
</table>

### GAMMSETP0
- CMD C0h
- PRM1 00h
- PRM2 00h
- PRM3 05h
- PRM4 0Eh
- PRM5 19h
- PRM6 24h
- PRM7 2Dh
- PRM8 3Ah
- PRM9 41h
- PRM10 41h
- PRM11 44h
- PRM12 48h
- PRM13 33h

### GAMMSETN0
- CMD C1h
- PRM1 00h
- PRM2 00h
- PRM3 05h
- PRM4 0Eh
- PRM5 19h
- PRM6 24h
- PRM7 2Dh
- PRM8 3Ah
- PRM9 41h
- PRM10 41h
- PRM11 44h
- PRM12 48h
- PRM13 33h

### PWMENB
- CMD 8Ah
- PRM1 01h

### ADCCTL
- CMD 5Bh
- CMD B1h
- CMD D0h
- Wait More than 200ms

### SSLCTL
- CMD 70h
- PRM1 00h

### RGBDN
- CMD Cc
- PRM1 00h
- PRM2 00h
- PRM3 00h
- PRM4 02h
- PRM5 02h
- PRM6 02h
- PRM7 02h
- PRM8 02h
- PRM9 02h
- PRM10 02h
- PRM11 02h
- PRM12 02h
- PRM13 02h
- PRM14 02h
- PRM15 02h
- PRM16 02h
- PRM17 02h
- PRM18 02h
- PRM19 02h
- PRM20 02h

### MADCTL
- CMD 36h
- PRM1 48h
- PRM2 00h
- PRM3 00h
- PRM4 00h
- PRM5 00h
- PRM6 00h
- PRM7 00h
- PRM8 00h
- PRM9 00h
- PRM10 00h
- PRM11 00h
- PRM12 00h
- PRM13 00h
- PRM14 00h
- PRM15 00h
- PRM16 00h
- PRM17 00h
- PRM18 00h
- PRM19 00h
- PRM20 00h

### MADDEF
- CMD B8h
- PRM1 00h
- PRM2 00h
- PRM3 00h
- PRM4 00h
- PRM5 00h
- PRM6 00h
- PRM7 00h
- PRM8 00h
- PRM9 00h
- PRM10 00h
- PRM11 00h
- PRM12 00h
- PRM13 00h
- PRM14 00h
- PRM15 00h
- PRM16 00h
- PRM17 00h
- PRM18 00h
- PRM19 00h
- PRM20 00h

### CASET
- CMD 2Ah
- PRM1 00h
- PRM2 00h
- PRM3 00h
- PRM4 00h
- PRM5 00h
- PRM6 00h
- PRM7 00h
- PRM8 00h
- PRM9 00h
- PRM10 00h
- PRM11 00h
- PRM12 00h
- PRM13 00h
- PRM14 00h
- PRM15 00h
- PRM16 00h
- PRM17 00h
- PRM18 00h
- PRM19 00h
- PRM20 00h

### PASET
- CMD 28h
- PRM1 00h
- PRM2 00h
- PRM3 00h
- PRM4 00h
- PRM5 00h
- PRM6 00h
- PRM7 00h
- PRM8 00h
- PRM9 00h
- PRM10 00h
- PRM11 00h
- PRM12 00h
- PRM13 00h
- PRM14 00h
- PRM15 00h
- PRM16 00h
- PRM17 00h
- PRM18 00h
- PRM19 00h
- PRM20 00h

### SSLPOUT
- CMD 1Fh
- Wait More than 200ms

### DLS
- CMD CCc
- PRM1 03h

### DISON
- CMD 29h
### 4.4.2 Power OFF Sequence

<table>
<thead>
<tr>
<th></th>
<th>CMD</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Display On state</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DISOFF CMD</td>
<td>28h</td>
<td></td>
</tr>
<tr>
<td>Wait</td>
<td>More than 40ms</td>
<td></td>
</tr>
<tr>
<td>DLS CMD</td>
<td>CDh</td>
<td></td>
</tr>
<tr>
<td>PRM1</td>
<td>00h</td>
<td></td>
</tr>
<tr>
<td>SLPIN CMD</td>
<td>10h</td>
<td></td>
</tr>
<tr>
<td>RGBDN CMD</td>
<td>CEh</td>
<td></td>
</tr>
<tr>
<td>PRM1</td>
<td>FEh</td>
<td></td>
</tr>
<tr>
<td>Wait</td>
<td>More than 200ms</td>
<td></td>
</tr>
<tr>
<td>RGB data, VSYNC, HSYNC, ENABLE, and PCLK stop</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power OFF</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5. OPTICAL SPECIFICATIONS

Values in "OPTICAL SPECIFICATIONS" are provided under the following conditions.
* Frame Frequency : 60Hz
* VDD/VDDI : 3.0V,

5.1 OPTICAL CHARACTERISTICS

5.1.1 Backlight ON (Transmissive Mode)  
Ta = 25°C

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Rating</th>
<th>Unit</th>
<th>Condition</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contrast ratio</td>
<td>CR</td>
<td>120 180 -</td>
<td>—</td>
<td>θ = 0°</td>
<td>1(1)</td>
</tr>
<tr>
<td>Response time</td>
<td>Rise</td>
<td>tr - 6 9 ms</td>
<td></td>
<td>θ = 0°</td>
<td>2(1)</td>
</tr>
<tr>
<td></td>
<td>Fall</td>
<td>tf - 25 37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brightness</td>
<td>B</td>
<td>150 200 - cd/m2</td>
<td>θ = 0°</td>
<td>7(1)</td>
<td></td>
</tr>
</tbody>
</table>

Color Coordinates

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Rating</th>
<th>Unit</th>
<th>Condition</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wx</td>
<td>-</td>
<td>0.26 0.31 0.36</td>
<td></td>
<td>θ = 0°</td>
<td>3(1)</td>
</tr>
<tr>
<td>Wy</td>
<td>-</td>
<td>0.28 0.33 0.38</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rx</td>
<td>-</td>
<td>0.53 -</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ry</td>
<td>-</td>
<td>0.32 -</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gx</td>
<td>-</td>
<td>0.32 -</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gy</td>
<td>-</td>
<td>0.53 -</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bx</td>
<td>-</td>
<td>0.16 -</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By</td>
<td>-</td>
<td>0.14 -</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NTSC ratio

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Rating</th>
<th>Unit</th>
<th>Condition</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>ϕ =0</td>
<td>-</td>
<td>50 60 -</td>
<td>deg.</td>
<td>CR ≥ 10</td>
<td>6(1)</td>
</tr>
<tr>
<td>ϕ =90</td>
<td>-</td>
<td>50 60 -</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ϕ =180</td>
<td>-</td>
<td>35 45 -</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ϕ =270</td>
<td>-</td>
<td>35 45 -</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Brightness deviation

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Rating</th>
<th>Unit</th>
<th>Condition</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>60 80</td>
<td>-</td>
<td>%</td>
<td>θ = 0°</td>
<td>7(1)</td>
</tr>
</tbody>
</table>

5.1.2 Backlight OFF (Reflective mode)  
Ta = 25°C

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Rating</th>
<th>Unit</th>
<th>Condition</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contrast ratio</td>
<td>CR</td>
<td>13 18 -</td>
<td>—</td>
<td>θ = 0°</td>
<td>1(2)</td>
</tr>
<tr>
<td>Reflectance</td>
<td>R</td>
<td>5 7 - %</td>
<td></td>
<td>θ = 0°</td>
<td>5(2)</td>
</tr>
<tr>
<td>Color Coordinates</td>
<td>Wx</td>
<td>- 0.31 -</td>
<td>%</td>
<td>θ = 0°</td>
<td>3(2)</td>
</tr>
<tr>
<td></td>
<td>Wy</td>
<td>- 0.33 -</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NTSC ratio</td>
<td>-</td>
<td>9 - %</td>
<td></td>
<td>θ = 0°</td>
<td>4(2)</td>
</tr>
</tbody>
</table>
5.2 DEFINITIONS AND CONDITIONS

5.2.1 Definitions of Optical Characteristics

Definition 1
Contrast ratio : Contrast ratio is showed by this calculating formula.
CR : Contrast ratio
Lw(White) : Brightness of white raster at standard measurement conditions.
Lb(Black) : Brightness of black raster at standard measurement conditions.

\[ CR = \frac{Lw \text{ (White)}}{Lb \text{ (Black)}} \]

Definition 2
Responsiveness :

tf : This is a time that increases to 90% of total change of the screen surface brightness from the point of 10%, after data signal is switched from black-raster to white-raster.

tr : This is a time that decreases to 10% of total change of the screen surface brightness from the point of 90%, after data signal is switched from white-raster to black-raster.

Normally White

![Graph showing brightness and times](#)
Definition 3
Display screen chromaticity: The R, G, B, W colors are specified by x and y coordinate on the CIE1931 chromaticity diagram.

Definition 4
Color area (NTSC ratio): This is the x-y coordinate of Red, Green, Blue and White colors specified on the CIE1931 chromaticity diagram.

Definition 5
Surface reflectance: Surface Reflectance is showed by this calculating formula.

\[ \text{Reflectance} = \frac{L_w(\text{White})}{L(\text{Ref})} \times 100 \% \]
Definition 6
Viewing angle : Viewing angle $\theta$ is the angle at which a contrast ratio of at least 10 is obtained when the panel is inclined by $\theta$ in the direction of $\Phi$ as shown in Fig A.

![Fig A](image)

Definition 7
Display surface brightness : Screen center brightness of the white raster at standard measurement conditions. (Fig B.)

Brightness uniformity : At points ①-⑤, Brightness uniformity. (Fig B.)

the Min. brightness / the Max. brightness $\times 100$ (%)
5.2.2 Measurement Conditions of Optical Characteristics

[ Electrical inputs and adjustments ]

- Frame Frequency: 60Hz
- VDD/VDDI: 3.0V / 3.0V
- Black raster display: R[ ] = G[ ] = B[ ] = 0
- White raster display: R[ ] = G[ ] = B[ ] = 63
- Saturate color raster display: R[, G[, B[ (one color only) = 63, otherwise = 0
- LED forward current: 20mA/chip

Condition (1)

[ Optical system ]

- L: Light source mounted to the LCD module(LED Back Light)
- M: LCD module
- D: Measurement instruments
- θ: Measurement angle (=90°)

[ Instruments and it's measurement conditions]

- Instrument: Color Luminance meter CS-1000A (KONICA MINOLTA)
- Measurement distance: 50cm
- Measurement field angle: 2°
- Measurement point: The center of the active area.
  The 9 points of the active area
Condition (2)

[Optical system]

L: Light source
M: LCD module
D: Measurement instruments
\( \theta \): Measurement angle (\( =90^\circ \))

[Instruments and its measurement conditions]
Instrument: Spectro photometer DMS803 (301) (autronic-MELCHERS)
Measurement distance: 112mm
Measurement aperture: 3.0mm
Light Source: D65
6. INSPECTION STANDARD

6.1 QUALITY STANDARDS

The quality standards are the quality level used to judge whether or not the product lots pass during the acceptance inspections of the products delivered to your company. The quality standards are shown below.

* Inspection method: Compliant with ANSI/ASQL Z1.4-1993, ordinary inspection level II, inspection by one time sampling.

* AQL

<table>
<thead>
<tr>
<th>Defect type</th>
<th>AQL</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major defects</td>
<td>0.4%</td>
<td>Accompanied with functional abnormalities</td>
</tr>
<tr>
<td>Minor defects</td>
<td>0.65%</td>
<td>Out of the range from &quot;6.2.2 Display appearance standards&quot;, but no functional abnormalities</td>
</tr>
</tbody>
</table>

6.2 INSPECTION CONDITION

(1). Environmental conditions

1. Temperature/humidity condition:
   - Normal temperature (25±5 degrees)
   - Normal humidity (60±20%RH)

2. Illuminance environment:
   - Not lighted appearance: 800~2000Lx
   - Lighted appearance:
     - Transmive type: 100~400Lx
     - Semi-Transmive: 800~2000Lx
* Some specified patterns: 50Lx or the less

(2). Inspection method: Inspection by naked eye

Inspect the screen by naked eye from a distance of about 30 cm and the angle shall be 30 degrees from the vertical direction to the product.

Viewing angle is 30 degrees from the vertical direction as shown in the picture below.

(3). Drive condition: It is done pursuant to product specification.
6.3 APPEARANCE STANDARD

6.3.1 Application Scope

The application scope is limited to the viewing area.
The product should be judged non-defective if all defects are outside of the viewing area and do not interfere with product quality or the assembly process.

6.3.2 Display Appearance Standards

<table>
<thead>
<tr>
<th>No.</th>
<th>ITEMS</th>
<th>JUDGMENT CRITERIA</th>
<th>CLASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Abnormal display</td>
<td>Must not be abnormal function such as not function or not to get normal pattern for input signal, etc.</td>
<td>Major defect</td>
</tr>
<tr>
<td>2</td>
<td>Line defect (Open, Short)</td>
<td>No line defect</td>
<td>Major defect</td>
</tr>
<tr>
<td>3</td>
<td>Dot defect (Dot failure)</td>
<td></td>
<td>Minor defect</td>
</tr>
<tr>
<td>4</td>
<td>Dot type defect (Black/White)</td>
<td></td>
<td>Minor defect</td>
</tr>
<tr>
<td>5</td>
<td>Line type defect (Black/White)</td>
<td></td>
<td>Minor defect</td>
</tr>
<tr>
<td>6</td>
<td>Unevenness display</td>
<td>Should not be remarkable.</td>
<td>Minor defect</td>
</tr>
<tr>
<td>7</td>
<td>Bubble in polarizer</td>
<td></td>
<td>Minor defect</td>
</tr>
</tbody>
</table>

### Table 6-3-1:

<table>
<thead>
<tr>
<th>No.</th>
<th>ITEMS</th>
<th>JUDGMENT CRITERIA</th>
<th>CLASS</th>
</tr>
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<tbody>
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<tr>
<td>3</td>
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<td></td>
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<tr>
<td>4</td>
<td>Dot type defect (Black/White)</td>
<td></td>
<td>Minor defect</td>
</tr>
<tr>
<td>5</td>
<td>Line type defect (Black/White)</td>
<td></td>
<td>Minor defect</td>
</tr>
<tr>
<td>6</td>
<td>Unevenness display</td>
<td>Should not be remarkable.</td>
<td>Minor defect</td>
</tr>
<tr>
<td>7</td>
<td>Bubble in polarizer</td>
<td></td>
<td>Minor defect</td>
</tr>
</tbody>
</table>

**Table 6-3-2:**

<table>
<thead>
<tr>
<th>No.</th>
<th>ITEMS</th>
<th>JUDGMENT CRITERIA</th>
<th>CLASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Abnormal display</td>
<td>Must not be abnormal function such as not function or not to get normal pattern for input signal, etc.</td>
<td>Major defect</td>
</tr>
<tr>
<td>2</td>
<td>Line defect (Open, Short)</td>
<td>No line defect</td>
<td>Major defect</td>
</tr>
<tr>
<td>3</td>
<td>Dot defect (Dot failure)</td>
<td></td>
<td>Minor defect</td>
</tr>
<tr>
<td>4</td>
<td>Dot type defect (Black/White)</td>
<td></td>
<td>Minor defect</td>
</tr>
<tr>
<td>5</td>
<td>Line type defect (Black/White)</td>
<td></td>
<td>Minor defect</td>
</tr>
<tr>
<td>6</td>
<td>Unevenness display</td>
<td>Should not be remarkable.</td>
<td>Minor defect</td>
</tr>
<tr>
<td>7</td>
<td>Bubble in polarizer</td>
<td></td>
<td>Minor defect</td>
</tr>
</tbody>
</table>
### 6.3.3 General Appearance Specifications

<table>
<thead>
<tr>
<th>No.</th>
<th>ITEMS</th>
<th>JUDGMENT CRITERIA</th>
<th>CLASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Different specifications</td>
<td>Not permitted</td>
<td>Major defect</td>
</tr>
<tr>
<td>2</td>
<td>Damaged resist on FPC</td>
<td>Copper patterns on FPC must not be visible.</td>
<td>Minor defect</td>
</tr>
<tr>
<td>3</td>
<td>Circuit pattern</td>
<td>Must not be peeled or separated from FPC.</td>
<td>Major defect</td>
</tr>
<tr>
<td>4</td>
<td>Conductive refuses</td>
<td>No solder refuses or solder balls easily moving. Fixed particle which has no functional affect can be ignored.</td>
<td>Minor defect</td>
</tr>
<tr>
<td>5</td>
<td>Dirt</td>
<td>Should not be prominent. Dirt on backside is permitted.</td>
<td>Minor defect</td>
</tr>
<tr>
<td>6</td>
<td>I/F terminal scratch/dirt</td>
<td>Should not be prominent.</td>
<td>Minor defect</td>
</tr>
<tr>
<td>7</td>
<td>Plating</td>
<td>Must not be peeled, no rust and no discoloration.</td>
<td>Minor defect</td>
</tr>
<tr>
<td>8</td>
<td>Soldering defect</td>
<td>Solder omissions is not permitted at any solder point. Solder bridges is not permitted. Cold soldering is not permitted.</td>
<td>Major defect</td>
</tr>
<tr>
<td>9</td>
<td>Parts soldering</td>
<td>There must be fillet.</td>
<td>Minor defect</td>
</tr>
<tr>
<td>10</td>
<td>Metal frame scratch/discholoration</td>
<td>Scratch out of viewing area and discoloration shall be ignored.</td>
<td>Minor defect</td>
</tr>
</tbody>
</table>

### 7. WARRANTY

EPSON IMAGING DEVICES CORP. warrants this product for a period of 14 months from the date of delivery. We replace or compensate for the defective product which is judged as our responsibility within the term of warranty.
8. DURABILITY TESTING

8.1 DURABILITY TESTING CONDITIONS

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Condition</th>
<th>Ratings</th>
<th>Evaluation Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High-temperature storage</td>
<td>70°C±2°C</td>
<td>240 h</td>
<td>After the test, and 2 hours elapsed at room temperature, it should not be changed in</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>external appearance and/or display appearance that could impair use.</td>
</tr>
<tr>
<td>2</td>
<td>Low-temperature storage</td>
<td>-20°C±2°C</td>
<td>240 h</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Temperature cycling (Non Operation)</td>
<td>-20°C ↔ 25°C ↔ 70°C</td>
<td>50 cycles</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>30min 10min 30min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>High-temperature operation</td>
<td>60°C±2°C</td>
<td>240 h</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Low-temperature operation</td>
<td>-10°C±2°C</td>
<td>240 h</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>High-temperature, high-humidity operation</td>
<td>60°C90%RH</td>
<td>240 h</td>
<td></td>
</tr>
</tbody>
</table>

8.2 MECHANICAL PERFORMANCE

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Condition</th>
<th>Criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Package drop</td>
<td>According to JIS-Z0202 Height for plane drop : 50 cm Height for corner and ridge drop : 30 cm</td>
<td>There must be no abnormalities of function or display.</td>
</tr>
</tbody>
</table>
|     |                                   | Vibration Frequency : 5Hz ~ 55Hz Amplitude : 5Hz ~ 20Hz amplitude control 2.5mm
|     |                                   | 20Hz ~ 55Hz acceleration control 1.5G Sweep Model : Logarithmic Frequency Modulation Sweep Time : 15min per sweep cycle Sweep Direction and Vibrating Time(testing time) X Direction – 30min Y Direction – 30min Z Direction – 30min |                                                                 |
9. PACKING SPECIFICATIONS

< INNER CARTON >

- Tray: 15 pcs Qt in a tray.
- Inner carton: 10 trays + 1 (top tray is empty) stacked in an inner carton.
- Master carton: 2 inner cartons in a master carton
- Maximum quantity: 15 x 10 x 2 = 300 pcs.
<Contents of the Inner / Master Label>

Lot number will be made according to the following format. The lot number has the same description with the printed number on each product. If plural lots are packed together into one package, plural lot numbers must be printed on the inner label. An empty inner carton should be used to fill the master carton if the total quantity is less than or equal to 150 pcs.

Lot No. description:
Upper 1st digit: year code
Upper 2nd, 3rd digits: week code
Upper 4th digit: day of the week code
The last digit: factory code
Show a final inspection day.

Factory code:
S: SUZHOU EPSON CO., LTD. (CHINA)
D: SUZHOU EPSON CO., LTD(D2) (CHINA)
L: EPSON IMAGING DEVICES (PHILIPPINES), INC.
P: EPSON IMAGING DEVICES(H.K.) LTD. (CHINA)
G: INGS SHINANO (JAPAN)

※<Printed Lot number on products>

Product Number

3 0 8 7 8 P 0 0

Lot No.

Shop order number
※10 digit lot serial number
<MASTER CARTON>

Insert inner cartons within a master carton
Gap is filled if necessary
Tape is applied if necessary
Tied if necessary

Indication onto [A] [B] [C] [D] on master carton are shown below.

A

B

C

D

MASTER LABEL
(same as an inner)

FRAGILE
STATIC SENSITIVE
DAMAGED BY EXCESS HEAT OR COLD

FRAGILE
STATIC SENSITIVE
DAMAGED BY EXCESS HEAT OR COLD
10. LCD MODULE USAGE AND PRECAUTIONS

10.1 DESIGN OF APPLICATION

1) To prevent damage to the module, design applications in consideration of the following:
   • The absolute maximum ratings represent the rated values which the LCD module must not exceed. When modules are used beyond this rating, the operating characteristics may be irreversibly affected. It is recommended that power supply lines [VDD, VDDI] include current surge protection (fuses, etc.). Without such protection, foreign material or isolated circuit failures can cause overheating or smoke emission, resulting in injury.
   • When logic circuit power is off, do not apply any signals to the input terminals.
   • Potentially irreversible abnormality may occur with forcible disconnection of LCD module power supply, such as removing the device battery.
   • Employ designs that avoid direct contact with the IC. In the event there is a chance of contact, please contact Epson Imaging Devices Corp. regarding precautions.

2) To prevent erroneous operation, design applications in consideration of the following:
   • To prevent the occurrence of erroneous operation caused by noise, pay special attention to satisfying specified operating conditions. This includes precautionary measures, like using short signal cables.
   • Note that peripheral devices can cause mutual noise interference with LCD modules. In particular, input devices such as touch panels may emit operational level noise as radiation, even when these devices are not in operation. Provisions for, and evaluation of, performance under actual usage conditions with the system are highly recommended.
   • The driver IC used by the LCD module is easily affected by light exposure because it is mounted as a bare chip on the module. To avoid increased current consumption and accompanied shut-down of power supply, give consideration to taking light-shielding countermeasures, and evaluating performance in the system.
   • Just as with general electronic components, ESD may cause LCD modules to malfunction. ESD countermeasures should be considered around components surrounding the LCD module, especially the driver IC and power IC. When an LCD module is mounted near the outer surface of a product, take extra care that components such as these cannot act as conductive paths for ESD.
   • By command, LCD module operation status and display data is saved, but that data can easily be altered by external noise. Noise should be minimized, or its effect avoided, at the device or system level.
   • As unexpected noise may occur, periodic refresh operations, such as resetting commands or resending display data, are highly recommended as part of the software routine.
   • As display problems can occur when signals are fed to the input/output cable NC terminals, system designs should keep them open.

3) System designs should consider the following:
   • Design applications so that excessive force will not be applied to the surface, perimeter or adjoining areas of LCD modules, as this may cause display panel color tone to vary.
   • Be sure that the LCD module is free from twisting, warping, or distortion as any stress can have great influence on the display quality. Ensure sufficient stiffness of the system’s outer case or frame. Also, exercise caution when handling.
   • Use the backlight frame section to set and fix the LCD module position inside the system. Using other components to fix the LCD module position may sever circuits on the FPC.
   • As part of the construction of the LCD module, the FPC board with on-board electronic components is only partly fixed to the case, in consideration of reworking. Potentially, the FPC may curve under the weight of individual components, and they may protrude beyond the outline of the case. As such, preventive measures should be taken to prevent any electrical contact between the LCD module components and other circuits inside the system.
   • The viewing angle of the LCD module and that of the system should match.
   • If a display frame or printed frame is provided, place it inside the viewing area and outside the active area for a good appearance.
4) Liquid crystal display elements are temperature dependent. Be sure to use the LCD modules within the specified operating temperature range, as recognition of the display becomes difficult when the LCD module is used outside its range. Also, keep in mind that the supply voltage necessary for clear image display will vary according to temperature.

5) To avoid EMI, preventive measures should be implemented in the system.

6) Note that sudden powering-up sends excessive inrush current to the LCD module, and can affect the entire system.

10.2 ASSEMBLY PRECAUTIONS

1) Static electricity can destroy LCD module elements, so carefully observe the following during assembly:
   • Be sure to ground your body when handling the LCD module.
   • Make sure that solder guns and all other tools required for assembly have been grounded.
   • The use of anti-static mats (0.5kΩ – 1MΩ) on the workbench for grounding is recommended.
   • To reduce occurrence of static electricity, avoid using this product in dry environments, (less than 50%RH).
   • To eliminate static electricity, the use of an ionizer (anti-static air blower) is recommended.
   • A protective film has been attached to the surface of the LCD panel. When peeling off the protective film, do so carefully near an ionizer.
   • To guard against performance degradation of the LCD module caused by destructive forces such as static electricity, etc., avoid direct contact to the terminal electrodes of connectors and FPC circuit pattern when handling.

2) In the inspection process, design and assemble structures that ensure sufficient light-shielding measures for the LCD driver.

3) The LCD Panel surface is protected by a protective film, which must be removed before system installation. Units having been in prolonged storage may have some adhesive residue left on the display panel. In such cases, please remove the contaminant according to the procedure in item 5) under "9.3 Handling Precautions" below.

4) As removing the LCD module’s protective film makes the polarizer susceptible to the adhesion of foreign material, do so immediately prior to assembly.

5) Exercise caution when applying adhesive to the LCD module as it is difficult to remove.

6) Do not touch or handle the LCD module directly with bare hands as residue of dirt, oil or water can cause corrosion. Be sure to wear finger stalls or gloves when handling LCD modules.

7) Handle LCD modules by their edges. Handling the screen directly can cause display problems or cracks in the panel.

8) When installing the LCD module, don’t forcibly bend or stretch the input/output cable. Bending or twisting the FPC section may damage circuit patterns. Applying any excessive stress to the LCD module can damage it.

9) Do not apply pressure to the LSI chip or surrounding mold area as it can cause damage.

10) Do not use sharp, pointy or rigid tools when handling LCD panels. These objects can scratch or nick the glass panel, which can cause it to crack.

11) Perform the LCD module power on/off of the system assembly inspection according to the procedure in the specification document.

12) Do not allow non-atmospheric, specialty gases to contact with the LCD module. Check plastic or rubber materials to be used in the system beforehand as gas they produce can cause functional degradation of internal components like the LCD panel polarizer.

13) Trays are used to package LCD modules for shipment. If LCD modules scratch the tray during shipment, tray material may be left on LCD modules. In such case, it may be necessary to air-clean the LCD modules, but take care not to use excess air pressure or apply air flow in the same area for too long as this can peel off attached tape.
10.3 HANDLING PRECAUTIONS

1) The display panel is made of glass. Do not subject it to mechanical shock such as dropping it from a high position, etc.

2) If the display panel is damaged and internal liquid crystal substance leaks out, be sure not to inhale or consume it. Direct contact with skin should also be avoided. Should contact with the internal liquid crystal substance occur, promptly apply the following responses:
   • Contact with clothing: Remove affected items
   • Contact with skin: Wash off using soap and running water
   • Contact with eyes: Wash out for 15 min. or longer with clean water then consult a physician
   • Ingestion: Induce vomiting with water and consult a physician

3) Take precautions in handling the LCD module because the glass plate has very keen edges. Should it break, take extra care to avoid injury from chips, shards and flying glass.

4) The polarizer covering the display panel surface of the LCD module is soft and can be easily scratched. Handle this polarizer carefully, avoiding contact with sharp, pointy instruments or stiff cloth.

5) If the polarizer surface becomes contaminated, use the following recommended or equivalent adhesive tape for contaminants removal:
   • Scotch-brand mending tape (No. 810)

6) Do not breathe on the display surface or use ethyl alcohol solvent for contaminant removal. This can cause cloudiness in the polarizer surface. Furthermore, do not use the following as they can damage the polarizer:
   • Water
   • Ketones
   • Aromatic solvents

7) Avoid using the LCD module under condensation or high-humidity environments as this may cause polarizer or other functional degradation.

8) After being in a high-humidity or condensation environment, keep the LCD module at room temperature more than 30 minutes before using.

9) Current flow in a condensation or high-humidity environment can cause corrosion of electrodes. Also, take precautions against water getting inside the LCD module as it can cause damage.

10) Liquid crystal freezes when stored below the storage temperature range and such freezing may cause orientation defects or bubbles (black or white) to appear in the LCD panel. Bubbles may also occur if the panel receives an impact in a low-temperature environment.

11) If the LCD module is left operating for a long time with the same display showing, the displayed pattern may leave traces on the screen or the contrast may become inconsistent.

12) As optimal operating voltage of the LCD module depends on the surrounding temperature, operation in a high-temperature environment may cause slight flickering.

10.4 DISASSEMBLY AND MODIFICATION

1) Do not attempt to disassemble or modify the LCD module. The internal construction of the LCD module is susceptible to shock, and foreign material or damage can cause screen loss. Epson Imaging Devices Corp. shall not be responsible in the event that a customer attempts to disassemble or modify the LCD module.

10.5 STORAGE

1) When storing LCD modules, avoid the following conditions or environments:
   • Exposure to direct sunlight or fluorescent lighting.
   • High-temperature/high-humidity or very low-temperature (below 0°C) environments.
   • Exposure to water droplets, condensation, etc.
   Furthermore, keep LCD modules in anti-static bags to prevent static electricity charge ups. Whenever possible, LCD modules should be stored in the same conditions in which they were shipped from Epson Imaging Devices Corp. When doing so, ensure there are no water droplets, or condensation.

2) Take precaution to minimize corrosion of electrodes. Corrosion of electrodes is accelerated by moisture, condensation or a current flow in a high-humidity environment.
3) **Recommended storage conditions:**
   - Storage environment: +15 °C to 35 °C, less than 65%RH
   - Duration: up to 2 months after shipping date
4) The shipping cartons must not be stacked up over 1.8m in height.

10.6 **DISPOSAL**

1) When disposing of LCD modules, consult companies authorized to handle industrial waste treatment. When incineration is the method of LCD module disposal, relevant environmental legislation must be observed.

10.7 **OTHERS**

1) This product is designed to be used in general electronic devices (such as office equipment, telecommunications equipment, home electronics, or video game devices). Do not use this product in applications that require an extremely high level of reliability and safety, especially in devices that may cause direct bodily damage to end users (such as equipment for aerospace, traffic control, nuclear, medical, life-support, or safety use).
2) Epson Imaging Devices Corp. shall not be responsible for defects that occur in this product or in equipment connected to this product if the product is used in an environment that exceeds the ranges specified in this document, or in an environment not described in this document.
3) Use this product within the scope of conditions and precautions set forth in this document. Even when used according to guidelines ensure sufficient safety at a system and design level to avoid the operation of this product becoming the cause of personal injury, fire or wider damage.

11. **CHANGES**

- Specification, cosmetic, specified components, circuit and design improvements may be carried out without prior notification. Design changes that are judged to have an impact on this specification document will be notified prior to implementation.
1. Module total height is measured in the pressed state.
2. Cosmetic imperfections will be allowed outside the View Area.
3. As a preventive method of SMD, the metal frame shall be connected with the GND plane.
4. Reference dimension.
5. Be sure to check the hatching area. If the metal frame is connected to GND, the hatching area will be influenced by the metal frame. Be sure to check the hatching area. If the metal frame is connected to GND, the hatching area will be influenced by the metal frame.
6. Metal frame: The metal frame cutout exists in both sides of the corner neighborhood. Here, besides, the cutting must be done such that the metal frame can be cut out accurately.
7. Do not scale this drawing.