# SPECIFICATION
# FOR
# LCD Module
# KD040WVFBD003-TP

| | |
|---|---|
| **MODULE:** | **KD040WVFBD003-TP** |
| **CUSTOMER:** | |

| REV | DESCRIPTION | DATE |
|---|---|---|
| 1.0 | FIRST ISSUE | 2015.05.26 |
| | | |

| STARTEK | INITIAL | DATE |
|---|---|---|
| PREPARED BY | | |
| CHECKED BY | | |
| APPROVED BY | | |

| CUSTOMER | INITIAL | DATE |
|---|---|---|
| APPROVED BY | | |

## Revision History

| Data | Rev. No. | Page | Summary |
|---|---|---|---|
| 2015.05.26 | V1.0 | ALL | FIRST ISSUE |
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# Contents

# General Description

## * Description

This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silicon TFT as a switching device. This model is composed of a Transmissive type TFT-LCD Panel, driver circuit, back-light unit. The resolution of a 4.0'TFT-LCD contains 480x800 pixels, and can display up to 65K colors.

## * Features

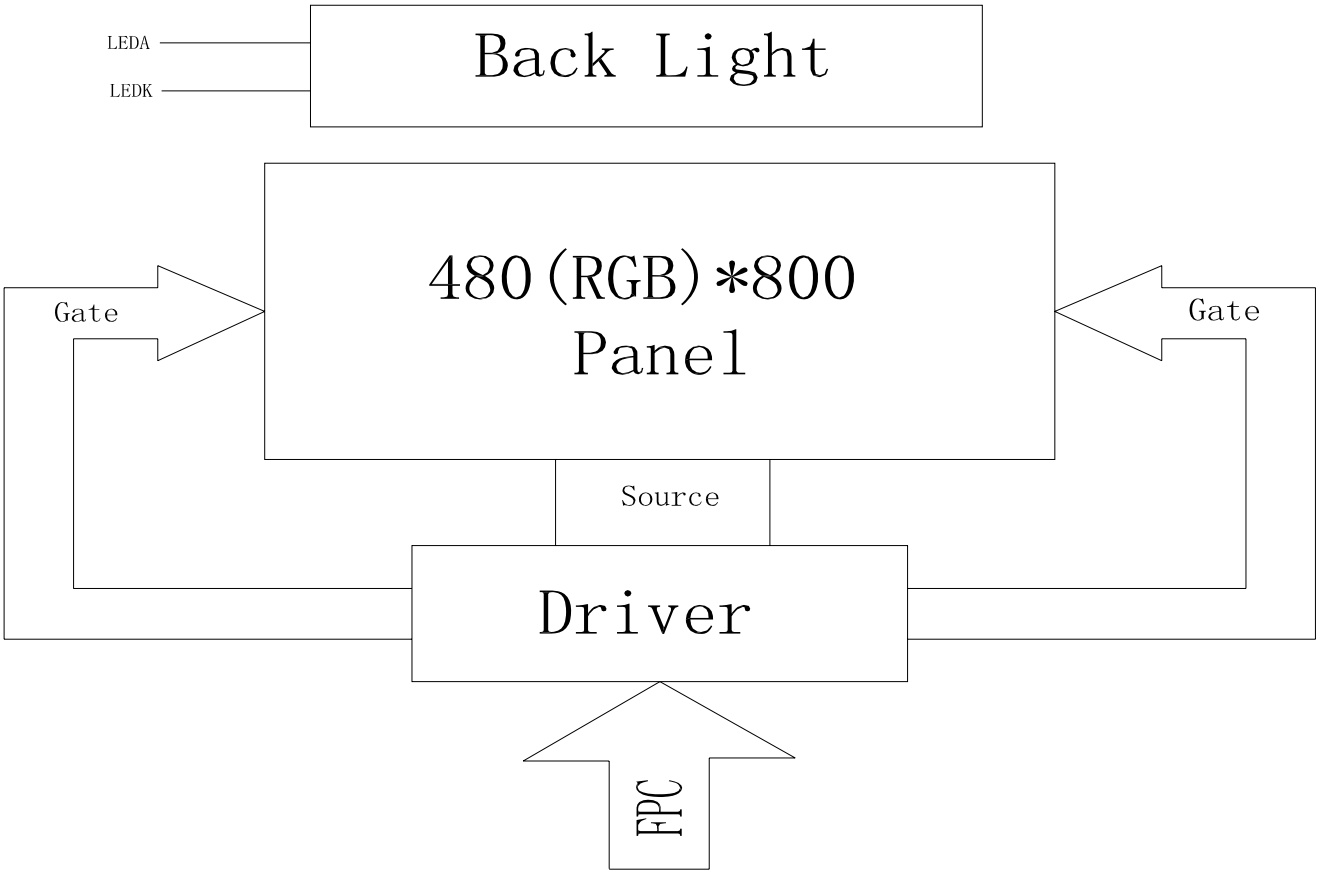
-Low Input Voltage: 3.3V(TYP)
-Display Colors of TFT LCD: 65K colors
-Interface: MCU 8/16BIT interface.

| General Information Items | Specification | Unit | Note |
|---|---|---|---|
| | Main Panel | | |
| Display area(AA) | 51.84(H)*86.4(V) (4.0inch) | mm | - |
| Driver element | TFT active matrix | - | - |
| Display colors | 65K | colors | - |
| Number of pixels | 480(RGB)*800 | dots | - |
| Pixel arrangement | RGB vertical stripe | - | - |
| Pixel pitch | 0.108(H)*0.108(V) | mm | - |
| Viewing angle | ALL | o'clock | - |
| Controller IC | ILI9806 | - | - |
| Display mode | Transmissive/Normally Black | - | - |
| Operating temperature | -20～+70 | ℃ | - |
| Storage temperature | -30～+80 | ℃ | - |

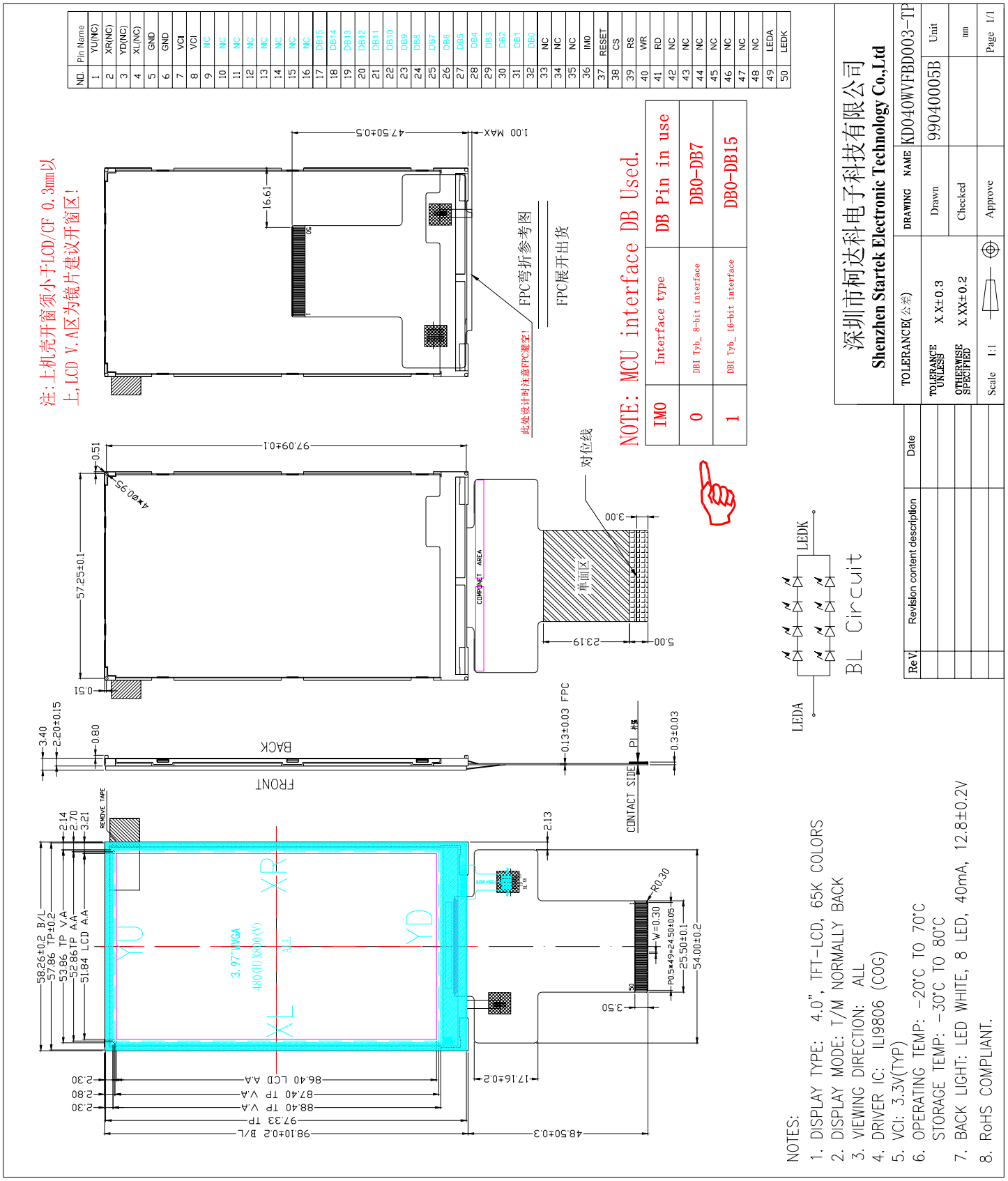
## * Mechanical Information

| Item | | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Module size | Horizontal(H) | | 58.26 | | mm | - |
| | Vertical(V) | | 98.1 | | mm | - |
| | Depth(D) | | 3.4 | | mm | - |
| Weight | | | TBD | | g | - |

## 1. Block Diagram



## 2.Outline dimension



## 3. Input terminal Pin Assignment

| Pin NO. | Symbol | Function | I/O |
|---|---|---|---|
| 1 | YU(NC) | Touch panel Top Film Terminal | A/D |
| 2 | XR(NC) | Touch panel Right Glass Terminal | A/D |
| 3 | YD(NC) | Touch panel Bottom Film Terminal | A/Dv |
| 4 | XL(NC) | Touch panel LIFT Glass Terminal | A/D |
| 5 | GND | Ground. | P |
| 6 | GND | Ground. | P |
| 7 | VCI | Supply voltage (3.3V). | P |
| 8 | VCI | Supply voltage (3.3V). | P |
| 9-16 | NC | | |
| 17-32 | DB15-DB0 | 16-bit parallel bi-directional data bus for MCU system interface mode .<br><br>Fix to GND level when not in use | I/O |
| 33-35 | NC | | |
| 36 | IM0 | Interface Select | I |
| 37 | RESET | Reset pin. Setting either pin low initializes the LSI.<br>Must be reset after power is supplied. | I |
| 38 | CS | Chip select signal.<br>Low: chip can be accessed;<br>High: chip cannot be accessed. | I |
| 39 | RS | Data / Command Selection pin | I |
| 40 | WR | Write enable clock input pin | I |
| 41 | RD | Read enable clock input pin | I |

| | | | |
|---|---|---|---|
| 42-48 | NC | | |
| 49 | LEDA | Anode pin of backlight. | P |
| 50 | LEDK | Cathode pin of backlight. | P |

# 4. LCD Optical Characteristics

## 4.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance 1lux and temperature = 25 2℃) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0 . We refer to θØ=0 (=θ3 ) as the 3 o‟clock direction (the “right”), θØ=90 (= θ12 ) as the 12 o‟clock direction (“upward”), θØ=180 (= θ9 ) as the 9 o‟clock direction (“left”) and θØ=270(= θ6 ) as the 6 o‟clock direction (“bottom”). While scanning θ and/or Ø, the center of the measuring spot on the Display surface shall stay fixed. Optimum viewing angle direction is 6 „clock.

## 4.2 Optical Specifications

| Parameter | | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| Viewing Angle range | Horizontal | $\Theta_3$ | CR > 10 | 80 | 85 | - | Deg. | Note 1 |
| | | $\Theta_9$ | | 80 | 85 | - | Deg. | |
| | Vertical | $\Theta_{12}$ | | 80 | 85 | - | Deg. | |
| | | $\Theta_6$ | | 80 | 85 | - | Deg. | |
| Contrast ratio | | CR | Θ = 0° | 550 | 800 | - | | Note 2 |
| Transmittance | | Tr. | | 3.34 | 3.93 | - | % | Without APF Note 3 |
| White Chromaticity | | $x_w$ | | 0.277 | 0.292 | 0.307 | | Note 4 CF Glass Base on C Light |
| | | $y_w$ | | 0.318 | 0.333 | 0.348 | | |
| Reproduction of color (C light) | Red | $R_x$ | | 0.650 | 0.665 | 0.680 | | |
| | | $R_y$ | | 0.308 | 0.323 | 0.338 | | |
| | Green | $G_x$ | | 0.257 | 0.272 | 0.287 | | |
| | | $G_y$ | | 0.573 | 0.588 | 0.613 | | |
| | Blue | $B_x$ | | 0.119 | 0.134 | 0.149 | | |
| | | $B_y$ | | 0.106 | 0.121 | 0.136 | | |
| Response Time (Rising + Falling) | | $T_r + T_f$ | Ta= 25° C Θ = 0° | - | 35 | - | ms | Note 5 |

Note:

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIGURE 1).

2. Contrast measurements shall be made at viewing angle of Θ= 0 and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state . (see FIGURE 1) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Transmittance is the Value with Polarizer

4. The color chromaticity coordinates specified in Table 5 shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

5. The electro-optical response time measurements shall be made as FIGURE 3 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr, and 90% to 10% is Td.

Figure 1. The Definition of Vth & Vsat

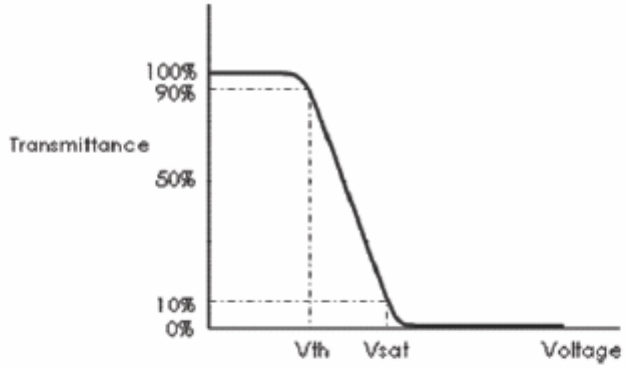



Figure 2. Measurement Set Up

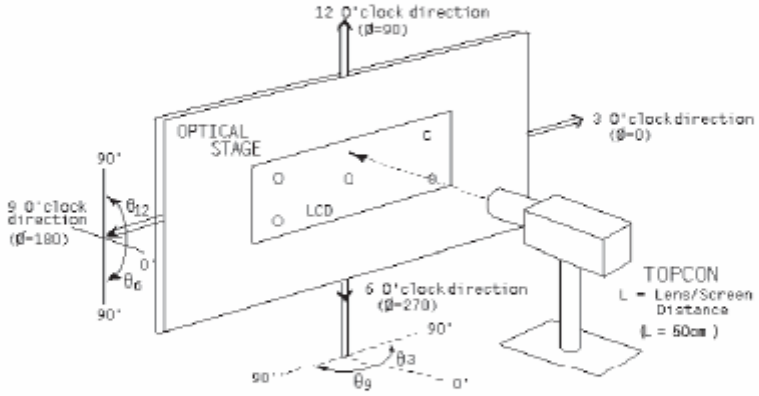
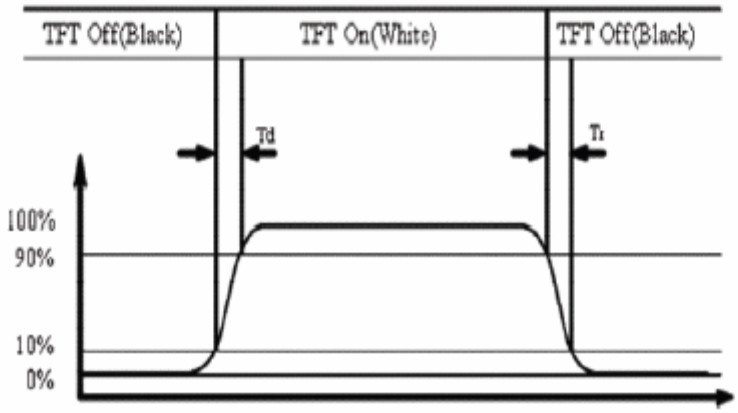



Figure 3. Response Time Testing



# 5. Electrical Characteristics

## 5.1 Absolute Maximum Rating (Ta=25 VSS=0V)

| Characteristics | Symbol | Min. | Max. | Unit |
|---|---|---|---|---|
| Digital Supply Voltage | VDD | -0.3 | 5.0 | **V** |
| Digital interface supple Voltage | VDDIO | -0.3 | 4.0 | **V** |
| Operating temperature | $T_{OP}$ | -20 | +70 | ℃ |
| Storage temperature | $T_{ST}$ | -30 | +80 | ℃ |

## 5.2 DC Electrical Characteristics

| Characteristics | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Digital Supply Voltage | VDD | 3.0 | 3.3 | 4.2 | V | -- |
| Digital interface supple Voltage | VDDIO | 1.65 | 3.3 | 4.2 | V | -- |
| Normal mode Current consumption | IDD | -- | 30 | -- | mA | -- |
| Level input voltage | $V_{IH}$ | $0.7V_{DDIO}$ | -- | $V_{DDIO}$ | V | -- |
| | $V_{IL}$ | GND | -- | $0.3V_{DDIO}$ | V | -- |
| Level output voltage | $V_{OH}$ | $V_{DDIO}$-0.4 | -- | -- | V | -- |
| | $V_{OL}$ | GND | -- | GND+0.4 | V | -- |

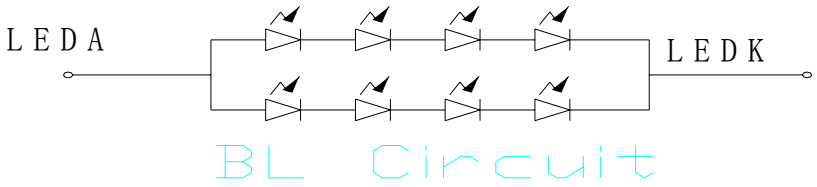
## 5.3 LED Backlight Characteristics

The back-light system is edge-lighting type with 8 chips White LED

| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Forward Current | $I_F$ | 30 | 40 | -- | mA | -- |
| Forward Voltage | $V_F$ | -- | 12.8 | -- | V | -- |
| LCM Luminance | $L_V$ | 400 | -- | -- | cd/m2 | $I_F$=40mA |
| LED life time | Hr | 50000 | | | Hour | Note1,2 |
| Uniformity | AVg | 80 | -- | -- | % | -- |

Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25±3 ℃, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note (2) The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and IL=40mA. The LED lifetime could be decreased if operating IL is larger than 40mA. The constant current driving method is suggested.




# 6. TP Feature

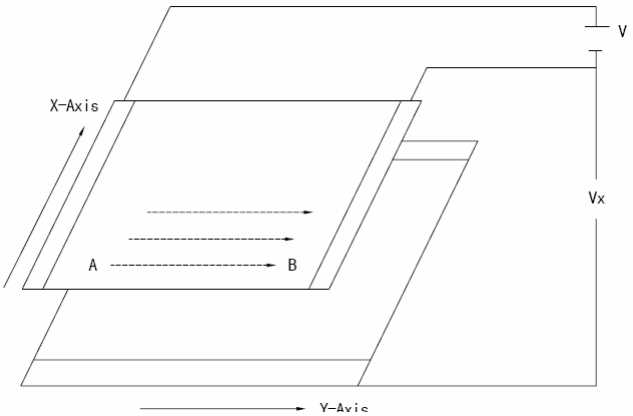
## 6.1 Conditions of use and storage

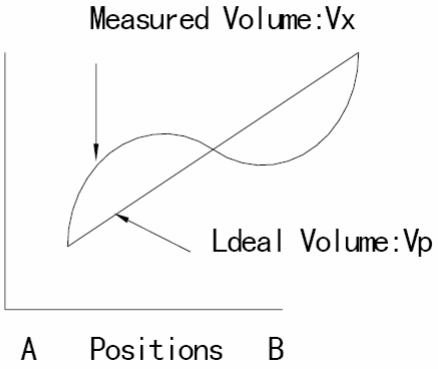
| Item | Value(condition) | Note |
|---|---|---|
| Temperature range upon operation | Humidity: 20%~90% non dew, condensation -20℃~70℃ | In a simple substance |
| Temperature range upon storage | Humidity: 20%~90% non dew, condensation -30℃~80℃ | In a simple substance |

## 6.2 Electrical property

| Item | Value | Note |
|---|---|---|
| Maximum voltage | DC5V | |
| Resistance between terminals | X direction[Film side]:200-600Ω | |
| | Y direction [Glass side]:300-900Ω | |
| Insulation resistance | DC 25V 20MΩor above | Connect X + ～X- and Y+ ～Y-, apply 25VDC Between X and Y for perform measurements |
| Chattering | 10 msec or below | |

| | | |
|---|---|---|
| Rating | Voltage is DC 5V | |




## 6.3 Mechanical property

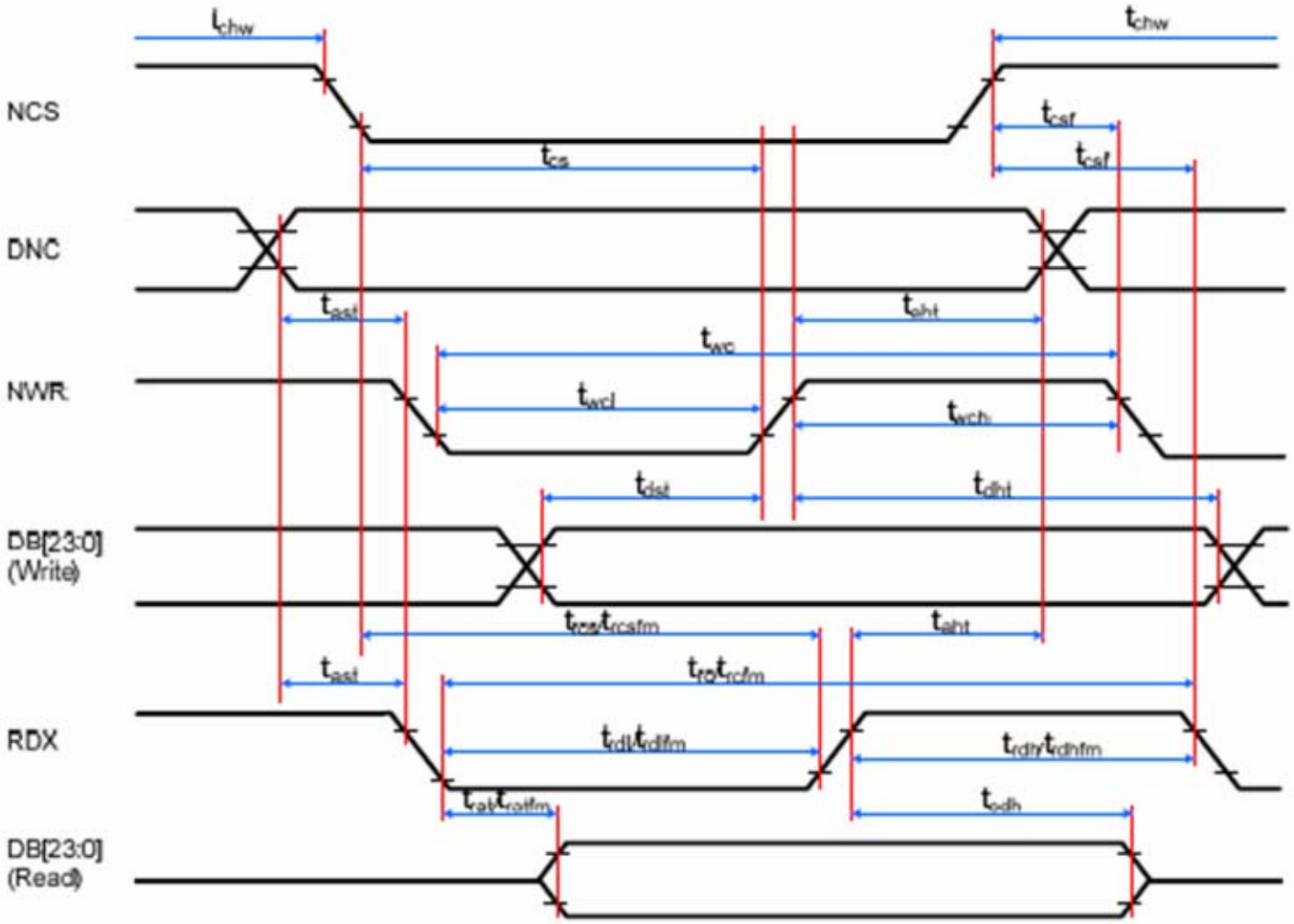
| Item | Performance | | Note |
|---|---|---|---|
| Input method | Used of an exclusive pen or finger | | |
| Load upon operation | Exclusive pen | 60-100g or below | Operation and measurement with a pen must be carried out under the following tip conditions: Stylus pen material : POM(ploy acetal) . Tip : Diameter 3.0mm, SR 0.8 mm |
| | Finger | 60-100g or below | Operations and measurement methods simulated for a finger must be carried out under the following tip conditions. Material :Silicon rubber (Hardness : 30°Hs) Tip : Diameter 12.0 mm, SR 12.5mm |
| Surface hardness | Pencil hardness : 3H or above | | It complies with the way of test method JIS K5400. |

## 6.4 Optical property

| Item | Performance | Note |
|---|---|---|
| Total light transmittance | 80% or above | JIS K7105 |
| Haze | 5% or below | JIS K7136 |
| Film specification | Polished type with hard coated surface | |

# 7. AC Characteristic

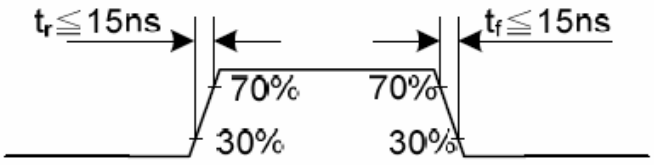
## 7.1 Display Parallel 16/8-bit Interface Timing Characteristics (8080-Ⅰ system)



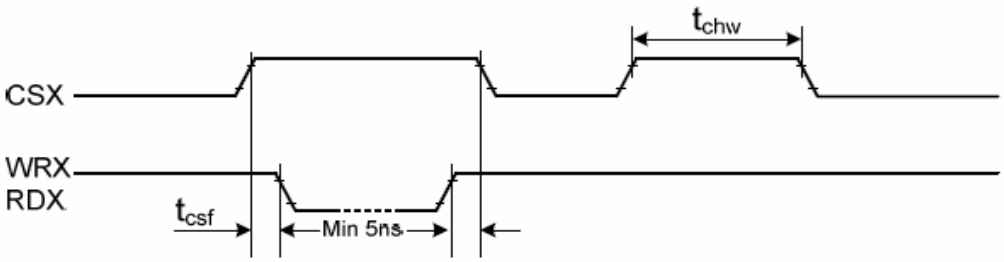
| Signal | Symbol | Parameter | min | max | Unit | Description |
|---|---|---|---|---|---|---|
| DCX | tast | Address setup time | 0 | - | ns | - |
| | taht | Address hold time (Write/Read) | 10 | - | ns | - |
| CSX | tchw | CSX "H" pulse width | 0 | - | ns | - |
| | tcs | Chip Select setup time (Write) | 10 | - | ns | - |
| | trcs | Chip Select setup time (Read ID) | 45 | - | ns | - |
| | trcsfm | Chip Select setup time (Read FM) | 355 | - | ns | - |
| | tcsf | Chip Select Wait time (Write/Read) | 10 | - | ns | - |
| WRX | twc | Write cycle | 30 | - | ns | - |
| | twrh | Write Control pulse H duration | 10 | - | ns | - |
| | twrl | Write Control pulse L duration | 10 | - | ns | - |
| RDX (FM) | trcfm | Read Cycle (FM) | 450 | - | ns | When read from the Frame Memory |
| | trdhfm | Read Control H duration (FM) | 90 | - | ns | |
| | trdlfm | Read Control L duration (FM) | 355 | - | ns | |
| RDX (ID) | trc | Read cycle (ID) | 160 | - | ns | When read ID data |
| | trdh | Read Control pulse H duration | 90 | - | ns | |
| | trdl | Read Control pulse L duration | 45 | - | ns | |
| DB[17:0], DB[15:0], DB[8:0] DB[7:0] | tdst | Write data setup time | 10 | - | ns | CL = 30pF (maximum) CL = 8pF (minimum) |
| | tdht | Write data hold time | 10 | - | ns | |
| | trat | Read access time | - | 40 | ns | |
| | tratfm | Read access time | - | 340 | ns | |
| | trodh | Read output disable time | 20 | 80 | ns | |

Notes:

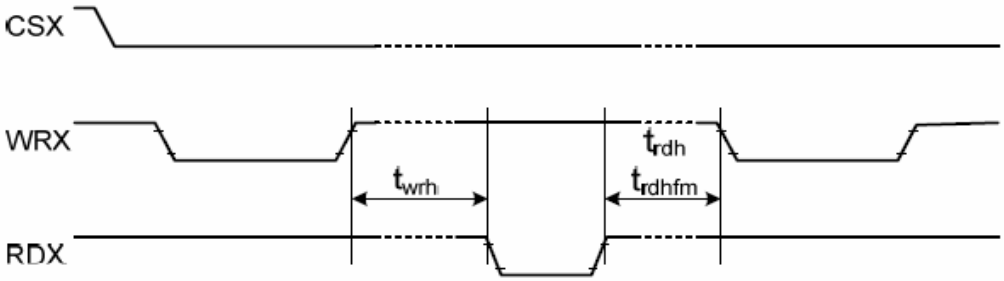
1. Ta = -30 to 70℃, VDDI = 1.65V to 3.3V, VDDA = 2.6V to 4.8V, VSSAM = GND= 0V
2. Logic high and low levels are specified as 30% and 70% of VDDI for input signals.
3. Input signal rising and falling time:




4. The CSX timing:




5. The Write-to-Read or the Read-to-Write timing:



## 7.2 Reset input timing

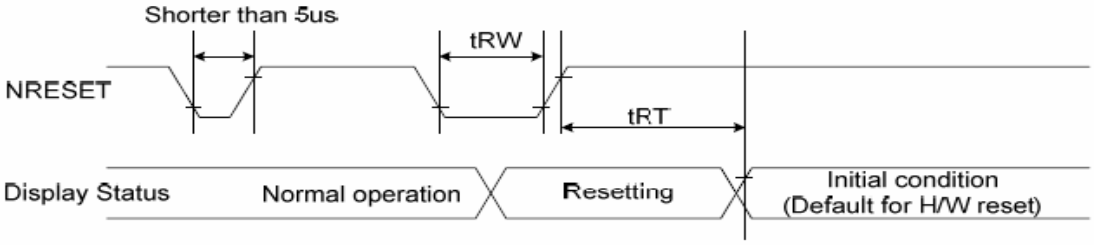



**Figure 180: Reset Timing**

**Table 47: Reset Timing**

| Signal | Symbol | Parameter | Min | Max | Unit |
|---|---|---|---|---|---|
| RESX | tRW | Reset pulse duration | 10 | | us |
| | tRT | Reset cancel | | 5 (note 1,5) | ms |
| | | | | 120 (note 1,6,7) | ms |

Notes:

1. The reset cancel also includes the required time for loading ID bytes, VCOM setting and other settings from the EEPROM to registers. After a rising edge of RESX, this loading is done within 5 ms after the H/W reset cancel (tRT).
2. A spike due to an electrostatic discharge on the RESX line does not cause irregular system reset, according to the Table 48.

**Table 48: Reset Description**

| RESX Pulse | Action |
|---|---|
| Shorter than 5us | Reset Rejected |
| Longer than 9us | Reset |
| Between 5us and 9us | Reset starts |

3. During the Resetting period, the display will be blanked (When Reset starts in the Sleep Out mode, the display will enter the blanking sequence in at least 120 ms. The display remains blank in the Sleep In mode.), and then return to the default condition for the Hardware Reset.
4. Spike Rejection can also be applied during a valid reset pulse as shown below:

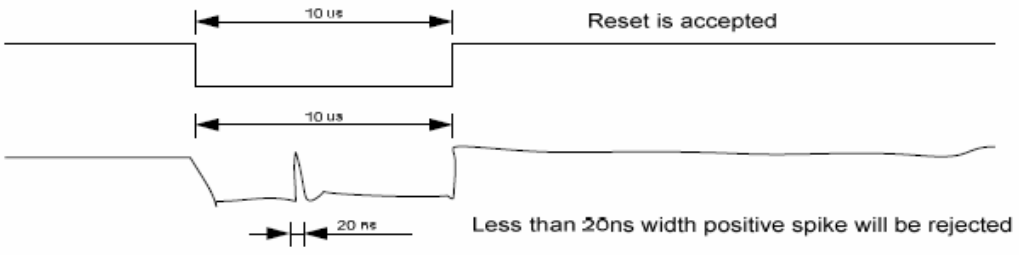



**Figure 181: Positive Noise Pulse during Reset Low**

5. When Reset applied during Sleep In Mode.
6. When Reset applied during Sleep Out Mode.
7. It is necessary to wait 5msec after releasing the RESX before sending commands. Moreover, the Sleep Out command cannot be sent in 120msec.

# 8. LCD Module Out-Going Quality Level

## 8.1 VISUAL & FUNCTION INSPECTION STANDARD

### 8.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

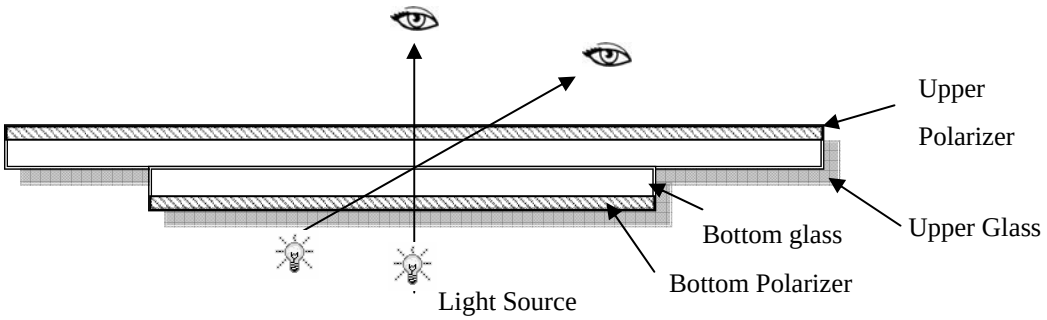
Temperature : 25±5℃

Humidity : 65%±10%RH

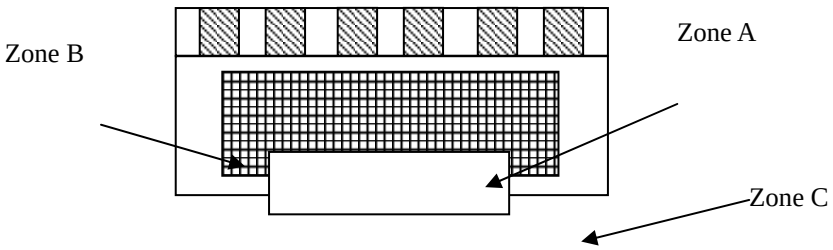
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance:30-50cm




### 8.1.2 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.

### 8.1.3 Sampling Plan

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

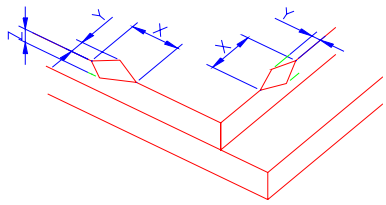
AQL:

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

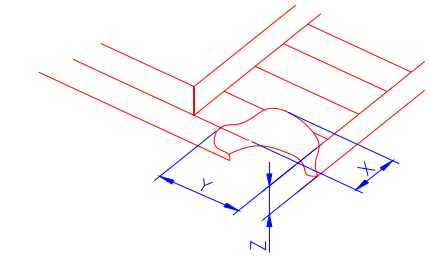
LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module

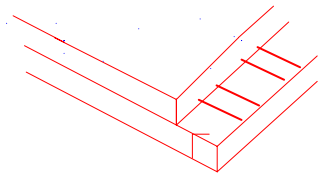
| No | Items to be inspected | Criteria | Classification of defects |
|---|---|---|---|
| 1 | Functional defects | 1) No display, Open or miss line<br>2) Display abnormally, Short<br>3) Backlight no lighting, abnormal lighting.<br>4) TP no function | Major |
| 2 | Missing | Missing component | |
| 3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

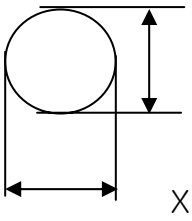
### 8.1.4 Criteria (Visual)

| Number | Items | Criteria(mm) |
|---|---|---|
| 1.0 LCD<br>Crack/Broken | (1) The edge of LCD broken |  <br> |

| X | Y | Z |
|---|---|---|
| ≤3.0mm | <Inner border line of the seal | ≤T |

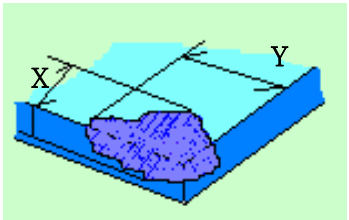
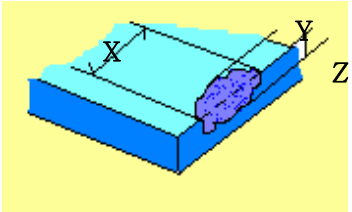
<table>
<tr><td rowspan="2">NOTE:<br>X: Length<br>Y: Width<br>Z: Height<br>L: Length of ITO,<br>T: Height of LCD</td><td>(2)LCD corner broken</td><td> 

<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>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≤0.20</td><td colspan="2">3( distance≧10mm)</td></tr>
<tr><td>0.20<Φ≤0.25</td><td colspan="2">2</td></tr>
<tr><td>Φ＞0.25</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>0.10<Φ≤0.20</td><td colspan="2">3( distance≧10mm)</td></tr>
<tr><td>0.20<Φ≤0.30</td><td colspan="2">2</td></tr>
<tr><td>Φ＞0.30</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>0.3<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>
<tr><td></td><td>Line defect (LCD/TP /Polarizer black/white line, scratch, stain)</td><td>
<table>
<tr><th rowspan="2">Width(mm)</th><th rowspan="2">Length(mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></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>
</table>

<table>
<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">3(distance≧10mm)</td></tr>
<tr><td>0.4<Φ≤0.6</td><td colspan="2">2</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>

<table>
<tr><td rowspan="5">5.0</td><td rowspan="5">TP<br>Related</td><td>TP bubble/ accidented spot</td><td colspan="2"><table>
<tr><td rowspan="2">Size Φ(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.1</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.1<Φ≤0.25</td><td colspan="2">3</td></tr>
<tr><td>0.25<Φ≤0.3</td><td colspan="2">2</td></tr>
<tr><td>0.3<Φ</td><td colspan="2">0</td></tr>
</table></td></tr>
<tr><td>Assembly<br>deflection</td><td colspan="2">beyond the edge of backlight ≤0.15mm</td></tr>
<tr><td>Newton Ring</td><td>Newton Ring area>1/3 TP area NG<br>Newton Ring area≤1/3 TP area OK</td><td> 


</td></tr>
<tr><td>TP corner broken<br>X：length<br>Y：width<br>Z：height</td><td><table>
<tr><td>X</td><td>Y</td><td>Z</td></tr>
<tr><td>X≤3.0mm</td><td>Y≤3.0mm</td><td>Z<LCD thicknes</td></tr>
</table>
Z<br>*<br>Circuitry broken is not allowed.</td><td> 
</td></tr>
<tr><td>TP edge broken<br>X：length<br>Y：width<br>Z：height</td><td><table>
<tr><td>X</td><td>Y</td><td>Z</td></tr>
<tr><td>X≤6.0mm</td><td>Y≤2.0mm</td><td>Z<LCD thicknes</td></tr>
</table>
* Circuitry broken is not allowed.</td><td> 
</td></tr>
</table>

Criteria ( functional items)

| Number | Items | Criteria (mm) |
|---|---|---|
| 1 | No display | Not allowed |
| 2 | Missing segment | Not allowed |
| 3 | Short | Not allowed |
| 4 | Backlight no lighting | Not allowed |
| 5 | TP no function | Not allowed |

# 9. Reliability Test Result

## 9.1 Condition

| Item | Condition | Sample Size | Test Result | Note |
|---|---|---|---|---|
| Low Temperature Operating Life test | -20℃, 96HR | 3ea | pass | - |
| Thermal Humidity Operating Life test | 60℃, 90%RH, 96HR | 3ea | pass | - |
| Temperature Cycle ON/OFF test | -20℃ ↔ 70℃, ON/OFF, 20CYC | 3ea | pass | (1) |
| High Temperature Storage test | 80℃, 96HR | 3ea | pass | - |
| Low Temperature Storage test | －30℃, 96HR | 3ea | pass | - |
| Thermal Shock Resistance | The sample should be allowed to stand the following 5 cycles of operation: TSTL for 30 minutes -> normal temperature for 5 minutes -> TSTH for 30 minutes -> normal temperature for 5 minutes, as one cycle, then taking it out and drying it at normal temperature, and allowing it stand for 24 hours | 3ea | pass | |
| Box Drop Test | 1 Corner 3 Edges 6 faces, 66㎝(MEDIUM BOX) | 1box | pass | - |

Note (1) ON Time over 10 seconds, OFF Time under 10 seconds

# 10. Cautions and Handling Precautions

## 10.1 Handling and Operating the Module

(1) When the module is assembled, it should be attached to the system firmly.
Do not warp or twist the module during assembly work.
(2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
(3) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.
(4) Do not allow drops of water or chemicals to remain on the display surface.
If you have the droplets for a long time, staining and discoloration may occur.
(5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
(6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane.
Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.
(8) Protect the module from static; it may cause damage to the CMOS ICs.
(9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
(10) Do not disassemble the module.
(11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
(12) Pins of I/F connector shall not be touched directly with bare hands.
(13) Do not connect, disconnect the module in the “Power ON” condition.
(14) Power supply should always be turned on/off by the item 6.1 Power On Sequence &6.2 Power Off Sequence

## 10.2 Storage and Transportation.

(1) Do not leave the panel in high temperature, and high humidity for a long time.
It is highly recommended to store the module with temperature from 0 to 35 ℃ and relative humidity of less than 70%
(2) Do not store the TFT-LCD module in direct sunlight.
(3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.
(4) It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module.
In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.
(5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.

## 11.Packing

**---TBD----**