# SPECIFICATIONS FOR LCD MODULE

<table>
<thead>
<tr>
<th>CUSTOMER</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CUSTOMER PART NO.</td>
<td></td>
</tr>
<tr>
<td>AMPIRE PART NO.</td>
<td>AMA-104A01-DI2511-G010</td>
</tr>
<tr>
<td>APPROVED BY</td>
<td></td>
</tr>
<tr>
<td>DATE</td>
<td></td>
</tr>
</tbody>
</table>

☐ Approved For Specifications  
☐ Approved For Specifications & Sample

AMPIRE CO., LTD.  
Building A., 4F., No.116, Sec. 1, Sintai 5th Rd., Xizhi Dist, New Taipei City 221, Taiwan (R.O.C.)  
新北市汐止區新台五路一段116號4樓(東方科學園區A棟)  
TEL:886-2-26967269, FAX:886-2-26967196 or 26967270

<table>
<thead>
<tr>
<th>APPROVED BY</th>
<th>CHECKED BY</th>
<th>ORGANIZED BY</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Signature]</td>
<td>[Signature]</td>
<td>[Signature]</td>
</tr>
</tbody>
</table>

Date: 2018/2/9
# RECORD OF REVISION

<table>
<thead>
<tr>
<th>Revision Date</th>
<th>Page</th>
<th>Contents</th>
<th>Editor</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018/2/9</td>
<td>-</td>
<td>New Release</td>
<td>Emil</td>
</tr>
</tbody>
</table>
1. General specification

AMA-104A01-DU2511-G010 is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT LCD panel, a driving circuit, a back light system and pcap touch module. This TFT LCD has a 10.4 inch diagonally measured active display area with HD (1024 horizontal by 768 vertical pixels) resolution.

(1) Construction: 10.4” a-Si TFT active matrix, White LED Backlight.
(2) Resolution (pixel): 1024(R.G.B) X 768
(3) Number of the Colors : 16.2M (R , G , B 8 bit digital each)
(4) LCD type : Normally black
(5) Interface : 24bits LVDS interface.

1.1 Display Characteristics

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display area</td>
<td>211.2(H) x 158.4(V) (10.4” diagonal)</td>
<td>mm</td>
</tr>
<tr>
<td>Number of Pixel</td>
<td>1024(H) x 768(V)</td>
<td>pixels</td>
</tr>
<tr>
<td>Pixel pitch</td>
<td>0.20625(H) x 0.20625(V)</td>
<td>mm</td>
</tr>
<tr>
<td>Pixel arrangement</td>
<td>RGB Vertical Stripe</td>
<td></td>
</tr>
<tr>
<td>Display mode</td>
<td>Normally Black</td>
<td></td>
</tr>
<tr>
<td>NTSC</td>
<td>70(Typ.)</td>
<td>%</td>
</tr>
<tr>
<td>Weight</td>
<td>TBD</td>
<td>g</td>
</tr>
<tr>
<td>Back-light</td>
<td>Single LED (Side-Light type)</td>
<td></td>
</tr>
</tbody>
</table>
# 2. Optical Characteristics

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Condition</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contrast</td>
<td>CR</td>
<td></td>
<td>600</td>
<td>900</td>
<td>–</td>
<td>–</td>
<td>(1)(2)</td>
</tr>
<tr>
<td>Response time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rising</td>
<td>TR+TF</td>
<td></td>
<td>–</td>
<td>30</td>
<td>40</td>
<td>msec</td>
<td>(1)(3)</td>
</tr>
<tr>
<td>Falling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White luminance (Center)</td>
<td>Y_L</td>
<td></td>
<td>400</td>
<td>500</td>
<td>–</td>
<td>cd/m²</td>
<td>(1)(4)</td>
</tr>
<tr>
<td>Color chromaticity (CIE1931)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(1)(4)</td>
</tr>
<tr>
<td>White</td>
<td></td>
<td>Normal viewing angle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>W_x</td>
<td>Θ=0</td>
<td>0.263</td>
<td>0.313</td>
<td>0.363</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>W_y</td>
<td></td>
<td>0.279</td>
<td>0.329</td>
<td>0.379</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>R_x</td>
<td></td>
<td>TBD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>R_y</td>
<td></td>
<td>TBD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green</td>
<td>G_x</td>
<td></td>
<td>TBD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green</td>
<td>G_y</td>
<td></td>
<td>TBD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blue</td>
<td>B_x</td>
<td></td>
<td>TBD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blue</td>
<td>B_y</td>
<td></td>
<td>TBD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viewing angle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hor.</td>
<td>Θ_L</td>
<td>CR&gt;10</td>
<td>80</td>
<td>85</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hor.</td>
<td>Θ_R</td>
<td></td>
<td>80</td>
<td>85</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hor.</td>
<td>Θ_U</td>
<td></td>
<td>80</td>
<td>85</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hor.</td>
<td>Θ_D</td>
<td></td>
<td>80</td>
<td>85</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brightness uniformity</td>
<td>B_UNI</td>
<td>Θ=0</td>
<td>70</td>
<td>80</td>
<td>–</td>
<td>%</td>
<td>(5)</td>
</tr>
<tr>
<td>Optima View Direction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(6)</td>
</tr>
</tbody>
</table>

**Measuring Condition**
- Measuring surrounding: dark room
- LED current IL: 480mA
- Ambient temperature: 25±2°C
- 15min. warm-up time.
Measuring Equipment

- FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.
- Measuring spot size: 20 ~ 21 mm

**Note (1)** Definition of Viewing Angle:

![Diagram showing viewing angles](image)

**Note (2)** Definition of Contrast Ratio (CR):
measured at the center point of panel

\[
CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}
\]
Note (3) Definition of Response Time: Sum of $T_R$ and $T_F$

![Diagram showing optical response and time]

Note (4) Definition of optical measurement setup

![Diagram of optical measurement setup with LCD Panel, field of view, and photo-detector]
**Note (5)** Definition of brightness uniformity

![Diagram](image)

\[
\text{Luminance uniformity} = \frac{\text{(Min Luminance of 9 points)}}{\text{(Max Luminance of 9 points)}} \times 100\% 
\]

**Note (6)**: Rubbing Direction (The different Rubbing Direction will cause the different optima view direction.)
3. Functional Block Diagram

Pixel Format

Date: 2018/2/9

AMPIRE CO., LTD.
### 3.1 Relationship between Displayed Color and Input

<table>
<thead>
<tr>
<th>Basic color</th>
<th>Display Color</th>
<th>Gray scale Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>Blue</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>Green</td>
<td>L L L L L L L L</td>
<td>H H H H H H H H</td>
</tr>
<tr>
<td>Light Blue</td>
<td>L L L L L L L L</td>
<td>H H H H H H H H</td>
</tr>
<tr>
<td>Red</td>
<td>H H H H H H H H</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>Purple</td>
<td>H H H H H H H H</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>Yellow</td>
<td>H H H H H H H H</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>White</td>
<td>H H H H H H H H</td>
<td>L L L L L L L L</td>
</tr>
</tbody>
</table>

### Gray scale of Red

<table>
<thead>
<tr>
<th>Gray scale level</th>
<th>Black</th>
<th>Dark</th>
<th>Light</th>
<th>Red</th>
</tr>
</thead>
<tbody>
<tr>
<td>L0</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>L1</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>L2</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>L3…L251</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>L252</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>L253</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>L254</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
</tbody>
</table>

### Gray scale of Green

<table>
<thead>
<tr>
<th>Gray scale level</th>
<th>Black</th>
<th>Dark</th>
<th>Light</th>
<th>Green</th>
</tr>
</thead>
<tbody>
<tr>
<td>L0</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>L1</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>L2</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>L3…L251</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>L252</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>L253</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>L254</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>Green L255</td>
<td>L L L L L L L L</td>
<td>H H H H H H H H</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
</tbody>
</table>

### Gray scale of Blue

<table>
<thead>
<tr>
<th>Gray scale level</th>
<th>Black</th>
<th>Dark</th>
<th>Light</th>
<th>Blue</th>
</tr>
</thead>
<tbody>
<tr>
<td>L0</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>L1</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>L2</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>L3…L251</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>L252</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>L253</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>L254</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>Blue L255</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
</tbody>
</table>

### Gray scale of White & Black

<table>
<thead>
<tr>
<th>Gray scale level</th>
<th>Black</th>
<th>Dark</th>
<th>Light</th>
<th>White</th>
</tr>
</thead>
<tbody>
<tr>
<td>L0</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>L1</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>L2</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>L3…L251</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>L252</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>L253</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>L254</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
<tr>
<td>White L255</td>
<td>L L L L L L L L</td>
<td>H H H H H H H H</td>
<td>L L L L L L L L</td>
<td>L L L L L L L L</td>
</tr>
</tbody>
</table>
4. ABSOLUTE MAXIMUM RATINGS

4.1 Absolute Ratings of TFT LCD Module

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Min.</th>
<th>Max.</th>
<th>Unit</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply voltage</td>
<td>VDD</td>
<td>-0.3</td>
<td>5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Logic Signal Input Level</td>
<td>$V_{DVDD}$</td>
<td>-0.3</td>
<td>5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$V_{DVDD_{LVDS}}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.2 Absolute Ratings of Environment

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Min.</th>
<th>Max.</th>
<th>Unit</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature</td>
<td>$T_{opa}$</td>
<td>-20</td>
<td>70</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>$T_{sig}$</td>
<td>-30</td>
<td>80</td>
<td>°C</td>
<td></td>
</tr>
</tbody>
</table>
# 5. ELECTRICAL CHARACTERISTICS

## 5.1 TFT LCD Module

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>VDD</td>
<td>3</td>
<td>3.3</td>
<td>3.6</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>VLED</td>
<td>12</td>
<td></td>
<td></td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>ADJ logic level High</td>
<td>VADJ_H</td>
<td>2.4</td>
<td>--</td>
<td>--</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>ADJ logic level Low</td>
<td>VADJ_L</td>
<td>--</td>
<td>--</td>
<td>0.7</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>fPWM</td>
<td>100</td>
<td>20K</td>
<td>Hz</td>
<td></td>
<td>Note1</td>
</tr>
<tr>
<td>Input signal voltage</td>
<td>ViH</td>
<td>0.8VDD</td>
<td></td>
<td>VDD</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ViL</td>
<td>0</td>
<td>0.2VDD</td>
<td></td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>

Note1: PWM dimming duty.

![PWM Duty Diagram](image-url)
5.2 Switching Characteristics for LVDS Receiver

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential Input High Threshold</td>
<td>Vth</td>
<td></td>
<td>100</td>
<td></td>
<td>mV</td>
<td>V_{CM}=1.2V</td>
</tr>
<tr>
<td>Differential Input Low Threshold</td>
<td>Vtl</td>
<td>-100</td>
<td></td>
<td></td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td>Input Current</td>
<td>I_{IN}</td>
<td>-10</td>
<td></td>
<td>10</td>
<td>μA</td>
<td></td>
</tr>
<tr>
<td>Differential input Voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common Mode Voltage Offset</td>
<td>V_{CM}</td>
<td>0.7</td>
<td>1.2</td>
<td>1.6</td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>

5.3 Bit LVDS input

5.3.1 6Bit LVDS input

5.3.2 8Bit LVDS input
5.4 Interface Timing (DE mode)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCLK frequency @Frame rate=60hz</td>
<td>folk</td>
<td>52</td>
<td>65</td>
<td>71</td>
<td>Mhz</td>
</tr>
<tr>
<td>Horizontal display area</td>
<td>thd</td>
<td>1024</td>
<td></td>
<td></td>
<td>DCLK</td>
</tr>
<tr>
<td>HSYNC period time</td>
<td>th</td>
<td>1114</td>
<td>1344</td>
<td>1400</td>
<td>DCLK</td>
</tr>
<tr>
<td>HSYNC blanking</td>
<td>thb+thfp</td>
<td>90</td>
<td>320</td>
<td>376</td>
<td>DCLK</td>
</tr>
<tr>
<td>Vertical display area</td>
<td>tvd</td>
<td>768</td>
<td></td>
<td></td>
<td>H</td>
</tr>
<tr>
<td>VSYNC period time</td>
<td>tv</td>
<td>778</td>
<td>806</td>
<td>845</td>
<td>H</td>
</tr>
<tr>
<td>VSYNC blanking</td>
<td>tvb+tvfp</td>
<td>10</td>
<td>38</td>
<td>77</td>
<td>H</td>
</tr>
</tbody>
</table>

Timing Diagram of Interface Signal (DE mode)

(1). Vertical input timing

(2). Horizontal input timing
5.5 Power On / Off Sequence

<table>
<thead>
<tr>
<th>Item</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP1</td>
<td>0.5</td>
<td>--</td>
<td>10</td>
<td>msec</td>
<td></td>
</tr>
<tr>
<td>TP2</td>
<td>0</td>
<td>--</td>
<td>50</td>
<td>msec</td>
<td></td>
</tr>
<tr>
<td>TP3</td>
<td>0</td>
<td>--</td>
<td>50</td>
<td>msec</td>
<td></td>
</tr>
<tr>
<td>TP4</td>
<td>500</td>
<td>--</td>
<td>--</td>
<td>msec</td>
<td></td>
</tr>
<tr>
<td>TP5</td>
<td>200</td>
<td>--</td>
<td>--</td>
<td>msec</td>
<td></td>
</tr>
<tr>
<td>TP6</td>
<td>200</td>
<td>--</td>
<td>--</td>
<td>msec</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**

1. The supply voltage of the external system for the module input should be the same as the definition of VDD.
2. Apply the lamp voltage within the LCD operation range. When the back-light turns on before the LCD operation or the LCD turns off before the back-light turns off, the display may momentarily become white.
3. In case of VDD = off level, please keep the level of input signal on the low or keep a high impedance.
4. TP4 should be measured after the module has been fully discharged between power off and on period.
5. Interface signal shall not be kept at high impedance when the power is on.
5.6 Backlight Unit

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED Current</td>
<td>$I_L$</td>
<td>--</td>
<td>480</td>
<td>--</td>
<td>mA</td>
<td>$Ta=25^\circ C$</td>
</tr>
<tr>
<td>LED Voltage</td>
<td>$V_L$</td>
<td>--</td>
<td>12.9</td>
<td>13.6</td>
<td>Volt</td>
<td>$Ta=25^\circ C$</td>
</tr>
<tr>
<td>LED Life-Time</td>
<td>N/A</td>
<td>30,000</td>
<td></td>
<td></td>
<td>Hour</td>
<td>$Ta=25^\circ C$; $I_f=60\text{mA}$</td>
</tr>
</tbody>
</table>

Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: $Ta=25\pm3^\circ C$, typical $I_L$ value indicated in the above table until the brightness becomes less than 50%.

Note (2) The "LED life time" is defined as the module brightness decrease to 50% original brightness at $Ta=25^\circ C$ and $I_L=480\text{mA}$. The LED lifetime could be decreased if operating $I_L$ is larger than $480\text{mA}$. The constant current driving method is suggested.

Note (3) LED Light Bar Circuit

When LCM is operated over $40^\circ C$ ambient temperature, the $I_L$ should be follow:

![Graph showing the relationship between Allowable Forward Current (mA) and Ambient Temperature ($^\circ C$)]
### 7. INTERFACE PIN CONNECTION

**CN2 LVDS connector: P1.0 20pin/CP100-S20G-H16**

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Symbol</th>
<th>I/O</th>
<th>Description</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VDD</td>
<td>P</td>
<td>Power Voltage for Logic: 3.3V</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>VDD</td>
<td>P</td>
<td>Power Voltage for Logic: 3.3V</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>P</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td>P</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>IN0-</td>
<td>I</td>
<td>LVDS differential data input</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>IN0+</td>
<td>I</td>
<td>LVDS differential data input</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
<td>P</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>IN1-</td>
<td>I</td>
<td>LVDS differential data input</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>IN1+</td>
<td>I</td>
<td>LVDS differential data input</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>GND</td>
<td>P</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>IN2-</td>
<td>I</td>
<td>LVDS differential data input</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>IN2+</td>
<td>I</td>
<td>LVDS differential data input</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>GND</td>
<td>P</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>CLK-</td>
<td>I</td>
<td>LVDS differential data input</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>CLK+</td>
<td>I</td>
<td>LVDS differential data input</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>GND</td>
<td>P</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>IN3-</td>
<td>I</td>
<td>LVDS differential data input</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>IN3+</td>
<td>I</td>
<td>LVDS differential data input</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>VLED</td>
<td>P</td>
<td>Power Voltage for Logic: 12V</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>ADJ</td>
<td>I</td>
<td>BL dimming pin, PWM signal</td>
<td></td>
</tr>
</tbody>
</table>

**Diagram:**

- **Duty=100% Brightness=100%**
- **Duty=75% Brightness=75%**
- **Duty=60% Brightness=50%**
- **Duty=25% Brightness=25%**
- **Duty=0% Brightness=0%**
8. TOUCH PANEL ELECTRICAL SPECIFICATION

8-1 Basic Characteristic

<table>
<thead>
<tr>
<th>ITEM</th>
<th>SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Projective Capacitive Touch Panel</td>
</tr>
<tr>
<td>Activation</td>
<td>Multi-touch</td>
</tr>
<tr>
<td>X/Y Position Reporting</td>
<td>Absolute Position</td>
</tr>
<tr>
<td>Touch Force</td>
<td>No contact pressure required</td>
</tr>
<tr>
<td>Calibration</td>
<td>No need for calibration</td>
</tr>
<tr>
<td>Report Rate</td>
<td>Approx 100 points/sec</td>
</tr>
<tr>
<td>Interface/Protocol</td>
<td>IIC/V3.X</td>
</tr>
<tr>
<td>Control IC</td>
<td>ILI2511</td>
</tr>
<tr>
<td>Conductive susceptibility</td>
<td>IEC/EN61000-4-6 10Vrms</td>
</tr>
<tr>
<td>Radiated Susceptibility</td>
<td>IEC/EN61000-4-3 30V/m</td>
</tr>
<tr>
<td>Cover Glass</td>
<td>1.1mm chemically strength glass with black border</td>
</tr>
<tr>
<td>Bonding method</td>
<td>CG to sensor: optical bonding</td>
</tr>
<tr>
<td></td>
<td>TP module to LCM: tape bonding</td>
</tr>
</tbody>
</table>

8-2 Electrical Characteristic

8-2-1 IIC Interface

Specify the normal operating condition
(GND=0V)

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply Voltage</td>
<td>VIN</td>
<td>3</td>
<td>3.3</td>
<td>3.6</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Signal IIC Interface Logic</td>
<td>V_IL</td>
<td>0</td>
<td>-</td>
<td>0.3*VIN</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>V_IH</td>
<td>0.7*VIN</td>
<td>-</td>
<td>VIN</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Power Consumption</td>
<td>I_VIN</td>
<td>50</td>
<td></td>
<td></td>
<td>mA</td>
<td>Ref.</td>
</tr>
</tbody>
</table>

7-2-2 Pin definition

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VIN</td>
<td>Power supply 3.3V</td>
</tr>
<tr>
<td>2</td>
<td>SCL</td>
<td>IIC Clock</td>
</tr>
<tr>
<td>3</td>
<td>SDA</td>
<td>IIC Data</td>
</tr>
<tr>
<td>4</td>
<td>INT</td>
<td>Interrupt signal Active “Low”</td>
</tr>
<tr>
<td>5</td>
<td>RESET</td>
<td>Reset touch panel controller Active “Low”</td>
</tr>
<tr>
<td>6</td>
<td>GND</td>
<td>Power GND</td>
</tr>
</tbody>
</table>
8-2-3 Power-on Timing Chart (IIC interface)

Symbol | Parameter | MIN. | MAX. | Unit
--- | --- | --- | --- | ---
\(T_{\text{Ini}}\) | After powering-on or resetting the device, the device needs \(T_{\text{Ini}}\) time to configure the system. | - | 100 | ms
\(T_{\text{Reset}}\) | /Reset pin low hold time | 50 | - | \(\mu\)s

8-2-4 IIC AC Waveform

8-2-5 IIC Characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>100KHz</th>
<th>400KHz</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>MIN</td>
<td>Max</td>
</tr>
</tbody>
</table>
| \(t_{\text{SCL}}\) | SCL clock frequency | 0 | 100 | kHz | 0 | 400 | kHz
| \(t_{\text{HLD,STA}}\) | Hold time (repeated) START condition. After this period, the first clock pulse is generated | 4.0 | - | \(\mu\)s | 0.6 | - | \(\mu\)s
| \(t_{\text{LOW}}\) | LOW period of the SCL clock | 4.7 | - | \(\mu\)s | 1.3 | - | \(\mu\)s
| \(t_{\text{HIGH}}\) | HIGH period of the SCL clock | 4.0 | - | \(\mu\)s | 0.6 | - | \(\mu\)s
| \(t_{\text{SLOW,STA}}\) | Set-up time for a repeated START condition | 4.7 | - | \(\mu\)s | 0.6 | - | \(\mu\)s
| \(t_{\text{HDLAT}}\) | Data hold time | 0 | 3.45 | \(\mu\)s | 0 | 0.9 | \(\mu\)s
| \(t_{\text{HDDAT}}\) | Data set-up time | 250 | - | ns | 100 | - | ns
| \(t_{\text{R}}\) | Rise time of both SDA and SCL signals | - | 1000 | ns | - | 300 | ns
| \(t_{\text{F}}\) | Fall time of both SDA and SCL signals | - | 300 | ns | - | 300 | ns
| \(t_{\text{SUETO}}\) | Set-up time for STOP condition | 4.0 | - | \(\mu\)s | 0.6 | - | \(\mu\)s
| \(t_{\text{LST}}\) | Bus free time between a STOP and START condition | 4.7 | - | \(\mu\)s | 1.3 | - | \(\mu\)s
### 7-2-6 Format Protocol
#### Protocol V3.X Command List

<table>
<thead>
<tr>
<th>CMD Code</th>
<th>Name</th>
<th>Set /Get</th>
<th>Note</th>
<th>b7</th>
<th>b6</th>
<th>b5</th>
<th>b4</th>
<th>b3</th>
<th>b2</th>
<th>b1</th>
<th>b0</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x10</td>
<td>Touch</td>
<td>Get</td>
<td>0: No touch</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Information</td>
<td></td>
<td>1: Last Report at ID 0 to ID 5 (include release status)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2: Last Report at ID 6 to ID 9 (include release status)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ID0</td>
<td></td>
<td>1: Touch Down,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0: Touch Off</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>X_High direction coordinate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>X_Low direction coordinate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ID1</td>
<td></td>
<td>1: Touch Down,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0: Touch Off</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>X_High direction coordinate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>X_Low direction coordinate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ID2</td>
<td></td>
<td>1: Touch Down,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0: Touch Off</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>X_High direction coordinate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>X_Low direction coordinate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ID3</td>
<td></td>
<td>1: Touch Down,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0: Touch Off</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>X_High direction coordinate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>X_Low direction coordinate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ID4</td>
<td></td>
<td>1: Touch Down,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0: Touch Off</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>X_High direction coordinate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>X_Low direction coordinate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Touch Pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Date: 2018/2/9

AMPIRE CO., LTD.
<table>
<thead>
<tr>
<th>ID</th>
<th>0x14 Touch Information 2</th>
<th>Get</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ID5</strong></td>
<td>1: Touch Down, 0: Touch Off</td>
<td>0</td>
<td>X_High direction coordinate</td>
</tr>
<tr>
<td></td>
<td>X_Low direction coordinate</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>Y_Low direction coordinate</td>
</tr>
<tr>
<td></td>
<td>Touch Pressure</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| ID6  | 1: Touch Down, 0: Touch Off | 0   | X_High direction coordinate |
|      | X_Low direction coordinate | 0   | 0    | Y_High direction coordinate |
|      | 0                         | 0   | Y_Low direction coordinate |
|      | Touch Pressure            |     |      |

| ID7  | 1: Touch Down, 0: Touch Off | 0   | X_High direction coordinate |
|      | X_Low direction **coordinate** | 0   | 0    | Y_High direction coordinate |
|      | 0                         | 0   | Y_Low direction coordinate |
|      | Touch Pressure            |     |      |

| ID8  | 1: Touch Down, 0: Touch Off | 0   | X_High direction coordinate |
|      | X_Low direction coordinate | 0   | 0    | Y_High direction coordinate |
|      | 0                         | 0   | Y_Low direction coordinate |
|      | Touch Pressure            |     |      |

| ID9  | 1: Touch Down, 0: Touch Off | 0   | X_High direction coordinate |
|      | X_Low direction coordinate | 0   | 0    | Y_High direction coordinate |
|      | 0                         | 0   | Y_Low direction coordinate |
|      | Touch Pressure            |     |      |

| 0x20 | The maximum X coordinate (bit 7:0) |
|      | The maximum X coordinate (bit 15:8) |
|      | The maximum Y coordinate (bit 7:0) |
|      | The maximum Y coordinate (bit 15:8) |
|      | The channel numbers of X direction |
|      | The channel numbers of Y direction |
|      | The maximum report points       |
### Protocol V3.X Data Format

<table>
<thead>
<tr>
<th>CMD Code</th>
<th>Name</th>
<th>Set / Get</th>
<th>Note</th>
<th>b7</th>
<th>b6</th>
<th>b5</th>
<th>b4</th>
<th>b3</th>
<th>b2</th>
<th>b1</th>
<th>b0</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x10</td>
<td>Touch Information</td>
<td>Get</td>
<td>Packet Number</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0: No touch</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1: Last Report at ID 0 to ID 5 (include release status)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2: Last Report at ID 6 to ID 9 (include release status)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ID0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1: Touch Down                                      0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0: Touch Off                                       0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>X_Low direction coordinate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y_Low direction coordinate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Touch Pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>X_High direction coordinate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y_High direction coordinate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ID</td>
<td>Touch State</td>
<td>X Low Direction</td>
<td>Y Low Direction</td>
<td>Touch Pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>-------------</td>
<td>-----------------</td>
<td>-----------------</td>
<td>---------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ID1</td>
<td>Touch Down, 0: Touch Off</td>
<td>0</td>
<td>X High direction coordinate</td>
<td>Touch Pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>X Low direction coordinate</td>
<td>Y High direction coordinate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ID2</td>
<td>Touch Down, 0: Touch Off</td>
<td>0</td>
<td>X High direction coordinate</td>
<td>Touch Pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>X Low direction coordinate</td>
<td>Y High direction coordinate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ID3</td>
<td>Touch Down, 0: Touch Off</td>
<td>0</td>
<td>X High direction coordinate</td>
<td>Touch Pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>X Low direction coordinate</td>
<td>Y High direction coordinate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ID4</td>
<td>Touch Down, 0: Touch Off</td>
<td>0</td>
<td>X High direction coordinate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>X Low direction coordinate</td>
<td>Y High direction coordinate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ID5</td>
<td>Touch Down, 0: Touch Off</td>
<td>0</td>
<td>X High direction coordinate</td>
<td>Touch Pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>X Low direction coordinate</td>
<td>Y High direction coordinate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>X Low direction coordinate</td>
<td>Y High direction coordinate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
7-2-7 Interrupt Pin (INT) Control
When a finger touches on the sensor surface, the INT pin will be pull low. TP controller supports two different type control method.

Method 1 (Polling): The INT will continue to be low until the finger leaves the sensor surface.

![Diagram 1](image1)

Fig 9: Method 1: INT Pin Control Diagram (Finger Touch)

Method 2 (Interrupt): The INT will continue to be pull low until host read 0x10 command.

![Diagram 2](image2)

Fig 10: Method 2: INT Pin Control Diagram (Finger Touch)
Fig 11: Method 2: INT Pin Control Diagram (Finger Release)
7-2-8 Device Address

<table>
<thead>
<tr>
<th>MSB</th>
<th>LSB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 0 0 0 0 0 1</td>
<td>0/1</td>
</tr>
</tbody>
</table>

Device Address: R/W

7-bit Device Address: 0x41
8-bit Device Read Address: 0x83
8-bit Device Write Address: 0x82

7-2-9 Data Transfer

Data is transferred over the IIC bus with 8-bit address and 8-bit data.

<table>
<thead>
<tr>
<th>1</th>
<th>7</th>
<th>1</th>
<th>1</th>
<th>8</th>
<th>1</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>Slave Address</td>
<td>Wr</td>
<td>A</td>
<td>Data Byte</td>
<td>A</td>
<td>P</td>
</tr>
</tbody>
</table>

S: Start Condition
Sr: Repeated Start Condition
Rd: Read (bit value of 1)
Wr: Write (bit value of 0)
A/NA: Acknowledge (this bit position may be ‘0’ for an ACK or ‘1’ for a NACK)
P: Stop Condition

Master-to-Slave
Slave-to-Master
Continue
I2C Write timing

SCL

SDA

A6, A5, A4, A3, A2, A1, A0, 0 => ACK, D7, D6, D5, D4, D3, D2, D1, D0

I2C Read timing

SCL

SDA

A6, A5, A4, A3, A2, A1, A0, 1 => ACK, D7, D6, D5, D4, D3, D2, D1, D0

Byte Write

SCL

SDA

0 0 1 0 0 0 0 0 => ACK, A5, A4, A3, A2, A1, A0, 0 0 0 0 0 0

Command code

S Slave Address Wr A Command Code A Data Byte A P

Byte Write

Byte Read

S Slave Address Wr A Command Code A Sr Slave Address Rd A Data Byte A P

Byte Read
### 9. RELIABILITY TEST CRITERIA

<table>
<thead>
<tr>
<th>Test Item</th>
<th>Test Conditions</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Temperature Operation</td>
<td>70±3°C , Dry t=240 hrs</td>
<td></td>
</tr>
<tr>
<td>Low Temperature Operation</td>
<td>-20±3°C , Dry t=240 hrs</td>
<td></td>
</tr>
<tr>
<td>High Temperature Storage</td>
<td>80±3°C , Dry t=240 hrs</td>
<td>1,2</td>
</tr>
<tr>
<td>Low Temperature Storage</td>
<td>-30±3°C , Dry t=240 hrs</td>
<td>1,2</td>
</tr>
<tr>
<td>Storage at High Temperature and Humidity</td>
<td>60°C, 90% RH t=240 hrs</td>
<td>1,2</td>
</tr>
<tr>
<td>Thermal Shock Test</td>
<td>-20°C (30min.) ~ 25°C(5min.) ~ 70°C (30min.) 100 cycles</td>
<td>1,2</td>
</tr>
<tr>
<td>Vibration Test (Packing)</td>
<td>Sweep frequency : 10 ~ 55 ~ 10 Hz/1min Amplitude : 0.75mm Test direction : X.Y.Z/3 axis Duration : 30min/each axis</td>
<td>2</td>
</tr>
</tbody>
</table>

Note 1: Condensation of water is not permitted on the module.

Note 2: The module should be inspected after 1 hour storage in normal conditions (15-35°C, 45-65%RH).

Note 3: The module shouldn’t be tested more than one condition, and all the test conditions are independent.

Note 4: All the reliability tests should be done without protective film on the module.
10. USE PRECAUTIONS

10-1 Safety

Liquid crystal is poisonous. Do not put it your month. If liquid crystal touches your skin or clothes, wash it off immediately by using soap and water.

10-2 Handling

1. The LCD panel is plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.
2. The polarizer attached to the display is easily damaged. Please handle it carefully to avoid scratch or other damages.
3. To avoid contamination on the display surface, do not touch the module surface with bare hands.
4. Keep a space so that the LCD panels do not touch other components.
5. Put cover board such as acrylic board on the surface of LCD panel to protect panel from damages.
6. Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where the condensation of dew occurs.
7. Do not leave module in direct sunlight to avoid malfunction of the ICs.

10-3 Static Electricity

1. Be sure to ground module before turning on power or operation module.
2. Do not apply voltage which exceeds the absolute maximum rating value.

10-4 Storage

1. Store the module in a dark room where must keep at \(+25\pm10\)\(^\circ\)C and 65\%RH or less.
2. Do not store the module in surroundings containing organic solvent or corrosive gas.
3. Store the module in an anti-electrostatic container or bag.

10-5 Cleaning

1. Do not wipe the polarizer with dry cloth. It might cause scratch.
2. Only use a soft sloth with IPA to wipe the polarizer, other chemicals might permanent damage to the polarizer.
10-6 Mechanism

(1) Please mount LCD module by using mounting holes arranged in four corners tightly.

(2) The square adhesive tape which is between the touch panel and display can’t provide well supporting in the long term and high ambient temperature condition. Whether upright or horizontal position the support holder which is in the back side of the display is needed. Do not let the display floating.

(3) TP needs to work in environment with stable stray capacitance. In order to minimize the variation in stray capacitance, all conductive mechanical parts must not be floating. Intermittent floating any conductive part around the touch sensor may cause significant stray capacitance change and abnormal touch function. It is recommended to keep all conductive parts having same electrical potential as the GND of the touch controller module.

GND1, GND2 and GND3 should be connected together to have the same ground
10-7 Others

1. AMIPRE will provide one year warrantee for all products and three months warrantee for all repairing products.
2. Do not keep the LCD at the same display pattern continually. The residual image will happen and it will damage the LCD. Please use screen save
11. OUTLINEDIMENSION

Note:
1. Unless indicated, Tolerance ±0.3 mm.
2. UV Glue for OLB Protection.