# Thin-Film-Transistor LCD Module
# Model: XTPD22SN01-02

| Acceptance |
|---|
| |

| Approved and Checked by |
|---|
| |

| Approved by | Checked by | | Made by |
|---|---|---|---|
| | | | |

Revise Records

| Rev. | Date | Contents | Written | Approved |
|---|---|---|---|---|
| A | 2011/11/07 | Preliminary Specification | GAO | JACK |
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Special Notes

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| Note1. | |
| Note2. | |
| Note3. | |
| Note4. | |
| Note5. | |
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## 1.General Description and Features

XTPD22SN01-02 is a TM (Transmissive) type color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model i s composed of a TFT-LCD module, a driver circuit and a back-light unit . The resolution of a 2. 2" contains 240RGBx320 dots and can display up to 262 colors. The following table described the features of XTPD22SN01-02.

LCD Module

| Item | Specification | Unit |
|---|---|---|
| Screen Size | 2.2inches | Diagonal |
| Display Resolution | 176GB(H)x220(W) | Dot |
| Active Area | 34.85(H) x43.56 (W) | mm |
| Outline Dimension | 40.3(H) x54.36(W) x 3.5MAX (T) | mm |
| Display Mode | Normally white TN | -- |
| Pixel Arrangement | RGB-Vertical Stripe | -- |
| Display Color | 262K | -- |
| Viewing Direction | 6 o'clock | -- |
| Gray viewing Direction | 12 o'clock | -- |
| Drive IC | IL9225G | -- |

## 2.Mechanical Information

| Item | | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Module Size | Horizontal (H) | -- | 40.3 | -- | mm | -- |
| | Vertical (V) | -- | 54.36 | -- | mm | (1) |
| | Thickness (T) | -- | 3.5 | -- | mm | (2) |
| Weight | | -- | N/A | -- | g | -- |

Note (1) Not include FPC.
Refer to the Outline Dimension for further information.
(2) Back-light unit are included.

## 3.Electrical Specifications

### 3.1 Absolute Max. Ratings

#### 3.1.1 Absolute Ratings of Environment

If the operating condition exceeds the following absolute maximum ratings, the TFT LCD module may be damaged permanently.

(Ta=25±2°C, $V_{SS}$=GND=0)

| Item | Symbol | Min. | Max. | Unit | Note |
|---|---|---|---|---|---|
| Storage temperature | $T_{STG}$ | -20 | 70 | °C | (1) |
| Operating temperature | $T_{OPR}$ | -10 | 60 | °C | (1,2,3) |

Note (1) 95 % RH Max. ( 40 °C ≥ Ta ). Maximum wet-bulb temperature at 39 °C or less. (Ta > 40 °C) No condensation.

Note (2) In case of below 0°, the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one. Level of retardation depends on temperature, because of LC's character

Note (3) Only operation is guarantied at operating temperature. Contrast, response time, another display quality are evaluated at +25°C.

### 3.2 Electrical Absolute Rating

#### 3.2.1 TFT-LCD Module

(Voltage Referenced to VSS)

| Item | Symbol | Value | | Unit | Condition |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Digital Power Supply Voltage | VDD | VSS-0.3 | 4.6 | V | -- |

#### 3.2.2 Back-Light Unit

(Ta=25±2°C)

| Item | Symbol | Min. | Max. | Unit | Note |
|---|---|---|---|---|---|
| Reverse voltage | $V_R$ | -- | 5.0 | V | (1) |

Note (1) Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded. Functional operation should be restricted to the conditions described under normal operating conditions.

## 4 Electrical Characteristics

### 4.1 TFT-LCD Module (DC Characteristics)

| Item | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Power Supply Voltage | | 2.5 | 3.0 | 3.3 | V | |
| Input High Threshold Voltage | $V_{IH}$ | 0.7 VDD | - | VDD | V | |
| Input Low Threshold Voltage | $V_{IL}$ | 0 | - | 0.3 VDD | V | |
| Power Supply Current | $I_{CC}$ | - | - | - | mA | (1) |
| Power Consumption | $P_L$ | - | - | - | mW | (1) |

Note (1) The specified power consumption is under the conditions at VDD=3.3V , $F_V$=60Hz, whereas a Power dissipation check pattern below is displayed.

Black Pattern / 0 Gray

Active Area

### 4.2 Backlight Unit

The back-light system is an edge-lighting type with3 white LEDs (Light Emitting Diode).

(Ta=25±2°C)

| Item | Symbol | Value | | | Unit | Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| LED Voltage | VF | 2.9 | 3.2 | 3.5 | V | |
| LED Current | IF | - | 45 | -- | mA | |
| Power Consumption | $P_{BL}$ | - | 144 | - | mW | |

Note (1) $P_{BL} = V_F \times I_F$

## 5 Input Terminal Pin Assignment

5.1 Pin Assignment (LCD)

| Pin No. | Symbol | I/O /P | Description |
|---|---|---|---|
| 1 | GND | P | POWER GROUND |
| 2 | IOVCC | I | Power supply for I/O interface circuits |
| 3 | VDD | I | Power supply for device |
| 4 | CS | I | A chip select signal.<br>Low: the ILI9225G is selected and accessible<br>High: the ILI9225G is not selected and not accessible<br>**Fix to IOVCC level when not in use.** |
| 5 | RS | I | A register select signal.<br>Low: select an index or status register<br>High: select a control register<br>**Fix to GND level when not in use.** |
| 6 | WR | I | In 68-system mode, this is used to select operation, read or write. (RW)<br>In 80-system mode, this serves as a write strobe signal (nWR).<br>In SPI mode, it serves as a synchronous clock (SCL). |
| 7 | RD | I | In 68-system mode, this serves as write/read enable strobe (E).<br>In 80-system mode, this serves as a read strobe signal. (nRD).<br>Must be fixed to GND level when SPI mode. |
| 8 | DB0 | | 18-bit parallel bi-directional data bus for MPU system interface mode<br><br>Serves as an input data bus for MPU I/F.<br>8-bit I/F: DB[17:10] is used. |
| 9 | DB1 | | |
| 10 | DB2 | | |
| 11 | DB3 | | |
| 12 | DB4 | | |
| 13 | DB5 | | |
| 14 | DB6 | | |

| | | | |
|---|---|---|---|
| 15 | DB7 | I | |
| 16 | DB8 | | |
| 17 | DB9 | | |
| 18 | DB10 | | |
| 19 | DB11 | | |
| 20 | DB12 | | |
| 21 | DB13 | | |
| 22 | DB14 | | |
| 23 | DB15 | | |
| 24 | RESET | I | A reset pin.<br>Initializes the ILI9225G with a low input. Be sure to execute a power-on reset after supplying power. |
| 25 | XL | I | TP signal |
| 26 | YD | | |
| 27 | XR | | |
| 28 | YU | | |
| 29 | LEDA | | Power supply for LED light |
| 30 | LEDK | | Ground supply for LED light |

## 6 Optical Characteristics

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (1).
Measuring equipment: BM-5A, BM-7,

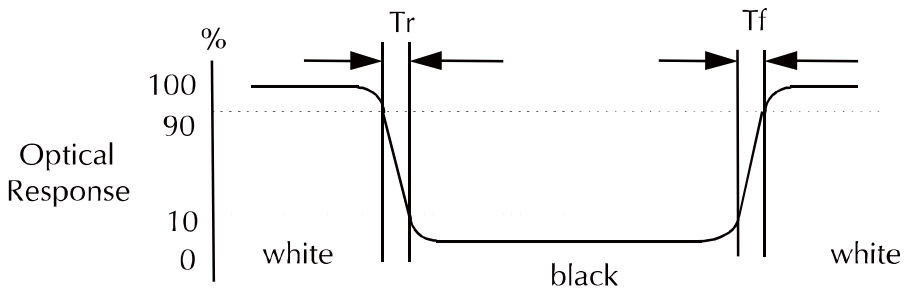
| Item | | Symbol | Condition | Min | Type | Max | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Brightness | | B | | -- | 175 | -- | $cd/m^2$ | |
| Response time | | $T_{r+}T_f$ | θ=0° T=25°C | -- | 20 | -- | ms | . |
| Contrast ratio | | CR | | -- | 500 | -- | -- | |
| Color Gamut | | NTSC % | -- | -- | 60 | -- | % | |
| Luminance Uniformity | | ΔL | | -- | 80 | -- | % | |
| Color Chromaticity (CIE 1931) | White | Wx | θ=0° Normal Viewing Angle | 0.3 | 0.303 | 0.306 | -- | BM-7A |
| | | Wy | | 0.322 | 0.325 | 0.328 | | |
| Viewing Angle | Hor. | $\theta_R$ | -- | -- | 45 | -- | Degree | |
| | | $\theta_L$ | | -- | 45 | -- | | |
| | Ver. | $\theta_U$ | | -- | 45 | -- | | |
| | | $\theta_D$ | | | 20 | -- | | |

a. Test equipment setup

After stabilizing and leaving the panel alone shall be warmed up for the stable operation of LCM, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7(fast) with a viewing angle of 2° at a distance of 50cm and normal direction.

b. Definition of response time: Tr and Tf

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".

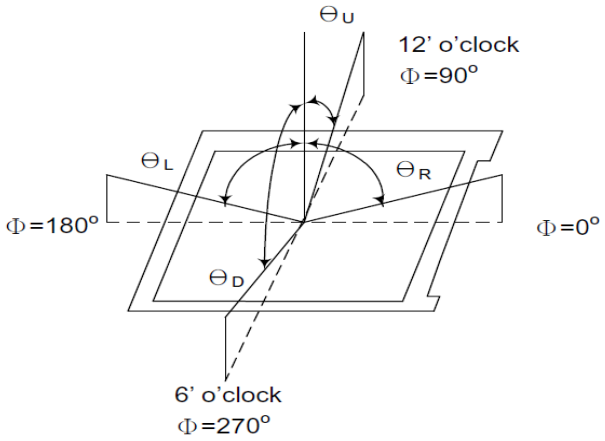


c. Definition of contrast ratio:

$$\text{Contrast Ratio (CR)} = \frac{\text{Brightness measured when LCD is at "white state"}}{\text{Brightness measured when LCD is at "black state"}}$$

d. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

e. View Angle




f. Definition of Luminance of White: Luminance of white at the center points

| Light Source of Back-Light Unit | LED Type |
|---|---|

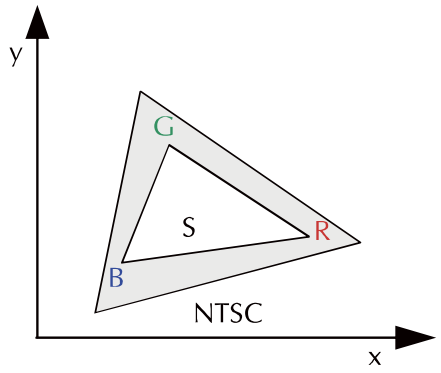
g. Definition of White Uniformity

$$\text{White Uniformity} = \frac{\text{Min. luminance of white among 9-points}}{\text{Max. luminance of white among 9-points}} \times 100\%$$

h. The definition of Color Gamut -Color Chromaticity CIE 1931

Color coordinate of white & red, green, blue at center point.

Color Gamut : NTSC(%) = ( RGB Triangle Area / NTSC Triangle Area ) x 100




## 7 Interface Timing

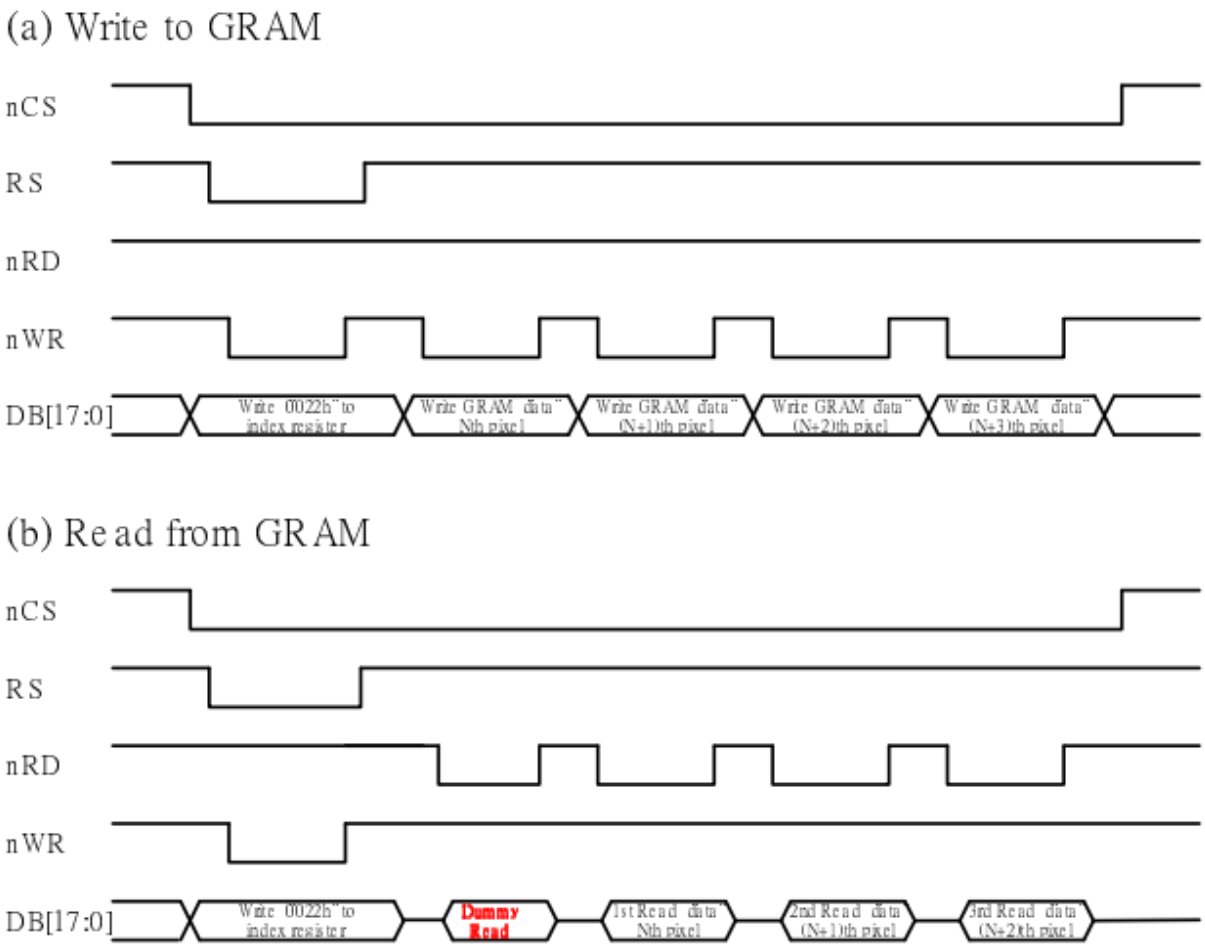



**Figure4 i80 16/18-bit System Interface Timing**

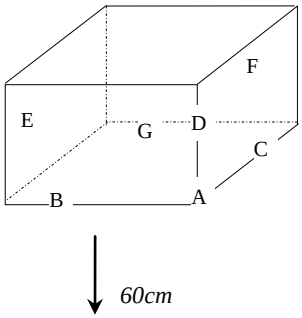
## 8 Reliability Condition for LCD

No change on display and in operation under the following test condition.

Condition: Unless otherwise specified, tests will be conducted under the following condition.

Temperature: 20±5°C Humidity: 65±5%RH

Tests will be not conducted under functioning state.

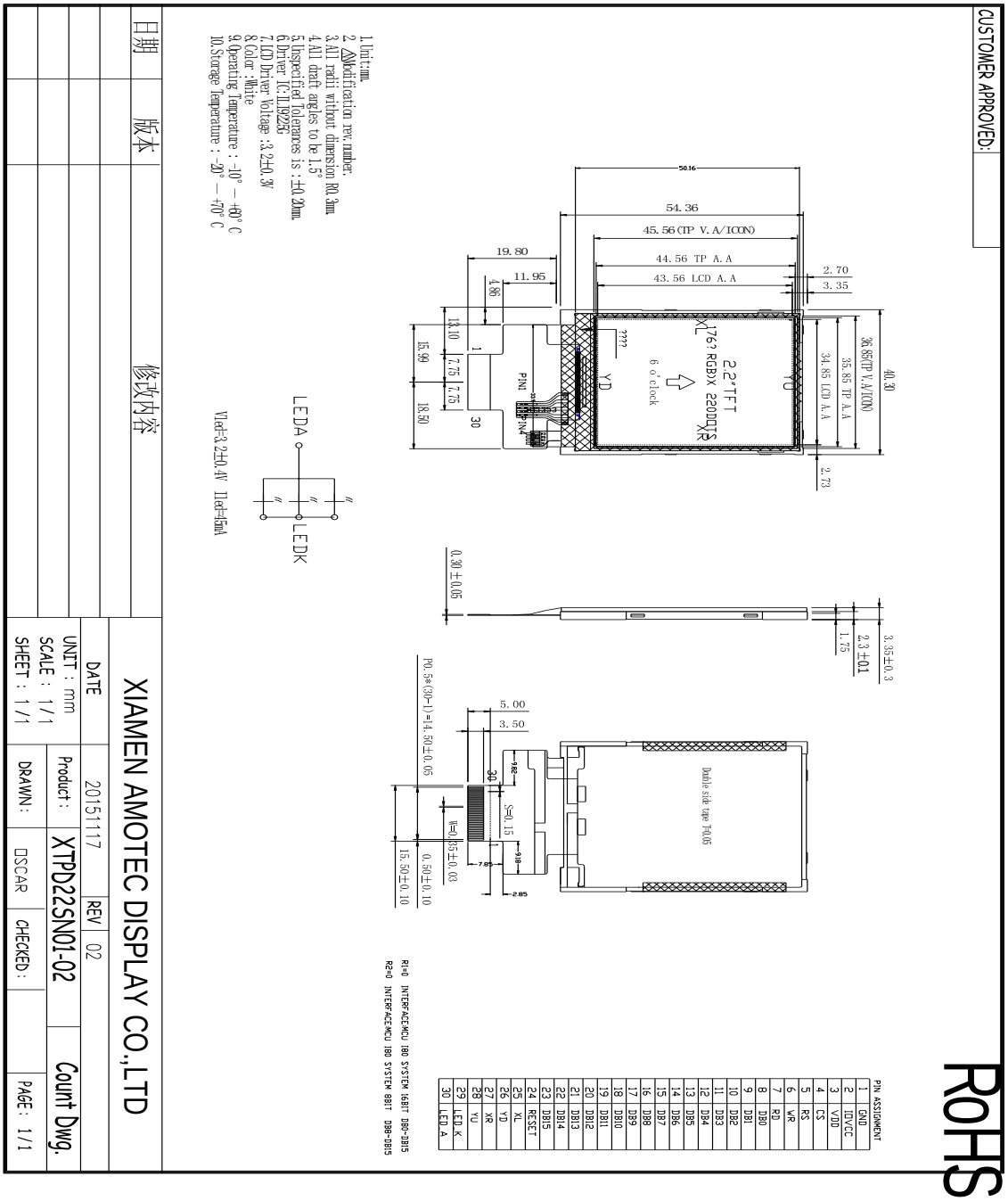
| No. | Parameter | Condition | Notes |
|---|---|---|---|
| 1 | High Temperature Operating | 60°C±2°C, 240hrs (Operation state) | -- |
| 2 | Low Temperature Operating | -10°C±2°C, 240hrs (Operation state) | -- |
| 3 | High Temperature Storage | 70°C±2°C, 240hrs | -- |
| 4 | Low Temperature Storage | -20°C±2°C, 240hrs | -- |
| 5 | High Temperature and High Humidity Operation Test | 60°C±2°C, 90%, 240hrs | -- |
| 6 | Vibration Test | Total fixed amplitude: 1.5mm<br>Vibration Frequency: 10~55Hz<br>One cycle 60 seconds to 3 direction of X, Y, Z each 15 minutes. | -- |
| 7. | Drop Test | To be measured after dropping from 60cm high on the concrete surface in packing state.<br>  <br>*Dropping method corner dropping*<br>*A corner: once*<br>*Edge dropping*<br>*B, C, D edge: once*<br>*Face dropping*<br>*E, F, G face: once* | -- |

Notes: 1. No dew condensation to be observed.

2. The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.

3. Vibration test will be conducted to the product itself without putting I in a container.

## 9 Dimensional outlines



## 10.1 VISUAL & FUNCTION INSPECTION STANDARD

### 10.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

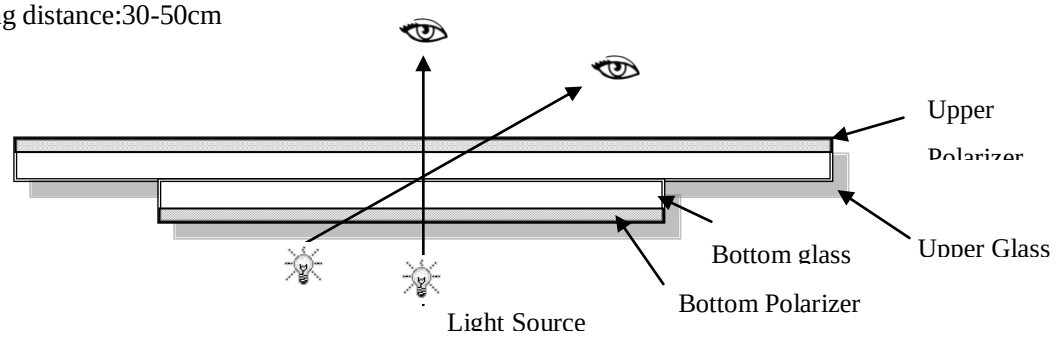
Temperature : 25±5℃

Humidity : 65%±10%RH

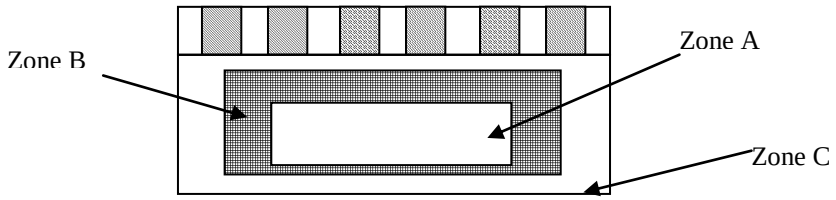
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance:30-50cm




### 10.1.2 Definition




Zone A : Effective Viewing Area(Character or Digit can be seen)

Zone B : Viewing Area except Zone A

Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer .)

Note:

As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer.

### 10.1.3 Sampling Plan

According to GB/T 2828-2003 ; , normal inspection, Class Ⅱ

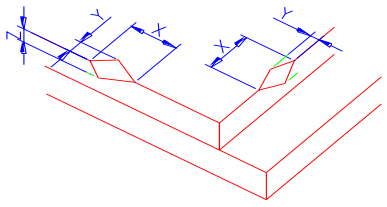
AQL:

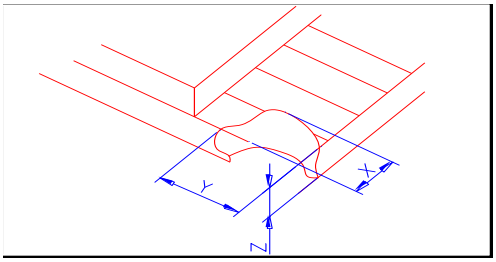
| Major defect | Minor defect |
|---|---|
| 0.65 | 1.5 |

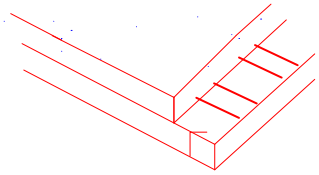
LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module

| No | Items to be inspected | Criteria | Classification of defects |
|---|---|---|---|
| 1 | Functional defects | 1) No display, Open or miss line<br>2) Display abnormally, Short<br>3) Backlight no lighting, abnormal lighting.<br>4) TP no function | Major |
| 2 | Missing | Missing component | |
| 3 | Outline dimension | Overall outline dimension beyond the drawing is not allowed | |
| 4 | Color tone | Color unevenness, refer to limited sample | Minor |
| 5 | Soldering appearance | Good soldering , Peeling off is not allowed. | |
| 6 | LCD/Polarizer/TP | Black/White spot/line, scratch, crack, etc. | |

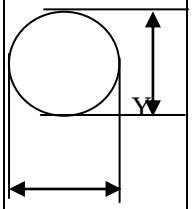
### 10.1.4 Criteria (Visual)

| Number | Items | Criteria(mm) |
|---|---|---|
| 1.0 LCD Crack/Broken<br><br>NOTE:<br>X: Length<br>Y: Width | (1) The edge of LCD broken |  <br><br>X: ≤3.0mm; Y: <Inner border line of the seal; Z: ≤T |

<table>
<tr><td rowspan="2">Z: Height<br>L: Length of ITO,<br>T: Height of LCD</td><td>(2)LCD corner broken</td><td> 

<table>
<tr><td>X</td><td>Y</td><td>Z</td></tr>
<tr><td>≤3.0mm</td><td>≤L</td><td>≤T</td></tr>
</table></td></tr>
<tr><td>(3) LCD crack</td><td>  <br>Crack<br>Not allowed</td></tr>
</table>

| Number | Items | Criteria (mm) |
|---|---|---|
| 2.0 | Spot defect | ① light dot（LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain） |




X

Φ=(X+Y)/2

| Zone / Size (mm) | Acceptable Qty A | B | C |
|---|---|---|---|
| Φ≤0.10 | Ignore | | |
| 0.10<Φ≤0.15 | 3( distance≧10mm) | | Ignore |
| 0.15<Φ≤0.2 | 1 | | |
| 0.2<Φ | 0 | | |

②Dim spot（LCD/TP/Polarizer dim dot, light leakage、dark spot）

| Zone / Size (mm) | Acceptable Qty A | B | C |
|---|---|---|---|
| Φ≤0.1 | Ignore | | |
| 0.1<Φ≤0.2 | 2( distance≧10mm) | | Ignore |
| 0.2<Φ≤0.3 | 1 | | |
| Φ＞0.3 | 0 | | |

③ Polarizer accidented spot

| Zone / Size (mm) | Acceptable Qty A | B | C |
|---|---|---|---|
| Φ≤0.2 | Ignore | | |
| 0.2<Φ≤0.5 | 2( distance≧10mm) | | Ignore |
| Φ>0.5 | 0 | | |

<table>
<tr><td></td><td>Line defect (LCD/TP /Polarizer black/white line, scratch, stain)</td><td>
<table>
<tr><td rowspan="2">Width(mm)</td><td rowspan="2">Length(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.03</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.03<W≤0.05</td><td>L≤3.0</td><td colspan="2">N≤2</td></tr>
<tr><td>0.05<W≤0.08</td><td>L≤2.0</td><td colspan="2">N≤2</td></tr>
<tr><td>0.08<W</td><td colspan="4">Define as spot defect</td></tr>
</table>
</td></tr>
<tr><td>3.0</td><td>Polarizer Bubble</td><td>
<table>
<tr><td rowspan="2">Zone<br>Size (mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ<0.2</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.2<Φ<0.4</td><td colspan="2">2(distance≧10mm)</td></tr>
<tr><td>0.4<Φ≤0.6</td><td colspan="2">1</td></tr>
<tr><td>0.6<Φ</td><td colspan="2">0</td></tr>
</table>
</td></tr>
<tr><td>4.0</td><td>SMT</td><td>According to IPC-A-610C class Ⅱ standard . Function defect and missing part are major defect ,the others are minor defect.</td></tr>
</table>