# Thin-Film-Transistor LCD Module
# Model:XTPJ17SN01-01

| Acceptance |
|---|
| |

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

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

Revise Records

| Rev. | Date | Contents | Written | Approved |
|---|---|---|---|---|
| A | 2017/04/26 | Preliminary Specification | LUO | 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

XTPJ17SN01-01 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 is composed of a TFT-LCD module, a driver circuit and a back-light unit . The resolution of a 1.77" contains 128RGBx160dots and can display up to 262K colors. The following table described the features of XTPJ17SN01-01.

LCD Module

| Item | Specification | Unit |
|---|---|---|
| Screen Size | 1.77inches | Diagonal |
| Display Resolution | 128RGB(H)x160(V) | Dot |
| Active Area | 28.03 (H) x 35.04(V) | mm |
| Outline Dimension | 33.83 (W) x 43.42(H) x 2.6 (D) | mm |
| Display Mode | Normally white/Transmissive | -- |
| Pixel Arrangement | RGB-Vertical Stripe | -- |
| Display Color | 262K | -- |
| Gray scale inversion Direction | 6 o'clock | |
| Viewing Direction | 12 o'clock | -- |
| Drive IC | ILI9163V | -- |

## 2.Mechanical Information

| Item | | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Module Size | Horizontal (H) | -- | 33.83 | -- | mm | -- |
| | Vertical (V) | -- | 43.42 | -- | mm | (1) |
| | Thickness (T) | -- | 2.6 | -- | 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 |
|---|---|---|---|---|---|
| Operating temperature | $T_{STG}$ | -20 | 70 | °C | (1) |
| Storage temperature | $T_{OPR}$ | -30 | 80 | °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 | 5.0 | V | -- |

3.2.2 Back-Light Unit

(Ta=25□2°C)

| Item | Symbol | Min. | Max. | Unit | Note |
|---|---|---|---|---|---|
| Current(1LED) | $I_f$ | -- | 30 | mA | (1) |
| 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 Backlight Unit

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

(Ta=25□2°C)

| Item | Symbol | Value | | | Unit | Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| LED Voltage | VF | 2.7 | 3.0 | 3.3 | V | If=80mA |
| LED Current | IF | - | 80 | - | mA | |
| Power Consumption | $P_{BL}$ | - | - | - | mW | |
| Brightness through TFT | Lv | - | 250 | 300 | nit | If=80mA |
| Color coordinate(TFT Surface) | Y | 0.25<x<0.29 | | | | |
| | X | 0.25<x<0.29 | | | | |
| Uniformity(TFT Surface) | | >=80% | | | | |

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

## 5 Input Terminal Pin Assignment

| PIN.NO | SYMBOL | I/O /P | FUNCTI | MEMARK |
|---|---|---|---|---|
| 1 | XL | - | - | |
| 2 | YU | - | - | |
| 3 | XR | - | - | |
| 4 | YD | - | - | |
| 5 | GND | P | POWER GROUND | |
| 6 | IOVCC(1.8/ 2.8V) | P | Power supply for interface logic circuits (1.65 ~ 3.3 V) | |
| 7 | VCI(2.8V) | P | Power supply for analog circuit.<br>Could connect to external power supply (VCI=2.5~4.0V). | |
| 8 | TE | O | Tearing effect output pin to synchronies MCU to frame writing, activated by S/W command. When this pin is not activated, this pin is low.<br>If not used, please open this pin. | |
| 9 | CS/SPI CS | I | Chip select input pin ("Low" enable).<br>This pin can be permanently fixed "Low" in MCU interface mode only. | |
| 10 | DC/SPI SDL | I | Display data / Command selection pin in parallel and SCL in 3-pin SPI interface.<br>D/CX='1': Display data.<br>D/CX='0': Command data.<br>If not used, please connect this pin to GND. | |
| 11 | WR(R/W)SPI DC | I | Write enable in parallel interface.<br>WRX: for 8080 MCU<br>R/WX: for 6800 MCU<br>D/CX: for 4-wire SPI<br>If not used, please connect this pin to VDDI or GND. | |
| 12 | RD/E | I | Read enable in 8080-parallel interface and Read/ Write operation enable pin in 6800-parallel interface.<br>In 8080-parallel interface, if not used, please connect this pin to VDDI.<br>In 6800-parallel interface, if not used, please connect this pin to VDDI or GND. | |
| 13 | GND | P | POWER GROUND | |

| | | | | |
|---|---|---|---|---|
| **14** | **P68** | **I** | 8080/6800 MCU Interface mode selection.<br>P68='1': select 6800-MCU parallel interface<br>P68='0': select 8080-MCU parallel interface<br>If not used, please fix this pin at GND level. | |
| **15** | **RESET** | **I** | Chip reset pin ("Low Active").<br>This signal low will reset the device and must be applied to properly initialize the chip. | |
| **16** | **GND** | **P** | **POWER GROUND** | |
| **17-34** | **DB0-DB17** | **I/O** | When RCM1='0' (MCU I/F), D[17:0] are used to MCU parallel interface data bus, and D0 is also the serial input/ output signal in SPI interface mode. In serial interface, D[17:1] are not used and should be connected to ground.<br>When RCM1='1' (RGB I/F), D[17:0] are used to RGB interface data bus. | |
| **35** | **A** | **P** | **POWER FOR BACKLIHT(ANODE)** | |
| **36** | **K** | **P** | **POWER FOR BACKLIHT(CATHODE)** | |
| **37** | **SPI4W** | **I** | SPI interface selection pin<br>SPI4W='0': 3-wire SPI. (default)<br>SPI4W='1': 4-wire SPI.<br>This pin is internal pull low. | |
| **38** | **IM0** | **I** | MCU parallel interface type selection | |
| **39** | **IM1** | | | |
| **40** | **IM2** | **I** | MCU Parallel interface bus and Serial interface select<br>- IM2='1';Parallel Interface<br>- IM2='0';Serial Interface | |

| IM1 | IM0 | Parallel interface |
|---|---|---|
| 0 | 0 | MCU 8-bit Parallel |
| 0 | 1 | MCU 16-bit Parallel |
| 1 | 0 | MCU 9-bit Parallel |
| 1 | 1 | MCU 18-bit Parallel |

## 6 LCD Optical Characteristics

| Item | Symbol | Condition | Specification | | | Unit | Remark |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| Response time | Tr+Tf | θ= 0° | - | 30 | 60 | ms | Note 6 |
| Contrast ratio | CR | θ= 0° | 200 | 300 | - | | Note 3,7 |
| Viewing angle | Top | CR≧10 | 40 | 45 | - | deg. | Note 3,7,8 |
| | Bottom | CR≧10 | 15 | 20 | - | | |
| | Left | CR≧10 | 40 | 45 | - | | |
| | Right | CR≧10 | 40 | 45 | **0.27** **0.27** | | |
| CF Color chromaticity(CIE) | Wx | θ= 0° | -0.02 | 0.308 | +0.02 | | Note 4 |
| | Wy | | | 0.327 | | | |
| | Rx | | | 0.610 | | | |
| | Ry | | | 0.329 | | | |
| | Gx | | | 0.299 | | | |
| | Gy | | | 0.567 | | | |
| | Bx | | | 0.143 | | | |
| | By | | | 0.111 | | | |
| Cross talk | ct | | | | 2% | | Note 10 |
| Transmittance | Trans | | 6.21% | 6.9% | - | | Note 5 |

Note 1: Ambient temperature = 25°C.

Note 2: To be measured in dark room after LED backlight warm up 5 minutes.

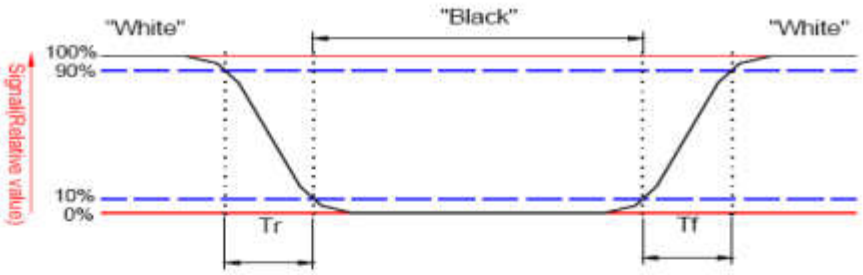
Note 3: To be measured with a viewing cone of 2°by Topcon luminance meter BM-5A.

Note 4: To be measured with Otsuta chromaticity meter LCF-2100M. CF only measure with C light

Note 5: CDY shipping status is cell without polarizer. Transmittance of Specification is cell with polarizer

Note 6: Definition of response time:

The output signals of TRD-100 are measured when the input signals are changed to "White" (falling time) and from "White" to "Black" (rising time), respectively. The interval is between the 10% and 90% of amplitudes. Refer to figure as below.

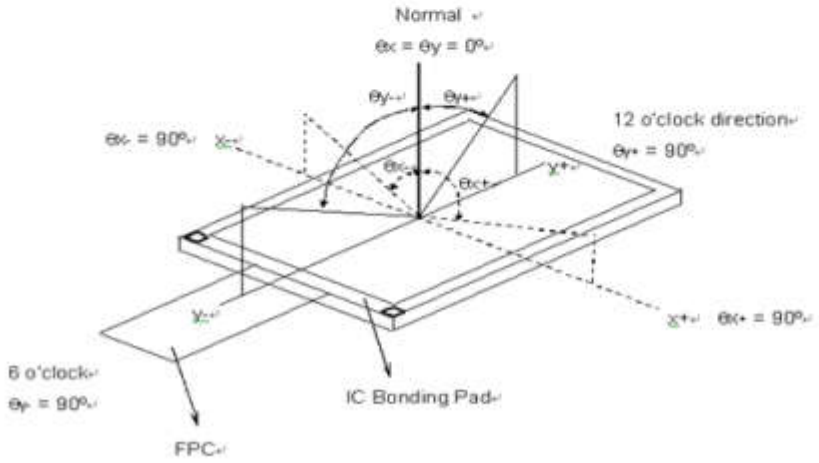



Note 7: Definition of contrast ratio:

Contrast ratio is calculated by the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "white" state}}{\text{Brightness on the "black" state}}$$

Note 8: Definition of viewing angle

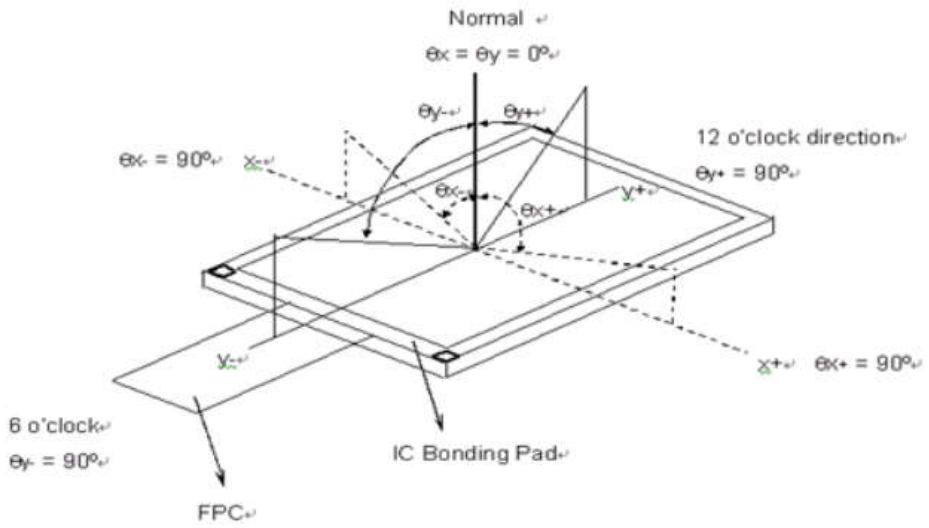


Note 7: Definition of contrast ratio:

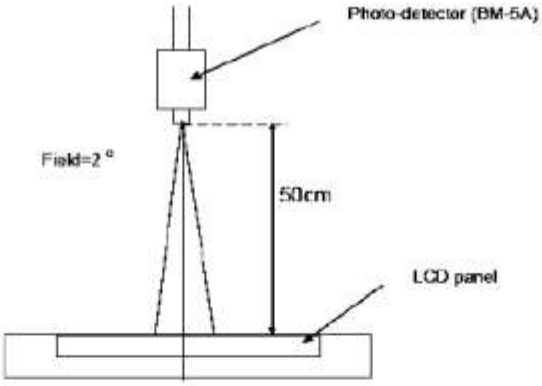
Contrast ratio is calculated by the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "white" state}}{\text{Brightness on the "black" state}}$$

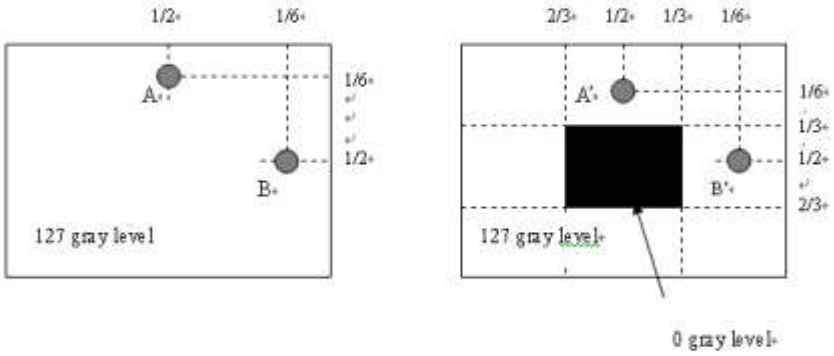
Note 8: Definition of viewing angle



Note 9: Optical characteristic measurement setup.




Note 10:




| LA-LA' | / LA x 100%= 2% max., LA and LA' are brightness at location A and A'

| LB-LB' | / LB x 100%= 2% max., LB and LB' are brightness at location B and B'

## E. Electronic Specification

| Item | Symbol | Values | | | Unit | Remark |
|---|---|---|---|---|---|---|
| | | Min | Type. | Max | | |
| TFT Operation Frame rate | Hz | 45 | 60 | 85 | Hz | |
| TFT common electrode voltage | $V_{COM\,H}$ | 2.5 | -- | 4.5 | V | |
| | $V_{COM\,L}$ | -2.0 | -- | 0 | V | |
| TFT gate on voltage | $V_{GH}$ | 13 | 15 | 17 | V | |
| TFT gate off voltage | $V_{GL}$ | -12 | -10 | -7 | V | |

## 7 Interface Timing

The timing chart of 18-/16-bit RGB interface mode is shown as below.

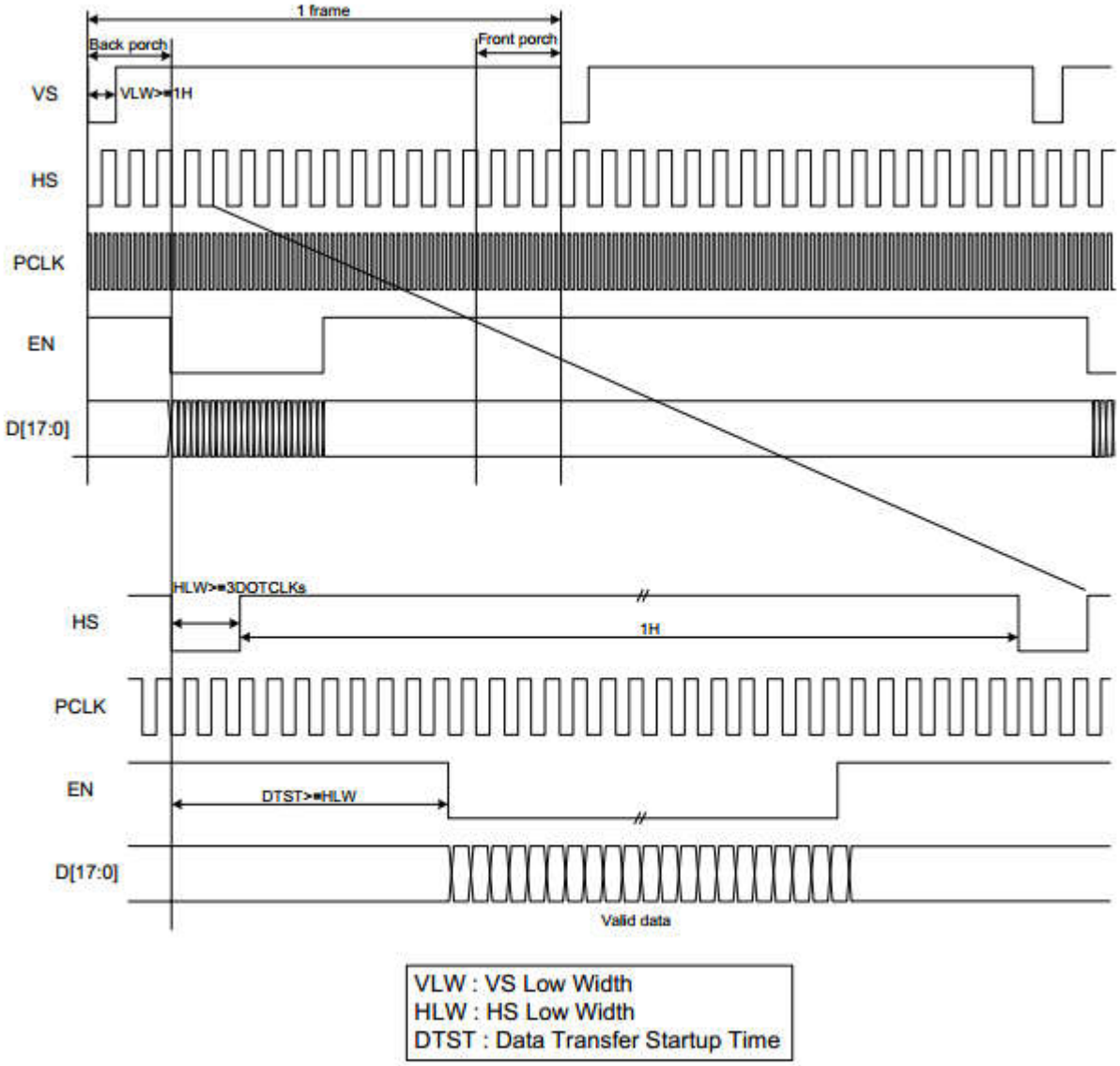



**Figure24: Timing Chart of Signals in 18-/16-bit RGB Interface Mode**

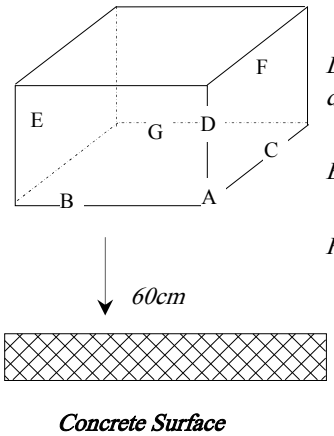
## 8 Reliability Condition for LCD

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.

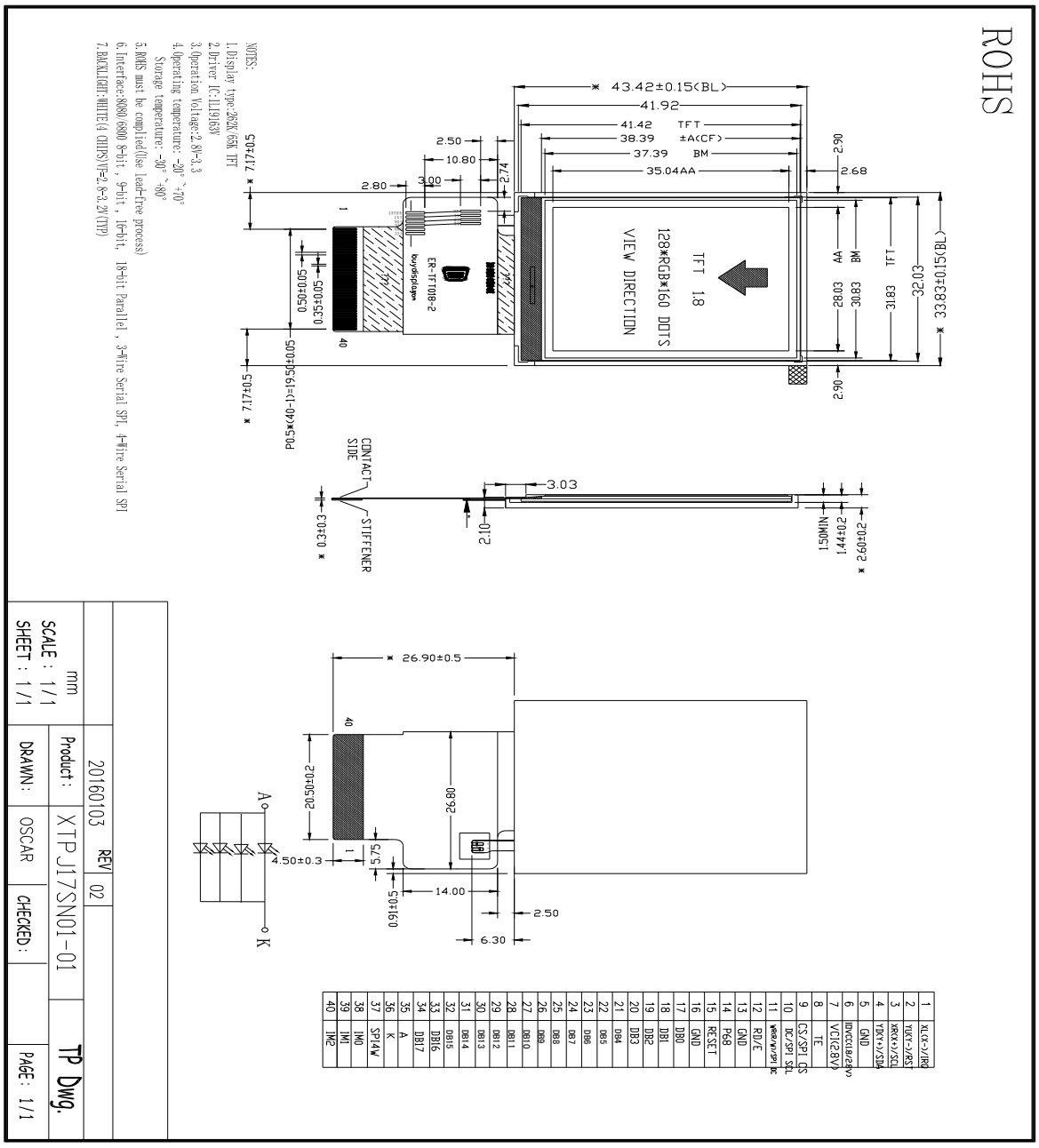
| No. | Parameter | Condition | Notes |
|---|---|---|---|
| 1 | High Temperature Operating | 70□C□2□C, 240hrs (Operation state) | -- |
| 2 | Low Temperature Operating | -20□C□2□C, 240hrs (Operation state) | -- |
| 3 | High Temperature Storage | 80□C□2□C, 240hrs | -- |
| 4 | Low Temperature Storage | -30□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><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 Incoming Inspection Standards

### 11.1 VISUAL & FUNCTION INSPECTION STANDARD

#### 11.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

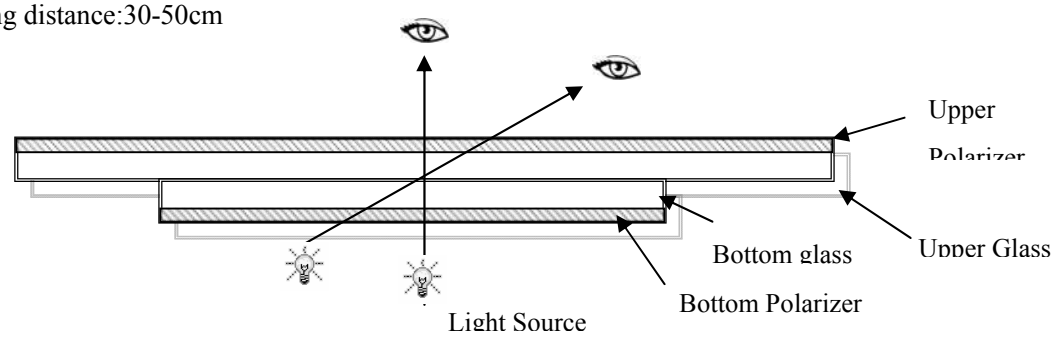
Temperature : 25±5℃

Humidity : 65%±10%RH

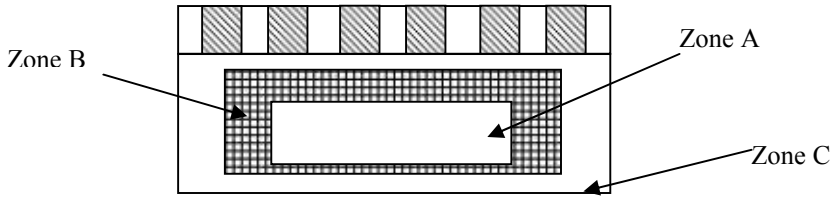
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance:30-50cm




#### 11.1.2 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.

#### 11.1.3 Sampling Plan

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

AQL:

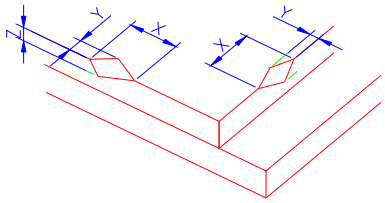
| | |
|---|---|
| Major defect | Minor defect |

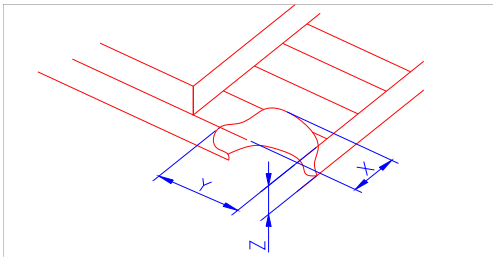
| | |
|---|---|
| 0.65 | 1.5 |

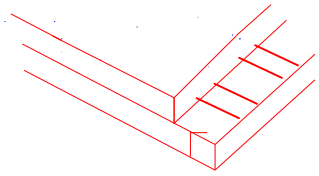
LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module

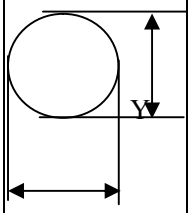
| No | Items to be inspected | Criteria | Classification of defects |
|---|---|---|---|
| 1 | Functional defects | 1) No display, Open or miss line<br>2) Display abnormally, Short<br>3) Backlight no lighting, abnormal lighting.<br>4) TP no function | Major |
| 2 | Missing | Missing component | |
| 3 | 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. | |

### 11.1.4 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>

<table>
<tr><th>Number</th><th>Items</th><th>Criteria (mm)</th></tr>
<tr><td>2.0</td><td>Spot defect<br>  <br><br>X<br>Φ=(X+Y)/2</td><td>① light dot（LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain）
<table>
<tr><th rowspan="2">Zone<br>Size (mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.10</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.10<Φ≤0.15</td><td colspan="2">3( distance≧10mm)</td></tr>
<tr><td>0.15<Φ≤0.2</td><td colspan="2">1</td></tr>
<tr><td>0.2<Φ</td><td colspan="2">0</td></tr>
</table>
②Dim spot（LCD/TP/Polarizer dim dot, light leakage、dark spot）
<table>
<tr><th rowspan="2">Zone<br>Size (mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.1</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.1<Φ≤0.2</td><td colspan="2">2( distance≧10mm)</td></tr>
<tr><td>0.2<Φ≤0.3</td><td colspan="2">1</td></tr>
<tr><td>Φ＞0.3</td><td colspan="2">0</td></tr>
</table>
③ Polarizer accidented spot
<table>
<tr><th rowspan="2">Zone<br>Size (mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.2</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.2<Φ≤0.5</td><td colspan="2">2( distance≧10mm)</td></tr>
<tr><td>Φ>0.5</td><td colspan="2">0</td></tr>
</table></td></tr>
</table>

<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>