Product Specifications

8.1" COLOR TFT-LCD Module

MODEL NAME: A081VW01

< ◆ > Preliminary Specification

< > Final Specification

Note: The content of this specification is subject to change.

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## Record of Revision

<table>
<thead>
<tr>
<th>Version</th>
<th>Revise Date</th>
<th>Page</th>
<th>Content</th>
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<td>2006/07/10</td>
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<td>Update outline dimension</td>
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<td>Re-define pin assignment sequence</td>
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<td>Update suggested application circuit</td>
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<td>19</td>
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<td>General Description modification.</td>
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<td>Updated pin description.</td>
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<td>Updated dclk frequency and period.</td>
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<td>Updated SPI timing, register default esettings and description.</td>
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<td>Added Stand-by mode timing.</td>
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<td>28~29</td>
<td>Updated power on/off sequence.</td>
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<td>15</td>
<td>Updated register table default value</td>
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<td>2007/08/10</td>
<td>10~11</td>
<td>Updated Pin Assignment</td>
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<td>Date</td>
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<td>0.7a</td>
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<td>Updated outline drawing, the suggested customer housing design</td>
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<td>Updated touch panel electronic characteristics and life test condition</td>
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<td>0.7b</td>
<td>2007/09/27</td>
<td>Updated backlight LED driving voltage</td>
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<tr>
<td>0.8</td>
<td>2007/10/17</td>
<td>Updated Absolute Maximum Ratings</td>
<td></td>
</tr>
<tr>
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<td></td>
<td>Updated LED backlight by 4 LEDs serial type</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Updated application circuit</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Updated Recommend Register Settings</td>
<td></td>
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<tr>
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<td></td>
<td>Updated Gamma2.2 Voltage and recommended resistors.</td>
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</tr>
<tr>
<td>0.8a</td>
<td>2007/11/19</td>
<td>Updated DE mode description</td>
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<tr>
<td></td>
<td></td>
<td>Updated register R516 from 10K to 0 ohm</td>
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<td>0.8b</td>
<td>2008/03/31</td>
<td>Define min. to CR and Viewing Angle</td>
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<tr>
<td>0.8c</td>
<td>2008/04/02</td>
<td>Updated outline drawing due to BLU label shift</td>
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</tbody>
</table>
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GENERAL DESCRIPTION

A081VW01 is a amorphous transmissive type TFT (Thin Film Transistor) LCD (Liquid crystal Display). This model is composed of TFT-LCD, drive IC, FPC (flexible printed circuit), backlight and touch panel. This model is the new driving type for 800RGBx300 application. The timing controller and one DCDC controller are integrated inside IC. It is easily to design for consumer product.

Features

- 8.1-inch display size with aspect ration of 8:3
- Resolution 800RGB x 300 in stripe dot arrangement
- 16.7M color supported
- Paralle 24 / 18-bit RGB interface
- SICC (Smart Integration Cascade Chip). Support below functions
  - VCOM DC value adjustable
  - SYNC timing adjustable
- Built in timing controller and one DC-DC controller
- Request 180mA for LED blacklight
- Standby mode supported
- 3-wire register setting
- Low power consumption
- RoHS compliant green design
### 1. General Information

<table>
<thead>
<tr>
<th>NO.</th>
<th>Item</th>
<th>Unit</th>
<th>Specification</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Display Resolution</td>
<td>dot</td>
<td>800RGB(H)×300(V)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Active Area</td>
<td>mm</td>
<td>192 (H)×72(V)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Screen Size</td>
<td>inch</td>
<td>8.1” (Diagonal)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Dot Pitch</td>
<td>mm</td>
<td>0.24(H)× 0.24(V)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Color Configuration</td>
<td>--</td>
<td>R. G. B. Stripe</td>
<td>Note 1</td>
</tr>
<tr>
<td>6</td>
<td>Color Depth</td>
<td>--</td>
<td>16.7M Colors</td>
<td>Note 2</td>
</tr>
<tr>
<td>7</td>
<td>Overall Dimension</td>
<td>mm</td>
<td>204.6(H)x 86.2(V)x 8.23(T)</td>
<td>Note 3</td>
</tr>
<tr>
<td>8</td>
<td>Weight</td>
<td>g</td>
<td>TBD (typ.)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Panel surface treatment</td>
<td>--</td>
<td>Hard coating</td>
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<tr>
<td>10</td>
<td>Display Mode</td>
<td>--</td>
<td>Normally White</td>
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</tbody>
</table>

Note 1: Below figure shows dot stripe arrangement.

![Dot Stripe Arrangement](image)

Note 2: The full color display depends on 24-bit data signal (pin 4~27).

Note 3: Not include FPC. Refer next page to get further information.
8.1inch Module Outline Dimension – Front View
8.1inch Module Outline Dimension – Back View
## 2. Electrical Specifications

### 2.1 FPC Pin Assignment (HRS FH27-60H-0.4SH)

<table>
<thead>
<tr>
<th>Pin no</th>
<th>Symbol</th>
<th>I/O</th>
<th>Description</th>
<th>Remark</th>
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<td>1</td>
<td>AGND2</td>
<td>P</td>
<td>Analog Ground</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>AVDD2</td>
<td>P</td>
<td>Analog Power</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>VDD</td>
<td>P</td>
<td>Digital Power</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>R0</td>
<td>I</td>
<td>Data input (LSB)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>R1</td>
<td>I</td>
<td>Data input</td>
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<tr>
<td>6</td>
<td>R2</td>
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<td>7</td>
<td>R3</td>
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</tr>
<tr>
<td>8</td>
<td>R4</td>
<td>I</td>
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<td>9</td>
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<td></td>
</tr>
<tr>
<td>10</td>
<td>R6</td>
<td>I</td>
<td>Data input</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>R7</td>
<td>I</td>
<td>Data input (MSB)</td>
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</tr>
<tr>
<td>12</td>
<td>G0</td>
<td>I</td>
<td>Data input (LSB)</td>
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<tr>
<td>13</td>
<td>G1</td>
<td>I</td>
<td>Data input</td>
<td></td>
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<tr>
<td>14</td>
<td>G2</td>
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<td></td>
</tr>
<tr>
<td>16</td>
<td>G4</td>
<td>I</td>
<td>Data input</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>G5</td>
<td>I</td>
<td>Data input</td>
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<td></td>
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<td>19</td>
<td>G7</td>
<td>I</td>
<td>Data input (MSB)</td>
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<td>20</td>
<td>B0</td>
<td>I</td>
<td>Data input (LSB)</td>
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<tr>
<td>21</td>
<td>B1</td>
<td>I</td>
<td>Data input</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>B2</td>
<td>I</td>
<td>Data input</td>
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<td>B4</td>
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<td>26</td>
<td>B6</td>
<td>I</td>
<td>Data input</td>
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</tr>
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<td>27</td>
<td>B7</td>
<td>I</td>
<td>Data input (MSB)</td>
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</tr>
<tr>
<td>28</td>
<td>DCLK</td>
<td>I</td>
<td>Data Clock input</td>
<td></td>
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<tr>
<td>29</td>
<td>DE</td>
<td>I</td>
<td>Data enable signal <em>(DE mode is with higher priority than HV mode.)</em></td>
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<tr>
<td>30</td>
<td>HSYNC</td>
<td>I</td>
<td>Horizontal sync input. Negative polarity</td>
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<tr>
<td>31</td>
<td>VSYNC</td>
<td>I</td>
<td>Vertical sync input. Negative polarity</td>
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<td>32</td>
<td>SCL</td>
<td>I</td>
<td>Serial communication clock input</td>
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<td>33</td>
<td>SDA</td>
<td>I</td>
<td>Serial communication data input</td>
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<tr>
<td>34</td>
<td>CSB</td>
<td>I</td>
<td>Serial communication chip select</td>
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</tr>
<tr>
<td>35</td>
<td>NC</td>
<td>I</td>
<td>Do not connect (Please leave it open)</td>
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</tr>
<tr>
<td>36</td>
<td>VDD</td>
<td>P</td>
<td>Digital Power</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>NC</td>
<td>I</td>
<td>Do not connect (Please leave it open)</td>
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</tr>
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<td>38</td>
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<td>40</td>
<td>AVDD</td>
<td>P</td>
<td>Analog Power</td>
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</tr>
<tr>
<td>41</td>
<td>VCOMin</td>
<td>I</td>
<td>For external VCOM DC input (Optional)</td>
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<tr>
<td>42</td>
<td>NC</td>
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<td>Do not connect (Please leave it open)</td>
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</tr>
<tr>
<td>43</td>
<td>NC</td>
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<td>Do not connect (Please leave it open)</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>VCOM</td>
<td>I</td>
<td>For external VCOM DC input (Optional)</td>
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<td>V10</td>
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<td>Gamma correction voltage reference</td>
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<td>46</td>
<td>V9</td>
<td>P</td>
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<td>47</td>
<td>V8</td>
<td>P</td>
<td>Gamma correction voltage reference</td>
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<tr>
<td>48</td>
<td>V7</td>
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<td>49</td>
<td>V6</td>
<td>P</td>
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<td>V5</td>
<td>P</td>
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<td>51</td>
<td>V4</td>
<td>P</td>
<td>Gamma correction voltage reference</td>
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2.2 Absolute Maximum Ratings

<table>
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<th>Item</th>
<th>Symbol</th>
<th>Condition</th>
<th>Min.</th>
<th>Max.</th>
<th>Unit</th>
<th>Remark</th>
</tr>
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<tr>
<td>Power voltage</td>
<td>VDD</td>
<td>GND=0</td>
<td>-0.5</td>
<td>5</td>
<td>V</td>
<td>Note 1</td>
</tr>
<tr>
<td></td>
<td>GVCC</td>
<td>GND=0</td>
<td>-0.5</td>
<td>5</td>
<td>V</td>
<td>Note 1</td>
</tr>
<tr>
<td></td>
<td>AVDD</td>
<td>AGND=0</td>
<td>-0.5</td>
<td>15</td>
<td>V</td>
<td>Note 1</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Topa</td>
<td>--</td>
<td>0</td>
<td>60</td>
<td>°C</td>
<td>Ambient Temperature</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>Tstg</td>
<td>--</td>
<td>-25</td>
<td>80</td>
<td>°C</td>
<td>Ambient Temperature</td>
</tr>
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</table>

Note 1: Functional operation should be restricted under normal ambient temperature.
2.3 Electrical Characteristics

The following items are measured under stable condition and suggested application circuit.

2.3.1. TFT- LCD Typical Operation Condition

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Remark</th>
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</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>VDD</td>
<td>3.2</td>
<td>3.3</td>
<td>3.6</td>
<td>V</td>
<td>Pin3 and Pin36</td>
</tr>
<tr>
<td></td>
<td>AVDD</td>
<td>(10.5)</td>
<td>(11)</td>
<td>(11.5)</td>
<td>V</td>
<td>Pin2 and Pin40</td>
</tr>
<tr>
<td></td>
<td>GVCC</td>
<td>3.2</td>
<td>3.3</td>
<td>3.6</td>
<td>V</td>
<td>Pin58</td>
</tr>
<tr>
<td></td>
<td>VGH</td>
<td>(14)</td>
<td>(15)</td>
<td>(16)</td>
<td>V</td>
<td>Pin56</td>
</tr>
<tr>
<td></td>
<td>VGL</td>
<td>(-7.5)</td>
<td>(-7)</td>
<td>(-6.5)</td>
<td>V</td>
<td>Pin57</td>
</tr>
<tr>
<td>Input Signal H Level</td>
<td>(V_{IH})</td>
<td>0.7(V_{CC})</td>
<td>-</td>
<td>(V_{CC})</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Input Signal L Level</td>
<td>(V_{IL})</td>
<td>GND</td>
<td>-</td>
<td>0.3(V_{CC})</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>VCOM</td>
<td>(V_{CDC})</td>
<td>(4.3)</td>
<td>(4.5)</td>
<td>(4.7)</td>
<td>V</td>
<td>DC component</td>
</tr>
<tr>
<td>Input Current</td>
<td>I(_{VDD})</td>
<td>11</td>
<td>20</td>
<td>mA</td>
<td>Pin3 + Pin36</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I(_{AVDD})</td>
<td>8</td>
<td>15</td>
<td>mA</td>
<td>Pin2 + Pin40</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I(_{GVCC})</td>
<td>0.02</td>
<td>0.1</td>
<td>mA</td>
<td>Pin58</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I(_{VGH})</td>
<td>0.2</td>
<td>0.3</td>
<td>mA</td>
<td>Pin56</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I(_{VGL})</td>
<td>0.2</td>
<td>0.3</td>
<td>mA</td>
<td>Pin57</td>
<td></td>
</tr>
</tbody>
</table>

Note: Above every operation range is based on stable operation from suggested application circuit

Note: Typical current test pattern

2.4 AC Characteristics

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>CONDITIONS</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clock High time</td>
<td>(T_{WCL})</td>
<td>8</td>
<td>-</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>Clock Low time</td>
<td>(T_{WCH})</td>
<td>8</td>
<td>-</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>Clock rising time</td>
<td>(T_{RCLK})</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>Clock falling time</td>
<td>(T_{ACK})</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>Hsync setup time</td>
<td>(T_{HSU})</td>
<td>5</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hsync hold time</td>
<td>(T_{HHD})</td>
<td>10</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vsync setup time</td>
<td>(T_{VSU})</td>
<td>0</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vsync hold time</td>
<td>(T_{VHD})</td>
<td>2</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data setup time</td>
<td>(T_{DSU})</td>
<td>5</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 2.5 RGB Parallel Input Timing

#### Horizontal Timing

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>CONDITIONS</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCLK frequency</td>
<td>$F_{\text{DCLK}}$</td>
<td></td>
<td>22</td>
<td>24</td>
<td>27.5</td>
<td>MHz</td>
</tr>
<tr>
<td>DCLK period</td>
<td>$T_{\text{DCLK}}$</td>
<td></td>
<td>36.4</td>
<td>41.7</td>
<td>45.5</td>
<td>ns</td>
</tr>
<tr>
<td>Hsync Period (= $T_{\text{HD}} + T_{\text{HBL}}$)</td>
<td>$T_{\text{H}}$</td>
<td></td>
<td>986</td>
<td>1056</td>
<td>1183</td>
<td>DCLK</td>
</tr>
<tr>
<td>Active Area</td>
<td>$T_{\text{HD}}$</td>
<td></td>
<td>-</td>
<td>800</td>
<td>-</td>
<td>DCLK</td>
</tr>
<tr>
<td>Horizontal blanking (= $T_{\text{HF}} + T_{\text{HE}}$)</td>
<td>$T_{\text{HBL}}$</td>
<td></td>
<td>186</td>
<td>256</td>
<td>383</td>
<td>CLK</td>
</tr>
<tr>
<td>Hsync front porch</td>
<td>$T_{\text{HF}}$</td>
<td></td>
<td>40</td>
<td>-</td>
<td>-</td>
<td>CLK</td>
</tr>
<tr>
<td>Delay from Hsync to 1st data input (= $T_{\text{HW}} + T_{\text{HB}}$)</td>
<td>$T_{\text{HE}}$</td>
<td>Function of $\text{HDL}[5..0]$ settings</td>
<td>146</td>
<td>216</td>
<td>343</td>
<td>DCLK</td>
</tr>
<tr>
<td>Hsync pulse width</td>
<td>$T_{\text{HW}}$</td>
<td></td>
<td>1</td>
<td>128</td>
<td>136</td>
<td>CLK</td>
</tr>
<tr>
<td>Hsync back porch</td>
<td>$T_{\text{HB}}$</td>
<td></td>
<td>10</td>
<td>88</td>
<td>342</td>
<td>CLK</td>
</tr>
</tbody>
</table>

#### Vertical Timing

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>CONDITIONS</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vsync period (= $T_{\text{VD}} + T_{\text{VBL}}$)</td>
<td>$T_{\text{V}}$</td>
<td></td>
<td>372</td>
<td>380</td>
<td>387</td>
<td>Th</td>
</tr>
<tr>
<td>Active lines</td>
<td>$T_{\text{VD}}$</td>
<td></td>
<td>300</td>
<td></td>
<td></td>
<td>Th</td>
</tr>
<tr>
<td>Vertical blanking (= $T_{\text{VF}} + T_{\text{VE}}$)</td>
<td>$T_{\text{VBL}}$</td>
<td></td>
<td>72</td>
<td>80</td>
<td>87</td>
<td>Th</td>
</tr>
<tr>
<td>Vsync front porch</td>
<td>$T_{\text{VF}}$</td>
<td></td>
<td>-</td>
<td>17</td>
<td>-</td>
<td>Th</td>
</tr>
<tr>
<td>GD start pulse delay</td>
<td>$T_{\text{VE}}$</td>
<td>Function of $\text{VDL}[3..0]$ settings</td>
<td>55</td>
<td>63</td>
<td>70</td>
<td>HS</td>
</tr>
<tr>
<td>Vsync pulse width</td>
<td>$T_{\text{WV}}$</td>
<td></td>
<td>1</td>
<td>2</td>
<td>20</td>
<td>Th</td>
</tr>
<tr>
<td>Hsync/ Vsync phase shift</td>
<td>$T_{\text{VPD}}$</td>
<td></td>
<td>2</td>
<td>320</td>
<td>-</td>
<td>CLK</td>
</tr>
</tbody>
</table>
Figure 4: Horizontal input timing. (HV mode)

Figure 5: Horizontal input timing. (DE mode)

Figure 6: Vertical timing. (HV mode)

Figure 7: Vertical timing. (DE mode)
2.6 Serial Control Interface AC characteristic

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>CONDITIONS</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial clock</td>
<td>$T_{SCK}$</td>
<td></td>
<td>320</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>SCL pulse duty</td>
<td>$T_{SCW}$</td>
<td></td>
<td></td>
<td>40</td>
<td>60</td>
<td>%</td>
</tr>
<tr>
<td>Serial data setup time</td>
<td>$T_{IST}$</td>
<td></td>
<td></td>
<td>120</td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>Serial data hold time</td>
<td>$T_{IHD}$</td>
<td></td>
<td></td>
<td>120</td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>Serial clock high/low</td>
<td>$T_{SSW}$</td>
<td></td>
<td></td>
<td>120</td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>CSB setup time</td>
<td>$T_{CST}$</td>
<td></td>
<td></td>
<td>120</td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>CSB hold time</td>
<td>$T_{CHD}$</td>
<td></td>
<td></td>
<td>120</td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>Chip select distinguish</td>
<td>$T_{CD}$</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>us</td>
</tr>
<tr>
<td>Delay from CSB to VSYNC</td>
<td>$T_{CV}$</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>us</td>
</tr>
</tbody>
</table>

Figure 2: AC serial interface write mode timing

2.7 Register Information

There is a total of 5 registers each containing several parameters. For a detailed description of the parameters refer to Table 1. The serial register has read/write function. D[15:12] are the register address, D[11] defines the read or write mode and D[10:0] are the data.

Figure 1: Serial interface write sequence
1. At power-on, the default values specified for each parameter (in Table 1) are taken.
2. If less than 16-bit data are read during the CS low time period, the data is cancelled.
   a. The write operation is cancelled.
3. All items are set at the falling edge of the vertical sync, except R0[1:0].
4. When GRB is activated through the serial interface, all registers are cleared, except the GRB value.
5. Register W setting: D11 = “L” → write mode;
6. The register setting values are valid when VCC already goes to high and after VSYNC starts.
7. It is suggested that VSYNC, HSYNC, DCLK always exists in the same time. But if HSYNC, DCLK stops, only VSYNC operating, the register setting is still valid.
8. If the chip goes to standby mode, the register value will still keep. MCU can wake up the chip only by changing standby mode value from low to high.
9. The register setting values are rewritten by the influence of static electricity, a noise, etc. to unsuitable value, incorrect operating may occur. It is suggested that the SPI interface will setup as frequently as possible.

### 2.7.1 Register Table (Default Register Settings)

<table>
<thead>
<tr>
<th>Reg No.</th>
<th>ADDRESS</th>
<th>W</th>
<th>DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>D15 D14 D13 D12</td>
<td>D11 D10 D9 D8</td>
<td>D7 D6</td>
<td>D5 D4 D3 D2</td>
</tr>
<tr>
<td>R0</td>
<td>0 0 0 0</td>
<td>0</td>
<td>01</td>
</tr>
<tr>
<td>R1</td>
<td>0 0 0 1</td>
<td>0</td>
<td>X</td>
</tr>
<tr>
<td>R2</td>
<td>0 0 1 0</td>
<td>0</td>
<td>X</td>
</tr>
<tr>
<td>R3</td>
<td>0 0 1 1</td>
<td>0</td>
<td>X</td>
</tr>
<tr>
<td>R4</td>
<td>0 1 0 0</td>
<td>0</td>
<td>X</td>
</tr>
<tr>
<td>R5</td>
<td>0 1 1 0</td>
<td>0</td>
<td>X</td>
</tr>
</tbody>
</table>

※ R4 Should be set to “411Fh”
X : Reserved, please set to “0”.

### 2.7.2 R0 Settings

<table>
<thead>
<tr>
<th>Address</th>
<th>Bit</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000</td>
<td>[10..0]</td>
<td>Bits 10-9</td>
<td>AUO Internal Use</td>
</tr>
<tr>
<td></td>
<td>Bits 7-8</td>
<td>AUO Internal Use</td>
<td>01</td>
</tr>
<tr>
<td></td>
<td>Bit6</td>
<td>AUO Internal Use</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Bit5 (U/D)</td>
<td>Vertical shift direction selection.</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Bit4 (SHL)</td>
<td>Horizontal shift direction selection.</td>
<td>1</td>
</tr>
</tbody>
</table>
Bit3 (SHDB1)  AVDD DC-DC converter shutdown setting.  1
Bit2        AUO Internal Use           0
Bit1 (GRB)  Global reset.             1
Bit0 (STB)  Standby mode setting.     1

Bit5       U/D function
0          Scan down; First line=Gn→Gn-1→…→G2→Last line=G1. (default)
1          Scan up; First line=G1→G2→…→Gn-1→Last line=Gn.

Bit4       SHL function
0          Shift left; First data=Y600→Y601→…→Y2→Last data=Y1.
1          Shift right; First data=Y1→Y2→…→Y600→Last data=Y600. (default)

Bit3       SHDB1 function
0          AVDD DC-DC converter is off.
1          AVDD DC-DC converter is on. (default)

Bit1       GRB function
0          The controller is reset. Reset all registers to default value.
1          Normal operation. (default)

Bit0       STB function
0          T-CON, source driver and DC-DC converters are off, and all outputs are High-Z.
1          Normal operation. (default)

R1 settings

<table>
<thead>
<tr>
<th>Address</th>
<th>Bit</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>0001</td>
<td>[8..0]</td>
<td>Bit9-8 AULO Internal Use</td>
<td>01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bit7-6 VCOM_M VCOM mode signal.</td>
<td>01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bit5-0 VCOM_LVL VCOM level adjustment</td>
<td>2Fh</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bit7-6</th>
<th></th>
<th>VCOM_M function.</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td></td>
<td>VCOM generator disabled. VCOM is generated externally.</td>
</tr>
</tbody>
</table>
VCOM internal reference disabled. DC voltage of VCOM follows VCOM_in signal. *(default)*

VCOM generator enabled. DC voltage of VCOM follows VCOM_LVL settings.

**NOTE:** Please refer to the following Figure. (COMA is panel internal signal)

<table>
<thead>
<tr>
<th>Bit5-0</th>
<th>VCOM_LVL function @V1=12.5V</th>
</tr>
</thead>
<tbody>
<tr>
<td>00h</td>
<td>VCOM_LVL = V1/2 – 47*31.25mV = 4.78125V</td>
</tr>
<tr>
<td>01h</td>
<td>VCOM_LVL = V1/2 – 46*31.25mV = 4.8125V</td>
</tr>
<tr>
<td>2Fh</td>
<td>VCOM_LVL = V1/2 = 6.25V <em>(default)</em></td>
</tr>
<tr>
<td>3Eh</td>
<td>VCOM_LVL = V1/2 + 15*31.25mV = 6.71875V</td>
</tr>
<tr>
<td>3Fh</td>
<td>VCOM_LVL = V1/2 + 16*31.25mV = 6.75V</td>
</tr>
</tbody>
</table>

### R2 settings

<table>
<thead>
<tr>
<th>Address</th>
<th>Bit</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>0010</td>
<td>[7..0] Bit7-0 (HDL)</td>
<td>Horizontal start pulse adjustment function</td>
<td>80h</td>
</tr>
</tbody>
</table>

**Bit7-0** HDL function.

- 00h \( T_{HE} = T_{HEtyp} - 128 \) CLK period.
- 80h \( T_{HE} = T_{HEtyp} \) *(default)*
- FFh \( T_{HE} = T_{HEtyp} + 127 \) CLK period.
### R3 settings

<table>
<thead>
<tr>
<th>Address</th>
<th>Bit</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>0011</td>
<td>6..0</td>
<td>Bit6 AUO Internal Use</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bit5 AUO Internal Use</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bit4 AUO Internal Use</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bit3-0 (VDL) Vertical start pulse adjustment function</td>
<td>1000</td>
</tr>
</tbody>
</table>

#### Bit3-0 VDL function.

- **0000** \(T_{VE} = T_{VEtyp} - 8\) Hs period.
- **0001** \(T_{VE} = T_{VEtyp} - 7\) Hs period.
- **0010** \(T_{VE} = T_{VEtyp} - 6\) Hs period.
- **0011** \(T_{VE} = T_{VEtyp} - 5\) Hs period.
- **0100** \(T_{VE} = T_{VEtyp} - 4\) Hs period.
- **0101** \(T_{VE} = T_{VEtyp} - 3\) Hs period.
- **0110** \(T_{VE} = T_{VEtyp} - 2\) Hs period.
- **0111** \(T_{VE} = T_{VEtyp} - 1\) Hs period.
- **1000** \(T_{VE} = T_{VEtyp}\) (default)
- **1001** \(T_{VE} = T_{VEtyp} + 1\) Hs period.
- **1010** \(T_{VE} = T_{VEtyp} + 2\) Hs period.
- **1011** \(T_{VE} = T_{VEtyp} + 3\) Hs period.
- **1100** \(T_{VE} = T_{VEtyp} + 4\) Hs period.
- **1101** \(T_{VE} = T_{VEtyp} + 5\) Hs period.
- **1110** \(T_{VE} = T_{VEtyp} + 6\) Hs period.
- **1111** \(T_{VE} = T_{VEtyp} + 7\) Hs period.

### R6 settings

<table>
<thead>
<tr>
<th>Address</th>
<th>Bit</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>0110</td>
<td>9..0</td>
<td>Bit9 AUO Internal Use</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bit8(EnGB12) Gamma buffer Enable for V9</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bit7(EnGB11) Gamma buffer Enable for V8</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bit6(EnGB10) Gamma buffer Enable for V7</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bit5 AUO Internal Use</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bit4 AUO Internal Use</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bit3(EnGB5) Gamma buffer Enable for V4</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bit2(EnGB4) Gamma buffer Enable for V3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bit1(EnGB3) Gamma buffer Enable for V2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bit0 AUO Internal Use</td>
<td>0</td>
</tr>
</tbody>
</table>
Bitx | EnGBx function
---|---
0 | Gamma buffer for VX is disable (High Z).
1 | Gamma buffer is enable. VX must be connected externally.

### 2.8 Stand-by mode

DCLK

Vsync

STB

LED

Panel Display

Operating Mode

White Display

### 2.9 Backlight Driving Conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED Current</td>
<td>$I_L$</td>
<td>---</td>
<td>(180)</td>
<td>(200)</td>
<td>mA</td>
<td>---</td>
</tr>
<tr>
<td>LED Voltage</td>
<td>$V_L$</td>
<td>---</td>
<td>13.2</td>
<td>---</td>
<td>V</td>
<td>---</td>
</tr>
<tr>
<td>LED Life Time</td>
<td>$L_L$</td>
<td>10,000</td>
<td>---</td>
<td>---</td>
<td>Hr</td>
<td>Note 2, 3</td>
</tr>
</tbody>
</table>

Note 1: LED backlight is four LEDs serial type.

Note 2: Define “LED Lifetime”: brightness is decreased to 50% of the initial value. LED Lifetime is restricted under normal condition, ambient temperature = 25°C and LED current = 180mA.

Note 3: If it uses larger LED current $I_L$ more than 200mA, it maybe decreases the LED lifetime.
3. 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>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rise</td>
<td>Tr</td>
<td>θ=0°</td>
<td>-</td>
<td>10</td>
<td>50</td>
<td>ms</td>
<td>Note 3</td>
</tr>
<tr>
<td>Fall</td>
<td>Tf</td>
<td></td>
<td>-</td>
<td>20</td>
<td>60</td>
<td>ms</td>
<td></td>
</tr>
<tr>
<td>Contrast ratio</td>
<td>CR</td>
<td>At optimized viewing angle</td>
<td>250</td>
<td>300</td>
<td>-</td>
<td></td>
<td>Note 4</td>
</tr>
<tr>
<td>Viewing Angle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top</td>
<td></td>
<td>CR ≥ 10</td>
<td>35</td>
<td>40</td>
<td>-</td>
<td>deg.</td>
<td>Note 5</td>
</tr>
<tr>
<td>Bottom</td>
<td></td>
<td>CR ≥ 10</td>
<td>55</td>
<td>60</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left</td>
<td></td>
<td>CR ≥ 10</td>
<td>55</td>
<td>60</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td></td>
<td>CR ≥ 10</td>
<td>55</td>
<td>60</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brightness (w/ TP)</td>
<td>Y_L</td>
<td>θ=0°</td>
<td>250</td>
<td>300</td>
<td>-</td>
<td>cd/m²</td>
<td>Note 6</td>
</tr>
<tr>
<td>White Chromaticity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X</td>
<td></td>
<td>θ=0°</td>
<td>0.26</td>
<td>0.31</td>
<td>0.36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>y</td>
<td></td>
<td>θ=0°</td>
<td>0.28</td>
<td>0.33</td>
<td>0.38</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note 1: Ambient temperature = 25°C, and lamp current I_L = 180 mA. To be measured in the dark room.

Note 2: To be measured on the center area of panel with a viewing cone of 1° by Topcon luminance meter BM-7, after 15 minutes operation.

Note 3: Definition of response time:

The output signals of photo detector are measured when the input signals are changed from “black” to “white” (falling time) and from “white” to “black” (rising time), respectively.

The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.
Note 4. Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

\[
\text{Contrast ratio (CR)} = \frac{\text{Photo detector output when LCD is at “White” state}}{\text{Photo detector output when LCD is at “Black” state}}
\]

Note 5. Definition of viewing angle, \( \theta \), Refer to figure as below.

![Viewing Angle Diagram](https://www.DataSheet.co.kr)

Note 6. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.
## 4. Reliability Test Items

<table>
<thead>
<tr>
<th>No.</th>
<th>Test Items</th>
<th>Conditions</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High temperature storage</td>
<td>Ta = 80°C</td>
<td>240Hrs</td>
</tr>
<tr>
<td>2</td>
<td>Low temperature storage</td>
<td>Ta = -25°C</td>
<td>240Hrs</td>
</tr>
<tr>
<td>3</td>
<td>High temperature operation</td>
<td>Ta = 60°C</td>
<td>240Hrs</td>
</tr>
<tr>
<td>4</td>
<td>Low temperature operation</td>
<td>Ta = 0°C</td>
<td>240Hrs</td>
</tr>
<tr>
<td>5</td>
<td>High temperature and high humidity</td>
<td>Ta = 60°C, 90% RH</td>
<td>240Hrs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Operation</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Heat shock</td>
<td>-25°C~80°C, 50 cycles, 2Hrs/cycle</td>
<td>Non-operation</td>
</tr>
<tr>
<td>7</td>
<td>Electrostatic discharge</td>
<td>±200V, 200pF (0Ω), once for each terminal</td>
<td>Non-operation</td>
</tr>
<tr>
<td>8</td>
<td>Vibration (with carton)</td>
<td>Random vibration:</td>
<td>IEC 68-34</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.015G²/Hz from 5~200Hz</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Drop (with carton)</td>
<td>Height: 60cm</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 corner, 3 edges, 6 surfaces</td>
<td></td>
</tr>
</tbody>
</table>

Note 1: Ta: Ambient temperature.
5. Touch Screen Panel Specifications

1. FPC Pin Assignment

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Symbol</th>
<th>I/O</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>XL</td>
<td>O</td>
</tr>
<tr>
<td>2</td>
<td>YL</td>
<td>O</td>
</tr>
<tr>
<td>3</td>
<td>XH</td>
<td>O</td>
</tr>
<tr>
<td>4</td>
<td>YH</td>
<td>O</td>
</tr>
</tbody>
</table>

2. Electrical Characteristics

<table>
<thead>
<tr>
<th>Item</th>
<th>Min.</th>
<th>Max.</th>
<th>Unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate DC Voltage</td>
<td>7</td>
<td></td>
<td>V</td>
<td>Standard 5V</td>
</tr>
<tr>
<td>Resistance X (Film)</td>
<td>400</td>
<td>1600</td>
<td>Ω</td>
<td>At connector</td>
</tr>
<tr>
<td>Resistance Y (Glass)</td>
<td>100</td>
<td>400</td>
<td>Ω</td>
<td></td>
</tr>
<tr>
<td>Linearity</td>
<td>-1.5%</td>
<td>1.5%</td>
<td>--</td>
<td>Note 1, test by 150 gf</td>
</tr>
<tr>
<td>Chattering</td>
<td>30</td>
<td></td>
<td>ms</td>
<td>At connector pin</td>
</tr>
<tr>
<td>Insulation Resistance</td>
<td>20M</td>
<td></td>
<td>Ω</td>
<td>DC 25V</td>
</tr>
</tbody>
</table>

Note 1: Measurement condition of Linearity: difference between actual voltage & theoretical voltage is an error at any points. Linearity is the value max. error voltage divided by voltage difference on active area.

3. Mechanical Characteristics

<table>
<thead>
<tr>
<th>Item</th>
<th>Min.</th>
<th>Max.</th>
<th>Unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardness of Surface</td>
<td>3</td>
<td>80</td>
<td>H</td>
<td>JIS K-5400</td>
</tr>
<tr>
<td>Operation Force (Pen or Finger)</td>
<td>--</td>
<td>80</td>
<td>gf</td>
<td>Note 1</td>
</tr>
</tbody>
</table>

Note 1: Within "guaranteed active area", but not on the edge and dot-spacer.
4. Life test Condition

<table>
<thead>
<tr>
<th>Item</th>
<th>Min.</th>
<th>Max.</th>
<th>Unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sliding Life</td>
<td>$10^5$</td>
<td>--</td>
<td>times</td>
<td>Note 1, 2</td>
</tr>
<tr>
<td>Input Life</td>
<td>$10^6$</td>
<td>--</td>
<td>times</td>
<td>Note 1, 3</td>
</tr>
</tbody>
</table>

Note 1: Measurement condition of Operation Force: Within "guaranteed active area". Resistance, Insulation resistance, and operation force should be under 5.2 & 5.3 condition. When user pushes down on the film, resistance between X & Y axis must be equal or lower than 2kΩ. Below is test figure.

Note 2: Sliding Life test condition (by pen): Sliding area for pen sliding life test is the center of active area, 20x20 mm. Sliding speed is 100mm/s.

Note 3: Input Life test condition (by finger): By silicone rubber tapping at center of active area. Tapping Load is 250g, and tapping frequency is 3 Hz.
5. Attention

Please pay attention for below matters at mounting design of touch panel of LCD module.

1. Do not design enclosure pressing the view area to prevent from miss input.
2. Enclosure support must not touch with view area.
3. Use elastic or non-conductive material to enclosure touch panel.
4. Do not bond film of touch panel with enclosure.
5. The touch panel edge is conductive. Do not touch it with any conductive part after mounting.
6. If user wants to cleaning touch panel by air gun, pressure 2kg/cm² below is suggested. Not to blow glass from FPC site to prevent FPC peeled off.
7. Do not put a heavy shock or stress on touch panel and film surface. Ex. Don`t lift the panel by film face with vacuum.
8. Do not lift LCD module by FPC.
9. Please use dry cloth or soft cloth with neutral detergent (after wring dry) or one with ethanol at cleaning. Do not use any organic solvent, acid or alkali liquor.
10. Do not pile touch panel. Do not put heavy goods on touch panel.

Recommendation of the cushion area:
6. Packing Form

Max Capacity: 40 Pcs Modules
Carton Optimal: 320mm*310mm*250mm

Module(97.08A05.000)
Wire Tape(94.01A01.001)
Panel Protect(97.08A05.001)
Tape Cover(90.11H04.003)
Anti-static Bag(97.08A05.001)

Carton(81.01A09.003)
Carton Label(83.08A05.001)
Carton Label(83.17B02.001)

Tape(90.13E01.011)

Carton Cover: 320mm*310mm*250mm

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7. Suggested Application Note

1. Application Circuit
2. Power On/Off Sequence

This IC may be damaged by a large current flow when an incorrect power sequence is applied. The recommended power-on sequence is to first connect the logical power (VCC&GND), then the analog and driver powers (AVDD&AGND) and finally the references V1~14. When shutting off the power, the inverse sequence should be applied or all power should be turned off simultaneously.

**Power On Sequence**

- **VCC**: 90% rise > 1ms
- **GND**: 90% fall
- **VCC**: 90% rise > 100us
- **GND**: 90% fall > 50us
- **Vsync**: 0% rise > 100us
- **Digital Input**: GND 90% fall > 0us; VCC 90% rise > 100us
- **AVDD**: 90% rise > 1ms
- **GND**: 90% fall
- **VGL**: 0% rise > 100us
- **GND**: 0% fall
- **VGH**: 90% rise > 80ms
- **GND**: 0% fall
- **LED**: 90% rise
Power Off Sequence

Note: Use external DCDC Controller for AVDD, VGL, and VGH.
### 3. Recommended Register Setting

<table>
<thead>
<tr>
<th>Reg No.</th>
<th>ADDRESS</th>
<th>W</th>
<th>DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>D15 D14 D13 D12 D11</td>
<td>D10 D9 D8 D7 D6</td>
<td>D5 D4 D3 D2 D1 D0</td>
</tr>
<tr>
<td>R0</td>
<td>0 0 0 0 0</td>
<td>0 0</td>
<td>0 0 1 0 1 0 0 1 1</td>
</tr>
<tr>
<td>R1</td>
<td>0 0 0 1 0</td>
<td>0 0</td>
<td>0 0 1 0 1 0 0 1 1</td>
</tr>
<tr>
<td>R4</td>
<td>0 1 0 0 0</td>
<td>0 0</td>
<td>1 0 0 0 1 1 1 1</td>
</tr>
</tbody>
</table>

※ R4 Should be set to “411Fh”
※ Use VCOM(Pin44) as input, R1 should be setted to “112Fh”
※ Use VCOMin(Pin41) as input, R1 should be setted to “116Fh”

- **Power On**

---

**VDD**

Input | DCLK, Hsync, Vsync, Data Input

**R0** | 06D3h

Close Internal DCDC function

**R1** | 116Fh

Select VCOM or VCOMin as Input

**R4** | 411Fh

---

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4. Gamma Voltage (TBD)

<table>
<thead>
<tr>
<th>Gamma 2.2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AVDD</td>
<td>(11)</td>
</tr>
<tr>
<td>00H</td>
<td>V1 (10)</td>
</tr>
<tr>
<td>10H</td>
<td>V2 (8.3)</td>
</tr>
<tr>
<td>20H</td>
<td>V3 (7.77)</td>
</tr>
<tr>
<td>30H</td>
<td>V4 (7.4)</td>
</tr>
<tr>
<td>3FH</td>
<td>V5 (6.7)</td>
</tr>
<tr>
<td>3FH</td>
<td>V6 (4.3)</td>
</tr>
<tr>
<td>30H</td>
<td>V7 (3.6)</td>
</tr>
<tr>
<td>20H</td>
<td>V8 (3.23)</td>
</tr>
<tr>
<td>10H</td>
<td>V9 (2.7)</td>
</tr>
<tr>
<td>00H</td>
<td>V10 (1)</td>
</tr>
</tbody>
</table>