



深圳市一众显示科技有限公司

SHEN ZHEN TEAM SOURCE DISPLAYTECH. CO, TD.

TFT-LCD Module Specification

Module NO.: TST024QVSS-11

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 | 2017-12-26 | Initial Release | |
| | | | |

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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) x 320 | pixel |
| LCM (W x H x D) | 42.72(W) x 60.26(H) x 2.3(D) | mm |
| Active Area (W x H) | 36.72 (W) x 48.96(H) | mm |
| Dot Pitch (W x H) | 0.153 (W) x 0.153 (H) | mm |
| Viewing Direction | 6 o'clock | - |
| Gray Scale Inversion Direction | 12 o'clock | - |
| Viewing Angle | Top:30, Bottom:45; Left/ Right:45 | deg. |
| Color Depth | 65K/262K | - |
| Pixel Arrangement | RGB Vertical stripe | - |
| Backlight Type | 4 LEDs, 80mA | - |
| Surface Luminance | 300 | cd/m ² |
| Surface Treatment | Anti-Glare | - |
| Polarizer | 0.17mm, TV | - |
| Driver IC | ST7789V | - |
| Interface Type | 4-Line SPI | - |
| 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

注：标注 请重点确认

Top view dimensions: 60.26 (BL), 56.31 (LCD), 52.51 (LCD/VA), 48.96 (LCD/AA), 42.72 (BU), 40.32 (CU), 36.72 (CU/AA), 3.00, 2.50±0.1, 11.50, 11.81, 14.00, 17.70, 20.10, 21.1" (diagonal), 210(R)×920

Side view: 不包括侧脚厚度 2.50±0.1

Bottom view: 双面胶T=0.05MM, 1.00MM, 16.91, 15.26, 1.80, 1.50, R0.40±0.01

Backlight circuit: 15mA@4, 3.2V DC

Pin List:

| PIN | DESCRIPTION |
|-----|-------------|
| 1 | LED-K |
| 2 | LED-K |
| 3 | LED-K |
| 4 | LED-A |
| 5 | GND |
| 6 | VCC-2.8V |
| 7 | IOWCC-1.8V |
| 8 | GND |
| 9 | CS |
| 10 | RESET |
| 11 | TE |
| 12 | CLK |
| 13 | SDA |
| 14 | A0 |
| 15 | GND |

屏使用3线双通道

Display mode: normal white.
Viewing direction: 6 o'clock
Driver IC: ST7789V
Operating temperature: -20 to 70.
Storage temperature: -30 to 80.
RoHS compliance.

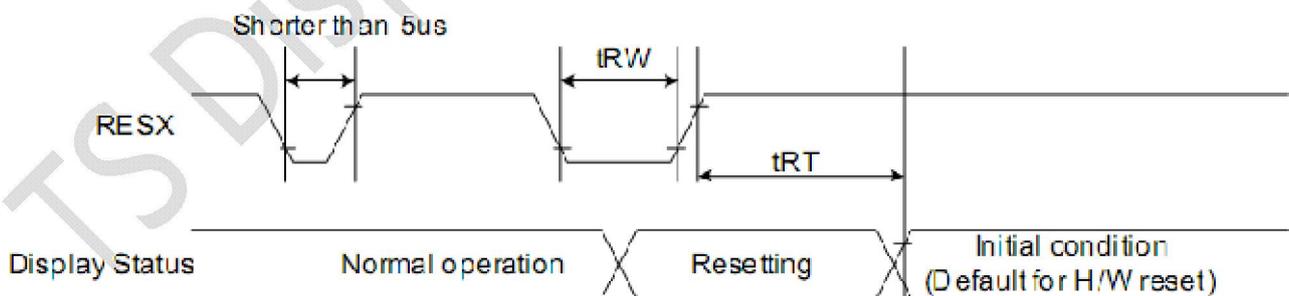
| | | | | |
|----|------|------------|------|---------------|
| VI | 首次发行 | 2017.10.27 | 客户项目 | 2017.10.27 |
| | 变更记录 | | 产品型号 | TST024QVSS-11 |
| | | | 比例 | 1:1 |
| | | | 单位 | MM |
| | | | 公差 | ±0.2 |
| | | | 审核 | |
| | | | 设计 | |

3 Interface description

| PIN NO. | Symbol | description |
|---------|--------|--|
| 1 | LEDK | Backlight K Cathode input pin. |
| 2 | LEDK | Backlight K Cathode input pin. |
| 3 | LEDK | Backlight K Cathode input pin. |
| 4 | LEDA | Backlight A Aothod input pin. |
| 5 | GND | System Ground. (0V) |
| 6 | VCC | Power supply +2.8 |
| 7 | IOVCC | Power supply +2.8V or 1.8V |
| 8 | GND | System Ground. (0V) |
| 9 | CS | Chip select signal. |
| 10 | RESET | Reset input signal |
| 11 | TE | Tearing effect output pin to synchronize MPU to frame writing, |
| 12 | SCL | serial clock input signal |
| 13 | SDA | Serial data input signal |
| 14 | A0 | Data/Command Selection pin |
| 15 | GND | System Ground. (0V) |

4 LCM Interface Timing

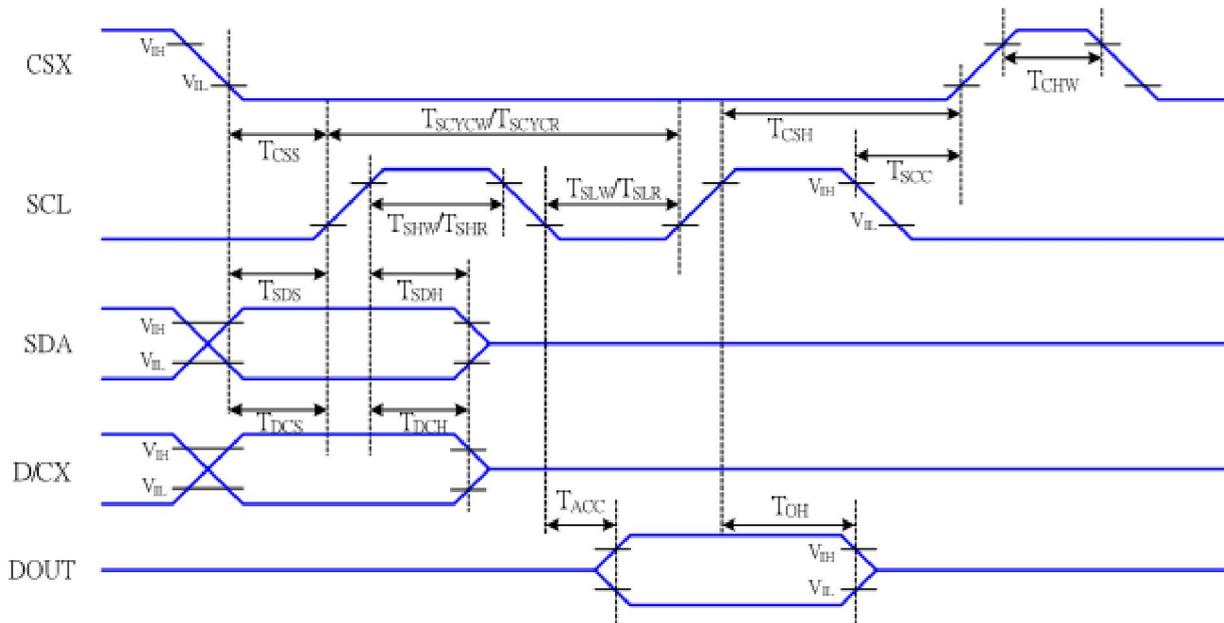
4.1 Reset Timing



| Signal | Symbol | Parameter | Min | Max | Unit |
|--------|--------|-----------------------|-----|-------------|------|
| RESX | tRW | Reset low pulse width | 10 | - | us |
| | tRT | Reset complete time | - | 5 (note 1) | ms |
| | | | - | 120(note 2) | ms |

Note: (1) When reset applied during SLPIN mode;
 (2) When reset applied during SLPOUT mode.

4.2 Serial Interface Characteristics (4-line serial)



IOVCC=1.65 to 3.3V, VCC=2.4 to 3.3V, AGND=DGND=0V, Ta=-30 to 70 °C

| Signal | Symbol | Parameter | MIN | MAX | Unit | Description |
|-----------|-------------------|--------------------------------|-----|-----|------|---------------------------|
| CSX | T _{css} | Chip select setup time (write) | 15 | | ns | |
| | T _{sch} | Chip select hold time (write) | 15 | | ns | |
| | T _{css} | Chip select setup time (read) | 60 | | ns | |
| | T _{scc} | Chip select hold time (read) | 65 | | ns | |
| | T _{chW} | Chip select "H" pulse width | 40 | | ns | |
| SCL | T _{scyW} | Serial clock cycle (Write) | 66 | | ns | -write command & data ram |
| | T _{shW} | SCL "H" pulse width (Write) | 15 | | ns | |
| | T _{slW} | SCL "L" pulse width (Write) | 15 | | ns | |
| | T _{scyR} | Serial clock cycle (Read) | 150 | | ns | -read command & data ram |
| | T _{shR} | SCL "H" pulse width (Read) | 60 | | ns | |
| | T _{slR} | SCL "L" pulse width (Read) | 60 | | ns | |
| D/CX | T _{dcs} | D/CX setup time | 10 | | ns | |
| | T _{dch} | D/CX hold time | 10 | | ns | |
| SDA (DIN) | T _{sdS} | Data setup time | 10 | | ns | |
| | T _{sdH} | Data hold time | 10 | | ns | |
| DOUT | T _{acc} | Access time | 10 | 50 | ns | For maximum CL=30pF |
| | T _{oh} | Output disable time | 15 | 50 | ns | For minimum CL=8pF |

5 Absolute Maximum Ratings

| PARAMETER | SYMBOL | MIN | MAX | UNIT |
|----------------------------|-----------|------|----------------|------|
| Supply Voltage (Analog) | VCC~GND | -0.3 | 4.6 | V |
| Logic signal voltage(I/O) | IOVCC~GND | -0.3 | 4.6 | V |
| Operating Temperature | Top | -20 | 70 | ° C |
| Storage Temperature | Tst | -30 | 80 | ° C |
| Operating Ambient Humidity | Hop | 10 | 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 | - | 3.2 | 3.4 | V |
| Current for LED backlight | I _f | - | 80 | - | mA |
| Power consumption | W _{bl} | - | 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 | $\theta = 0^\circ$ | - | 30 | - | ms | Note 5 |
| Contrast ratio | CR | $\theta = 0^\circ$ | - | 250 | - | | Note 2,6 |
| Viewing angle | Top | $CR \geq 10$ | - | 30 | - | Deg. | Note 2,6,7 |
| | Bottom | $CR \geq 10$ | - | 45 | - | | |
| | Left | $CR \geq 10$ | - | 45 | - | | |
| | Right | $CR \geq 10$ | - | 45 | - | | |
| Color chromaticity (CF only with ITO, light source is C light, CIE 1931) | Wx | $\theta = 0^\circ$ | 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 | | | | |
| Transmittance (with Polarizer) | T(%) | $\theta = 0^\circ$ | - | 5.0 | - | % | |

Note 1: Ambient temperature = 25°C.

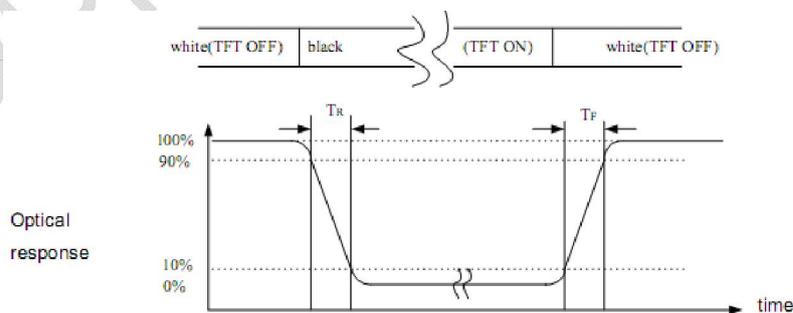
Note 2: To be measured with a viewing cone of 2° by Topcon luminance meter BM-5A.

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

Note 4: this 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.

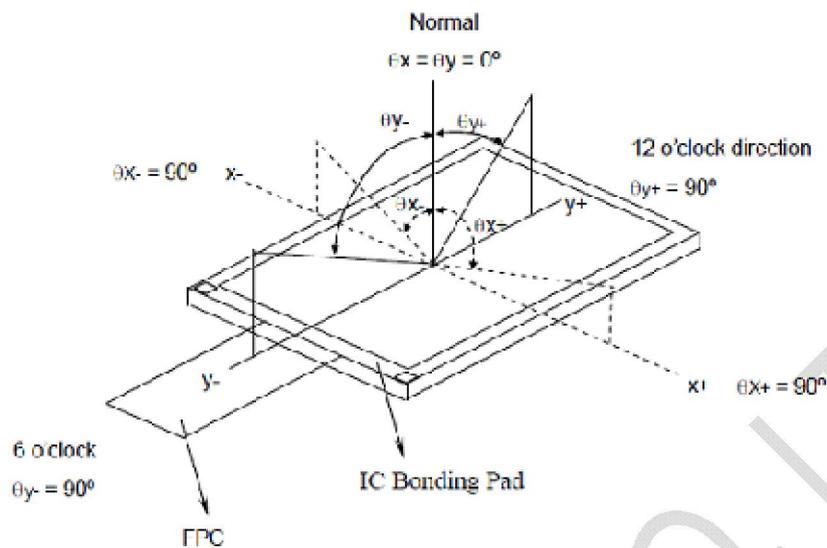


Note 6: Definition of contrast ratio:

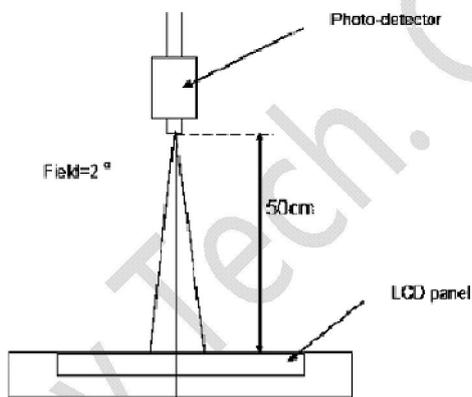
Contrast ratio is calculated by the following formula.

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

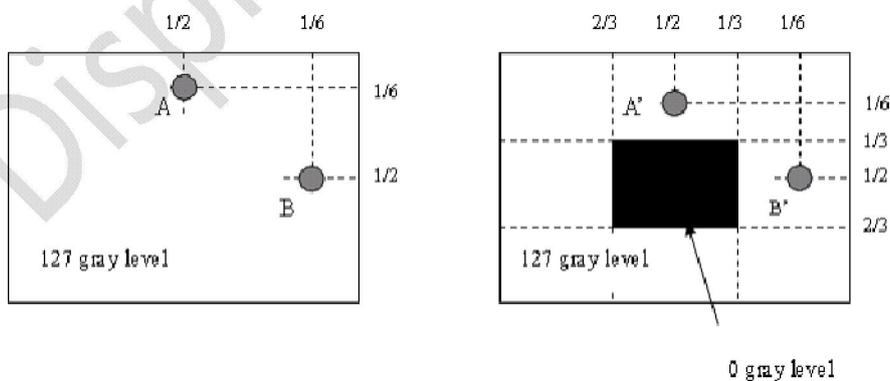
Note 7: Definition of viewing angle



Note 8: Optical characteristic measurement setup.



Note 9:



$1 \frac{LA-LA'}{LA} \times 100\% = 2\% \text{ max.}$, LA and LA' are brightness at location A and A'.

$1 \frac{LB-LB'}{LB} \times 100\% = 2\% \text{ max.}$, LB and LB' are brightness at location B and B'.

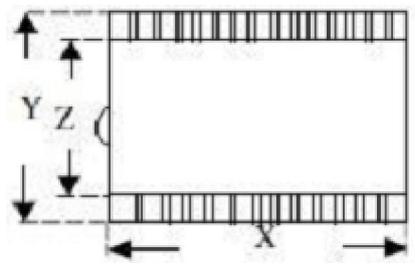
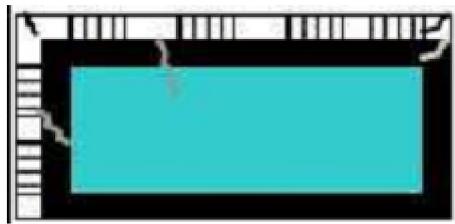
9 RELIABILITY TEST

| 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: 1. Air bubble in the LCD 2. Seal leak 3. Non-display 4. Missing segments 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 (30 min.) (5min.) (30min.) | |
| 6 | Damp Proof Test | 60°C ±5°C × 90%RH/96 hours | |
| 7 | Vibration Test | Frequency 10Hz~55Hz Stroke: 1.5mm Sweep: 10Hz~150 Hz~10Hz 2 hours For each direction of X, Y, Z | |
| 8 | Shock Test | Half-sine, wave, 300m/s | |
| 9 | Packing Drop Test | Height: 80 cm 1 corner, concrete floor | |
| 10 | Electrostatic Discharge Test | C=150pF, R=330 Ω Air: ±8KV 150pF/330Ω 30 times Contact: ±4KV,20 times | |

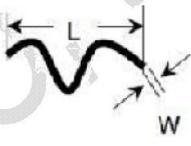
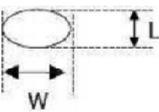
10 Inspection standards

10.1 Visual inspection criterion in cosmetic

10.1.1 Glass defect

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

10.1.2 LCM appearance defect

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

10.1.3 FPC

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

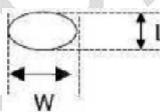
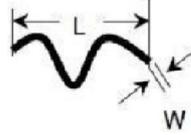
10.1.4 Black tape

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

10.1.5 Silicon

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

10.2 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 | 1:1 sub-pixel: 1R or 1G or 1B 2:Point defect area 1/2 sub pixel. |
| | | Dark point | 2 | |
| 6 | Round type (Minor) | $\phi \leq 0.1\text{mm}$ | Disregard | 1. $\phi = (W+L)/2$, L:Length,W=Width 2.Disregard if out of A.A  |
| | | $0.1 < \phi \leq 0.2$ | 3 | |
| | | $\phi > 0.2\text{mm}$ | 0 | |
| | Line type (Minor) | $W \leq 0.03\text{mm}$ | Disregard | 1. L:Length,W=Width 2.Disregard if out of A.A  |
| | | $L \leq 3.0\text{mm}$ and $0.03\text{mm} < W \leq 0.05\text{mm}$ | 2 | |
| | | $L \leq 3.0\text{mm}$ and $0.05\text{mm} < W \leq 0.1\text{mm}$ | 1 | |
| | | $W > 0.10\text{mm}$ or $L > 3.0\text{mm}$ | 0 | |
| | Mura (Minor) | By 5% ND filter invisible | | |

10.3 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)

11 Suggestions for using LCD modules

11.1 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.

11.2 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.

