MODEL NO.: TM090RDH01-00
ISSUED DATE: 2010-11-24
VERSION: Ver. 1.0

- Preliminary Specification
- Final Product Specification

Customer: ____________________________

<table>
<thead>
<tr>
<th>Approved by</th>
<th>Notes</th>
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<tbody>
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SHANGHAI AVIC Confirmed:

<table>
<thead>
<tr>
<th>Approved by</th>
<th>Checked by</th>
<th>Prepared by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anfernee. Du</td>
<td>Hyman. Chen</td>
<td>Ye. Chen</td>
</tr>
</tbody>
</table>

This technical specification is subjected to change without notice.

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## Record of Revision

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<th>Rev</th>
<th>Issued Date</th>
<th>Description</th>
<th>Editor</th>
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<tr>
<td>1.0</td>
<td>2010-11-24</td>
<td>Preliminary Specification Release</td>
<td>Ye Chen</td>
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# 1 General Specifications

## 1.1 General Specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>Spec</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Display Spec</strong></td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>9 inch</td>
</tr>
<tr>
<td>Resolution</td>
<td>800(RGB) × 480</td>
</tr>
<tr>
<td>Interface</td>
<td>TTL</td>
</tr>
<tr>
<td>Color Depth</td>
<td>16.7M</td>
</tr>
<tr>
<td>Technology Type</td>
<td>a-Si</td>
</tr>
<tr>
<td>Pixel Pitch (mm)</td>
<td>0.2475(H) × 0.2327(V)</td>
</tr>
<tr>
<td>Pixel Configuration</td>
<td>R.G.B. Stripe</td>
</tr>
<tr>
<td>Display Mode</td>
<td>TM with Normally White</td>
</tr>
<tr>
<td>Surface Treatment (Up Polarizer)</td>
<td>Anti Glare</td>
</tr>
<tr>
<td>Viewing Direction (Note 1)</td>
<td>12 o’clock</td>
</tr>
<tr>
<td>Gray Scale Inversion Direction</td>
<td>6 o’clock</td>
</tr>
<tr>
<td><strong>Mechanical Characteristics</strong></td>
<td></td>
</tr>
<tr>
<td>LCM (W x H x D)(mm)</td>
<td>211.10 × 126.50 × 5.60</td>
</tr>
<tr>
<td>Active Area (W x H)(mm)</td>
<td>198.00 × 111.70</td>
</tr>
<tr>
<td>With /Without TSP</td>
<td>Without TSP</td>
</tr>
<tr>
<td>Weight (g)(Note 3)</td>
<td>TBD</td>
</tr>
</tbody>
</table>

**Note 1:** Viewing direction for best image quality is different from TFT definition. There is a 180 degree shift.

**Note 2:** Requirements on Environmental Protection: RoHS

**Note 3:** Weight tolerance: +/- 5%
### 2 Input/Output Terminals

#### 2.1 INPUT TERMINALS PIN ASSIGNMENT

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Symbol</th>
<th>I/O (Note1)</th>
<th>Description</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LEDA</td>
<td>P</td>
<td>LED Anode</td>
<td>Note1</td>
</tr>
<tr>
<td>2</td>
<td>LEDA</td>
<td>P</td>
<td>LED Anode</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>LEDK</td>
<td>P</td>
<td>LED Cathode</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>LEDK</td>
<td>P</td>
<td>LED Cathode</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>P</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>VCOM</td>
<td>P</td>
<td>Common Voltage</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>DVDD</td>
<td>P</td>
<td>Digital power input,</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>MODE</td>
<td>I</td>
<td>DE/SYNC mode select. Normally pull high: 0: SYNC mode; 1: DE mode. DE Mode: Mode=&quot;H&quot;, Hsync and Vsync must pull high. SYNCMode: Mode=&quot;L&quot;, DE must be connected to GND.</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>DE</td>
<td>I</td>
<td>DATA INPUT Enable</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>VSYNC</td>
<td>I</td>
<td>Vertical Synchronization</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>HSYNC</td>
<td>I</td>
<td>Horizontal Synchronization</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>B7</td>
<td>I</td>
<td>Blue data(MSB)</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>B6</td>
<td>I</td>
<td>Blue data</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>B5</td>
<td>I</td>
<td>Blue data</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>B4</td>
<td>I</td>
<td>Blue data</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>B3</td>
<td>I</td>
<td>Blue data</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>B2</td>
<td>I</td>
<td>Blue data</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>B1</td>
<td>I</td>
<td>Blue data</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>B0</td>
<td>I</td>
<td>Blue data(LSB)</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>G7</td>
<td>I</td>
<td>Green data(MSB)</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>G6</td>
<td>I</td>
<td>Green data</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>G5</td>
<td>I</td>
<td>Green data</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>G4</td>
<td>I</td>
<td>Green data</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>G3</td>
<td>I</td>
<td>Green data</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>G2</td>
<td>I</td>
<td>Green data</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>G1</td>
<td>I</td>
<td>Green data</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>G0</td>
<td>I</td>
<td>Green data(LSB)</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>R7</td>
<td>I</td>
<td>RED data(MSB)</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>R6</td>
<td>I</td>
<td>RED data</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>R5</td>
<td>I</td>
<td>RED data</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>R4</td>
<td>I</td>
<td>RED data</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>R3</td>
<td>I</td>
<td>RED data</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>R2</td>
<td>I</td>
<td>RED data</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>R1</td>
<td>I</td>
<td>RED data</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>R0</td>
<td>I</td>
<td>RED data(LSB)</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>GND</td>
<td>P</td>
<td>Ground</td>
<td></td>
</tr>
</tbody>
</table>

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### 2.2 U/D R/L Function Description

#### Scan Control Input

<table>
<thead>
<tr>
<th>UPDN</th>
<th>SHLR</th>
<th>Scanning Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>GND</td>
<td>DVDD</td>
<td>Up to Down, Left to Right</td>
</tr>
<tr>
<td>DVDD</td>
<td>GND</td>
<td>Down to Up, Right to Left</td>
</tr>
<tr>
<td>GND</td>
<td>GND</td>
<td>Up to Down, Right to Left</td>
</tr>
<tr>
<td>DVDD</td>
<td>DVDD</td>
<td>Down to Up, Left to Right</td>
</tr>
</tbody>
</table>

### 3 Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital supply voltage</td>
<td>DVDD</td>
<td>-0.5</td>
<td>5.0</td>
<td>V</td>
<td>-</td>
</tr>
<tr>
<td>Analog supply voltage</td>
<td>AVDD</td>
<td>-0.5</td>
<td>15</td>
<td>V</td>
<td>-</td>
</tr>
<tr>
<td>Power supply voltage 1</td>
<td>VGH</td>
<td>-0.3</td>
<td>42</td>
<td>V</td>
<td>-</td>
</tr>
<tr>
<td>Power supply voltage 2</td>
<td>VGL</td>
<td>VGH-42</td>
<td>+0.3</td>
<td>V</td>
<td>-</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>( T_{OPR} )</td>
<td>-20</td>
<td>70</td>
<td>°C</td>
<td>-</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>( T_{STG} )</td>
<td>-30</td>
<td>80</td>
<td>°C</td>
<td>-</td>
</tr>
</tbody>
</table>

AGND=GND=0V, \( Ta = 25°C \)

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4 Electrical Characteristics

4.1 Recommended Operating Condition

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Min</th>
<th>Typ.</th>
<th>Max</th>
<th>Unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital Supply Voltage</td>
<td>DVDD</td>
<td>2.7</td>
<td>3.3</td>
<td>3.6</td>
<td>V</td>
<td>-</td>
</tr>
<tr>
<td>Analog Supply Voltage</td>
<td>AVDD</td>
<td>-</td>
<td>10.4</td>
<td>-</td>
<td>V</td>
<td>-</td>
</tr>
<tr>
<td>Gate On Voltage</td>
<td>VGH</td>
<td>-</td>
<td>17.0</td>
<td>-</td>
<td>V</td>
<td>-</td>
</tr>
<tr>
<td>Gate Off Voltage</td>
<td>VGL</td>
<td>-</td>
<td>-5.0</td>
<td>-</td>
<td>V</td>
<td>-</td>
</tr>
<tr>
<td>Common Electrode Driving Signal</td>
<td>VCOM</td>
<td>-</td>
<td>4.3</td>
<td>-</td>
<td>V</td>
<td>-</td>
</tr>
</tbody>
</table>

4.2 Power Consumption

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Condition</th>
<th>Min</th>
<th>Typ.</th>
<th>Max</th>
<th>Unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital Supply Current</td>
<td>IVCC</td>
<td>DVDD=3.3V</td>
<td>-</td>
<td>TBD</td>
<td></td>
<td>mA</td>
<td>-</td>
</tr>
<tr>
<td>Analog Supply Current</td>
<td>IAVDD</td>
<td>AVDD=10.4V</td>
<td>-</td>
<td>TBD</td>
<td></td>
<td>mA</td>
<td>-</td>
</tr>
<tr>
<td>Gate On Current</td>
<td>IVGH</td>
<td>VGH=17.0V</td>
<td>-</td>
<td>TBD</td>
<td></td>
<td>mA</td>
<td>-</td>
</tr>
<tr>
<td>Gate Off Current</td>
<td>IVGL</td>
<td>VGL=-5.0V</td>
<td>-</td>
<td>TBD</td>
<td></td>
<td>mA</td>
<td>-</td>
</tr>
<tr>
<td>Power Consumption</td>
<td></td>
<td>Pane &amp; Gamma</td>
<td>-</td>
<td>TBD</td>
<td></td>
<td>mW</td>
<td>-</td>
</tr>
</tbody>
</table>

Note1: Checkered flag pattern for Typ.;

4.3 Recommended Driving Condition for Backlight

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Min</th>
<th>Typ.</th>
<th>Max</th>
<th>Unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward Current</td>
<td>IF</td>
<td>-</td>
<td>20</td>
<td></td>
<td>mA</td>
<td>33 LEDs (3 LED Serial, 11 LED Parallel)</td>
</tr>
<tr>
<td>Forward Voltage</td>
<td>VF</td>
<td>9.0</td>
<td>9.9</td>
<td>10.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Backlight Power Consumption</td>
<td>WBL</td>
<td>-</td>
<td>2.178</td>
<td></td>
<td>W</td>
<td></td>
</tr>
<tr>
<td>Operating Life Time</td>
<td></td>
<td>-</td>
<td>20,000</td>
<td>-</td>
<td>Hrs</td>
<td>IF =20mA</td>
</tr>
</tbody>
</table>

Note1: The LED driving condition is defined for each LED module (3 LED Serial, 11 LED Parallel). For each LED: IF (1/11) =20mA, VF (1/3) =3.3V.

Note2: Under LCM operating, the stable forward current should be inputted. And forward voltage is for reference only.

Note3: IF is defined for one channel LED. Optical performance should be evaluated at Ta=25°C only

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If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

Note 4: The LED driving condition is defined for each LED module.
4.4 Block Diagram

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5 Interface Timing

5.1 AC Electrical Characteristics (For TTL input mode)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Spec.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Min.</td>
<td>Typ.</td>
</tr>
<tr>
<td>HS setup time</td>
<td>$T_{\text{hs}}$</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>HS hold time</td>
<td>$T_{\text{sh}}$</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>VS setup time</td>
<td>$T_{\text{vs}}$</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>VS hold time</td>
<td>$T_{\text{vh}}$</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>Data setup time</td>
<td>$T_{\text{ds}}$</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>Data hold time</td>
<td>$T_{\text{dh}}$</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>DE setup time</td>
<td>$T_{\text{es}}$</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>DE hold time</td>
<td>$T_{\text{eh}}$</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>VDD Power On Slew rate</td>
<td>$T_{\text{SOR}}$</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>RSTB pulse width</td>
<td>$T_{\text{Rst}}$</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>CLKIN cycle time</td>
<td>$T_{\text{clh}}$</td>
<td>20</td>
<td>-</td>
</tr>
<tr>
<td>CLKIN pulse duty</td>
<td>$T_{\text{clh}}$</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>Output stable time</td>
<td>$T_{\text{set}}$</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

DVDD=3.3V, Ta=25°C

5.2 Data input format

- Horizontal timing

---

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### Vertical timing


![Vertical Timing Diagram](image)

### Horizontal timing

<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>Horizontal Display Area</td>
<td>thd</td>
<td>800</td>
<td></td>
<td></td>
<td>DCLK</td>
</tr>
<tr>
<td>DCLK frequency</td>
<td>fclk</td>
<td>-</td>
<td>30</td>
<td>50</td>
<td>MHz</td>
</tr>
<tr>
<td>One Horizontal Line</td>
<td>th</td>
<td>889</td>
<td>928</td>
<td>1143</td>
<td>DCLK</td>
</tr>
<tr>
<td>HS pulse width</td>
<td>thpw</td>
<td>1</td>
<td>48</td>
<td>255</td>
<td>DCLK</td>
</tr>
<tr>
<td>HS Back Porch (Blanking)</td>
<td>thbp</td>
<td>88</td>
<td></td>
<td></td>
<td>DCLK</td>
</tr>
<tr>
<td>HS Front Porch</td>
<td>tvfp</td>
<td>1</td>
<td>40</td>
<td>255</td>
<td>DCLK</td>
</tr>
<tr>
<td>DE mode Blanking</td>
<td>th-thd</td>
<td>85</td>
<td>128</td>
<td>512</td>
<td>DCLK</td>
</tr>
</tbody>
</table>

### Vertical timing

<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>Vertical Display Area</td>
<td>tvd</td>
<td>480</td>
<td></td>
<td></td>
<td>th</td>
</tr>
<tr>
<td>VS period time</td>
<td>tv</td>
<td>513</td>
<td>525</td>
<td>767</td>
<td>th</td>
</tr>
<tr>
<td>VS pulse width</td>
<td>tvpw</td>
<td>3</td>
<td>3</td>
<td>255</td>
<td>th</td>
</tr>
<tr>
<td>VS Back Porch (Blanking)</td>
<td>tvb</td>
<td>32</td>
<td></td>
<td></td>
<td>th</td>
</tr>
<tr>
<td>VS Front Porch</td>
<td>tvfp</td>
<td>1</td>
<td>13</td>
<td>255</td>
<td>th</td>
</tr>
<tr>
<td>DE mode Blanking</td>
<td>tv-tvd</td>
<td>4</td>
<td>45</td>
<td>255</td>
<td>th</td>
</tr>
</tbody>
</table>

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5.3 Input clock and data timing waveform

5.4 Power ON/OFF Sequence

When power on: DVDD → VEE → VGH

When power off: VGH → VEE → DVDD
## 6 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>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>View Angles</td>
<td>θT</td>
<td>CR ≥ 10</td>
<td>-</td>
<td>50</td>
<td>-</td>
<td>Degree</td>
<td>Note 2</td>
</tr>
<tr>
<td></td>
<td>θB</td>
<td>-</td>
<td>-</td>
<td>70</td>
<td>-</td>
<td>Degree</td>
<td>Note 2</td>
</tr>
<tr>
<td></td>
<td>θL</td>
<td>-</td>
<td>-</td>
<td>70</td>
<td>-</td>
<td>Degree</td>
<td>Note 2</td>
</tr>
<tr>
<td></td>
<td>θR</td>
<td>-</td>
<td>-</td>
<td>70</td>
<td>-</td>
<td>Degree</td>
<td>Note 2</td>
</tr>
<tr>
<td>Contrast Ratio</td>
<td>CR</td>
<td>θ=0°</td>
<td>400</td>
<td>500</td>
<td>-</td>
<td>-</td>
<td>Note 1, Note 3</td>
</tr>
<tr>
<td>Response Time</td>
<td>T&lt;sub&gt;ON&lt;/sub&gt;</td>
<td>25°C</td>
<td>-</td>
<td>25</td>
<td>-</td>
<td>ms</td>
<td>Note 1, Note 4</td>
</tr>
<tr>
<td></td>
<td>T&lt;sub&gt;OFF&lt;/sub&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chromaticity</td>
<td>White</td>
<td>x</td>
<td></td>
<td>0.31</td>
<td></td>
<td></td>
<td>Note 5, Note 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>y</td>
<td></td>
<td>0.33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Red</td>
<td>x</td>
<td></td>
<td>TBD</td>
<td></td>
<td></td>
<td>Note 5, Note 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>y</td>
<td></td>
<td>TBD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>x</td>
<td></td>
<td>TBD</td>
<td></td>
<td></td>
<td>Note 5, Note 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>y</td>
<td></td>
<td>TBD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Blue</td>
<td>x</td>
<td></td>
<td>TBD</td>
<td></td>
<td></td>
<td>Note 5, Note 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>y</td>
<td></td>
<td>TBD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NTSC</td>
<td>-</td>
<td>-</td>
<td>50</td>
<td>-</td>
<td>-</td>
<td>%</td>
<td>Note 5</td>
</tr>
<tr>
<td>Luminance</td>
<td>L</td>
<td>-</td>
<td>250</td>
<td>-</td>
<td>-</td>
<td>cd/m²</td>
<td>Note 1, Note 7</td>
</tr>
<tr>
<td>Uniformity</td>
<td>U</td>
<td>70</td>
<td>75</td>
<td>-</td>
<td>-</td>
<td>%</td>
<td>Note 1, Note 6</td>
</tr>
</tbody>
</table>

**Test Conditions:**
1. The ambient temperature is 25°C.
2. The test systems refer to Note 1 and Note 2.
Note 1: Definition of optical measurement system

The optical characteristics should be measured in a dark room. After 5 minutes of operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be grounded when measuring the center area of the panel.

<table>
<thead>
<tr>
<th>Item</th>
<th>Photo detector</th>
<th>Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contrast Ratio</td>
<td>BM-5A</td>
<td>1°</td>
</tr>
<tr>
<td>Luminance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lum Uniformity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chromaticity</td>
<td>SR-3A</td>
<td></td>
</tr>
<tr>
<td>Response Time</td>
<td>TRD100</td>
<td>-</td>
</tr>
</tbody>
</table>

Note 2: Definition of viewing angle range and measurement system

Viewing angle is measured at the center point of the LCD by CONOSCOPE (ergo-80).

Note 3: Definition of contrast ratio

\[
\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}
\]

“White state”: The state is that the LCD should drive by V_white.

“Black state”: The state is that the LCD should drive by V_black.

V_white: To be determined  V_black: To be determined.

Note 4: Definition of response time

The response time is defined as the LCD optical switching time interval between “White” state and
“Black” state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.

Note 5: Definition of color chromaticity (CIE1931)
Color coordinates measured at center point of LCD.

Note 6: Definition of luminance uniformity
Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

Luminance Uniformity (U) = \text{Lmin} / \text{Lmax}

L---Active area length \quad W---Active area width

Lmax: The measured maximum luminance of all measurement position.
Lmin: The measured minimum luminance of all measurement position.

Note 7: Definition of luminance
Measure the luminance of white state at center point.
## 7 Environmental / Reliability Test

<table>
<thead>
<tr>
<th>No.</th>
<th>Test Item</th>
<th>Condition</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High Temperature Operation</td>
<td>Ts = +70°C, 240 hours (Note1)</td>
<td>IEC60068-2-1:2007 GB2423.2-2008</td>
</tr>
<tr>
<td>2</td>
<td>Low Temperature Operation</td>
<td>Ta = -20°C, 240 hours (Note2)</td>
<td>IEC60068-2-1:2007 GB2423.1-2008</td>
</tr>
<tr>
<td>3</td>
<td>High Temperature Storage</td>
<td>Ta = +80°C, 240 hours</td>
<td>IEC60068-2-1:2007 GB2423.2-2008</td>
</tr>
<tr>
<td>4</td>
<td>Low Temperature Storage</td>
<td>Ta = -30°C, 240 hours</td>
<td>IEC60068-2-1:2007 GB2423.2-2008</td>
</tr>
<tr>
<td>5</td>
<td>Storage at High Temperature and Humidity</td>
<td>Ta = +60°C, 90% RH max, 240 hours</td>
<td>IEC60068-2-78 :2001 GB/T2423.3—2006</td>
</tr>
<tr>
<td>6</td>
<td>Thermal Shock (non-operation)</td>
<td>-30°C 30 min ~ +80°C 30 min, Change time:5min, 20 Cycle</td>
<td>IEC61000-4-2:2001 GB/T17626.2-2006</td>
</tr>
<tr>
<td>7</td>
<td>ESD</td>
<td>C=150pF, R=330Ω, 5point/panel</td>
<td>IEC60068-2-6:1982 GB/T2423.10—1995</td>
</tr>
<tr>
<td>10</td>
<td>Package Drop Test</td>
<td>Height: 80cm, 1corner, 3edges, 6surfaces</td>
<td>IEC60068-2-32:1990 GB/T2423.8—1995</td>
</tr>
</tbody>
</table>

**Note1:** Ts is the temperature of panel's surface.

**Note2:** Ta is the ambient temperature of samples.
9 Packing Drawing

---TBD
10 Precautions for Use of LCD Panels

10.1 Handling Precautions

10.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

10.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

10.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

10.1.4 The polarizer covering the display surface of the LCD Panel is soft and easily scratched. Handle this polarizer carefully.

10.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

- Isopropyl alcohol
- Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

- Water
- Ketone
- Aromatic solvents

10.1.6 Do not attempt to disassemble the LCD Panel.

10.1.7 If the logic circuit power is off, do not apply the input signals.

10.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

- Be sure to ground the body when handling the LCD Panels.
- Tools required for assembly, such as soldering irons, must be properly ground.
- To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
- The LCD Panel is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

10.2 Storage Precautions

10.2.1 When storing the LCD Panels, avoid exposure to direct sunlight or to the light of fluorescent lamps.

10.2.2 The LCD Panels should be stored under the storage temperature range. If the LCD Panels will be stored for a long time, the recommend condition is:

Temperature: 0°C ~ 40°C, Relatively humidity: ≤80%

10.2.3 The LCD Panels should be stored in the room without acid, alkali and harmful gas.

10.3 Transportation Precautions

10.3.1 The LCD Panels should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.