TO:

Date: May, 08 2005

HannStar Product Information

Model: HSD050I551-A**

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2. The information contained herein is presented merely to indicate the characteristics and performance of our products. No responsibility is assumed by HannStar for any intellectual property claims or other problems that may result from application based on the module described herein.
3. The mark "**" of Model means sub-model code.
Record of Revisions

<table>
<thead>
<tr>
<th>Rev.</th>
<th>Date</th>
<th>Sub-Model</th>
<th>Description of change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>May. 08, 2005</td>
<td>A**</td>
<td>HSD050I551 Product Information was first issued.</td>
</tr>
</tbody>
</table>
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1.0 GENERAL DESCRIPTION

1.1 Introduction
HannStar Display model HSD050I551-A 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 and a back light system. This TFT LCD has a 5.0 inch diagonally measured active display area with 960 x 234 dot (320 horizontal by 234 vertical pixel) resolution.

1.2 Features
- 5 inch (4:3 diagonal) configuration
- Compatible with NTSC & PAL system
- Image Reversion: UP/DOWN and LEFT/RIGHT

1.3 Applications
- Portable TV
- Portable DVD
- Door Phone
- Multimedia applications and Others AV system

1.4 General information

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outline Dimension</td>
<td>119.3 x 91.4 x 7.5 (Typ.)</td>
<td>mm</td>
</tr>
<tr>
<td>Display area</td>
<td>102.72(H) x 74.53(V)</td>
<td>mm</td>
</tr>
<tr>
<td>Number of Pixel</td>
<td>320RGB(H) x234(V)</td>
<td>pixels</td>
</tr>
<tr>
<td>Pixel pitch</td>
<td>0.321(H) x 0.3185(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 white</td>
<td></td>
</tr>
<tr>
<td>Surface treatment</td>
<td>Antiglare, Hard-Coating(3H) with WV film</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>120 (Typ.)</td>
<td>g</td>
</tr>
<tr>
<td>Back-light</td>
<td>Single CCFL (Side-Light type)</td>
<td></td>
</tr>
</tbody>
</table>
1.5 Mechanical Information

<table>
<thead>
<tr>
<th>Item</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal (H)</td>
<td>119.0</td>
<td>119.3</td>
<td>119.6</td>
<td>mm</td>
</tr>
<tr>
<td>Vertical (V)</td>
<td>91.1</td>
<td>91.4</td>
<td>91.7</td>
<td>mm</td>
</tr>
<tr>
<td>Depth (D)</td>
<td>–</td>
<td>7.5</td>
<td>7.8</td>
<td>mm</td>
</tr>
<tr>
<td>Weight (Without inverter)</td>
<td>–</td>
<td>(120)</td>
<td>(130)</td>
<td>g</td>
</tr>
<tr>
<td>Torque of customer screw hole</td>
<td>–</td>
<td>–</td>
<td>2.0</td>
<td>Kgf•Cm</td>
</tr>
</tbody>
</table>
# 2.0 ABSOLUTE MAXIMUM RATINGS

## 2.1 Electrical Absolute Rating

### 2.1.1 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>$V_{DH}$</td>
<td>-0.3</td>
<td>6</td>
<td>V</td>
<td>GND=0</td>
</tr>
<tr>
<td></td>
<td>$V_{GH}$</td>
<td>-0.3</td>
<td>40</td>
<td>V</td>
<td>GND=0</td>
</tr>
<tr>
<td></td>
<td>$V_{GL}$</td>
<td>-20</td>
<td>0.3</td>
<td>V</td>
<td>GND=0</td>
</tr>
<tr>
<td></td>
<td>$AV_{DD}$</td>
<td>-0.2</td>
<td>$AV_{DD}+0.2$</td>
<td>V</td>
<td>AGND=0</td>
</tr>
<tr>
<td></td>
<td>$V_{COM}$</td>
<td>-1.1</td>
<td>4.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Analog Signal Input Level</td>
<td>$V_R, V_G, V_B$</td>
<td>-0.2</td>
<td>$AV_{DD}+0.2$</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Logic Signal Input Level</td>
<td>$V_I$</td>
<td>-0.3</td>
<td>$DV_{DD}+0.3$</td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>

### 2.1.2 Back-Light Unit

<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>Lamp voltage</td>
<td>$V_{FL}$</td>
<td>0</td>
<td>1500</td>
<td>$V_{(rms)}$</td>
<td>(1) (2)</td>
</tr>
<tr>
<td>Lamp current</td>
<td>$I_L$</td>
<td>0</td>
<td>(7.0)</td>
<td>mA</td>
<td>(1) (2)</td>
</tr>
<tr>
<td>Lamp frequency</td>
<td>$f_L$</td>
<td>0</td>
<td>100</td>
<td>KHz</td>
<td>(1) (2)</td>
</tr>
</tbody>
</table>

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### 3.0 OPTICAL CHARACTERISTICS

#### 3.1 Optical specification

<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>250</td>
<td>350</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</td>
<td>θ=0 Normal viewing angle</td>
<td>-</td>
<td>(5)</td>
<td>-</td>
<td>msec</td>
<td>(1)(3)</td>
</tr>
<tr>
<td>Falling</td>
<td>TF</td>
<td></td>
<td>-</td>
<td>(20)</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White luminance (Center)</td>
<td>YL</td>
<td></td>
<td>340</td>
<td>400</td>
<td>-</td>
<td>cd/m²</td>
<td>(1)(4)</td>
</tr>
<tr>
<td>Color chromaticity (CIE1931)</td>
<td>Wy, Wy</td>
<td>Normal viewing angle</td>
<td>0.25</td>
<td>0.30</td>
<td>0.35</td>
<td></td>
<td>(1)(4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.30</td>
<td>0.35</td>
<td>0.40</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 3.2 Measuring Condition

- Measuring surrounding: dark room
- Lamp current $I_L: 6.0±0.1mA(rms),\ Lamp freq. F_L=50KHz,\ Inverter: HIU-766-22pF
- Ambient temperature: 25±2°C
- 30min. warm-up time.
3.3 Measuring Equipment

- Otsuka Electrics Corp., which utilized MCPD-3000 for Chromaticity and BM-5 for other optical characteristics.
- Measuring spot size: 10 ~ 12 mm

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

- 12’ o’clock: Φ = 90°
- 6’ o’clock: Φ = 270°
- 12’ o’clock: Φ = 90°
- 6’ o’clock: Φ = 270°

**Note (2)** Definition of Contrast Ratio (CR):

Luminance with all pixels white

\[
CR = \frac{L_{\text{white}}}{L_{\text{black}}}
\]

Luminance with all pixels black
Note (3) Definition of Response Time: Sum of $T_R$ and $T_F$

Note (4) Definition of brightness uniformity
**Note (5) Definition of brightness uniformity**

Luminance uniformity: \[
\frac{\text{(Min Luminance of 9 points)}}{\text{(Max Luminance of 9 points)}} \times 100\%
\]
4.0 BLOCK DIAGRAM

4.1 TFT LCD Module

4.2 Pixel Format
### 5.0 INTERFACE PIN CONNECTION

#### 5.1 TFT LCD Module

**CN1 (Input signal):** FPC Down Connector, 30 pins, pitch: 0.5mm

<table>
<thead>
<tr>
<th>Terminal no.</th>
<th>Symbol</th>
<th>I/O</th>
<th>Function</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>STV1</td>
<td>I/O</td>
<td>Vertical start pulse</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>CKV</td>
<td>I</td>
<td>Shift clock input for scan (Gate) driver</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>VGL</td>
<td>I</td>
<td>Power for scan (Gate) driver (DC voltage)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td></td>
<td>No Connection</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>VGL</td>
<td>I</td>
<td>Power for scan (Gate) driver (DC voltage)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>NC</td>
<td></td>
<td>No Connection</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>OEV</td>
<td>I</td>
<td>Output enable input for scan (Gate) driver</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>DGND</td>
<td>-</td>
<td>Ground for logic circuit</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>DVDD</td>
<td>I</td>
<td>Supply voltage of logic control circuit for scan (Gate) driver</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>NC</td>
<td></td>
<td>No Connection</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>VGH</td>
<td>I</td>
<td>Positive power for scan (Gate) driver</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>NC</td>
<td></td>
<td>No Connection</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>U/D</td>
<td>I</td>
<td>UP/DOWN control input for scan (Gate) driver</td>
<td>(2)</td>
</tr>
<tr>
<td>14</td>
<td>STV2</td>
<td>I/O</td>
<td>Vertical start pulse</td>
<td>(1)</td>
</tr>
<tr>
<td>15</td>
<td>VCOM</td>
<td>I</td>
<td>Common electrode driving signal</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>STH1</td>
<td>I/O</td>
<td>Start pulse for horizontal (Source) driver</td>
<td>(1)</td>
</tr>
<tr>
<td>17</td>
<td>DVDD</td>
<td>I</td>
<td>Supply voltage of logic control circuit for data(Source) driver</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>DGND</td>
<td>-</td>
<td>Ground for logic circuit</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>AVDD</td>
<td>I</td>
<td>Supply voltage for analog circuit</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>AGND</td>
<td>-</td>
<td>Ground for analog circuit</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>L/R</td>
<td>I</td>
<td>LEFT/RIGHT control(Source driver) input</td>
<td>(2)</td>
</tr>
<tr>
<td>22</td>
<td>V&lt;sub&gt;R&lt;/sub&gt;</td>
<td>I</td>
<td>Alternated video signal input(Red)</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>V&lt;sub&gt;G&lt;/sub&gt;</td>
<td>I</td>
<td>Alternated video signal input(Green)</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>V&lt;sub&gt;B&lt;/sub&gt;</td>
<td>I</td>
<td>Alternated video signal input(blue)</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>CPH1</td>
<td>I</td>
<td>Sampling and shifting clock pulse for data (Source) driver</td>
<td>(2)</td>
</tr>
<tr>
<td>26</td>
<td>CPH2</td>
<td>I</td>
<td>Please connect to DGND</td>
<td>(2)</td>
</tr>
<tr>
<td>27</td>
<td>CPH2</td>
<td>I</td>
<td>Please connect to DGND</td>
<td>(2)</td>
</tr>
<tr>
<td>28</td>
<td>STH2</td>
<td>I/O</td>
<td>Start pulse for horizontal scan (Source) line</td>
<td>(1)</td>
</tr>
<tr>
<td>29</td>
<td>OEH</td>
<td>I</td>
<td>Output enable input for data (Source) driver</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>NC</td>
<td></td>
<td>No Connection</td>
<td></td>
</tr>
</tbody>
</table>

Note (1) Selection of scanning mode (please refer to the following table)

<table>
<thead>
<tr>
<th>Setting of scan control input</th>
<th>IN/OUT state for start pulse</th>
<th>Scanning direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>U/D(pin13)</td>
<td>L/R(pin21)</td>
<td>STV1</td>
</tr>
<tr>
<td>GND</td>
<td>V&lt;sub&gt;cc&lt;/sub&gt;</td>
<td>Output</td>
</tr>
<tr>
<td>V&lt;sub&gt;cc&lt;/sub&gt;</td>
<td>GND</td>
<td>Input</td>
</tr>
<tr>
<td>GND</td>
<td>V&lt;sub&gt;cc&lt;/sub&gt;</td>
<td>Output</td>
</tr>
</tbody>
</table>

Note (2) The MOD had internal connect to H level as a simultaneous sampling. Please connect the CPH2 and CPH3 to DGND.
### 5.2 Back-Light Unit

**CN2** CCFL Power Source *(BHSR-02VS-1) / JAPAN SOLDERLESS TERMINAL MFG CO., LTD.*

**Mating Connector:** *(SBHT-002T-P0.5) / JAPAN SOLDERLESS TERMINAL MFG CO., LTD.*

<table>
<thead>
<tr>
<th>Terminal no.</th>
<th>Symbol</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VL</td>
<td>CCFL power supply (high voltage)</td>
</tr>
<tr>
<td>2</td>
<td>GL</td>
<td>CCFL power supply (low voltage)</td>
</tr>
</tbody>
</table>
6.0 ELECTRICAL CHARACTERISTICS

6.1 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></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DVDD</td>
<td>3</td>
<td>5</td>
<td>5.5</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VGH</td>
<td>14.3</td>
<td>15</td>
<td>15.7</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VGL</td>
<td>-10.5</td>
<td>-10</td>
<td>-9.5</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AVDD</td>
<td>4.5</td>
<td>5</td>
<td>5.5</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Video signal amplitude</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(VR, VG, VB)</td>
<td>V_A</td>
<td>0.4</td>
<td>-</td>
<td>AV_DD-0.4</td>
<td>V</td>
<td>AC component,</td>
</tr>
<tr>
<td></td>
<td>V_AAC</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>V</td>
<td>DC component</td>
</tr>
<tr>
<td></td>
<td>V_DC</td>
<td>-</td>
<td>AV_DD/2</td>
<td>-</td>
<td>V</td>
<td>DC component</td>
</tr>
<tr>
<td>VCOM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>V_CAC</td>
<td>5.6</td>
<td>VP-P</td>
<td>AC component</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>V_CDC</td>
<td>1.5</td>
<td>1.7</td>
<td>1.9</td>
<td>V</td>
<td>DC component, (1)</td>
</tr>
<tr>
<td>Input signal voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>VH</td>
<td>0.8</td>
<td>DV_DD</td>
<td>DV_DD</td>
<td>V</td>
<td>(2)</td>
</tr>
<tr>
<td></td>
<td>V_L</td>
<td>0</td>
<td>0.2</td>
<td>DV_DD</td>
<td>V</td>
<td>(2)</td>
</tr>
<tr>
<td>Current of power supply</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I_DD(3.3V)</td>
<td>-</td>
<td>(4.3)</td>
<td>TBD</td>
<td>mA</td>
<td>DV_DD = 3.3V</td>
</tr>
<tr>
<td></td>
<td>I_ADD</td>
<td>-</td>
<td>(5.8)</td>
<td>TBD</td>
<td>mA</td>
<td>AV_DD = 5V</td>
</tr>
<tr>
<td></td>
<td>I_GH</td>
<td>-</td>
<td>(0.06)</td>
<td>TBD</td>
<td>mA</td>
<td>V_GH = 15V</td>
</tr>
<tr>
<td></td>
<td>I_GL</td>
<td>-</td>
<td>(0.5)</td>
<td>TBD</td>
<td>mA</td>
<td>V_GL = -10V</td>
</tr>
</tbody>
</table>

Note (1): The brightness of LCD panel could be changed by adjusting the AC component of V_COM.
Note (2): STH1, STH2, OEH, L/R, CPH1~CPH3, STV1, STV2, OVE, CKV, U/D
Note (3): Be sure to apply the power voltage as the power sequence spec.
Note (4): DGND = AGND = 0V,
6.2 Back-Light Unit

The back-light system is an edge-lighting type with 1 CCFL (Cold Cathode Fluorescent Lamp). The characteristics of the lamp are shown in the following tables.

<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>Lamp current</td>
<td>IL</td>
<td>3.0</td>
<td>6.0</td>
<td>7.0</td>
<td>mA (rms)</td>
<td>(1)(6)</td>
</tr>
<tr>
<td>Lamp voltage</td>
<td>VL</td>
<td>(490)</td>
<td>(550)</td>
<td>(610)</td>
<td>V (rms)</td>
<td>(6)I_L = 6.0 mA</td>
</tr>
<tr>
<td>Frequency</td>
<td>fL</td>
<td>20</td>
<td>50</td>
<td>100</td>
<td>KHz</td>
<td>(2)</td>
</tr>
<tr>
<td>Operating lamp life</td>
<td>Hr</td>
<td>10,000</td>
<td></td>
<td></td>
<td>Hour</td>
<td>(3)</td>
</tr>
<tr>
<td>Start up voltage</td>
<td>Vs</td>
<td>1500</td>
<td>1900</td>
<td></td>
<td>V (rms)</td>
<td>(4)(5) at 25°C</td>
</tr>
</tbody>
</table>

Note (1) Lamp current is measured with a current meter for high frequency as shown below. Specified values are for single lamp.

Note (2) Lamp frequency may produce interference with horizontal synchronous frequency and this may cause ripple noise on the display. Therefore lamp frequency shall be kept away from the horizontal synchronous frequency and its harmonics as far as possible in order to avoid interference.

Note (3) Lamp life time (Hr) can be defined as the time in which it continues to operate under the condition: Ta = 25±3°C, typical IL value indicated in the above table and fL = 50 kHz until the brightness becomes less than 50%.

Note (4) CCFL inverter should be able to provide a voltage over the specified value (Vs) in the above table. Lamp units need at least Vs value shown above to ignition.
Note (5)  The voltage over specified value (Vs) should be applied to the lamp more than 1 second after startup. Otherwise, the lamp may not be turned on. The used lamp current is the lamp typical current.

Note (6)  The output voltage waveform and current waveform of the inverter must be symmetrical (Unsymmetrical ratio is less than 10%). Please do not use the inverter which has unsymmetrical voltage and current waveform, and spike waveform. The inverter design which can provide the best optical performance, power efficiency, and lamp life should under the following conditions.

a. The asymmetry rate of the inverter waveform should be less than 10%.
b. The distortion rate of the waveform should be within $\sqrt{2}$±10%.
c. The inverter output waveform should be better similar to the ideal sine wave.

\[
\text{Asymmetry rate} = \frac{|I_p - I_{-p}|}{I_{rms}} \times 100\%
\]
\[
\text{Distortion rate} = \frac{I_p \text{ (or } I_{-p})}{I_{rms}}
\]
### 6.3 AC Characteristics

<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>Rising time</td>
<td>t_r</td>
<td>-</td>
<td>-</td>
<td>10</td>
<td>ns</td>
<td>(1)</td>
</tr>
<tr>
<td>Falling time</td>
<td>t_r</td>
<td>-</td>
<td>-</td>
<td>10</td>
<td>ns</td>
<td>(1)</td>
</tr>
<tr>
<td>High and low level pulse duty</td>
<td>t_{CPH}</td>
<td>-</td>
<td>156</td>
<td>-</td>
<td>ns</td>
<td>CPH1~CPH3</td>
</tr>
<tr>
<td>CPH pulse duty</td>
<td>t_{CWH}</td>
<td>40</td>
<td>50</td>
<td>60</td>
<td>ns</td>
<td>CPH1~CPH3</td>
</tr>
<tr>
<td>STH setup time</td>
<td>t_{SUH}</td>
<td>20</td>
<td>-</td>
<td>-</td>
<td>ns</td>
<td>STHR,STHL</td>
</tr>
<tr>
<td>STH hold time</td>
<td>t_{SDH}</td>
<td>10</td>
<td>-</td>
<td>-</td>
<td>ns</td>
<td>STHR,STHL</td>
</tr>
<tr>
<td>STH pulse width</td>
<td>t_{STH}</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>t_{CPH}</td>
<td>STHR,STHL</td>
</tr>
<tr>
<td>STH period</td>
<td>t_{PH}</td>
<td>61.5</td>
<td>63.5</td>
<td>65.5</td>
<td>μs</td>
<td>STHR,STHL</td>
</tr>
<tr>
<td>OEH pulse width</td>
<td>t_{OEH}</td>
<td>-</td>
<td>7</td>
<td>-</td>
<td>μs</td>
<td>OEH</td>
</tr>
<tr>
<td>Sample and hold disable time</td>
<td>t_{DIS1}</td>
<td>-</td>
<td>54</td>
<td>-</td>
<td>μs</td>
<td></td>
</tr>
<tr>
<td>OEV pulse width</td>
<td>t_{OEV}</td>
<td>-</td>
<td>26</td>
<td>-</td>
<td>μs</td>
<td>OEV</td>
</tr>
<tr>
<td>CKV pulse width</td>
<td>t_{CKV}</td>
<td>-</td>
<td>40</td>
<td>-</td>
<td>μs</td>
<td>CKV</td>
</tr>
<tr>
<td>Clean enable time</td>
<td>t_{DIS2}</td>
<td>-</td>
<td>3.74</td>
<td>-</td>
<td>μs</td>
<td></td>
</tr>
<tr>
<td>Horizontal display timing range</td>
<td>t_{DH}</td>
<td>-</td>
<td>1440</td>
<td>-</td>
<td>t_{CPH}/3</td>
<td></td>
</tr>
<tr>
<td>STV setup time</td>
<td>t_{SUV}</td>
<td>200</td>
<td>-</td>
<td>-</td>
<td>ns</td>
<td>STV1,STV2</td>
</tr>
<tr>
<td>STV hold time</td>
<td>t_{HDV}</td>
<td>300</td>
<td>-</td>
<td>-</td>
<td>ns</td>
<td>STV2,STV2</td>
</tr>
<tr>
<td>STV pulse width</td>
<td>t_{STV}</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>t_{PH}</td>
<td>STV1,STV2</td>
</tr>
<tr>
<td>Horizontal line per field</td>
<td>t_{v}</td>
<td>256</td>
<td>262</td>
<td>268</td>
<td>t_{PH}</td>
<td>(2)</td>
</tr>
<tr>
<td>Vertical display start</td>
<td>t_{SV}</td>
<td>3</td>
<td>-</td>
<td>t_{PH}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vertical display timing range</td>
<td>t_{SV}</td>
<td>234</td>
<td>-</td>
<td>t_{PH}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VCOM Rising time</td>
<td>t_{RCOM}</td>
<td>-</td>
<td>5</td>
<td>μs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VCOM Falling time</td>
<td>t_{RCOM}</td>
<td>-</td>
<td>5</td>
<td>μs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VCOM delay time</td>
<td>t_{DCOM}</td>
<td>-</td>
<td>3</td>
<td>μs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RGB delay time</td>
<td>t_{RGB}</td>
<td>-</td>
<td>1</td>
<td>μs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note (1): For all of the logic signals.

Note (2): Please don’t use odd horizontal lines to drive LCD panel for both odd and even filed simultaneously.
6.4 Timing Diagram of Interface Signal

![Timing Diagram]

Sampling clock timing

Horizontal display timing range

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6.5 Power Sequence

Power Sequence: VCC -> VGL -> VGH  
(Undefined)

Note  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.
### 7.0 Reliability test items

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Conditions</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High Temperature Storage</td>
<td>Ta=+70°C, 240hrs</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Low Temperature Storage</td>
<td>Ta=-20°C, 240hrs</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>High Temperature Operation</td>
<td>Ta=+60°C, 240hrs</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Low Temperature Operation</td>
<td>Ta=-10°C, 240hrs</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>High Temperature and High Humidity (operation)</td>
<td>Ta=+60°C, 90%RH, 240hrs</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Thermal Cycling Test (non operation)</td>
<td>-20°C(30min)→+70°C(30min), 200cycles</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Electrostatic Discharge</td>
<td>±200V, 200pF(0Ω) 1 time/each terminal</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Vibration</td>
<td>Random: 1.04Grms, 10~500Hz, X/Y/Z 30min/each direction</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Shock</td>
<td>100G, 6ms, ±X, ±Y, ±Z 3 time for each direction</td>
<td>JIS C7021, A-10 (Condition A)</td>
</tr>
<tr>
<td>10</td>
<td>Vibration (with carton)</td>
<td>Random: 1.04Grms, 10~500Hz, X/Y/Z 30min/each direction Fixed: 5Hz, 1.5Grms, X/Y/Z 30min/each direction</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Drop (with carton)</td>
<td>Height: 60cm 1 corner, 3 edges, 6 surfaces</td>
<td>JIS Z0202</td>
</tr>
</tbody>
</table>

**Note:** There are no display function NG issue occurred, All the cosmetic specification is judged before the reliability stress.
8.0 OUTLINE DIMENSION
8.1 Outline Dimension

8.1.1 Front view

Unit: mm
8.1.2 Back View
9.0 LOT MARK

9.1 Lot Mark

```
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
```

code 1,2,3,4,5,6: HannStar internal flow control code.
code 7: production location.
code 8: production year.
code 9: production month.
code 10,11,12,13,14,15: serial number.

Note (1) Production Year

<table>
<thead>
<tr>
<th>Year</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mark</td>
<td>9</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
</tbody>
</table>

Note (2) Production Month

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mark</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
</tbody>
</table>

9.2 Location of Lot Mark

(1) The label is attached to the backside of the LCD module.
(2) This is subject to change without prior notice.
10.0 PACKAGE SPECIFICATION

10.1 Packing form

(1) Package quantity in one carton: 90 pieces.

(2) Carton size: 464±3 mm×360±3 mm×370±3 mm.

(3) For domestic transportation only.

10.2 Packing assembly drawings
11.0 GENERAL PRECAUTION

11.1 Use Restriction
This product is not authorized for use in life supporting systems, aircraft navigation control systems, military systems and any other application where performance failure could be life-threatening or otherwise catastrophic.

11.2 Disassembling or Modification
Do not disassemble or modify the module. It may damage sensitive parts inside LCD module, and may cause scratches or dust on the display. HannStar does not warrant the module, if customers disassemble or modify the module.

11.3 Breakage of LCD Panel
(1) If LCD panel is broken and liquid crystal spills out, do not ingest or inhale liquid crystal, and do not contact liquid crystal with skin.
(2) If liquid crystal contacts mouth or eyes, rinse out with water immediately.
(3) If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and rinse thoroughly with water.
(4) Handle carefully with chips of glass that may cause injury, when the glass is broken.

11.4 Electric Shock
(1) Disconnect power supply before handling LCD module.
(2) Do not pull or fold the CCFL cable.
(3) Do not touch the parts inside LCD modules and the fluorescent lamp’s connector able in order to prevent electric shock.

11.5 Absolute Maximum Ratings and Power Protection Circuit
(1) Do not exceed the absolute maximum rating values, such as the supply voltage variation, input voltage variation, variation in parts’ parameters, environmental temperature, etc., otherwise LCD module may be damaged.
(2) Please do not leave LCD module in the environment of high humidity and high temperature for a long time.
(3) It’s recommended to employing protection circuit for power supply.

11.6 Operation
(1) Do not touch, push or rub the polarizer with anything harder than HB pencil lead.
(2) Use fingerstalls of soft gloves in order to keep clean display quality, when person handle the LCD module for incoming inspection or assembly.
(3) When the surface is dusty, please wipe gently with absorbent cotton or other soft material.
(4) Wipe off saliva or water drops as soon as possible. If saliva or water drops contact with polarizer for a long time, they may causes deformation or color fading.
(5) When cleaning the adhesives, please use absorbent cotton wetted with a little petroleum benzine or other adequate solvent.

11.7 Mechanism
Please mount LCD module by using mounting holes arranged in four corners tightly.

11.8 Static Electricity
(1) Protection film must remove very slowly from the surface of LCD module to prevent from electrostatic occurrence.
(2) Because LCD module use CMOS-IC on circuit board and TFT-LCD panel, it is very weak to electrostatic discharge. Please be careful with electrostatic discharge. Persons who handle the module should be grounded through adequate methods.

11.9 Strong Light Exposure
The module shall not be exposed under strong light such as direct sunlight. Otherwise, display characteristics may be changed.

11.10 Disposal
When disposing LCD module, obey the local environmental regulations.