# TFT-LCD Module Specification

## Module NO.： TST024QVSN-17

### Version： V1.0

☐ APPROVAL FOR SPECIFICATION ☐ APPROVAL FOR SAMPLE

| For Customer’ s Acceptance： | |
|---|---|
| **Approved by** | **Comment** |
| | |

| Team Source Display： | | |
|---|---|---|
| **Presented by** | **Reviewed by** | **Organized by** |
| | | |

| Version No. | Date | Content | Remark |
|---|---|---|---|
| V1.0 | 2018-3-21 | Initial Release | |
| | | | |

## CONTENTS

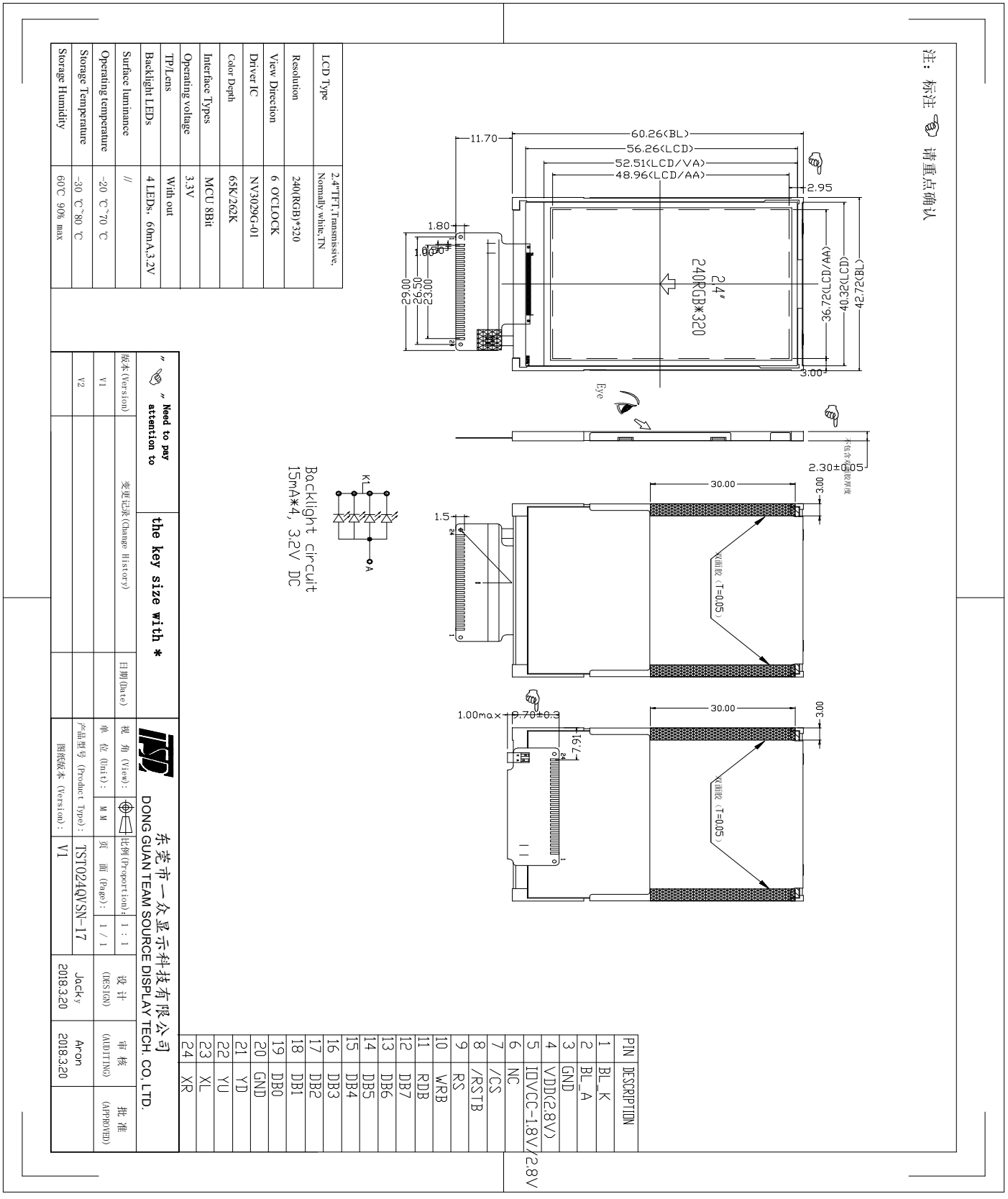
# 1 General Characteristics

| ITEM | Specification | Unit |
|---|---|---|
| LCD Type | a-Si TFT,Transmissive,Normally white,TN | - |
| LCD Size | 2.4 | inch |
| Resolution (W x H) | 240 x (RGB) × 320 | pixel |
| LCM (W × H × D ) | 42.72W) x 60.26(H) x 2.3(D) | mm |
| Active Area (W × H) | 36.72 (W) x 48.96 (H) | mm |
| Dot Pitch (W × H) | 0.051 (W) x 0.153 (H) | mm |
| Viewing Direction | 6 o'clock | - |
| Gray Scale Inversion Direction | 12 o'clock | - |
| Viewing Angle(with EWV) | Top:55,Bottom:70; Left/ Right:70 | deg. |
| Color Depth | 65K/262K | - |
| Pixel Arrangement | RGB Vertical stripe | - |
| Backlight Type | 4 LEDs,60mA,3.2V | - |
| Surface Treatment | Anti-Glare | - |
| Driver IC | NV3029G-01 | - |
| Interface Type | MCU 8Bit | - |
| Input Voltage | 2.8 | V |
| With/Without TP | Without | - |
| Weight | TBD. | g |

**Note 1: RoHS compliant**

**Note 2: LCM weight tolerance: ± 5%.**

# 2 Product drawings




| LCD Type | 2.4"TFT,Transmissive, Nomally white,TN |
|---|---|
| Resolution | 240(RGB)*320 |
| View Direction | 6 OCLOCK |
| Driver IC | NV3029G-01 |
| Color Depth | 65K/262K |
| Interface Types | MCU 8Bit |
| Operating voltage | 3.3V |
| TP/Lens | With out |
| Backlight LEDs | 4 LEDs, 60mA,3.2V |
| Surface luminance | // |
| Operating temperature | -20 ℃~70 ℃ |
| Storage Temperature | -30 ℃~80 ℃ |
| Storage Humidity | 60℃ 90% max |

| PIN | DESCRIPTION |
|---|---|
| 1 | BL_K |
| 2 | BL_A |
| 3 | GND |
| 4 | VDD(2.8V) |
| 5 | IOVCC-1.8V/2.8V |
| 6 | NC |
| 7 | /CS |
| 8 | /RSTB |
| 9 | RS |
| 10 | WRB |
| 11 | RDB |
| 12 | DB7 |
| 13 | DB6 |
| 14 | DB5 |
| 15 | DB4 |
| 16 | DB3 |
| 17 | DB2 |
| 18 | DB1 |
| 19 | DB0 |
| 20 | GND |
| 21 | YD |
| 22 | YU |
| 23 | XL |
| 24 | XR |

" Need to pay attention to the key size with *

| 版本(Version) | 变更记录(Change History) | 日期(Date) |
|---|---|---|
| V1 | | |
| V2 | | |

东莞市一众显示科技有限公司
DONG GUAN TEAM SOURCE DISPLAY TECH. CO. LTD.

| 视 角 (View): | | 比例(Proportion): | 1 : 1 | 设 计 (DESIGN) | 审 核 (AUDITING) | 批 准 (APPROVED) |
|---|---|---|---|---|---|---|
| 单 位 (Unit): | M M | 页 面 (Page): | 1 / 1 | | | |
| 产品型号 (Product Type): | TST024QVSN-17 | | | Jacky | Aron | |
| 图纸版本 (Version): | V1 | | | 2018.3.20 | 2018.3.20 | |

# 3 Interface description

| PIN NO. | Symbol | description |
|---|---|---|
| 1 | LEDK | Backlight K Cathode input pin. |
| 2 | LEDA | Backlight A Anode input pin. |
| 3 | GND | System Ground. (0V) |
| 4 | VCC-2.8V | Power supply +2.8V |
| 5 | IOVCC-1.8V/2.8V | Power supply +2.8V or 1.8V |
| 6 | NC | |
| 7 | CS | Chip select signal. |
| 8 | REST | Reset input signal |
| 9 | RS | Data/Command Selection pin |
| 10 | WR | write signal |
| 11 | RD | read signal |
| 12~19 | DB7~DB0 | Data BUS |
| 20 | GND | System Ground. (0V) |
| 21 | NC | |
| 22 | NC | |
| 23 | NC | |
| 24 | NC | |

Select the MPU system interface mode.

| IM3 | IM2 | IM1 | IM0 | MPU interface Mode | DB pins | |
|---|---|---|---|---|---|---|
| | | | | | Register | Gram |
| 0 | 0 | 0 | 0 | i80-system 8 bit interface I | DB[7:0] | DB[7:0] |
| 0 | 0 | 0 | 1 | i80-system 16-bit interface I | DB[7:0] | DB[15:0] |
| 0 | 0 | 1 | 0 | i80-system 9-bit interface I | DB[7:0] | DB[8:0] |
| 0 | 0 | 1 | 1 | i80-system 18-bit interface I | DB[7:0] | DB[17:0] |
| 0 | 1 | 0 | 1 | 3-wire 9-bit data Serial interface I | SDA: in/out | |
| | | | | 2 data lane serial interface | | |
| 0 | 1 | 1 | 0 | 4-wire 8-bit data Serial interface I | SDA: in/out | |
| 1 | 0 | 0 | 0 | i80-system 16-bit interface II | DB[8:1] | DB[8:1], DB[17:10] |
| 1 | 0 | 0 | 1 | i80-system 8 bit interface II | DB[17:10] | DB[17:10] |
| 1 | 0 | 1 | 0 | i80-system 18-bit interface II | DB[8:1] | DB[17:0] |
| 1 | 0 | 1 | 1 | i80-system 9-bit interface II | DB[17:10] | DB[17:9] |
| 1 | 1 | 0 | 1 | 3-wire 9-bit data Serial interface II | SDI: in SDO: out | |
| 1 | 1 | 1 | 0 | 4-wire 8-bit data Serial interface II | SDI: in SDO: out | |

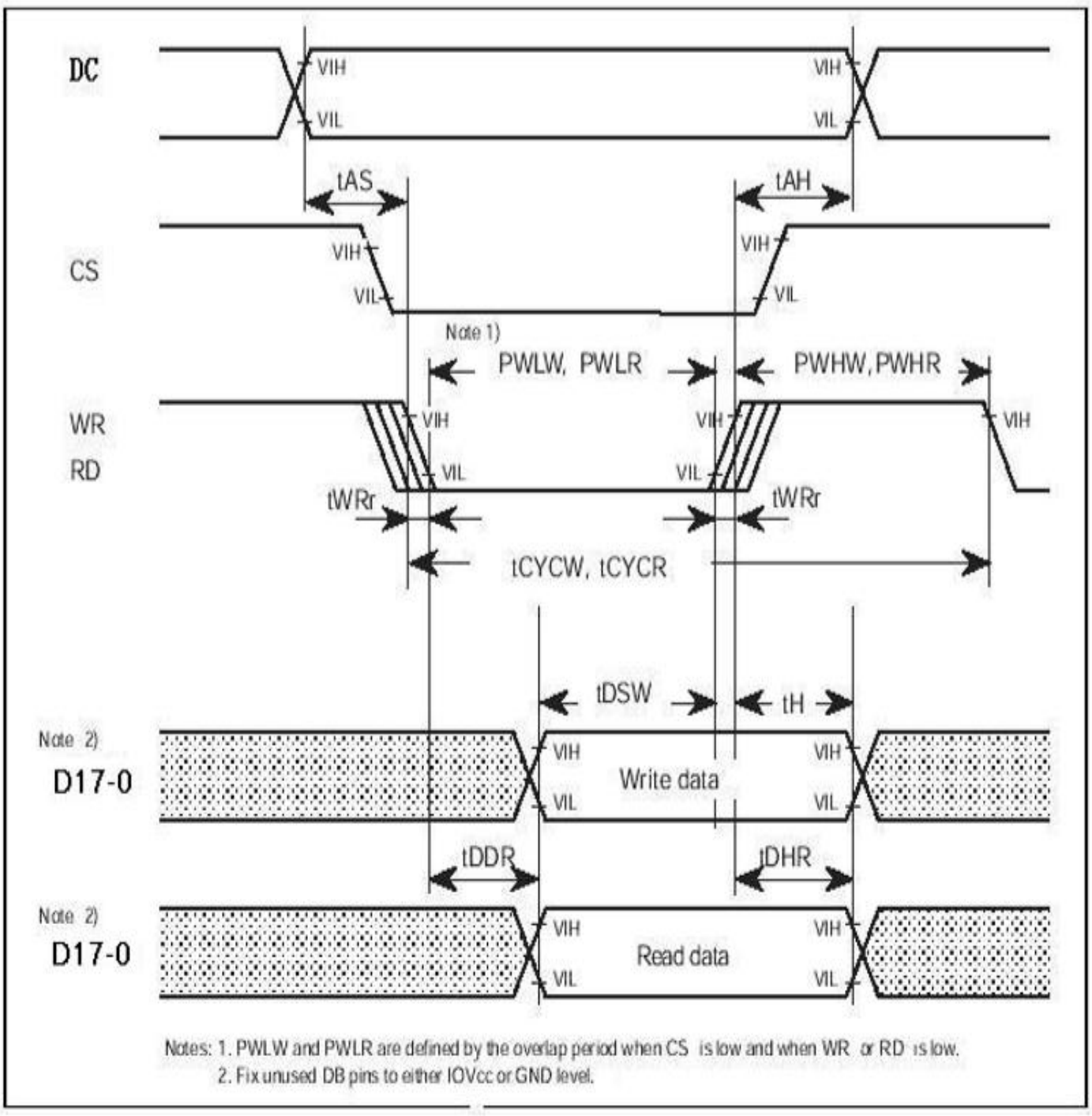
MPU Parallel interface bus and serial interface select

Note:

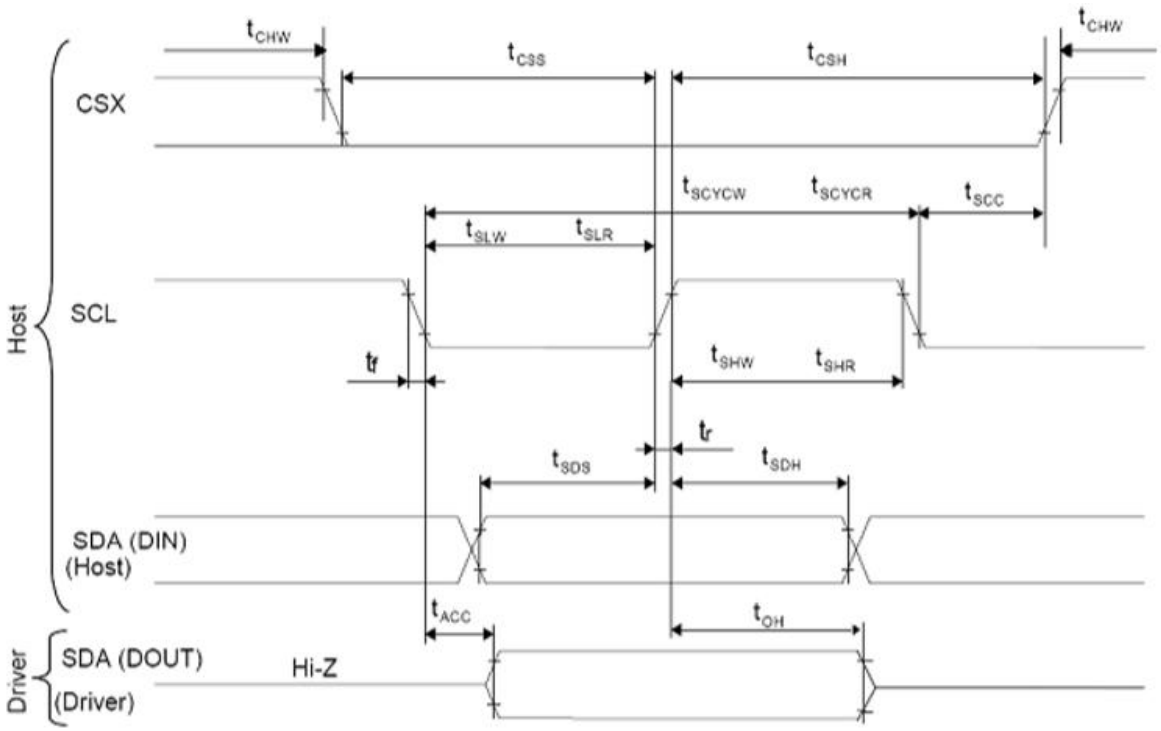
1. “0”connect to GND; “1”connect to IOVCC.
2. If use RGB Interface must select serial interface.

# 4. Timing Characteristics

80-systemBusInterfaceOperation

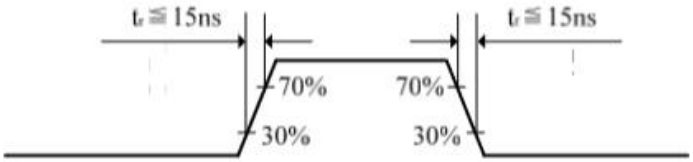


## 4.1 Display Serial Interface Timing Characteristics (3-line SPI system)

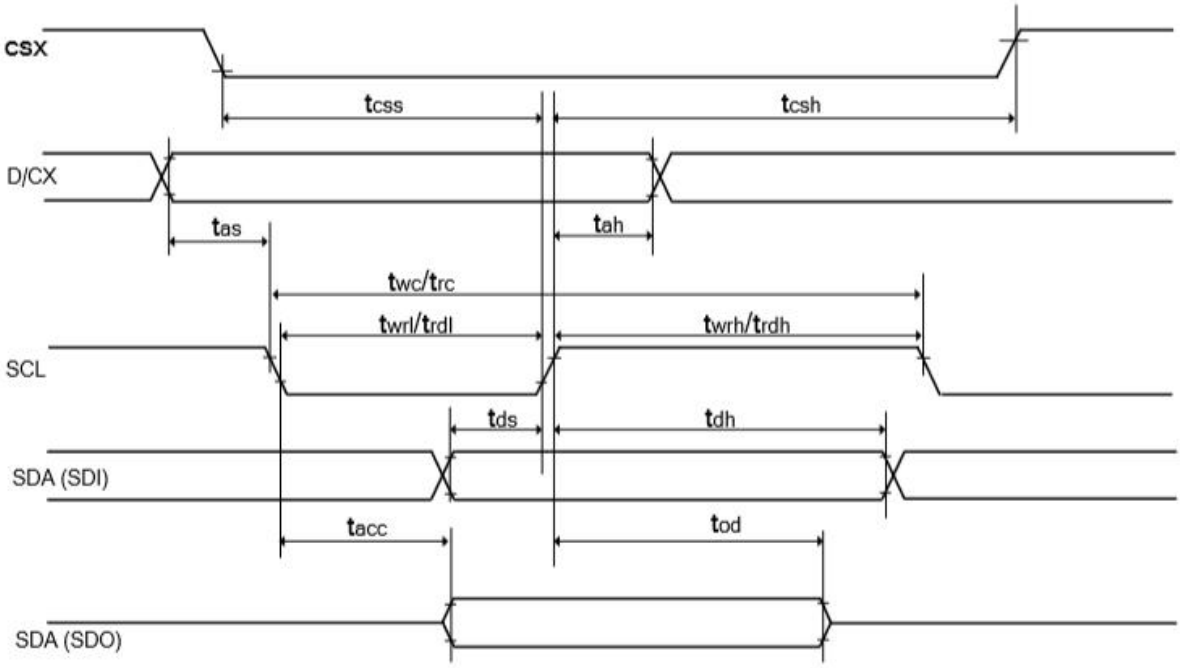



| Signal | Symbol | Parameter | min | max | Unit | Description |
|---|---|---|---|---|---|---|
| SCL | tscycw | Serial Clock Cycle (Write) | 25 | - | ns | |
| | tshw | SCL "H" Pulse Width (Write) | 10 | - | ns | |
| | tslw | SCL "L" Pulse Width (Write) | 10 | - | ns | |
| | tscycr | Serial Clock Cycle (Read) | 80 | - | ns | |
| | tshr | SCL "H" Pulse Width (Read) | 32 | - | ns | |
| | tslr | SCL "L" Pulse Width (Read) | 32 | - | ns | |
| SDA/SDI (Input) | tsds | Data setup time (Write) | 12 | - | ns | |
| | tsdh | Data hold time (Write) | 12 | - | ns | |
| SDA / SDO (Output) | tacc | Access time (Read) | 5 | 20 | ns | |
| | toh | Output disable time (Read) | 15 | 60 | ns | |
| CSX | tscc | SCL-CSX | 20 | - | ns | |
| | tchw | CSX "H" Pulse Width | 10 | - | ns | |
| | tcss | CSX-SCL Time | 15 | - | ns | |
| | tcsh | | 30 | - | ns | |

Note: Ta = 25 ° C, VDDI=1.65V to 3.3V, VCI=2.5V to 3.3V, GNDA=VSS=0V

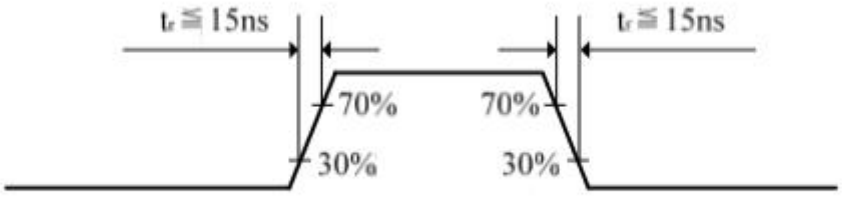


## 4.2 Display Serial Interface Timing Characteristics (4-line SPI system)

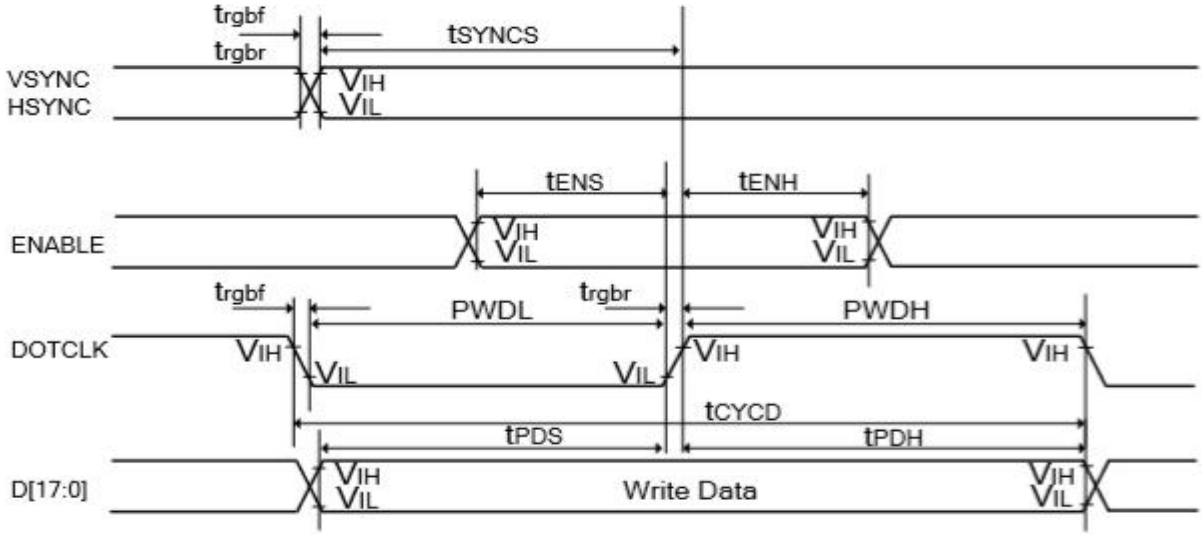



| Signal | Symbol | Parameter | min | max | Unit | Description |
|---|---|---|---|---|---|---|
| CSX | tcss | Chip select time (Write) | 15 | - | ns | |
| | tcsh | Chip select hold time (Read) | 30 | - | ns | |
| SCL | twc | Serial clock cycle (Write) | 25 | - | ns | |
| | twrh | SCL "H" pulse width (Write) | 10 | - | ns | |
| | twrl | SCL "L" pulse width (Write) | 10 | - | ns | |
| | trc | Serial clock cycle (Read) | 80 | - | ns | |
| | trdh | SCL "H" pulse width (Read) | 32 | - | ns | |
| | trdl | SCL "L" pulse width (Read) | 32 | - | ns | |
| D/CX | tas | D/CX setup time | 2 | - | | |
| | tah | D/CX hold time (Write / Read) | 10 | - | | |
| SDA / SDI (Input) | tds | Data setup time (Write) | 12 | - | ns | |
| | tdh | Data hold time (Write) | 12 | - | ns | |
| SDA / SDO (Output) | tacc | Access time (Read) | 5 | 20 | ns | For maximum CL=30pF |
| | tod | Output disable time (Read) | 15 | 60 | ns | For minimum CL=8pF |

Note: Ta = 25 ° C, VDDI=1.65V to 3.3V, VCI=2.5V to 3.3V, GNDA=VSS=0V

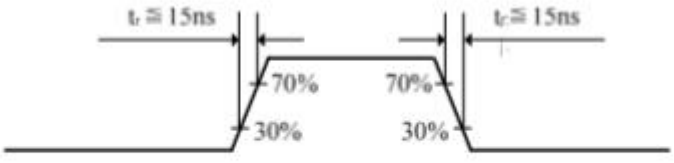


## 4.3 Parallel 18/16/6-bit RGB Interface Timing Characteristics




| Signal | Symbol | Parameter | min | max | Unit | Description |
|---|---|---|---|---|---|---|
| VSYNC / HSYNC | tSYNCS | VSYNC/HSYNC setup time | 15 | - | ns | 18/16-bit bus RGB interface mode |
| | tSYNCH | VSYNC/HSYNC hold time | 15 | - | ns | |
| DE | tENS | DE setup time | 15 | - | ns | |
| | tENH | DE hold time | 15 | - | ns | |
| D[17:0] | tPOS | Data setup time | 15 | - | ns | |
| | tPDH | Data hold time | 15 | - | ns | |
| DOTCLK | PWDH | DOTCLK high-level period | 15 | - | ns | |
| | PWDL | DOTCLK low-level period | 15 | - | ns | |
| | tCYCD | DOTCLK cycle time | 100 | | ns | |
| | trgbr , trgbf | DOTCLK,HSYNC,VSYNC rise/fall time | - | 15 | ns | |
| VSYNC / HSYNC | tSYNCS | VSYNC/HSYNC setup time | 15 | - | ns | 6-bit bus RGB interface mode |
| | tSYNCH | VSYNC/HSYNC hold time | 15 | - | ns | |
| DE | tENS | DE setup time | 15 | - | ns | |
| | tENH | DE hold time | 15 | - | ns | |
| D[17:0] | tPOS | Data setup time | 15 | - | ns | |
| | tPDH | Data hold time | 15 | - | ns | |
| DOTCLK | PWDH | DOTCLK high-level pulse period | 15 | - | ns | |
| | PWDL | DOTCLK low- level pulse period | 15 | - | ns | |
| | tCYCD | DOTCLK cycle time | 100 | | ns | |
| | trgbr , trgbf | DOTCLK,HSYNC,VSYNC rise/fall time | - | 15 | ns | |

Note: Ta = -30 to 70 ° C, VDDI=1.65V to 3.3V, VCI=2.5V to 3.3V, GNDA=VSS=0V



# 5 Absolute Maximum Ratings

| PARAMETER | SYMBOL | MIN | MAX | UNIT |
|---|---|---|---|---|
| Supply Voltage (Analog) | VCC~GND | -0.3 | 3.3 | V |
| Logic signal voltage(I/O) | IOVCC~GND | -0.3 | 3.3 | V |
| Operating Temperature | TOP | -20 | 70 | ° C |
| Storage Temperature | TST | -30 | 80 | ° C |
| Humidity | RH | - | 90%(Max 60° C) | RH |

# 6 Electrical Characteristics

| PARAMETER | SYMBOL | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| Analog operating voltage | VCC | 2.5 | 2.8 | 3.3 | V |
| Logic operating voltage | IOVCC | 1.65 | 1.8 | 3.3 | V |
| Input Current | IDD | - | TBD | - | mA |
| Input Voltage ' H ' level | VIH | 0.7IOVCC | - | IOVCC | V |
| Input Voltage ' L ' level | VIL | GND | - | 0.3IOVCC | |
| Output Voltage ' H ' level | VOH | 0.8IOVCC | - | IOVCC | |
| Output Voltage ' L ' level | VOL | GND | - | 0.2IOVCC | |

# 7 Backlight Characteristics

| ITEM | SYMBOL | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| Voltage for LED backlight | $V_f$ | - | 3.1 | 3.2 | V |
| Current for LED backlight | $I_f$ | - | 60 | 80 | mA |
| Power consumption | Wbl | - | 190 | 256 | mW |
| Uniformity | Avg | 80 | - | - | % |
| LED Life Time | - | 30000 | 40000 | - | Hrs |

Note:

1.The LED life time is defined as the module brightness decrease to 50% original brightness at Ta=25°C, 60%RH ±5 %.

2. The life time of LED will be reduced if LED is driven by high current, high ambient temperature and humidity conditions.

3. Typical operating life time is an estimated data.

4. 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.

# 8 LCD Optical specifications

| Item | Symbol | Condition | Specification | | | Unit | Remark |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| Response time (By Quick) | Tr+Tf | θ = 0° | - | 30 | - | ms | Note 5 |
| Contrast ratio | CR | θ = 0° | - | 250 | - | | Note 2,6 |
| Viewing angle （with EWV Polarizer ） | Top | CR≧10 | - | 55 | - | Deg. | Note 2,6,7 |
| | Bottom | CR≧10 | - | 70 | - | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Left | CR≧10 | - | 70 | - | | |
| | Right | CR≧10 | - | 70 | - | | |
| Color chromaticity ( CF only with ITO, light source is C light, CIE 1931) | Wx | θ = 0° | 0.288 | 0.308 | 0.328 | | Note 3 |
| | Wy | | 0.305 | 0.325 | 0.345 | | |
| | Rx | | 0.592 | 0.612 | 0.632 | | |
| | Ry | | 0.309 | 0.329 | 0.349 | | |
| | Gx | | 0.279 | 0.299 | 0.319 | | |
| | Gy | | 0.547 | 0.567 | 0.587 | | |
| | Bx | | 0.124 | 0.144 | 0.164 | | |
| | By | | 0.090 | 0.110 | 0.130 | | |
| NTSC | | | | 60% | | | Note 3 |
| Transmittance (with Polarizer) | T(%) | θ = 0° | 4.5 | 5.0 | - | % | |

Note 1: Ambient temperature = 25°C.

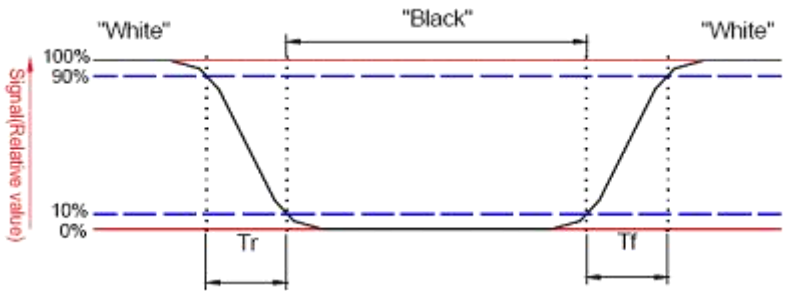
Note 2: To be measured with a viewing cone of 2°by Topcon luminance meter BM-5A.

Note 3: To be measured with Otsuta chromaticity meter LCF-2100M, CF only measure under C light simulation.

Note 4: CTC shipping status is cell without polarizer. Transmittance of Specification is cell with polarizer. The tolerance of Transmittance is ±10%.

Note 5: 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.

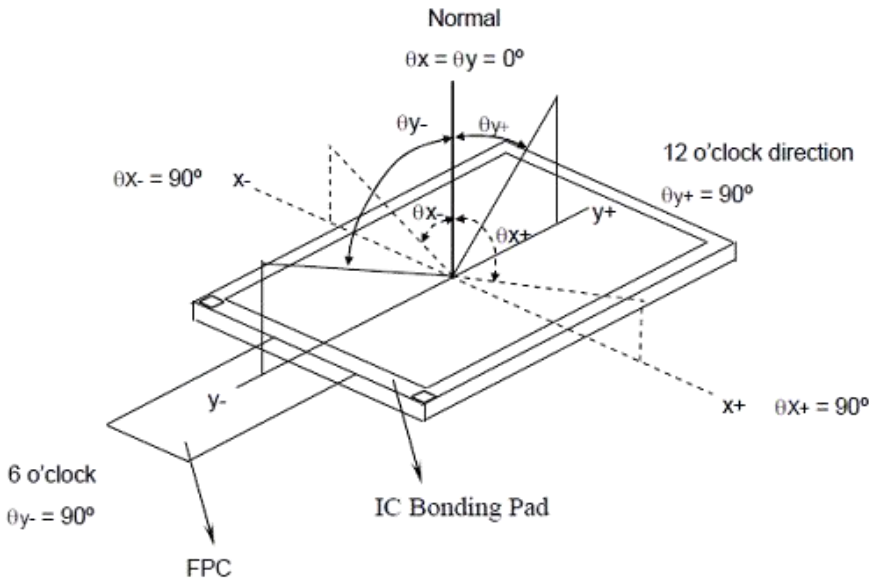



Note 6: Definition of contrast ratio:

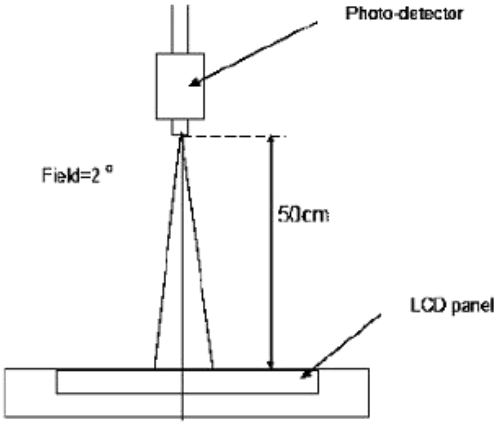
Contrast ratio is calculated by the following formula.

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

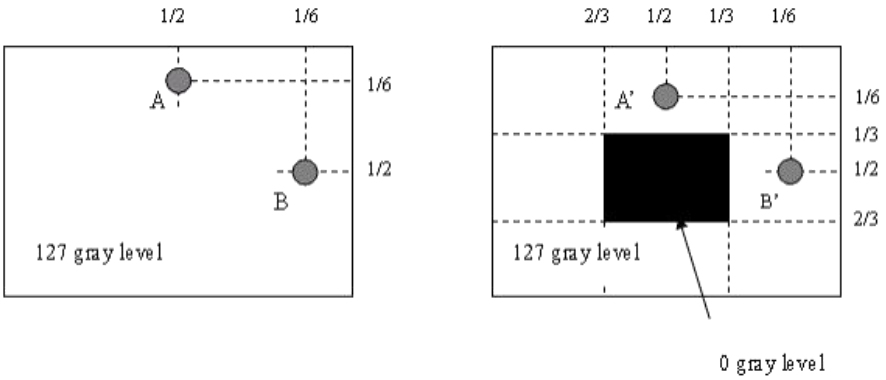
Note 7: Definition of viewing angle




Note 8: Optical characteristic measurement setup.




Note 9:




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

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

# 9 Touch Panel specifications

| ITEM | VALUE | UNIT | REMARK |
|---|---|---|---|

| | Min. | Typ. | Max. | | |
|---|---|---|---|---|---|
| Linearity | - | - | 1.5 | % | Analog X and Y directions |
| Terminal Resistance | 200 | - | 600 | Ω | x |
| | 300 | - | 900 | | y |
| Insulation Resistance | 10 | - | - | MΩ | DC 25V |
| Voltage | - | 3 | 10 | V | DC |
| Chattering | - | - | 15 | ms | 100kΩ pull-up |
| Transparency | 80 | - | - | % | - |
| Operation Force | 60 | - | 100 | g | - |
| Endurance | 1,000,000 | - | - | Touches | 100g Operation Force |
| | - | - | 30,000 | Slides | |
| Surface Hardness | 3 | - | - | H | - |

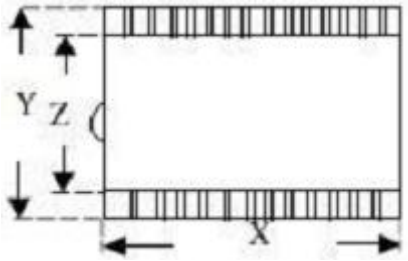
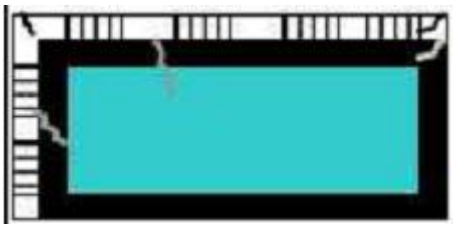
# 10 RELIABILITY TEST

| NO. | TEST ITEM | TEST CONDITION | INSPECTION AFTER TEST |
|---|---|---|---|
| 1 | High Temperature Storage | 80±2°C/96 hours | Inspection after 2~4 hours storage at room temperature and humidity. The condensation is not accepted. The sample shall be free from defects:<br>1. Air bubble in the LCD<br>2. Seal leak<br>3. Non-display<br>4. Missing segments<br>5. Glass crack |
| 2 | Low Temperature Storage | -30±2°C/96 hours | |
| 3 | High Temperature Operating | 70±2°C/96 hours | |
| 4 | Low Temperature Operating | -20±2°C/96 hours | |
| 5 | Temperature Cycle | -30±2°C ~ 25~ 80± 2°C × 10 cycles<br>(30 min.) (5min.) (30min.) | |
| 6 | Damp Proof Test | 60°C ±5°C × 90%RH/96 hours | |
| 7 | Vibration Test | Frequency 10Hz~55Hz<br>Stroke: 1.5mm<br>Sweep: 10Hz~150 Hz~10Hz 2 hours<br>For each direction of X, Y, Z | |
| 8 | Shock Test | Half-sine, wave, 300m/s | |
| 9 | Packing Drop Test | Height: 80 cm<br>1 corner, concrete floor | |
| 10 | Electrostatic Discharge Test | C=150pF, R=330 Ω<br>Air: ±8KV 150pF/330Ω 30 times<br>Contact: ±4KV,20 times | |

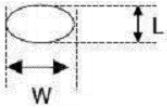
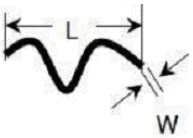
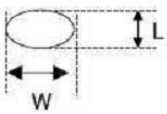
# 11 Inspection standards

## 11.1 Visual inspection criterion in cosmetic

### 11.1.1 Glass defect

| NO. | Defect | Criteria | Remark |
|---|---|---|---|
| 1 | Dimension(Minor) | By engineering diagram |  |
| 2 | Cracks(Major) | Extensive crack [Reject] |  |

### 11.1.2 LCM appearance defect

| NO. | Defect | Criteria | | Remark |
|---|---|---|---|---|
| | | Spec | Permissible Qty | |
| 1 | Round type(Minor) | ϕ≤0.1mm | Disregard | 1. ϕ=(W+L)/2, L:Length,W=Width<br>2.Disregard if out of A.A<br>  |
| | | 0.1mm< ϕ ≤0.2mm | 2 | |
| | | ϕ >0.2mm | 0 | |
| 2 | Line type(Minor) | W ≤0.03mm | Disregard | |
| | | L≤ 3.0mm and 0.03mm<W≤0.05mm | 2 | 1. L:Length,W=Width<br>2.Disregard if out of A.A<br>  |
| | | L≤ 3.0mm and 0.05mm<W≤0.1mm | 1 | |
| | | W>0.10mm or L>3.0mm | 0 | |
| 3 | Polarizer dent(Minor) | ϕ≤0.2mm | Disregard | 1. ϕ=(W+L)/2, L:Length,W=Width<br>2.Disregard if out of A.A<br>  |
| | | 0.2mm< ϕ ≤0.3mm | 2 | |
| | | 0.3mm< ϕ ≤0.5mm | 1 | |
| | | ϕ >0.5mm | 0 | |

### 11.1.3 FPC

| NO. | Defect | Criteria | Remark |
|---|---|---|---|
| 1 | Copper peeling(Minor) | Copper peeling [Reject] | |
| 2 | Damaged | Damaged[Reject] | |

### 11.1.4 Black tape

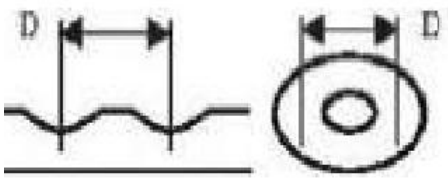
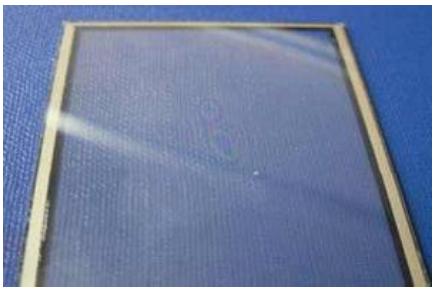
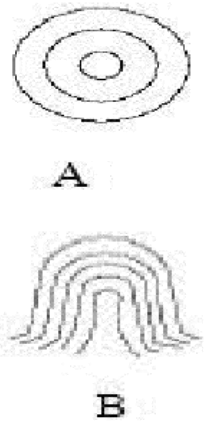
| NO. | Defect | Criteria | Remark |
|---|---|---|---|
| 1 | Shift(Minor) | IC exposed [Reject] | |
| 2 | No black tape(Minor) | No black tape [Reject] | |

### 11.1.5 Silicon

| NO. | Defect | Criteria | Remark |
|---|---|---|---|
| 1 | Amount of silicon (Minor) | ITO exposed [Reject] | |

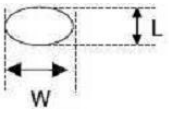
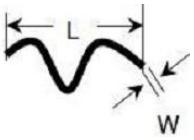
### 11.1.6 Touch Panel

| Defect | Criteria | Remark |
|---|---|---|
| TP shift | Click on the TP, the distance between the show position and click position>1.5mm [Reject] | |

| | | |
|---|---|---|
| TP Circle, Dent Dot, Bubble MI | Size(mm) / Accessible QTY<br>D ≤0.20 / Access<br>0.2＜D≤0.3 / 2<br>0.3＜D≤0.5 / 1<br>D>0.5 / 0 |  |
| TP Ripple MI | 1.(Figure A): Ripple D>5mm [Reject]<br>2.(Figure B): Ripple area<1/7 TP area and not impact fonts display effect [Access]<br>  |  |
| Remark: Tear up the protective film to inspect.<br>The distance of two dirt must>10mm;<br>The white dot found in manufacture is conformity to 0.1mm, if >0.1mm [Reject] | | |

## 11.2 Visual inspection criterion in electrical display

| NO. | Defect | Criteria | | Remark |
|---|---|---|---|---|
| | | Spec. | Permissible Qty | |
| 1 | No display (Major) | Not allowed | | |

| | | | | |
|---|---|---|---|---|
| 2 | Missing line (Major) | Not allowed | | |
| 3 | Darker or lighter Line (Major) | Not allowed | | |
| 4 | Weak line(Major) | By limited sample | | |
| 5 | Bright / Dark point (Minor) | Bright point | 1 | 1:1sub-pixel: 1R or 1G or 1B<br>2:Point defect area 1/2 sub pixel. |
| | | Dark point | 2 | |
| 6 | Round type (Minor) | ϕ ≤0.1mm | Disregard | 1. ϕ=(W+L)/2,<br>L:Length,W=Width<br>2.Disregard if out of A.A<br>  |
| | | 0.1< ϕ ≤0.2 | 3 | |
| | | ϕ >0.2mm | 0 | |
| | Line type (Minor) | W ≤0.03mm | Disregard | 1. L:Length,W=Width<br>2.Disregard if out of A.A<br>  |
| | | L≤ 3.0mm and 0.03mm<W≤0.05mm | 2 | |
| | | L≤ 3.0mm and 0.05mm<W≤0.1mm | 1 | |
| | | W>0.10mm or L>3.0mm | 0 | |
| | Mura (Minor) | By 5% ND filter invisible | | |

## 11.3 Others

1. Issues that are not defined in this document shall be discussed and agreed with both parties. (Customer and supplier)
2. Unless otherwise agreed upon in writing, the criteria shall be applied to both parties. (Customer and supplier)

# 12 Suggestions for using LCD modules

## 12.1 Handling of LCM

1. The LCD screen is made of glass. Don't give excessive external shock, or drop from a high place.
2. If the LCD screen is damaged and the liquid crystal leaks out, do not lick and swallow. When the liquid is attach to your hand, skin, cloth etc, wash it off by using soap and water thoroughly and immediately.
3. Don't apply excessive force on the surface of the LCM.
4. If the surface is contaminated, clean it with soft cloth. If the LCM is severely contaminated, use Isopropyl alcohol/Ethyl alcohol to clean. Other solvents may damage the polarizer. The following solvents is especially prohibited: water , ketone Aromatic solvents etc.
5. Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
6. Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.
7. Don’t disassemble the LCM.
8. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

- Be sure to ground the body when handling the LCD modules.

- Tools required for assembling, such as soldering irons, must be properly grounded.
- To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions.
- The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

9. Do not alter, modify or change the the shape of the tab on the metal frame.
10. Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
11. Do not damage or modify the pattern writing on the printed circuit board.
12. Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector
13. Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
14. Do not drop, bend or twist LCM.

## 12.2 Storage

1. Store in an ambient temperature of 5 to 45 C, and in a relative humidity of 40% to 60%. Don't expose to sunlight or fluorescent light.
2. Storage in a clean environment, free from dust, active gas, and solvent.
3. Store in antistatic container.