MODEL NO. : TM022HDH20
ISSUED DATE: 2010-05-07
VERSION : Ver 1.1

- Preliminary Specification
- Final Product Specification

Customer: __________________________

<table>
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<th>Approved by</th>
<th>Notes</th>
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SHANGHAI TIANMA Confirmed:

<table>
<thead>
<tr>
<th>Prepared by</th>
<th>Checked by</th>
<th>Approved by</th>
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This technical specification is subjected to change without notice.
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## Record of Revision

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<th>Issue Date</th>
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<tr>
<td>1.0</td>
<td>2010-04-23</td>
<td>Preliminary release.</td>
<td>Qiuping Yang</td>
</tr>
<tr>
<td>1.1</td>
<td>2010-05-07</td>
<td>Update mechanical drawing on page 26.</td>
<td>Qiuping Yang</td>
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# 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>2.2 inch</td>
</tr>
<tr>
<td>Resolution</td>
<td>240(RGB) x 320</td>
</tr>
<tr>
<td>Interface</td>
<td>CPU 8/16 bit</td>
</tr>
<tr>
<td>Color Depth</td>
<td>262K</td>
</tr>
<tr>
<td>Technology Type</td>
<td>a-Si</td>
</tr>
<tr>
<td>Pixel Pitch (mm)</td>
<td>0.141 x 0.141</td>
</tr>
<tr>
<td>Pixel Configuration</td>
<td>R.G.B. Vertical Stripe</td>
</tr>
<tr>
<td>Display Mode</td>
<td>TM with Normally White</td>
</tr>
<tr>
<td>Surface Treatment</td>
<td>Clear type (3H)</td>
</tr>
<tr>
<td>Viewing Direction</td>
<td>6 o’clock</td>
</tr>
<tr>
<td>Gray Scale Inversion Direction</td>
<td>12 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>40.10×55.20×2.35</td>
</tr>
<tr>
<td>Active Area(mm)</td>
<td>33.84×45.12</td>
</tr>
<tr>
<td>With /Without TSP</td>
<td>Without TSP</td>
</tr>
<tr>
<td>Weight (g)</td>
<td>TBD</td>
</tr>
<tr>
<td>LED Numbers</td>
<td>4 LEDs</td>
</tr>
<tr>
<td><strong>Electronic</strong></td>
<td></td>
</tr>
<tr>
<td>Driver IC</td>
<td>ILI9340</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: LCM weight tolerance: +/- 5%.
2 Input/Output Terminals

2.1 TFT LCD Panel

<table>
<thead>
<tr>
<th>No</th>
<th>Symbol</th>
<th>I/O</th>
<th>Description</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DB0</td>
<td>I</td>
<td>Data bus</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>DB1</td>
<td>I</td>
<td>Data bus</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>DB2</td>
<td>I</td>
<td>Data bus</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>DB3</td>
<td>I</td>
<td>Data bus</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>P</td>
<td>Power Ground</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>VCC</td>
<td>P</td>
<td>Power Supply</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>/CS</td>
<td>I</td>
<td>Chip select</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>RS</td>
<td>I</td>
<td>Register select</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>/WR</td>
<td>I</td>
<td>Write strobe</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>/RD</td>
<td>I</td>
<td>Read strobe</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>IM0</td>
<td>I</td>
<td>Mode select</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>NC(XR)</td>
<td></td>
<td>No connection</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>NC(YU)</td>
<td></td>
<td>No connection</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>NC(XL)</td>
<td></td>
<td>No connection</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>NC(YD)</td>
<td></td>
<td>No connection</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>LED-A</td>
<td>P</td>
<td>LED anode</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>LED-K1</td>
<td>P</td>
<td>LED cathode</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>LED-K2</td>
<td>P</td>
<td>LED cathode</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>LED-K3</td>
<td>P</td>
<td>LED cathode</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>LED-K4</td>
<td>P</td>
<td>LED cathode</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>NC</td>
<td></td>
<td>No connection</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>DB4</td>
<td>I</td>
<td>Data bus</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>DB8</td>
<td>I</td>
<td>Data bus</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>DB9</td>
<td>I</td>
<td>Data bus</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>DB10</td>
<td>I</td>
<td>Data bus</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>DB11</td>
<td>I</td>
<td>Data bus</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>DB12</td>
<td>I</td>
<td>Data bus</td>
<td></td>
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<td>28</td>
<td>DB13</td>
<td>I</td>
<td>Data bus</td>
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<td>29</td>
<td>DB14</td>
<td>I</td>
<td>Data bus</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>DB15</td>
<td>I</td>
<td>Data bus</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>/RESET</td>
<td>I</td>
<td>Reset</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>VCI</td>
<td>P</td>
<td>Power Supply</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>VCC</td>
<td>P</td>
<td>Power Supply</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>GND</td>
<td>P</td>
<td>Power Ground</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>DB5</td>
<td>I</td>
<td>Data bus</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>DB6</td>
<td>I</td>
<td>Data bus</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>DB7</td>
<td>I</td>
<td>Data bus</td>
<td></td>
</tr>
</tbody>
</table>

Note1: I/O definition: I-----Input; O---Output; P----Power/Ground.

<table>
<thead>
<tr>
<th>IM0</th>
<th>Interface</th>
<th>DB pin</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>i80-parallel 16bit interface</td>
<td>DB[15~0]</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>i80-parallel 8bit interface</td>
<td>DB[15~8]</td>
<td>D0~D7 If not use, fix to GND</td>
</tr>
</tbody>
</table>

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# 3 Absolute Maximum Ratings

## 3.1 Driving TFT LCD Panel

GND=0V, Ta=25°C

<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>Analog Supply Voltage</td>
<td>VCI</td>
<td>-0.3</td>
<td>4.6</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Logic Supply Voltage</td>
<td>VCC</td>
<td>-0.3</td>
<td>4.6</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Input Signal Voltage</td>
<td>/CS, /WR, /RD, /RS, /RESET, IM0, DB[0:15]</td>
<td>-0.3</td>
<td>VCC+0.3</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Back Light Forward Current</td>
<td>I_{LED}</td>
<td>--</td>
<td>25.0</td>
<td>mA</td>
<td>For each LED</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>
4 Electrical Characteristics

4.1 Driving TFT LCD Panel

GND=0V, Ta=25°C

<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>Analog Supply Voltage</td>
<td>VCl</td>
<td>2.5</td>
<td>2.8</td>
<td>3.3</td>
<td>V</td>
<td>V</td>
</tr>
<tr>
<td>Logic Supply Voltage</td>
<td>VCC</td>
<td>1.65</td>
<td>1.8/2.8</td>
<td>3.3</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Input Signal Voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Level</td>
<td>VIL</td>
<td>0</td>
<td>--</td>
<td>0.2xVCC</td>
<td>V</td>
<td>/CS, /WR, /RD, RS, /RESET IM0, DB[0:15]</td>
</tr>
<tr>
<td>High Level</td>
<td>VIH</td>
<td>0.8xVCC</td>
<td>--</td>
<td>VCC</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Output Signal Voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Level</td>
<td>VOL</td>
<td>0</td>
<td>--</td>
<td>0.2xVCC</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>High Level</td>
<td>VOH</td>
<td>0.8xVCC</td>
<td>--</td>
<td>VCC</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>(Panel+ LSI) Power Consumption</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black Mode</td>
<td>--</td>
<td>TBD</td>
<td>--</td>
<td>--</td>
<td>mW</td>
<td>Frame Rate: 60Hz</td>
</tr>
<tr>
<td>8 color Mode</td>
<td>--</td>
<td>TBD</td>
<td>--</td>
<td>--</td>
<td>μW</td>
<td></td>
</tr>
<tr>
<td>Sleeping Mode</td>
<td>--</td>
<td>TBD</td>
<td>--</td>
<td>--</td>
<td>μW</td>
<td></td>
</tr>
</tbody>
</table>
4.2 Driving 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>$I_F$</td>
<td>--</td>
<td>18</td>
<td>--</td>
<td>mA</td>
<td>For each LED</td>
</tr>
<tr>
<td>Forward Voltage</td>
<td>$V_F$</td>
<td>--</td>
<td>3.2</td>
<td>--</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Power Consumption</td>
<td>$W_{BL}$</td>
<td>--</td>
<td>230.4</td>
<td>--</td>
<td>mW</td>
<td></td>
</tr>
<tr>
<td>Operating Life Time</td>
<td>--</td>
<td>10000</td>
<td>(20000)</td>
<td>--</td>
<td>Hrs</td>
<td></td>
</tr>
</tbody>
</table>

Note 1: The figure below shows the connection of backlight LED.

Note 2: One LED: $I_F = 18 mA$, $V_F = 3.2 V$.

Note 3:
$I_F$ is defined for one channel LED.
Optical performance should be evaluated at Ta=25°C only.
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.
### 4.3 Block Diagram

The diagram illustrates the components and connections within the LCD Driver Chip (COG), which includes:

- **RAM**
- **Source+ Gate Driver**
- **Grayscale Manipulation Voltage**
- **DC/DC**
- **VCOM& TCON**

**Connections**:
- **Data Bus (DB0~DB15)**
- **CPU I/F**
- **FPC**
- **BLU**
- **LED_A, LED_K1, LED_K2, LED_K2, LED_K4**
- **/CS, /WR, /RD, RS**
- **/RESET, IM0**
- **VCC**
- **VCI**

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## 5 Timing Chart

### 5.1 Timing Parameter

<table>
<thead>
<tr>
<th>Signal</th>
<th>Symbol</th>
<th>Parameter</th>
<th>min</th>
<th>max</th>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS</td>
<td>tast</td>
<td>Address setup time</td>
<td>0</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>taht</td>
<td>Address hold time (Write/Read)</td>
<td>10</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>/CS</td>
<td>tchw</td>
<td>CSX “H” pulse width</td>
<td>0</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tcs</td>
<td>Chip Select setup time (Write)</td>
<td>15</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>trcs</td>
<td>Chip Select setup time (Read ID)</td>
<td>45</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>trcsfm</td>
<td>Chip Select setup time (Read FM)</td>
<td>355</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tcsf</td>
<td>Chip Select Wait time (Write/Read)</td>
<td>10</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>/WR</td>
<td>twc</td>
<td>Write cycle</td>
<td>66</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>twrh</td>
<td>Write Control pulse H duration</td>
<td>15</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>twrl</td>
<td>Write Control pulse L duration</td>
<td>15</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>/RD(FM)</td>
<td>trcfm</td>
<td>Read Cycle (FM)</td>
<td>450</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>trdhfm</td>
<td>Read Control H duration (FM)</td>
<td>90</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>trdlfm</td>
<td>Read Control L duration (FM)</td>
<td>355</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>/RD(ID)</td>
<td>trec</td>
<td>Read cycle (ID)</td>
<td>160</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>trdh</td>
<td>Read Control pulse H duration</td>
<td>90</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>trdl</td>
<td>Read Control pulse L duration</td>
<td>45</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tdst</td>
<td>Write data setup time</td>
<td>10</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tdht</td>
<td>Write data hold time</td>
<td>10</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>trat</td>
<td>Read access time</td>
<td>-</td>
<td>40</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tratfm</td>
<td>Read access time</td>
<td>-</td>
<td>340</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>trod</td>
<td>Read output disable time</td>
<td>20</td>
<td>80</td>
<td>ns</td>
<td></td>
</tr>
</tbody>
</table>

Table 5.1 Timing Parameter
I80-parallel 16bit register write/read timing

I80-parallel 8bit register write/read timing
5.2 Register write/read timing

5.2.1 Register Write Timing

5.2.1.1 16-bit System Bus Interface Register Write Timing

*Note: NR is an unsynchronized signal (It can be stopped)*

Figure 5.2.1.1 16-bit System Bus Interface Timing (Register Write Timing)
5.2.1.2 8-bit System Bus Interface Register Write Timing

**Note:** NVR is an unsynchronized signal (it can be stopped)

![Diagram of 8-bit System Bus Interface Timing (Register Write Timing)]

**Figure 5.2.1.2 8-bit System Bus Interface Timing (Register Write Timing)**
5.2.2 Register read Timing

5.2.2.1 16-bit System Bus Interface Register read Timing

Note: IWR is an unsynchronized signal (It can be stopped).

Figure 5.2.2.1 16-bit System Bus Interface Timing (Register Read Timing)
5.2.2.2 8-bit System Bus Interface Register read Timing

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### 5.3 GRAM write/read timing

#### 5.3.1 16-bit Read/Write GRAM Data format

<table>
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<tr>
<th>Count</th>
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<th>0</th>
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<th>3</th>
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<th>240</th>
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<td>238B1</td>
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**Figure 5.3.1.1** 16-bit Read/Write GRAM Data format(65K)

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<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
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**Figure 5.3.1.2** 16-bit Read/Write GRAM Data format(262K)
### 5.3.2 8-bit Read/Write GRAM Data format

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<td>1</td>
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<td>238R3</td>
<td>238G1</td>
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<td>238B0</td>
<td>239G3</td>
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</tbody>
</table>

![Figure 5.3.1.2 8-bit Read/Write GRAM Data format(65K)](image)

<table>
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<td>1</td>
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<td>0G5</td>
<td>0B5</td>
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<td>239G5</td>
<td>239B5</td>
</tr>
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<td>0B3</td>
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<td>239R3</td>
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<td>239B3</td>
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5.4 Reset Timing Characteristics

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<td></td>
<td>tRT</td>
<td>Reset cancel</td>
<td></td>
<td>5 (note 1,5)</td>
<td>mS</td>
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<td></td>
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<td>120 (note 1,6,7)</td>
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![Diagram showing reset timing characteristics](image)

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5.5 Power ON/OFF Sequence

5.5.1 Power ON Sequence

- Power Supply ON \((V_{CC}, V_{CC})\)

- Power On Reset and Display OFF

- Registers setting before power supply startup

- Registers setting for power supply startup

- 50ms or more Stabilizing time

- 80ms or more Step-up circuit stabilizing time

- Operational Amplifier stabilizing time

- Set the other registers

- Display ON sequence

- Display ON

- BLU ON
5.5.2 Power OFF Sequence

1. Normal Display
2. BLU OFF
3. Display OFF
4. Power Supply Halt Setting
5. Power Supply OFF (VCC, VCC)

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## Optical Characteristics

### Optical Specification

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<th>Symbol</th>
<th>Condition</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
<th>Remark</th>
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<td>View Angle</td>
<td>θT</td>
<td>CR≥10</td>
<td>60</td>
<td>70</td>
<td>--</td>
<td>Degree</td>
<td>Note 2</td>
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<tr>
<td></td>
<td>θB</td>
<td></td>
<td>50</td>
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<td>θL</td>
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<td>20</td>
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<td>0.584</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blue</td>
<td>x</td>
<td></td>
<td>0.096</td>
<td>0.146</td>
<td>0.196</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>y</td>
<td></td>
<td>0.056</td>
<td>0.106</td>
<td>0.156</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uniformity (%)</td>
<td>U</td>
<td></td>
<td>--</td>
<td>80</td>
<td>--</td>
<td></td>
<td>Note 1, Note 6</td>
</tr>
<tr>
<td>NTSC (%)</td>
<td></td>
<td></td>
<td>--</td>
<td>50</td>
<td>--</td>
<td></td>
<td>Note 5</td>
</tr>
<tr>
<td>Luminance</td>
<td>L</td>
<td></td>
<td>170</td>
<td>220</td>
<td>--</td>
<td></td>
<td>Note 1, Note 7</td>
</tr>
</tbody>
</table>

### Test Conditions:

1. $V_F = 3.2V, I_F = 18mA$ (LED current), 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 dark room. After 5 minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.

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).

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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 driven by V_{white}.

"Black state": The state is that the LCD should driven 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) = Lmin / Lmax

L-------Active area length W----- Active area width

![Fig. 2 Definition of uniformity](image)

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>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High Temperature Operation</td>
<td>$T_s=+70^\circ \text{C}$, 240hrs</td>
<td>Note1 IEC60068-2-1,GB2423.2</td>
</tr>
<tr>
<td>2</td>
<td>Low Temperature Operation</td>
<td>$T_a=-20^\circ \text{C}$, 240hrs</td>
<td>IEC60068-2-1 GB2423.1</td>
</tr>
<tr>
<td>3</td>
<td>High Temperature Storage</td>
<td>$T_a=+80^\circ \text{C}$, 240hrs</td>
<td>IEC60068-2-1 GB2423.2</td>
</tr>
<tr>
<td>4</td>
<td>Low Temperature Storage</td>
<td>$T_a=-30^\circ \text{C}$, 240hrs</td>
<td>IEC60068-2-1 GB2423.1</td>
</tr>
<tr>
<td>5</td>
<td>High Temperature &amp; High Humidity Storage</td>
<td>$T_a=+60^\circ \text{C}$, 90% RH 240 hours</td>
<td>Note2 IEC60068-2-78 GB/T2423.3</td>
</tr>
<tr>
<td>6</td>
<td>Thermal Shock (Non-operation)</td>
<td>-30°C 30 min to +80°C 30 min, Change time: 5 min, 20 Cycles</td>
<td>Start with cold temperature, End with high temperature, IEC60068-2-14,GB2423.22</td>
</tr>
<tr>
<td>7</td>
<td>Electro Static Discharge (Operation)</td>
<td>$C=150\mu\text{F}$, $R=330\Omega$, 5 points/panel Air: ±8KV, 5 times; Contact: ±4KV, 5 times; (Environment: 15°C~35°C, 30%<del>60%, 86Kpa</del>106Kpa).</td>
<td>IEC61000-4-2 GB/T17626.2</td>
</tr>
<tr>
<td>8</td>
<td>Vibration (Non-operation)</td>
<td>Frequency range: 10<del>55Hz, Stroke: 1.5mm Sweep: 10Hz</del>55Hz~10Hz 2 hours for each direction of X,Y,Z. (6 hours for total)(Package condition)</td>
<td>IEC60068-2-6 GB/T2423.10</td>
</tr>
<tr>
<td>9</td>
<td>Shock (Non-operation)</td>
<td>$60\text{G} \times \text{ms}$, $\pm X, \pm Y, \pm Z$ 3 times, for each direction</td>
<td>IEC60068-2-27 GB/T2423.5</td>
</tr>
<tr>
<td>10</td>
<td>Package Drop Test</td>
<td>Height: 80 cm, 1 corner, 3 edges, 6 surfaces</td>
<td>IEC60068-2-32 GB/T2423.8</td>
</tr>
<tr>
<td>11</td>
<td>Package Vibration Test</td>
<td>Random Vibration: 0.015GxG/Hz for 5-200Hz, -6dB/Octave from 200-500Hz 2 hours for each direction of X,Y,Z (6 hours for total)</td>
<td>IEC60068-2-34 GB/T2423.11</td>
</tr>
</tbody>
</table>

Note1: $T_s$ is the temperature of panel’s surface.
Note2: $T_a$ is the ambient temperature of sample.
9 Packing Drawing

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Model (Material)</th>
<th>Dimensions(mm)</th>
<th>Unit Weight(Kg)</th>
<th>Quantity</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LCM module</td>
<td>TM022HDH20</td>
<td>40.10×55.20×2.35</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>2</td>
<td>Tray</td>
<td>PET(Transmit)</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>3</td>
<td>EPE</td>
<td>EPE</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>4</td>
<td>Desiccant</td>
<td>Desiccant</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>5</td>
<td>Anti-static bag</td>
<td>PE</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>6</td>
<td>BOX</td>
<td>Corrugated paper</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>7</td>
<td>Carton</td>
<td>Corrugated paper</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>8</td>
<td>Total Weight(Kg)</td>
<td></td>
<td></td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
</tr>
</tbody>
</table>

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10 Precautions for Use of LCD Modules

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 module 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 Module.

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.

10.1.8.1 Be sure to ground the body when handling the LCD Modules.

10.1.8.2 Tools required for assembly, such as soldering irons, must be properly ground.

10.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

10.1.8.4 The LCD Module 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 modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

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

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

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

10.3 Transportation Precautions:

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