INNOLux DISPLAY CORPORATION
LCD MODULE
SPECIFICATION

Customer: 

Model Name: PT035TN01 V.3
SPEC NO.: P035-01-TT-31
Date: 2006/03/10
Version: 01

☐ Preliminary Specification
☒ Final Specification

For Customer’s Acceptance

<table>
<thead>
<tr>
<th>Approved by</th>
<th>Comment</th>
</tr>
</thead>
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<tr>
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</table>

Approved by | Reviewed by | Prepared by |
-------------|-------------|-------------|
[Signature]  | [Signature] | [Signature] |
3/10/06      | 3/10/06     | 3/10/06     |

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## Record of Revision

<table>
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<td>1</td>
<td>2006/3/10</td>
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<td>Initial release</td>
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# 1. General Specifications

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Specification</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LCD size</td>
<td>3.5’ inch</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Driver element</td>
<td>a-Si TFT active matrix</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Resolution</td>
<td>320X3(RGB)X240</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Display mode</td>
<td>Normally White, Transmissive with Micro Reflective</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Dot pitch</td>
<td>0.073(W)X0.219(H) mm</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Active area</td>
<td>70.08(W)X52.56(H) mm</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Module size</td>
<td>78.2(W)X65.0(H)X3.5(D) mm</td>
<td>Note 1</td>
</tr>
<tr>
<td>8</td>
<td>Surface treatment</td>
<td>Hard coating</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Color arrangement</td>
<td>RGB-stripe</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Interface</td>
<td>Digital</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Backlight power consumption</td>
<td>0.396W(Typ.)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Panel power consumption</td>
<td>20mW(Typ.)</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Weight</td>
<td>35g</td>
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Note 1: Refer to Mechanical Drawing.
## 2. Pin Assignment

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Symbol</th>
<th>I/O</th>
<th>Function</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GLED</td>
<td>P</td>
<td>GND for LED</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>GLED</td>
<td>P</td>
<td>GND for LED</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>VLED</td>
<td>P</td>
<td>Power for LED</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>VLED</td>
<td>P</td>
<td>Power for LED</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>P</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>NC</td>
<td>I</td>
<td>No connect</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>NC</td>
<td>I</td>
<td>No connect</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>NC</td>
<td>I</td>
<td>No connect</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>NC</td>
<td>I</td>
<td>No connect</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>GND</td>
<td>P</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>NC</td>
<td>-</td>
<td>No connect</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>NC</td>
<td>-</td>
<td>No connect</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>POL</td>
<td>O</td>
<td>Polarity select for the line inversion control signal.</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>RESET</td>
<td>I</td>
<td>Reset</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>SPENA</td>
<td>I</td>
<td>Serial port data enable signal. Normally pull high.</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>SPCK</td>
<td>I</td>
<td>Serial port clock. Normally pull high.</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>SPDA</td>
<td>I/O</td>
<td>Serial port data input/output.</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>D00</td>
<td>I</td>
<td>Data 00</td>
<td>Note2</td>
</tr>
<tr>
<td>19</td>
<td>D01</td>
<td>I</td>
<td>Data 01</td>
<td>Note2</td>
</tr>
<tr>
<td>20</td>
<td>D02</td>
<td>I</td>
<td>Data 02</td>
<td>Note2</td>
</tr>
<tr>
<td>21</td>
<td>D03</td>
<td>I</td>
<td>Data 03</td>
<td>Note2</td>
</tr>
<tr>
<td>22</td>
<td>D04</td>
<td>I</td>
<td>Data 04</td>
<td>Note2</td>
</tr>
<tr>
<td>#</td>
<td>Pin</td>
<td>Type</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>----</td>
<td>-------</td>
<td>------</td>
<td>------------------------------</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>D05</td>
<td>I</td>
<td>Data 05</td>
<td>Note2</td>
</tr>
<tr>
<td>24</td>
<td>D06</td>
<td>I</td>
<td>Data 06</td>
<td>Note2</td>
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<tr>
<td>25</td>
<td>D07</td>
<td>I</td>
<td>Data 07</td>
<td>Note2</td>
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<td>26</td>
<td>D08</td>
<td>I</td>
<td>Data 08</td>
<td>Note2</td>
</tr>
<tr>
<td>27</td>
<td>D09</td>
<td>I</td>
<td>Data 09</td>
<td>Note2</td>
</tr>
<tr>
<td>28</td>
<td>D10</td>
<td>I</td>
<td>Data 10</td>
<td>Note2</td>
</tr>
<tr>
<td>29</td>
<td>D11</td>
<td>I</td>
<td>Data 11</td>
<td>Note2</td>
</tr>
<tr>
<td>30</td>
<td>D12</td>
<td>I</td>
<td>Data 12</td>
<td>Note2</td>
</tr>
<tr>
<td>31</td>
<td>D13</td>
<td>I</td>
<td>Data 13</td>
<td>Note2</td>
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<tr>
<td>32</td>
<td>D14</td>
<td>I</td>
<td>Data 14</td>
<td>Note2</td>
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<td>33</td>
<td>D15</td>
<td>I</td>
<td>Data 15</td>
<td>Note2</td>
</tr>
<tr>
<td>34</td>
<td>D16</td>
<td>I</td>
<td>Data 16</td>
<td>Note2</td>
</tr>
<tr>
<td>35</td>
<td>D17</td>
<td>I</td>
<td>Data 17</td>
<td>Note2</td>
</tr>
<tr>
<td>36</td>
<td>D18</td>
<td>I</td>
<td>Data 18</td>
<td>Note2</td>
</tr>
<tr>
<td>37</td>
<td>D19</td>
<td>I</td>
<td>Data 19</td>
<td>Note2</td>
</tr>
<tr>
<td>38</td>
<td>D20</td>
<td>I</td>
<td>Data 20</td>
<td>Note2</td>
</tr>
<tr>
<td>39</td>
<td>D21</td>
<td>I</td>
<td>Data 21</td>
<td>Note2</td>
</tr>
<tr>
<td>40</td>
<td>D22</td>
<td>I</td>
<td>Data 22</td>
<td>Note2</td>
</tr>
<tr>
<td>41</td>
<td>D23</td>
<td>I</td>
<td>Data 23</td>
<td>Note2</td>
</tr>
<tr>
<td>42</td>
<td>IHS</td>
<td>I</td>
<td>Horizontal synchronous signal</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>IVS</td>
<td>I</td>
<td>Vertical synchronous signal</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>CLK</td>
<td>I</td>
<td>Data clock</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>AV&lt;sub&gt;DD&lt;/sub&gt;</td>
<td>P</td>
<td>Analog power supply(+5V)</td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>AV&lt;sub&gt;DD&lt;/sub&gt;</td>
<td>P</td>
<td>Analog power supply(+5V)</td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>V&lt;sub&gt;CC&lt;/sub&gt;</td>
<td>P</td>
<td>Digital power supply(+3.3V)</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>V&lt;sub&gt;CC&lt;/sub&gt;</td>
<td>P</td>
<td>Digital power supply(+3.3V)</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>NC</td>
<td>-</td>
<td>No connect</td>
<td></td>
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<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
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<tr>
<td>50</td>
<td>$V_{GL}$ I Negative power for scan driver</td>
</tr>
<tr>
<td>51</td>
<td>$V_{GL}$ I Negative power for scan driver</td>
</tr>
<tr>
<td>52</td>
<td>NC - No connect</td>
</tr>
<tr>
<td>53</td>
<td>$V_{GH}$ I Positive power for scan driver</td>
</tr>
<tr>
<td>54</td>
<td>NC - No connect</td>
</tr>
<tr>
<td>55</td>
<td>NC - No connect</td>
</tr>
<tr>
<td>56</td>
<td>$V_{COM}$ I $V_{COM}$ input</td>
</tr>
<tr>
<td>57</td>
<td>$V_{COM}$ I $V_{COM}$ input</td>
</tr>
<tr>
<td>58</td>
<td>DEN I Data enabling signal</td>
</tr>
<tr>
<td>59</td>
<td>GND P Ground</td>
</tr>
<tr>
<td>60</td>
<td>GND P Ground</td>
</tr>
</tbody>
</table>

**Note 1:**
- P - Power
- I - Input
- O - Output

**Note 2:**

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ITU-R BT 656</td>
<td>D[23:16]</td>
<td>GND</td>
<td>GND</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>ITU-R BT 601</td>
<td>D[23:16]</td>
<td>GND</td>
<td>GND</td>
<td>IHS</td>
<td>IVS</td>
<td>NC</td>
</tr>
<tr>
<td>8 bit RGB</td>
<td>D[23:16]</td>
<td>GND</td>
<td>GND</td>
<td>IHS</td>
<td>IVS</td>
<td>NC for HV Mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DEN for DEN Mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DEN for DEN Mode</td>
</tr>
</tbody>
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# 3. Operation Specifications

## 3.1. Absolute Maximum Rating

(GND = 0V, Note 1)

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Values</th>
<th>Unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power voltage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>( V_{CC} )</td>
<td>-0.3</td>
<td>7</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>( AV_{DD} )</td>
<td>-0.3</td>
<td>7</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>( V_{GH} )</td>
<td>-0.3</td>
<td>18</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>( V_{GL} )</td>
<td>-15</td>
<td>0.3</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>( V_{GH}+V_{GL} )</td>
<td>-</td>
<td>33</td>
<td>V</td>
</tr>
<tr>
<td><strong>Operation Temperature</strong></td>
<td>( T_{OP} )</td>
<td>-30</td>
<td>85</td>
<td>°C</td>
</tr>
<tr>
<td><strong>Storage Temperature</strong></td>
<td>( T_{ST} )</td>
<td>-30</td>
<td>85</td>
<td>°C</td>
</tr>
</tbody>
</table>

Note 1: Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above.
3.2. Power Sequence

3.2.1 Power on:

3.2.2 Power off:

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3.3. Electrical Characteristics

3.3.1. Typical Operation Conditions

(GND =0V, Note 2)

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Values</th>
<th>Unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>Min.</strong></td>
<td><strong>Typ.</strong></td>
<td><strong>Max.</strong></td>
</tr>
<tr>
<td>Power voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$V_{CC}$</td>
<td>3.0</td>
<td>3.3</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td>$AV_{DD}$</td>
<td>4.8</td>
<td>5.0</td>
<td>5.2</td>
</tr>
<tr>
<td></td>
<td>$V_{GH}$</td>
<td>14.3</td>
<td>15</td>
<td>15.7</td>
</tr>
<tr>
<td></td>
<td>$V_{GL}$</td>
<td>-10.5</td>
<td>-10</td>
<td>-9.5</td>
</tr>
<tr>
<td>$V_{COM}$</td>
<td>$V_{CAC}$</td>
<td>-</td>
<td>5.0</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>$V_{CDC}$</td>
<td>1.29</td>
<td>1.49</td>
<td>1.69</td>
</tr>
<tr>
<td>Input logic high voltage</td>
<td>$V_{IH}$</td>
<td>0.7$V_{CC}$</td>
<td>-</td>
<td>$V_{CC}$</td>
</tr>
<tr>
<td>Input logic low voltage</td>
<td>$V_{IL}$</td>
<td>0</td>
<td>-</td>
<td>0.3$V_{CC}$</td>
</tr>
</tbody>
</table>

Note 1: The brightness of LCD panel could be changed by adjusting the AC component of $V_{COM}$.

Note 2: Be sure to apply GND, $V_{CC}$, and $V_{GL}$, to the LCD first, and then apply $V_{GH}$. 
### 3.3.2. Current Consumption

(GND =0V)

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Values</th>
<th>Unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current for Driver</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IGH</td>
<td>-</td>
<td>100</td>
<td>300</td>
<td>uA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VGH =+15V</td>
</tr>
<tr>
<td>IGL</td>
<td>-</td>
<td>-100</td>
<td>-300</td>
<td>uA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VGL = -10V</td>
</tr>
<tr>
<td>ICC</td>
<td>-</td>
<td>1.3</td>
<td>5</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VCC =3.3V</td>
</tr>
<tr>
<td>IDD</td>
<td>-</td>
<td>2</td>
<td>5</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>AVDD =5V</td>
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### 3.3.3. Backlight Driving Condition

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Values</th>
<th>Unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED voltage</td>
<td>V_L</td>
<td>-</td>
<td>19.8</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Note 1</td>
</tr>
<tr>
<td>LED current</td>
<td>I_L</td>
<td>-</td>
<td>20</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Note 1</td>
</tr>
<tr>
<td>LED life time</td>
<td>-</td>
<td>20,000</td>
<td>-</td>
<td>Hr</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Note 2</td>
</tr>
</tbody>
</table>

Note 1: The LED driving condition is defined for each LED module. (See the figure)

Note 2: The “LED life time” is defined as the module brightness decrease to 50% original brightness that the ambient temperature is 25°C and I_L =20mA.
# 3.4. Timing Characteristics

## 3.4.1. AC Electrical Characteristics

### 3.3.1.1 AC Electrical Characteristics (VCC=3.3V, AVDD=5.0V, GND=AGND=0V, TA=25°C)

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Values</th>
<th>Unit.</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Min.</td>
<td>Typ.</td>
<td>Max.</td>
</tr>
<tr>
<td>System Operation Timing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VDD power on slew time</td>
<td>T_POR</td>
<td></td>
<td>1000</td>
<td>us</td>
</tr>
<tr>
<td>Input Output Timing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLKIN clock time</td>
<td>T_clk</td>
<td>-</td>
<td>37</td>
<td>ns</td>
</tr>
<tr>
<td>HSD to CLKIN</td>
<td>T_hc</td>
<td>-</td>
<td>1</td>
<td>T_clk</td>
</tr>
<tr>
<td>HSD width</td>
<td>T_wh</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>VSD width</td>
<td>T_vwh</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>HSD period time</td>
<td>T_h</td>
<td>60</td>
<td>63.56</td>
<td>67</td>
</tr>
<tr>
<td>VSD setup time</td>
<td>T_vst</td>
<td>12</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>VSD hold time</td>
<td>T_vh</td>
<td>12</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>HSD setup time</td>
<td>T_hst</td>
<td>12</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Data set-up time</td>
<td>T_dsu</td>
<td>12</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Data hold time</td>
<td>T_dh</td>
<td>12</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>DEN setup time</td>
<td>T_esd</td>
<td>12</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>VCOMOUT output stable time</td>
<td>T_cst</td>
<td>-</td>
<td>4</td>
<td>8</td>
</tr>
</tbody>
</table>
3.3.1.2 Timing Table

**ITU-R BT 601 Mode A/B***(Note 1)***

<table>
<thead>
<tr>
<th>ITEM</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLKIN frequency</td>
<td>Fclk</td>
<td>24.54/27</td>
<td>30 Mhz</td>
<td>VCC=3.3V</td>
</tr>
<tr>
<td>CLKIN cycle time</td>
<td>Tclk</td>
<td>40/37</td>
<td>- ns</td>
<td></td>
</tr>
<tr>
<td>CLKIN pulse duty</td>
<td>Tcwh</td>
<td>40 50 60 %</td>
<td>Tclk</td>
<td></td>
</tr>
</tbody>
</table>

**ITU-R BT 656 Mode A/B***(Note 1)***

<table>
<thead>
<tr>
<th>ITEM</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLKIN frequency</td>
<td>Fclk</td>
<td>27</td>
<td>30 Mhz</td>
<td>VCC=3.3V</td>
</tr>
<tr>
<td>CLKIN cycle time</td>
<td>Tclk</td>
<td>37</td>
<td>- ns</td>
<td></td>
</tr>
<tr>
<td>CLKIN pulse duty</td>
<td>Tcwh</td>
<td>40 50 60 %</td>
<td>Tclk</td>
<td></td>
</tr>
</tbody>
</table>

**8 bit RGB 960x240 Mode**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLKIN frequency</td>
<td>Fclk</td>
<td>27</td>
<td>30 Mhz</td>
<td>VCC=3.3V</td>
</tr>
<tr>
<td>CLKIN cycle time</td>
<td>Tclk</td>
<td>37</td>
<td>- ns</td>
<td></td>
</tr>
<tr>
<td>CLKIN pulse duty</td>
<td>Tcwh</td>
<td>40 50 60 %</td>
<td>Tclk</td>
<td></td>
</tr>
</tbody>
</table>

Note 1: YUV mode A: Data sequence are "Cb-Y-Cr-Y…"
YUV mode B: Data sequence are "Cr-Y-Cb-Y…”

---

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### 24 Bit RGB 960 CH Mode (320(RGB) x 240)

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Values</th>
<th>Unit.</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>Min.</strong></td>
<td><strong>Typ.</strong></td>
<td><strong>Max.</strong></td>
</tr>
<tr>
<td>CLKin frequency</td>
<td>$F_{clk}$</td>
<td>-</td>
<td>-</td>
<td>27</td>
</tr>
<tr>
<td>CLKin cycle time</td>
<td>$T_{clk}$</td>
<td>-</td>
<td>-</td>
<td>37</td>
</tr>
<tr>
<td>CLKin pulse duty</td>
<td>$T_{cwh}$</td>
<td>40</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>Time from HSD to STV</td>
<td>$T_{hstv}$</td>
<td>-</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Time from HSD to LD</td>
<td>$T_{hid}$</td>
<td>-</td>
<td>24</td>
<td>-</td>
</tr>
<tr>
<td>Time from HSD to CKV</td>
<td>$T_{hckv}$</td>
<td>-</td>
<td>20</td>
<td>-</td>
</tr>
<tr>
<td>Time from HSD to OEV</td>
<td>$T_{hoev}$</td>
<td>-</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>Time from HSD to VCOMOUT</td>
<td>$T_{hvcm}$</td>
<td>-</td>
<td>40</td>
<td>-</td>
</tr>
<tr>
<td>Time from HSD to DATSEQ</td>
<td>$T_{hseq}$</td>
<td>-</td>
<td>20</td>
<td>-</td>
</tr>
<tr>
<td>LD pulse width</td>
<td>$T_{wld}$</td>
<td>-</td>
<td>16</td>
<td>-</td>
</tr>
<tr>
<td>CKV pulse width</td>
<td>$T_{wckv}$</td>
<td>-</td>
<td>40</td>
<td>-</td>
</tr>
<tr>
<td>OEV pulse width</td>
<td>$T_{woev}$</td>
<td>-</td>
<td>40</td>
<td>-</td>
</tr>
<tr>
<td>Time that HSD to 1’st data input</td>
<td>$T_{hs}$</td>
<td>24</td>
<td>70</td>
<td>255</td>
</tr>
</tbody>
</table>

#### 3.3.1.3 3-wire serial communication AC timing

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Values</th>
<th>Unit.</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>Min.</strong></td>
<td><strong>Typ.</strong></td>
<td><strong>Max.</strong></td>
</tr>
<tr>
<td>Serial Clock Period Time</td>
<td>$T_{spck}$</td>
<td>320</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>SPCK pulse duty cycle</td>
<td>$T_{scdut}$</td>
<td>40</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>Serial data setup time</td>
<td>$T_{isu}$</td>
<td>120</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Serial data hold time</td>
<td>$T_{ihd}$</td>
<td>120</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Serial clock high/low</td>
<td>$T_{ssw}$</td>
<td>120</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>SPENA select distinguish</td>
<td>$T_{cd}$</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
3.4.2. Timing Diagram

Input Data Timing

1. Clock and Data Input Timing Diagram

![Clock and Data Input Timing Diagram]

2. 8 bit RGB input Data format

![8 bit RGB input Data format]

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3. ITU-R BT 601

4. ITU-R BT 656

5. 24 bit RGB mode for 960 x 240
### 3-Wire Timing Diagram

#### Note: 3-Wire Control Registers List

<table>
<thead>
<tr>
<th>3-Wire Register</th>
<th>Name</th>
<th>Init</th>
<th>R/W</th>
<th>Function Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D[15:10]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>000000b</td>
<td>R00</td>
<td>(03h)</td>
<td>R/W</td>
<td>System control register</td>
</tr>
<tr>
<td>000001b</td>
<td>R01</td>
<td>(40h)</td>
<td>R/W</td>
<td>Timing controller function register</td>
</tr>
<tr>
<td>000010b</td>
<td>R02</td>
<td>(11h)</td>
<td>R/W</td>
<td>Operation control register</td>
</tr>
<tr>
<td>000011b</td>
<td>R03</td>
<td>(cch)*</td>
<td>R/W</td>
<td>Input data format control register</td>
</tr>
<tr>
<td>000100b</td>
<td>R04</td>
<td>(93h)</td>
<td>R/W</td>
<td>Source Timing delay control register</td>
</tr>
<tr>
<td>000101b</td>
<td>R05</td>
<td>(12h)</td>
<td>R/W</td>
<td>Gate Timing delay control register</td>
</tr>
<tr>
<td>00111b</td>
<td>R07</td>
<td>(03h)</td>
<td>R/W</td>
<td>Internal function control register</td>
</tr>
<tr>
<td>001000b</td>
<td>R08</td>
<td>(08h)</td>
<td>R/W</td>
<td>RGB contrast control register</td>
</tr>
<tr>
<td>001001b</td>
<td>R09</td>
<td>(40h)</td>
<td>R/W</td>
<td>RGB brightness control register</td>
</tr>
<tr>
<td>001010b</td>
<td>R0A</td>
<td>(88h)</td>
<td>R/W</td>
<td>Hue/Saturation control register</td>
</tr>
<tr>
<td>00111b</td>
<td>R0B</td>
<td>(88h)</td>
<td>R/W</td>
<td>R/B Sub-contrast control register</td>
</tr>
<tr>
<td>001100b</td>
<td>R0C</td>
<td>(20h)</td>
<td>R/W</td>
<td>R Sub-brightness control register</td>
</tr>
<tr>
<td>001101b</td>
<td>R0D</td>
<td>(20h)</td>
<td>R/W</td>
<td>B Sub-brightness control register</td>
</tr>
</tbody>
</table>

* Note: c4h:ITU-R BT 656 Mode  
c2h:ITU-R BT 601 Mode  
c8h:8 bit RGB Mode(HV Mode)  
c9h:8 bit RGB Mode(DE Mode)  
cch:24 bit RGB Mode (HV mode)  
cdh:24 bit RGB Mode (DE mode)
# 4. Optical Specifications

<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>Viewing angle (CR≥10)</td>
<td>$\theta_L$</td>
<td>$\Phi=180^\circ$ (9 o’clock)</td>
<td>55</td>
<td>65</td>
<td>-</td>
<td>degree</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$\theta_R$</td>
<td>$\Phi=0^\circ$ (3 o’clock)</td>
<td>55</td>
<td>65</td>
<td>-</td>
<td></td>
<td>Note 1</td>
</tr>
<tr>
<td></td>
<td>$\theta_T$</td>
<td>$\Phi=90^\circ$ (12 o’clock)</td>
<td>35</td>
<td>45</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$\theta_B$</td>
<td>$\Phi=270^\circ$ (6 o’clock)</td>
<td>55</td>
<td>65</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response Time</td>
<td>$T_{ON}$</td>
<td></td>
<td>-</td>
<td>15</td>
<td>30</td>
<td>msec</td>
<td>Note 3</td>
</tr>
<tr>
<td></td>
<td>$T_{OFF}$</td>
<td></td>
<td>-</td>
<td>20</td>
<td>50</td>
<td>msec</td>
<td>Note 3</td>
</tr>
<tr>
<td>Contrast ratio</td>
<td>CR</td>
<td>Normal $\theta=\Phi=0^\circ$</td>
<td>200</td>
<td>300</td>
<td>-</td>
<td>-</td>
<td>Note 4</td>
</tr>
<tr>
<td>Color chromaticity</td>
<td>$W_X$</td>
<td></td>
<td>-</td>
<td>(0.33)</td>
<td>-</td>
<td>-</td>
<td>Note 5</td>
</tr>
<tr>
<td></td>
<td>$W_Y$</td>
<td></td>
<td>-</td>
<td>(0.36)</td>
<td>-</td>
<td>-</td>
<td>Note 6</td>
</tr>
<tr>
<td>Luminance</td>
<td>L</td>
<td></td>
<td>300</td>
<td>350</td>
<td>-</td>
<td>cd/m²</td>
<td>Note 6</td>
</tr>
<tr>
<td>Luminance uniformity</td>
<td>$Y_U$</td>
<td></td>
<td>70</td>
<td>75</td>
<td>-</td>
<td>%</td>
<td>Note 7</td>
</tr>
</tbody>
</table>

Test Conditions:
1. $V_{CC}=3.3V$, $V_{DD}=5.0V$, $I_L=20mA$ (Backlight current), the ambient temperature is 25°C.
2. The test systems refer to Note 2.
Note 1: Definition of viewing angle range

Figure 5-1 Definition of viewing angle

Note 2: Definition of optical measurement system.

The optical characteristics should be measured in dark room. The optical properties are measured at the center point of the LCD screen. (Response time is measured by Photo detector TOPCON BM-7, other items are measured by BM-5A/Field of view: 1° /Height: 500mm.)

Figure 5-2 Optical measurement system setup

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Note 3: Definition of Response time

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

![Image of response time diagram]

Fig. 5-3 Definition of response time

Note 4: Definition of contrast ratio

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

Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: All input terminals LCD panel must be ground when measuring the center area of the panel.

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Note 7: Definition of Luminance Uniformity
To test for uniformity, the tested area, which is inside the active area, is divided into 3 rows and 3 columns. The measurement spot is placed at the center of each box.

\[
Luminance\ Uniformity\ (Yu) = \frac{B_{\min}}{B_{\max}}
\]

\(L\)-------Active area length \(W\)-------Active area width

\(B_{\max}\): The measured maximum luminance of all measurement position.
\(B_{\min}\): The measured minimum luminance of all measurement position.

Fig. 5-4 Definition of uniformity
## 5. Reliability Test Items

<table>
<thead>
<tr>
<th>Item</th>
<th>Test Conditions</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Temperature Storage</td>
<td>$Ta = 85^\circ C$</td>
<td>240 hrs</td>
</tr>
<tr>
<td>Low Temperature Storage</td>
<td>$Ta = -30^\circ C$</td>
<td>240hrs</td>
</tr>
<tr>
<td>High Temperature Operation</td>
<td>$Ts = 85^\circ C$</td>
<td>240hrs</td>
</tr>
<tr>
<td>Low Temperature Operation</td>
<td>$Ta = -30^\circ C$</td>
<td>240hrs</td>
</tr>
<tr>
<td>Operate at High Temperature and Humidity</td>
<td>$+60^\circ C, 90%$RH max.</td>
<td>240 hrs</td>
</tr>
<tr>
<td>Thermal Shock</td>
<td>$-30^\circ C/30$ min $+85^\circ C/30$ min for a total 100 cycles, Start with cold temperature and end with high temperature</td>
<td></td>
</tr>
<tr>
<td>Vibration Test</td>
<td>Frequency range:10<del>55Hz Stroke:1.5mm Sweep:10Hz</del>55Hz~10Hz 2 hours for each direction of X, Y, Z. (6 hours for total)</td>
<td></td>
</tr>
<tr>
<td>Mechanical Shock</td>
<td>100G 6ms,$\pm$X, $\pm$Y, $\pm$Z 3 times for each direction</td>
<td></td>
</tr>
<tr>
<td>Package Vibration Test</td>
<td>Random Vibration: 0.015G*G/Hz from 5-200HZ, -6dB/Octave from 200-500HZ 2 hours for each direction of X, Y, Z. (6 hours for total)</td>
<td></td>
</tr>
<tr>
<td>Package Drop Test</td>
<td>Height:60 cm 1 corner, 3 edges, 6 surfaces</td>
<td></td>
</tr>
<tr>
<td>Electro Static Discharge</td>
<td>$\pm 2$KV, Human Body Mode, 100pF/1500$\Omega$</td>
<td></td>
</tr>
</tbody>
</table>

Note 1: $Ta$ is the ambient temperature of samples.
Note 2: $Ts$ is the temperature of panel’s surface.
Note 3: In the standard condition, there shall be no practical problem that may affect the display function.
6. Handling Precautions

6.1. Safety

Liquid crystal is poisonous. Do not put it in your mouth. If liquid crystal touches your skin or clothes, wash it off immediately by using soap and water.

6.2. Handling

1. The LCD panel is plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.
2. The polarizer attached to the display is easily damaged. Please handle it carefully to avoid scratch or other damages.
3. To avoid contamination on the display surface, do not touch the module surface with bare hands.
4. Keep a space so that the LCD panels do not touch other components.
5. Put cover board such as acrylic board on the surface of LCD panel to protect panel from damages.
6. Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where the condensation of dew occurs.
7. Do not leave module in direct sunlight to avoid malfunction of the ICs.

6.3. Static Electricity

1. Be sure to ground module before turning on power or operating module.
2. Do not apply voltage which exceeds the absolute maximum rating value.

6.4. Storage

1. Store the module in a dark room where must keep at +25±10°C and 65%RH or less.
2. Do not store the module in surroundings containing organic solvent or corrosive gas.
3. Store the module in an anti-electrostatic container or bag.

6.5. Cleaning

1. Do not wipe the polarizer with dry cloth. It might cause scratch.
2. Only use a soft sloth with IPA to wipe the polarizer, other chemicals might permanent damage to the polarizer.
7. Mechanical Drawing
# 8. Package Drawing

## 8.1. Packaging Material Table

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Model (Material)</th>
<th>Dimensions(mm)</th>
<th>Unit Weight(Kg)</th>
<th>Quantity (pcs)</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LCM module</td>
<td>PT035TN01 V.3</td>
<td>78.2 × 65.0 × 3.5</td>
<td>0.0352</td>
<td>260</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Corrugated Board-1 BC</td>
<td>Corrugated Paper</td>
<td>510 × 343</td>
<td>0.130</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Corrugated Board-2 B</td>
<td>Corrugated Paper</td>
<td>1152 × 512</td>
<td>0.26</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Corrugated Bar B</td>
<td>Corrugated Paper</td>
<td>343 × 104</td>
<td>0.020</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Partition BC</td>
<td>Corrugated Paper</td>
<td>512 × 343 × 106</td>
<td>1.045</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Dust-Proof Bag PE</td>
<td></td>
<td>700 × 530</td>
<td>0.0604</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>A/S Bag PE</td>
<td></td>
<td>112 × 90</td>
<td>1.1108 × 10^-3</td>
<td>260</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Carton Corrugated Paper</td>
<td></td>
<td>530 × 355 × 255</td>
<td>1.1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Total weight</td>
<td></td>
<td></td>
<td>13.5± 5% Kg</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## 8.2. Packaging Quantity

- (1) LCM quantity per Partition: 2 row x 21 pcs + 4 row x 22 pcs = 130 pcs
- (2) Total LCM quantity in Carton: 2 layer x 130 pcs per Partition = 260 pcs
8.3. Packaging Drawing