SPECIFICATION FOR APPROVAL

Preliminary Specification

Final Specification

Title | 20.1” UXGA TFT LCD

<table>
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<td>SUFFIX</td>
<td>SLA1</td>
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*When you obtain standard approval, please use the above model name without suffix.

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Please return 1 copy for your confirmation with your signature and comments.

APPROVED BY: S.G. Hong / G.Manager

REVIEWED BY: P.Y. Kim / Manager

PREPARED BY: S.R. Yoo / Engineer

MNT Products Engineering Dept.
LG. Philips LCD Co., Ltd.
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<td>27</td>
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# RECORD OF REVISIONS

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<td>20,21,22</td>
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<td>Jul. 25. 2005</td>
<td>6</td>
<td>Update The Electrical Specifications.</td>
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<td></td>
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<td>Final Draft.</td>
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</table>
1. General Description

The LM201U05-SLA1 is a Color Active Matrix Liquid Crystal Display with an integral Cold Cathode Fluorescent Lamp (CCFL) backlight system. The matrix employs a-Si Thin Film Transistor as the active element. It is a transmissive type display operating in the normally black mode. This TFT-LCD has a 20.1 inch diagonally measured active display area with UXGA resolution (1200 vertical by 1600 horizontal pixel array). Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the brightness of the sub-pixel color is determined with a 8-bit gray scale signal for each dot, thus, presenting a palette of more than 16,777,216 colors.

The LM201U05-SLA1 has been designed to apply the interface method that enables low power, high speed, low EMI. FPD Link must be used as a LVDS (Low Voltage Differential Signaling) chip.

The LM201U05-SLA1 is intended to support applications where thin thickness, wide viewing angle, low power are critical factors and graphic displays are important. In combination with the vertical arrangement of the sub-pixels, the LM201U05-SLA1 characteristics provide an excellent flat panel display for office automation products such as monitors.

### General Features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active screen size</td>
<td>20.1 inches (510.54mm) diagonal</td>
</tr>
<tr>
<td>Outline Dimension</td>
<td>432.0(H) x 331.5(V) x 25.0(D) mm(Typ.)</td>
</tr>
<tr>
<td>Pixel Pitch</td>
<td>0.255 mm x 0.255 mm</td>
</tr>
<tr>
<td>Pixel Format</td>
<td>1600 horizontal By 1200 vertical Pixels RGB stripe arrangement</td>
</tr>
<tr>
<td>Color depth</td>
<td>8-bits, 16,777,216 colors</td>
</tr>
<tr>
<td>Luminance, white</td>
<td>300 cd/m²(Typ. Center 1 point)</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>Total 36.6 Watt(Typ.), (7.2 Watt @Vcc, 29.4 Watt @300cd/m² [Lamp=7.0mA])</td>
</tr>
<tr>
<td>Weight</td>
<td>3200g (Typ.)</td>
</tr>
<tr>
<td>Display operating mode</td>
<td>Transmissive mode, normally black</td>
</tr>
<tr>
<td>Surface treatments</td>
<td>Hard coating (3H), Anti-glare treatment of the front polarizer</td>
</tr>
</tbody>
</table>
2. Absolute Maximum Ratings

The following are maximum values which, if exceeded, may cause faulty operation or damage to the unit.

Table 1. ABSOLUTE MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Values</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Input Voltage</td>
<td>V_{CC}</td>
<td>Min. -0.3</td>
<td>Max. +23</td>
<td>V_{dc}</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>T_{OP}</td>
<td>0</td>
<td>+50</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>T_{ST}</td>
<td>-20</td>
<td>+60</td>
<td>°C</td>
</tr>
<tr>
<td>Operating Ambient Humidity</td>
<td>H_{OP}</td>
<td>10</td>
<td>+90</td>
<td>%RH</td>
</tr>
<tr>
<td>Storage Humidity</td>
<td>H_{ST}</td>
<td>10</td>
<td>+90</td>
<td>%RH</td>
</tr>
</tbody>
</table>

Note: 1. Temperature and relative humidity range are shown in the figure below. Wet bulb temperature should be 39 °C Max, and no condensation of water.
3. Electrical Specifications

3-1. Electrical Characteristics

The LM201U05-SLA1 requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second input which powers the CCFL, is typically generated by an inverter. The inverter is an external unit to the LCD.

Table 2. ELECTRICAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Values</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Min.</td>
<td>Typ.</td>
<td>Max.</td>
</tr>
<tr>
<td>MODULE:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Supply Input Voltage</td>
<td>V_{CC}</td>
<td>17V</td>
<td>18V</td>
<td>19V</td>
</tr>
<tr>
<td>Power Supply Input Current</td>
<td>I_{CC}</td>
<td>0.40</td>
<td>0.60</td>
<td></td>
</tr>
<tr>
<td>Power Consumption</td>
<td>P_{c}</td>
<td>7.2</td>
<td>10.8</td>
<td></td>
</tr>
<tr>
<td>Differential Impedance</td>
<td>Z_{m}</td>
<td>100</td>
<td></td>
<td>3.0</td>
</tr>
<tr>
<td>Rush Current</td>
<td>I_{Rush}</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LAMP (each CCFL)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating voltage</td>
<td>V_{BL}</td>
<td>670(8.0mA)</td>
<td>700</td>
<td>825(3mA)</td>
</tr>
<tr>
<td>Operating Current</td>
<td>I_{BL}</td>
<td>3.0</td>
<td>7.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Established Starting Voltage</td>
<td>V_s</td>
<td>-</td>
<td>-</td>
<td>1150</td>
</tr>
<tr>
<td>at 25°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>at 0°C</td>
<td></td>
<td></td>
<td></td>
<td>1450</td>
</tr>
<tr>
<td>Operating Frequency</td>
<td>F_{BL}</td>
<td>40</td>
<td>50</td>
<td>80</td>
</tr>
<tr>
<td>Power Consumption (6 CCFL's)</td>
<td>P_{BL}</td>
<td>-</td>
<td>29.4</td>
<td>32.3</td>
</tr>
<tr>
<td>Discharge Stabilization Time</td>
<td>T_s</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Life time</td>
<td></td>
<td>45000</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Notes: 1. The specified current and power consumption are under the $V_{CC}=18.0V$, $25^\circ C$, $f_c=60$Hz condition, typical supply current is measured at the condition of 8 X 6 chess pattern (white & black) and Max supply current is measured at the sub 1dot pattern.
2. This impedance value is for impedance matching between LVDS $T_X$ and the mating connector of the LCD.
3. The duration of rush current is about 1ms.
4. Operating voltage is measured at $25^\circ C$. The variance of the voltage is $\pm 10\%$.
5. The output voltage at the transformer in the inverter must be high considering to the loss of the ballast capacitor in the inverter. The voltage above $V_s$ should be applied to the lamps for more than 1 second for start-up. Otherwise, the lamps may not be turned on.
6. Lamp frequency may produce interface with horizontal synchronous frequency and as a result this may cause beat on the display. Therefore lamp frequency shall be as away possible from the horizontal synchronous frequency and from its harmonics in order to prevent interference.
7. The lamp power consumption shown above does not include loss of external inverter at $25^\circ C$. The used lamp current is the lamp typical current.
8. Let's define the brightness of the lamp after being lighted for 5 minutes as 100%. $T_s$ is the time required for the brightness of the center of the lamp to be not less than 95%. The used lamp current is the lamp typical current.
9. The life time is defined as the time at which brightness of lamp is 50% compare to that of initial value at the typical lamp current on condition of continuous operating at $25\pm 2^\circ C$. 

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Note. Do not attach a conducting tape to connecting wire. If the lamp wire attach to a conducting tape, TFT-LCD Module has a low luminance and the inverter has abnormal action. Because leakage current is occurred between lamp wire and conducting tape.

The design of the inverter must have specifications for the lamp in LCD Assembly. The performance of the Lamp in LCM, for example life time or brightness, is extremely influenced by the characteristics of the DC-AC inverter. So all the parameters of an inverter should be carefully designed so as not to produce too much leakage current from high-voltage output of the inverter. When you design or order the inverter, please make sure unwanted lighting caused by the mismatch of the lamp and the inverter (no lighting, flicker, etc) never occurs. When you confirm it, the LCD – Assembly should be operated in the same condition as installed in you instrument.

Requirements for a system inverter design, which is intended to have a better display performance, a better power efficiency and a more reliable lamp.
It shall help increase the lamp lifetime and reduce its leakage current.
   a. The asymmetry rate of the inverter current and voltage waveform should be 10% below;
   b. The distortion rate of the current and voltage waveform should be within $\sqrt{2} \pm 10\%$;
   c. The ideal sine current and voltage waveform shall be symmetric in positive and negative polarities.

*A symmetry rate = $|I_p - I_{-p}| / I_{rms} \times 100\%$

* Distortion rate = $I_p$ (or $I_{-p}$) / $I_{rms}$
3-2. Interface Connections

Interface chip must be used LVDS, part No. DS90CF383MTD(Transmitter) made by National Semiconductor. Or used the compatible interface chips(TI:SN75LVDS83).

This LCD employs seven interface connections, a 30-pin connector is used for the module electronics interface. Six 2-pin connectors are used for the integral back-light system.

The electronics interface connector is locking type and a model IS100-L30R-C23 manufactured by UJU or FI-XB30SSRL-HF16 manufactured by JAE, The mating connector part number FI-X30M(JAE) or equivalent. The pin configuration for the connector is shown in the table 3.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Vcc</td>
<td>Supply voltage for LCD module</td>
</tr>
<tr>
<td>2</td>
<td>Vcc</td>
<td>Supply voltage for LCD module</td>
</tr>
<tr>
<td>3</td>
<td>Vcc</td>
<td>Supply voltage for LCD module</td>
</tr>
<tr>
<td>4</td>
<td>Vcc</td>
<td>Supply voltage for LCD module</td>
</tr>
<tr>
<td>5</td>
<td>NC</td>
<td>NC (No Connection)</td>
</tr>
<tr>
<td>6</td>
<td>NC</td>
<td>NC (No Connection)</td>
</tr>
<tr>
<td>7</td>
<td>SR3P</td>
<td>Plus signal of even channel 3 (LVDS)</td>
</tr>
<tr>
<td>8</td>
<td>SR3M</td>
<td>Minus signal of even channel 3 (LVDS)</td>
</tr>
<tr>
<td>9</td>
<td>SCLKINP</td>
<td>Plus signal of even clock channel (LVDS)</td>
</tr>
<tr>
<td>10</td>
<td>SCLKINM</td>
<td>Minus signal of even clock channel (LVDS)</td>
</tr>
<tr>
<td>11</td>
<td>SR2P</td>
<td>Plus signal of even channel 2 (LVDS)</td>
</tr>
<tr>
<td>12</td>
<td>SR2M</td>
<td>Minus signal of even channel 2 (LVDS)</td>
</tr>
<tr>
<td>13</td>
<td>SR1P</td>
<td>Plus signal of even channel 1 (LVDS)</td>
</tr>
<tr>
<td>14</td>
<td>SR1M</td>
<td>Minus signal of even channel 1 (LVDS)</td>
</tr>
<tr>
<td>15</td>
<td>SR0P</td>
<td>Plus signal of even channel 0 (LVDS)</td>
</tr>
<tr>
<td>16</td>
<td>SR0M</td>
<td>Minus signal of even channel 0 (LVDS)</td>
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<td>17</td>
<td>GND</td>
<td>Ground</td>
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<td>18</td>
<td>GND</td>
<td>Ground</td>
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<td>19</td>
<td>FR3P</td>
<td>Plus signal of odd channel 3 (LVDS)</td>
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<tr>
<td>20</td>
<td>FR3M</td>
<td>Minus signal of odd channel 3 (LVDS)</td>
</tr>
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<td>21</td>
<td>FCLKINP</td>
<td>Plus signal of odd clock channel (LVDS)</td>
</tr>
<tr>
<td>22</td>
<td>FCLKINM</td>
<td>Minus signal of odd clock channel (LVDS)</td>
</tr>
<tr>
<td>23</td>
<td>FR2P</td>
<td>Plus signal of odd channel 2 (LVDS)</td>
</tr>
<tr>
<td>24</td>
<td>FR2M</td>
<td>Minus signal of odd channel 2 (LVDS)</td>
</tr>
<tr>
<td>25</td>
<td>FR1P</td>
<td>Plus signal of odd channel 1 (LVDS)</td>
</tr>
<tr>
<td>26</td>
<td>FR1M</td>
<td>Minus signal of odd channel 1 (LVDS)</td>
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<tr>
<td>27</td>
<td>FR0P</td>
<td>Plus signal of odd channel 0 (LVDS)</td>
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<tr>
<td>28</td>
<td>FR0M</td>
<td>Minus signal of odd channel 0 (LVDS)</td>
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<tr>
<td>29</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>30</td>
<td>GND</td>
<td>Ground</td>
</tr>
</tbody>
</table>

Connector pin arrangement

<table>
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<tr>
<th>30</th>
<th>1</th>
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</thead>
</table>

Table 3. MODULE CONNECTOR PIN CONFIGURATION(LVDS)
The backlight interface connector is a model 1674817-1(CN2/CN3) manufactured by AMP (or equivalent BHSR-02VS-1 manufactured by JST) and BHR-05VS-1(CN1/CN4) manufactured by JST. The mating connector part number are SM02B-BHSS-1-TB(2pin), SM04(9-E2)B-BHS-1-TB or equivalent. The pin configuration for the connector is shown in the table below.

Table 4. BACKLIGHT CONNECTOR PIN CONFIGURATION

<table>
<thead>
<tr>
<th>No</th>
<th>Pin</th>
<th>Symbol</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN1</td>
<td>1</td>
<td>HV</td>
<td>Power supply for lamp 1(High voltage side)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>HV</td>
<td>Power supply for lamp 2(High voltage side)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>NC</td>
<td>NC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>LV</td>
<td>Power supply for lamp 1(Low voltage side)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>LV</td>
<td>Power supply for lamp 2(Low voltage side)</td>
<td></td>
</tr>
<tr>
<td>CN2</td>
<td>1</td>
<td>HV</td>
<td>Power supply for lamp 3(High voltage side)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>LV</td>
<td>Power supply for lamp 3(Low voltage side)</td>
<td></td>
</tr>
<tr>
<td>CN3</td>
<td>1</td>
<td>HV</td>
<td>Power supply for lamp 4(High voltage side)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>LV</td>
<td>Power supply for lamp 4(Low voltage side)</td>
<td></td>
</tr>
<tr>
<td>CN4</td>
<td>1</td>
<td>HV</td>
<td>Power supply for lamp 5(High voltage side)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>NC</td>
<td>NC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>LV</td>
<td>Power supply for lamp 6(Low voltage side)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>LV</td>
<td>Power supply for lamp 5(Low voltage side)</td>
<td></td>
</tr>
</tbody>
</table>

Notes: 1. The high voltage power terminal is thick line.
2. The low voltage power terminal is thin line.

<BACKLIGHT CONNECTOR DIAGRAM>
3-3. Signal Timing Specifications

This is the signal timing required at the input of the LVDS Transmitter. All of the interface signal timing should be satisfied with the following specifications for its proper operation.

Table 5. Timing Table

<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>DCLK</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Period</td>
<td>tCLK</td>
<td>14.28</td>
<td>15.625</td>
<td>16.00</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>fCLK</td>
<td>62.5</td>
<td>64.0</td>
<td>70.0</td>
<td>MHz</td>
<td>2pixel/clk</td>
</tr>
<tr>
<td>Hsync</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Period</td>
<td>tHP</td>
<td>852</td>
<td>860</td>
<td>906</td>
<td>tCLK</td>
<td>1</td>
</tr>
<tr>
<td>Width-Active</td>
<td>tWH</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>tHP</td>
<td>2</td>
</tr>
<tr>
<td>Vsync</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Period</td>
<td>tVP</td>
<td>1230</td>
<td>1240</td>
<td>1250</td>
<td>tHP</td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>fV</td>
<td>59</td>
<td>60</td>
<td>61</td>
<td>Hz</td>
<td>3</td>
</tr>
<tr>
<td>Width-Active</td>
<td>tVV</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>tHP</td>
<td>4</td>
</tr>
<tr>
<td>Data Enable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horizontal Valid</td>
<td>tHV</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>tCLK</td>
<td></td>
</tr>
<tr>
<td>Horizontal Back Porch</td>
<td>tHBP</td>
<td>20</td>
<td>24</td>
<td>48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horizontal Front Porch</td>
<td>tHFP</td>
<td>16</td>
<td>20</td>
<td>42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horizontal Blank</td>
<td>tWH</td>
<td>52</td>
<td>60</td>
<td>106</td>
<td>=tWH+ tHBP+ tHFP</td>
<td></td>
</tr>
<tr>
<td>Vertical Valid</td>
<td>tVV</td>
<td>1200</td>
<td>1200</td>
<td>1200</td>
<td>MHz</td>
<td></td>
</tr>
<tr>
<td>Vertical Back Porch</td>
<td>tVBP</td>
<td>24</td>
<td>32</td>
<td>42</td>
<td>tHP</td>
<td></td>
</tr>
<tr>
<td>Vertical Front Porch</td>
<td>tVFP</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>tVFP</td>
<td></td>
</tr>
<tr>
<td>Vertical Blank</td>
<td></td>
<td>30</td>
<td>40</td>
<td>50</td>
<td>=tVBP+ tVFP</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. Hsync period shall be a double number of 4 (based on 2pixel/clk)
2. Horizontal sync shall be active high.
3. Vertical frequency should be keep the above specification when the resolution & mode are changed.
4. Vertical sync shall be active high.
3-4. Signal Timing Waveforms

Data are latched at the falling edge of DCLK.
3-5. Color Input Data Reference

The brightness of each primary color (red, green, and blue) is based on the 8-bit gray scale data input for the color; the higher the binary input, the brighter the color. The table below provides a reference for color versus data input.

Table 6. COLOR DATA REFERENCE

<table>
<thead>
<tr>
<th>Color</th>
<th>Input Color Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Red</td>
</tr>
<tr>
<td></td>
<td>MSB</td>
</tr>
<tr>
<td></td>
<td>R7</td>
</tr>
<tr>
<td>Black</td>
<td>00000000000000</td>
</tr>
<tr>
<td>Red (255)</td>
<td>11111111111111</td>
</tr>
<tr>
<td>Green (255)</td>
<td>00000000000000</td>
</tr>
<tr>
<td>Cyan</td>
<td>00000000000000</td>
</tr>
<tr>
<td>Magenta</td>
<td>11111111111111</td>
</tr>
<tr>
<td>Yellow</td>
<td>11111111111111</td>
</tr>
<tr>
<td>White</td>
<td>11111111111111</td>
</tr>
<tr>
<td>Red(000) Dark</td>
<td>00000000000000</td>
</tr>
<tr>
<td>Red(001)</td>
<td>00000000000000</td>
</tr>
<tr>
<td>Red(002)</td>
<td>00000000000000</td>
</tr>
<tr>
<td>Red(253)</td>
<td>11111111111111</td>
</tr>
<tr>
<td>Red(254)</td>
<td>11111111111111</td>
</tr>
<tr>
<td>Red(255) Bright</td>
<td>11111111111111</td>
</tr>
<tr>
<td>Green(000) Dark</td>
<td>00000000000000</td>
</tr>
<tr>
<td>Green(001)</td>
<td>00000000000000</td>
</tr>
<tr>
<td>Green(002)</td>
<td>00000000000000</td>
</tr>
<tr>
<td>Green(253)</td>
<td>00000000000000</td>
</tr>
<tr>
<td>Green(254)</td>
<td>00000000000000</td>
</tr>
<tr>
<td>Green(255) Bright</td>
<td>00000000000000</td>
</tr>
<tr>
<td>Blue(000) Dark</td>
<td>00000000000000</td>
</tr>
<tr>
<td>Blue(001)</td>
<td>00000000000000</td>
</tr>
<tr>
<td>Blue(002)</td>
<td>00000000000000</td>
</tr>
<tr>
<td>Blue(253)</td>
<td>00000000000000</td>
</tr>
<tr>
<td>Blue(254)</td>
<td>00000000000000</td>
</tr>
<tr>
<td>Blue(255) Bright</td>
<td>00000000000000</td>
</tr>
</tbody>
</table>
3-6. Power Sequence

Table 7. POWER SEQUENCE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Values</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min.</td>
<td>Typ.</td>
</tr>
<tr>
<td>T 1</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>T 2</td>
<td>0</td>
<td>–</td>
</tr>
<tr>
<td>T 3</td>
<td>200</td>
<td>–</td>
</tr>
<tr>
<td>T 4</td>
<td>200</td>
<td>–</td>
</tr>
<tr>
<td>T 5</td>
<td>0</td>
<td>–</td>
</tr>
<tr>
<td>T 6</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>T 7</td>
<td>400</td>
<td>–</td>
</tr>
</tbody>
</table>

Notes: 1. Please avoid floating state of interface signal at invalid period.
2. When the interface signal is invalid, be sure to pull down the power supply for LCD V\textsubscript{cc} to 0V.
   Invalid signal with Vcc for a long period of time, causes permanent damage to LCD panel.
3. Lamp power must be turn on after power supply for LCD and interface signals are valid.
4. Optical Specifications

Optical characteristics are determined after the unit has been ‘ON’ for 30 minutes in a dark environment at 25 °C. The values specified are at an approximate distance 50cm from the LCD surface at a viewing angle of Φ and θ equal to 0 °.

FIG. 1 presents additional information concerning the measurement equipment and method.

**FIG. 1 Optical Characteristic Measurement Equipment and Method**

<table>
<thead>
<tr>
<th>Table 8. OPTICAL CHARACTERISTICS</th>
<th>(Ta=25 °C, V_{CC}=18.0V, f_{dp}=60Hz, Dclk=128MHz, I_{BL}=7.0mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Parameter</strong></td>
<td><strong>Symbol</strong></td>
</tr>
<tr>
<td>Contrast Ratio</td>
<td>CR</td>
</tr>
<tr>
<td>Surface Luminance, white</td>
<td>L_{WH}</td>
</tr>
<tr>
<td>Luminance Variation</td>
<td>G_{WHITE}</td>
</tr>
<tr>
<td>Response Time</td>
<td>Rise Time</td>
</tr>
<tr>
<td></td>
<td>Decay Time</td>
</tr>
<tr>
<td>Gray To Gray</td>
<td>T_{GTG,AVR}</td>
</tr>
<tr>
<td></td>
<td>T_{GTG.MAX}</td>
</tr>
<tr>
<td>Color Coordinates</td>
<td></td>
</tr>
<tr>
<td>RED</td>
<td>RX</td>
</tr>
<tr>
<td></td>
<td>RY</td>
</tr>
<tr>
<td>GREEN</td>
<td>GX</td>
</tr>
<tr>
<td></td>
<td>GY</td>
</tr>
<tr>
<td>BLUE</td>
<td>BX</td>
</tr>
<tr>
<td>WHITE</td>
<td>BY</td>
</tr>
<tr>
<td></td>
<td>WX</td>
</tr>
<tr>
<td></td>
<td>WY</td>
</tr>
<tr>
<td>Color shift</td>
<td></td>
</tr>
<tr>
<td>Horizontal</td>
<td>θ_{CST.H}</td>
</tr>
<tr>
<td>Vertical</td>
<td>θ_{CST.V}</td>
</tr>
<tr>
<td>Viewing Angle</td>
<td></td>
</tr>
<tr>
<td>general</td>
<td>θ_{H}</td>
</tr>
<tr>
<td>Horizontal</td>
<td>θ_{V}</td>
</tr>
<tr>
<td>Vertical</td>
<td>θ_{GMA.H}</td>
</tr>
<tr>
<td>Effective</td>
<td>θ_{GMA.V}</td>
</tr>
<tr>
<td>Gray Scale</td>
<td></td>
</tr>
</tbody>
</table>
Notes 1. Contrast Ratio (CR) is defined mathematically as:

\[
\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}
\]

2. Surface luminance is the center point across the LCD surface 50cm from the surface with all pixels displaying white under the condition of IBL = 7.0mAms. For more information see FIG 2.

3. The variation in surface luminance, \( \delta \text{WHITE} \) is determined by measuring LON at each test position 1 through 9, and then dividing the maximum LON of 9 points luminance by minimum LON of 9 points luminance. For more information see FIG 2

\[
\delta \text{WHITE} = \left[ \frac{\text{Minimum}(LON1,LON2, \ldots , LON9)}{\text{Maximum}(LON1,LON2, \ldots , LON9)} \right] \times 100 \% 
\]
4. **The response time** is defined as the following figure and shall be measured by switching the input signal for “black” and “white”. Response time is the time required for the display to transition from black to white (Rise Time, $T_{rR}$) and from white to black (Decay Time, $T_{rD}$).

![Response Time Diagram](image)

**FIG. 3 Response Time**

5. **The Gray to Gray response time** is defined as the following figure and shall be measured by switching the input signal for “Gray To Gray”.
   - Gray step : 5 Step
   - $T_{GTG, AVG}$ is the total average time at rising time and falling time for “Gray To Gray”.
   - $T_{GTG, MAX}$ is the max time at rising time or falling time for “Gray To Gray”.

<table>
<thead>
<tr>
<th>Gray to Gray</th>
<th>Rising Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falling Time</td>
<td>G255 G191 G127 G63 G0</td>
</tr>
<tr>
<td>G255</td>
<td></td>
</tr>
<tr>
<td>G191</td>
<td></td>
</tr>
<tr>
<td>G127</td>
<td></td>
</tr>
<tr>
<td>G63</td>
<td></td>
</tr>
<tr>
<td>G0</td>
<td></td>
</tr>
</tbody>
</table>
6. **Color shift** is the angle at which the color difference is lower than 0.04.
   - Color difference ($\Delta u'v'$)
     
     $$
     u' = \frac{4x}{-2x + 12y + 3}
     $$
     
     $$
     v' = \frac{9y}{-2x + 12y + 3}
     $$
     
     $$
     \Delta u'v' = \sqrt{(u'-u'_2)^2+(v'-v'_2)^2}
     $$
     
     - Pattern size: 25% Box size
     - Viewing angle direction of color shift: Horizontal, Vertical

### AVERAGE RGB VALUES IN BRUCE RGB FOR MACBETH CHART

<table>
<thead>
<tr>
<th>dark skin</th>
<th>light skin</th>
<th>blue sky</th>
<th>magenta</th>
<th>blue flower</th>
<th>bluish green</th>
</tr>
</thead>
<tbody>
<tr>
<td>R 96</td>
<td>208</td>
<td>85</td>
<td>77</td>
<td>128</td>
<td>114</td>
</tr>
<tr>
<td>G 56</td>
<td>142</td>
<td>112</td>
<td>102</td>
<td>118</td>
<td>119</td>
</tr>
<tr>
<td>B 45</td>
<td>123</td>
<td>101</td>
<td>46</td>
<td>185</td>
<td>178</td>
</tr>
<tr>
<td>R 219</td>
<td>56</td>
<td>211</td>
<td>76</td>
<td>160</td>
<td>230</td>
</tr>
<tr>
<td>G 104</td>
<td>57</td>
<td>85</td>
<td>38</td>
<td>183</td>
<td>192</td>
</tr>
<tr>
<td>B 24</td>
<td>172</td>
<td>87</td>
<td>66</td>
<td>58</td>
<td>29</td>
</tr>
<tr>
<td>orange</td>
<td>purplish blue</td>
<td>moderate red</td>
<td>purple</td>
<td>yellow green</td>
<td>orange yellow</td>
</tr>
<tr>
<td>R 219</td>
<td>56</td>
<td>211</td>
<td>76</td>
<td>160</td>
<td>230</td>
</tr>
<tr>
<td>G 104</td>
<td>57</td>
<td>85</td>
<td>38</td>
<td>183</td>
<td>192</td>
</tr>
<tr>
<td>B 24</td>
<td>172</td>
<td>87</td>
<td>66</td>
<td>58</td>
<td>29</td>
</tr>
<tr>
<td>blue</td>
<td>green</td>
<td>red</td>
<td>yellow</td>
<td>magenta</td>
<td>cyan</td>
</tr>
<tr>
<td>R 26</td>
<td>72</td>
<td>197</td>
<td>241</td>
<td>297</td>
<td>35</td>
</tr>
<tr>
<td>G 32</td>
<td>148</td>
<td>27</td>
<td>212</td>
<td>62</td>
<td>126</td>
</tr>
<tr>
<td>B 145</td>
<td>32</td>
<td>37</td>
<td>50</td>
<td>151</td>
<td>172</td>
</tr>
<tr>
<td>white</td>
<td>neutral 8</td>
<td>neutral 6,6</td>
<td>neutral 6</td>
<td>neutral 3,6</td>
<td>black</td>
</tr>
<tr>
<td>R 240</td>
<td>208</td>
<td>155</td>
<td>110</td>
<td>63</td>
<td>22</td>
</tr>
<tr>
<td>G 240</td>
<td>208</td>
<td>155</td>
<td>110</td>
<td>63</td>
<td>22</td>
</tr>
<tr>
<td>B 240</td>
<td>208</td>
<td>155</td>
<td>110</td>
<td>63</td>
<td>22</td>
</tr>
</tbody>
</table>

( Test Pattern: Macbeth Chart )
7. **Viewing angle (general)** is the angle at which the contrast ratio is greater than 10.

8. **Effective viewing angle** is the angle at which the gamma shift of gray scale is lower than 0.3.

\[ L = aV^\gamma + L_b \]

**FIG. 4**  \[ \log(L - L_a) = r \log(V) + \log(a) \]

Here the Parameter $\alpha$ and $\gamma$ relate the signal level $V$ to the luminance $L$.

The GAMMA we calculate from the log-log representation (Fig. 4)

9. Grayscale Specification

<table>
<thead>
<tr>
<th>Gray Level</th>
<th>Relative Luminance [%] (Typ.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.125</td>
</tr>
<tr>
<td>31</td>
<td>1.20</td>
</tr>
<tr>
<td>63</td>
<td>4.57</td>
</tr>
<tr>
<td>95</td>
<td>11.3</td>
</tr>
<tr>
<td>127</td>
<td>21.4</td>
</tr>
<tr>
<td>159</td>
<td>35.2</td>
</tr>
<tr>
<td>191</td>
<td>52.8</td>
</tr>
<tr>
<td>223</td>
<td>74.4</td>
</tr>
<tr>
<td>255</td>
<td>100</td>
</tr>
</tbody>
</table>
5. Mechanical Characteristics

The contents provide general mechanical characteristics for the model LM201U05-SLA1. In addition, the figures in the next page are detailed mechanical drawing of the LCD.

<table>
<thead>
<tr>
<th></th>
<th>Horizontal</th>
<th>Vertical</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside dimensions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vertical</td>
<td>432.0 ± 0.5 mm</td>
<td>331.5 ± 0.5 mm</td>
<td>25.0 ± 0.5 mm</td>
</tr>
<tr>
<td>Bezel area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horizontal</td>
<td>413.0 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vertical</td>
<td>311.0 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active display area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horizontal</td>
<td>408.0 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vertical</td>
<td>306.0 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight (approximate)</td>
<td></td>
<td></td>
<td>3,200g (Typ.)</td>
</tr>
</tbody>
</table>

Surface Treatment
- Hard coating (3H)
- Anti-glare treatment of the front polarizer
- Haze (25%)
NOTES
1. Unspecified tolerances are to be ±0.5mm.
2. Both backlight wires and connection tubes are excluded from outline dimensions.
3. Tilt and partial disposition tolerance of display area are as following.
   (1) Y-Direction : |A-B| ≤1.0mm
   (2) X-Direction : |C-D| ≤1.0mm
4. V / V Connector Specification : IG100-LJQR-C23 or Compatible
5. Lamp Connector Specification
   - BHR-05VS-125(V) or Compatible
   - BHR-05VS-240(V) or Compatible
6. Lamp(CCFL) lot No.is marked at backlight connector.
7. Do not wrap conductive tapes around the backlight wires.
6. Reliability

Environment test condition

<table>
<thead>
<tr>
<th>No.</th>
<th>Test Item</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High temperature storage test</td>
<td>Ta= 60°C  240h</td>
</tr>
<tr>
<td>2</td>
<td>Low temperature storage test</td>
<td>Ta= -20°C  240h</td>
</tr>
<tr>
<td>3</td>
<td>High temperature operation test</td>
<td>Ta= 50°C  60%RH  240h</td>
</tr>
<tr>
<td>4</td>
<td>Low temperature operation test</td>
<td>Ta= 0°C  240h</td>
</tr>
<tr>
<td>5</td>
<td>Vibration test (non-operating)</td>
<td>Waveform : Random</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vibration level : 1.0G RMS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bandwidth : 10 ~ 500Hz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Duration : X,Y,Z 10min</td>
</tr>
<tr>
<td></td>
<td></td>
<td>One time each direction</td>
</tr>
<tr>
<td>6</td>
<td>Shock test (non-operating)</td>
<td>Shock level : 100G</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Waveform: half sine wave, 2ms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Direction : ±X, ±Y, ±Z</td>
</tr>
<tr>
<td></td>
<td></td>
<td>One time each direction</td>
</tr>
<tr>
<td>7</td>
<td>Altitude storage / shipment operating</td>
<td>0 - 40,000 feet(12,192m)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 - 12,000 feet (3657.6m)</td>
</tr>
</tbody>
</table>

(Result Evaluation Criteria)

There should be no change which might affect the practical display function when the display quality test is conducted under normal operating condition.
7. International Standards

7-1. Safety

b) CAN/CSA C22.2, No. 60950-1-03 1st Ed. April 1, 2003, Canadian Standards Association,
c) EN 60950-1:2001, First Edition,
European Committee for Electrotechnical Standardization(CENELEC)
European Standard for Safety of Information Technology Equipment.

7-2. EMC

a) ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and
Electrical Equipment in the Range of 9kHz to 40GHz. "American National Standards Institute(ANSI),
1992
b) C.I.S.P.R. "Limits and Methods of Measurement of Radio Interface Characteristics of Information
Technology Equipment." International Special Committee on Radio Interference.
c) EN 55022 "Limits and Methods of Measurement of Radio Interface Characteristics of Information
Technology Equipment." European Committee for Electrotechnical Standardization(CENELEC), 1998
( Including A1: 2000 )
8. Packing

8-1. Designation of Lot Mark

a) Lot Mark

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
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</tr>
</tbody>
</table>
A, B, C : Inch  
D : Year  
E : Month  
F : Panel Code  
G : Factory Code  
H : Assembly Code  
I, J, K, L, M : Serial No

Note

1. Year

<table>
<thead>
<tr>
<th>Year</th>
<th>97</th>
<th>98</th>
<th>99</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
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<th>2004</th>
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<td>Mark</td>
<td>7</td>
<td>8</td>
<td>9</td>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
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</table>

2. Month

<table>
<thead>
<tr>
<th>Month</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</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>

3. Panel Code

<table>
<thead>
<tr>
<th>Panel Code</th>
<th>P1 Factory</th>
<th>P2 Factory</th>
<th>P3 Factory</th>
<th>P4 Factory</th>
<th>P5 Factory</th>
<th>Hydis Panel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mark</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>H</td>
</tr>
</tbody>
</table>

4. Factory Code

<table>
<thead>
<tr>
<th>Factory Code</th>
<th>LPL Gumi</th>
<th>LPL Nanjing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mark</td>
<td>K</td>
<td>C</td>
</tr>
</tbody>
</table>

5. Serial No

<table>
<thead>
<tr>
<th>Serial No.</th>
<th>1 ~ 99,999</th>
<th>100,000 ~</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mark</td>
<td>00001 ~ 99999</td>
<td>A0001 ~ A99999, - - - - , Z9999</td>
</tr>
</tbody>
</table>

b) Location of Lot Mark

Serial NO. is printed on the label. The label is attached to the backside of the LCD module.  
This is subject to change without prior notice.

8-2. Packing Form

a) Package quantity in one box : 5 pcs

b) Box Size : 530mm × 307mm × 453mm
9. PRECAUTIONS

Please pay attention to the following when you use this TFT LCD module.

9-1. MOUNTING PRECAUTIONS

(1) You must mount a module using holes arranged in four corners or four sides.
(2) You should consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the module.
   And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
(3) Please attach a transparent protective plate to the surface in order to protect the polarizer.
   Transparent protective plate should have sufficient strength in order to the resist external force.
(4) You should adopt radiation structure to satisfy the temperature specification.
(5) Acetic acid type and chlorine type materials for the cover case are not describe because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
(6) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
   Do not touch the surface of polarizer for bare hand or greasy cloth. (Some cosmetics are determined to the polarizer.)
(7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soak with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
(8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
(9) Do not open the case because inside circuits do not have sufficient strength.

9-2. OPERATING PRECAUTIONS

(1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage : 
   \[ V = \pm 200 \text{mV} \] (Over and under shoot voltage)
(2) Response time depends on the temperature. (In lower temperature, it becomes longer.)
(3) Brightness depends on the temperature. (In lower temperature, it becomes lower.)
   And in lower temperature, response time (required time that brightness is stable after turned on) becomes longer.
(4) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
(5) When fixed patterns are displayed for a long time, remnant image is likely to occur.
(6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.
(7) Please do not give any mechanical and/or acoustical impact to LCM. Otherwise, LCM can not be operated its full characteristics perfectly.
9-3. ELECTROSTATIC DISCHARGE CONTROL
Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

9-4. PRECAUTIONS FOR STRONG LIGHT EXPOSURE
Strong light exposure causes degradation of polarizer and color filter.

9-5. STORAGE
When storing modules as spares for a long time, the following precautions are necessary.
(1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
(2) The polarizer surface should not come in contact with any other object.
   It is recommended that they be stored in the container in which they were shipped.

9-6. HANDLING PRECAUTIONS FOR PROTECTION FILM
(1) The protection film is attached to the bezel with a small masking tape
   When the protection film is peeled off, static electricity is generated between the film and polarizer.
   This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
(2) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the bezel after the protection film is peeled off.
(3) You can remove the glue easily. When the glue remains on the bezel or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.
APPENDIX 1. REQUIRED SIGNAL ASSIGNMENT FOR FlatLink(TI:SN75LVDS83) Transmitter

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Pin Name</th>
<th>Require Signal</th>
<th>Pin #</th>
<th>Pin Name</th>
<th>Require Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VCC</td>
<td>Power Supply for TTL Input</td>
<td>29</td>
<td>GND</td>
<td>Ground pin for TTL</td>
</tr>
<tr>
<td>2</td>
<td>D5</td>
<td>TTL Input (R7)</td>
<td>30</td>
<td>D26</td>
<td>TTL Input (DE)</td>
</tr>
<tr>
<td>3</td>
<td>D6</td>
<td>TTL Input (R5)</td>
<td>31</td>
<td>TX_CLKIN</td>
<td>TTL Level clock Input</td>
</tr>
<tr>
<td>4</td>
<td>D7</td>
<td>TTL Input (G0)</td>
<td>32</td>
<td>PWR DWN</td>
<td>Power Down Input</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>Ground pin for TTL</td>
<td>33</td>
<td>PLL GND</td>
<td>Ground pin for PLL</td>
</tr>
<tr>
<td>6</td>
<td>D8</td>
<td>TTL Input (G1)</td>
<td>34</td>
<td>PLL VCC</td>
<td>Power Supply for PLL</td>
</tr>
<tr>
<td>7</td>
<td>D9</td>
<td>TTL Input (G2)</td>
<td>35</td>
<td>PLL GND</td>
<td>Ground pin for PLL</td>
</tr>
<tr>
<td>8</td>
<td>D10</td>
<td>TTL Input (G6)</td>
<td>36</td>
<td>LVDS GND</td>
<td>Ground pin for LVDS</td>
</tr>
<tr>
<td>9</td>
<td>VCC</td>
<td>Power Supply for TTL Input</td>
<td>37</td>
<td>TXOUT3 +</td>
<td>Positive LVDS differential data output 3</td>
</tr>
<tr>
<td>10</td>
<td>D11</td>
<td>TTL Input (G7)</td>
<td>38</td>
<td>TXOUT3 −</td>
<td>Negative LVDS differential data output 3</td>
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<tr>
<td>11</td>
<td>D12</td>
<td>TTL Input (G3)</td>
<td>39</td>
<td>TX_CLKOUT +</td>
<td>Positive LVDS differential clock output</td>
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<tr>
<td>12</td>
<td>D13</td>
<td>TTL Input (G4)</td>
<td>40</td>
<td>TX_CLKOUT −</td>
<td>Negative LVDS differential clock output</td>
</tr>
<tr>
<td>13</td>
<td>GND</td>
<td>Ground pin for TTL</td>
<td>41</td>
<td>TXOUT2 +</td>
<td>Positive LVDS differential data output 2</td>
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<tr>
<td>14</td>
<td>D14</td>
<td>TTL Input (G5)</td>
<td>42</td>
<td>TXOUT2 −</td>
<td>Negative LVDS differential data output 2</td>
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<tr>
<td>15</td>
<td>D15</td>
<td>TTL Input (B0)</td>
<td>43</td>
<td>LVDS GND</td>
<td>Ground pin for LVDS</td>
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<tr>
<td>16</td>
<td>D16</td>
<td>TTL Input (B6)</td>
<td>44</td>
<td>LVDS VCC</td>
<td>Power Supply for LVDS</td>
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<tr>
<td>17</td>
<td>VCC</td>
<td>Power Supply for TTL Input</td>
<td>45</td>
<td>TXOUT1 +</td>
<td>Positive LVDS differential data output 1</td>
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<tr>
<td>18</td>
<td>D17</td>
<td>TTL Input (B7)</td>
<td>46</td>
<td>TXOUT1 −</td>
<td>Negative LVDS differential data output 1</td>
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<tr>
<td>19</td>
<td>D18</td>
<td>TTL Input (B1)</td>
<td>47</td>
<td>TXOUT0 +</td>
<td>Positive LVDS differential data output 0</td>
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<tr>
<td>20</td>
<td>D19</td>
<td>TTL Input (B2)</td>
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<td>TXOUT0 −</td>
<td>Negative LVDS differential data output 0</td>
</tr>
<tr>
<td>21</td>
<td>GND</td>
<td>Ground pin for TTL Input</td>
<td>49</td>
<td>LVDS GND</td>
<td>Ground pin for LVDS</td>
</tr>
<tr>
<td>22</td>
<td>D20</td>
<td>TTL Input (B3)</td>
<td>50</td>
<td>D27</td>
<td>TTL Input (R6)</td>
</tr>
<tr>
<td>23</td>
<td>D21</td>
<td>TTL Input (B4)</td>
<td>51</td>
<td>D0</td>
<td>TTL Input (R0)</td>
</tr>
<tr>
<td>24</td>
<td>D22</td>
<td>TTL Input (B5)</td>
<td>52</td>
<td>D1</td>
<td>TTL Input (R1)</td>
</tr>
<tr>
<td>25</td>
<td>D23</td>
<td>TTL Input (RSVD)</td>
<td>53</td>
<td>GND</td>
<td>Ground pin for TTL</td>
</tr>
<tr>
<td>26</td>
<td>VCC</td>
<td>Power Supply for TTL Input</td>
<td>54</td>
<td>D2</td>
<td>TTL Input (R2)</td>
</tr>
<tr>
<td>27</td>
<td>D24</td>
<td>TTL Input (HSYNC)</td>
<td>55</td>
<td>D3</td>
<td>TTL Input (R2)</td>
</tr>
<tr>
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<td>D25</td>
<td>TTL Input (VSYNC)</td>
<td>56</td>
<td>D4</td>
<td>TTL Input (R4)</td>
</tr>
</tbody>
</table>

Notes: Refer to LVDS Transmitter Data Sheet for detail descriptions.
Warranty for Non-Inclusion of Hazardous Substances in Products (ver.4.1)

Our company hereby warrants and guarantees that all of or part of products, including, but not limited to, the peripherals, accessories or (including your subsidiaries and affiliated company) directly or packages, manufactured and/or delivered to your company indirectly by our company (including our subsidiaries or affiliated companies) are free from any of the substances listed in your company’s Technology Standard or its subsequent revision, including the following articles.

1. Our company actually cooperates with environment-friendly policy pushed by your company and follows the total abolition schedule of Pb, Cd, Cr+6, Hg, PBB and PBDEs proposed by Hazardous substances management standard in your company.

2. Our company don’t excessively enclose to the noxious material including Cd, Pb in products and parts supporting to the department of DID in LG electronics. If the environmental accident is occurred by our company’s mistake and insufficient improvement, acts on our company’s responsibility.

3. Our company ensure that all of information submitted to your company is not arbitrary estimation and is to the exact document based on reliable data.

By attached Data, Our company warrants this products confirm to following requirements. (Check each applicable item)

- [ ] Pb Free Soldering
- [ ] Pb Free
- [ ] RoHS Free
- [ ] TCO ’03

Definition:
- Pb Free Soldering : Parts must meet DID’s Heat resistance condition. (Reflow Type: 250°C, 10sec, Flow Type: 260°C, 10sec)
- Pb Free : Lead wire plating is Pb Free (Pb content < 1,000ppm) and Inner contact point and Body itself don’t contain Pb (Pb content < 1,000ppm) 
- RoHS Free : Part does not contain Pb, Cd, Cr+6, Hg, PBBs and PBDEs (Cd<100ppm, Others<1,000ppm) and supplier must submit evidences (ICP, AAS, UV-Vis, GC) certificated by authorised agency
- TCO ’03 : Part meet TCO’03 and LG electronics requirement (Cd<5ppm, Pb<50ppm, Hg<2ppm, Cr+6,PBBs, PBDEs<100)

Company name: LG Philips LCD
Date: Jan. 11, 2005
Representative: Min-Hoel Jeong
Signature: [Signature]

Ver 1.0 Sep. 21. 2005