

**SPECIFICATION
FOR
LCD Module**

Customer P/N:

Santek P/N: ST0200U4W-RSLW-F

DOC. Revision: RS03

Customer Approval:

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| |
|--|

| | SIGNATURE | DATE |
|--------------------|------------------|-------------------|
| PREPARED BY | Aaron Lu | 2018-11-28 |
| CHECKED BY | Andy Song | 2018-11-29 |
| APPROVED BY | Natty Lee | 2018-Dec-1 |

Document Revision History

| Version | Revise Date | Description | Changed by |
|---------|-------------|---|------------|
| RS01 | 2018-05-30 | First issue | Zhiyi |
| RS02 | 2018-09-06 | Updated the standard of inspection for TFT (Page 20-25) | Zhiyi |
| RS03 | 2018-11-28 | Updated the mechanical drawing(Page6) Correct PIN description(Page5,7,8) | Aaron Lu |

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1. GENERAL SPECIFICATION

1.1.Description

The ST0200U4W-RSLW-F is a color active matrix Thin Film Transistor (TFT) Liquid Crystal Display (LCD) that uses amorphous silicon(a-Si) TFT as a switching device. This model is composed of a single 2.0 inches transmissive type main TFT-LCD panel. The resolution of the panel is 240*320 pixels and can display up to 262K color.

1.2.Feature

- Structure COG+FPC+BL
- Full, Normal (Still), Partial, Sleep, mode are available

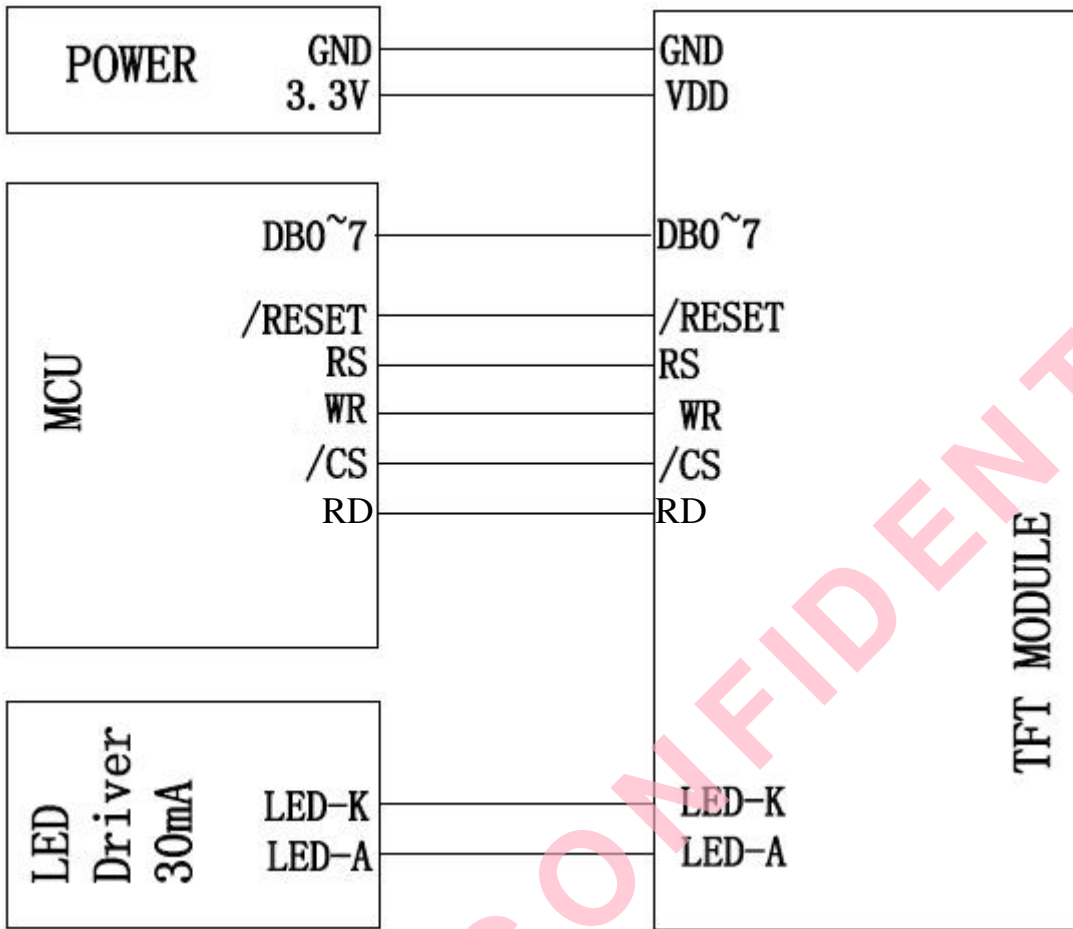
1.3.General Specification

| No. | Item | Specification | Unit | Remark |
|-----|--------------------------|------------------------------|-------|--------|
| 1 | LCD Size | 2.0 | inch | - |
| 2 | Panel Type | a-Si TFT transmissive | - | - |
| 3 | Resolution | 240 x (RGB) x 320 | pixel | - |
| 4 | Display Mode | Normally Black, Transmissive | - | - |
| 5 | Display Number of Colors | 262K | - | - |
| 6 | Viewing Direction | ALL | - | Note |
| 7 | Contrast Ratio | 800(Typ) | - | - |
| 8 | Luminance | 330(MIN) | cd/m2 | - |
| 9 | Module Size | 35.7(W) x 51.2(L) x 2.4(T) | mm | Note |
| 10 | Active Area | 30.6(W) x 40.8(L) | mm | Note |
| 11 | Pixel Pitch | 0.180(W) x 0.180 (L) | mm | - |
| 12 | Weight | TBD(TYP) | g | - |
| 13 | Driver IC | ST7789V | - | - |
| 14 | Driver IC Size | 1515X700X300 | um | - |
| 15 | Light Source | 4 White LEDs | - | - |
| 16 | Interface | 8080 MCU 8bit | - | - |
| 17 | Operating Temperature | -20~70 | °C | - |

Note: Please refer to the mechanical drawing.

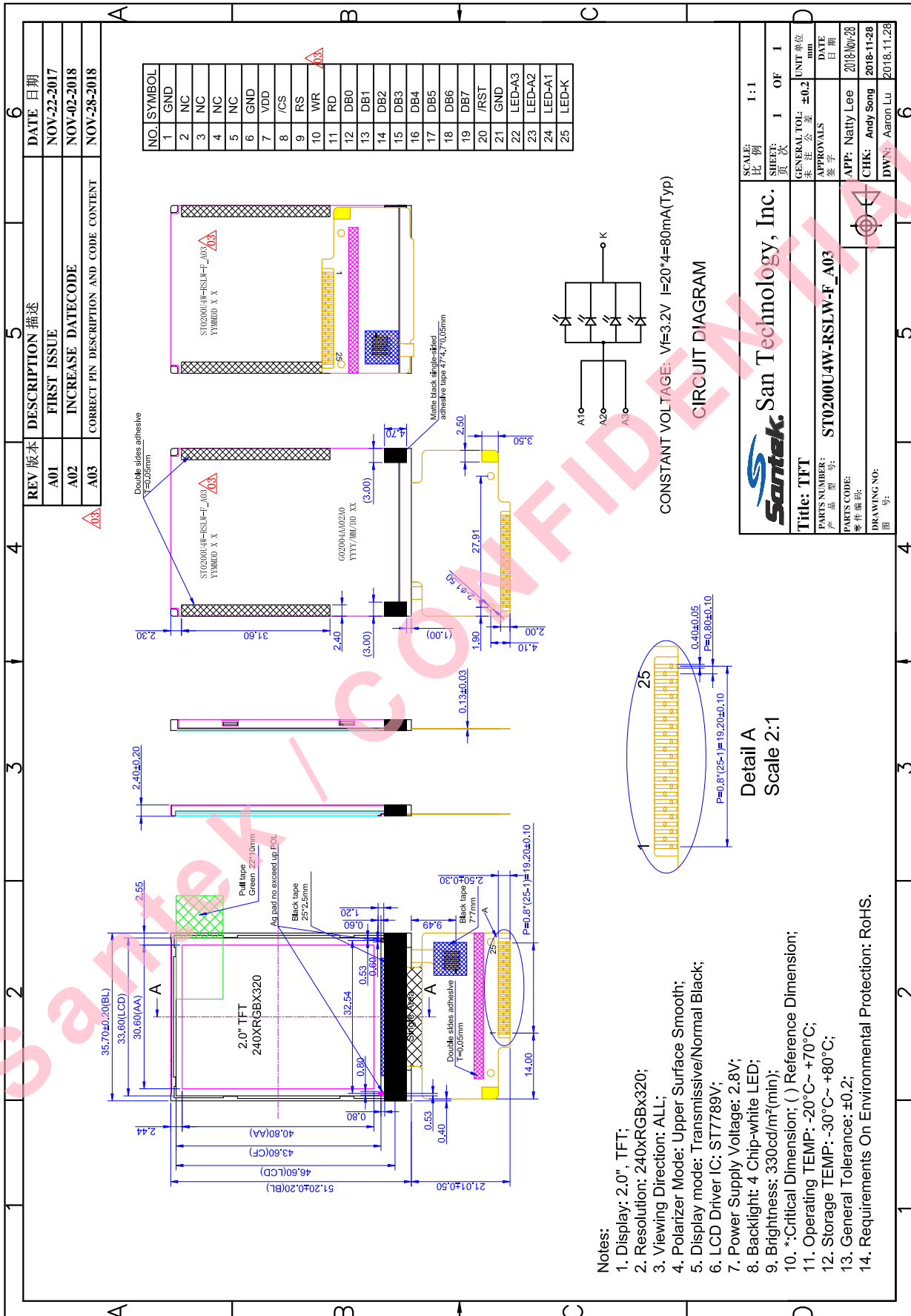
Note 1: The data order is as follows, MSB=D15, LSB=D0 and picture data is MSB=Bit 5.

2. BLOCK DIAGRAM



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3. MECHANICAL DRAWING



| | | | |
|-----|----|--|----|
| REV | 版本 | DESCRIPTION | 描述 |
| A01 | | FIRST ISSUE | |
| A02 | | INCREASE DATECODE | |
| A03 | | CORRECT PIN DESCRIPTION AND CODE CONTENT | |

| | |
|-------------|----|
| DATE | 日期 |
| NOV-22-2017 | |
| NOV-02-2018 | |
| NOV-28-2018 | |

| | | |
|--------------|----|------------|
| SCALE: | 比例 | 1:1 |
| SHEET: | 页次 | 1 OF 1 |
| GENERAL TOL: | 公差 | ±0.2 |
| UNIT: | 单位 | mm |
| APPROVALS: | 签字 | |
| DATE: | 日期 | |
| APP: | 李国 | 2018/11/28 |
| CHK: | 李国 | 2018-11-28 |
| DWN: | 李国 | 2018-11-28 |

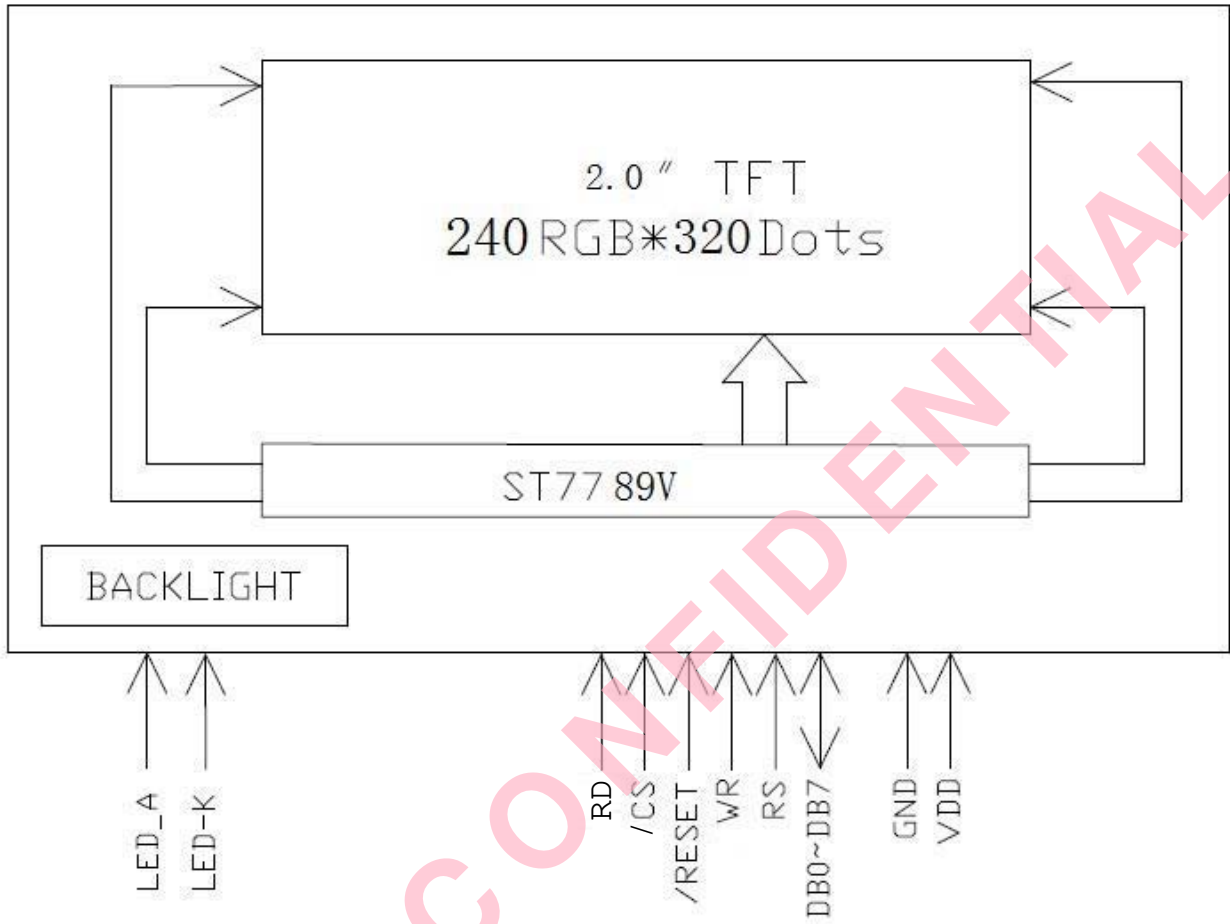
Santek
San Technology, Inc.

Title: TFT
PARTS NUMBER: ST0200U4W-RSLW-F_A03
产品型号:
PARTS CODE:
零件编号:
DRAWING NO:
图号:

4. INTERFACE PIN ASSIGNMENT

| | | |
|----|--------|--|
| 1 | GND | Ground |
| 2 | NC | NC |
| 3 | NC | NC |
| 4 | NC | NC |
| 5 | NC | NC |
| 6 | GND | Ground |
| 7 | VDD | Power supply for system |
| 8 | /CS | Chip selection pin for TFT |
| 9 | RS | TFT display data/command selection pin for TFT |
| 10 | WR | Serves as a write signal and writes data at the rising edge |
| 11 | RD | Serves as a read signal and read data at the rising edge |
| 12 | DB0 | Data bus |
| 13 | DB1 | Data bus |
| 14 | DB2 | Data bus |
| 15 | DB3 | Data bus |
| 16 | DB4 | Data bus |
| 17 | DB5 | Data bus |
| 18 | DB6 | Data bus |
| 19 | DB7 | Data bus |
| 20 | /RST | The external reset input. Initializes the chip with a low input. |
| 21 | GND | Ground |
| 22 | LED-A3 | Anode power supply for backlight (LED+). |
| 23 | LED-A2 | Anode power supply for backlight (LED+). |
| 24 | LED-A1 | Anode power supply for backlight (LED+). |
| 25 | LED-K | Cathode power supply for backlight (LED-). |

5. ELECTRICAL SPECIFICATION FOR TFT
5.1. APPLICATION CIRCUIT



5.2. TFT ABSOLUTE MAXIMUM RATINGS

| ITEM | SYMBOL | CONDITION | STANDARD VALUE | | | UNIT |
|-----------------------------|--------|-----------|----------------|-----|-----|------|
| | | | MIN | TYP | MAX | |
| Power Supply for Analog | VCC | Ta=25 °C | -0.3 | - | 5.5 | V |
| Power Supply for Digital IO | IOVCC | Ta=25 °C | -0.3 | - | 3.5 | V |

Note: Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is applied.

5.3. TFT TYPICAL OPERATION CONDITION

5.3.1 TFT DC Characteristics

| ITEM | SYMBOL | CONDITION | STANDARD VALUE | | | UNIT |
|-----------------------------|-----------------|-------------------------|----------------|-----|----------|------|
| | | | MIN | TYP | MAX | |
| Power Supply for Analog | VDD | Ta=25 °C | 2.5 | 2.8 | 3.5 | V |
| Power Supply for Digital IO | IOVDD | Ta=25 °C | 1.65 | 1.8 | 3.3 | V |
| Input Signal "H" Level | V _{IH} | - | 0.7IOVDD | - | IOVDD | V |
| Input Signal "L" Level | V _{IL} | - | 0 | - | 0.3IOVDD | V |
| Output Signal "H" Level | V _{OH} | I _{OH} =-1.0mA | 0.8IOVDD | - | IOVDD | V |
| Output Signal "L" Level | V _{OL} | I _{OL} =1.0mA | 0 | - | 0.2IOVDD | V |
| Frame Frequency | FRAME | - | 50 | 70 | 80 | Hz |

Note: To prevent IC latch up or DC operation in LCD panel, the power on/off sequence should follow the driver IC specification.

5.3.2 TFT Current Consumption

| Item | Symbol | Values | | Unit | Remark |
|-----------------------|------------------|--------|------|------|--------|
| | | Type | Max. | | |
| MIPI 2-Lane Interface | | | | | |
| Normal(Still) Mode | I _{CC1} | 40 | 60 | mA | Note1 |
| Standby Mode | I _{CC1} | - | 150 | uA | Note2 |

Note1: Test Condition

Typ: IOVCC=VCI=2.85V

Display Pattern: All Pixel White

Frame Rate=60Hz at 2-dot Inversion

Max. current check pattern:

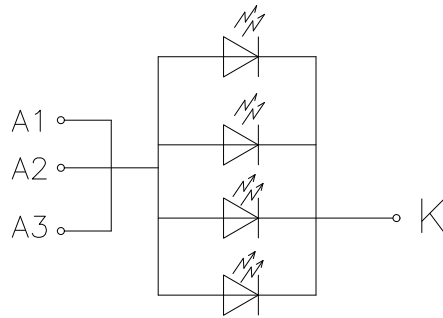


White

Note2: In the standby mode, all the internal display operations are suspended including the internal R-C oscillator.

5.4. BACKLIGHT SPECIFICATION

5.4.1 Backlight Circuit



LED CIRCUIT

CONSTANT VOLTAGE: $V_f = 3.2V$ $I = 20 \times 4 = 80mA$

5.4.2 Electrical Characteristics

(T=25°C)

| PARAMETER | SYMBOL | CONDITION | STANDARD VALUE | | | UNIT |
|-----------------|----------------|----------------------|----------------|-----|-----|------|
| | | | MIN | TYP | MAX | |
| Forward Voltage | V _F | I _F =80mA | 2.8 | 3.2 | 3.5 | v |

| Signal | Symbol | Parameter | Min | Max | Unit | Description |
|----------|-------------|------------------------------------|-----|-----|------|-----------------------------|
| D/CX | T_{AST} | Address setup time | 0 | | ns | |
| | T_{AHT} | Address hold time (Write/Read) | 10 | | ns | |
| CSX | T_{CHW} | Chip select "H" pulse width | 0 | | ns | |
| | T_{CS} | Chip select setup time (Write) | 15 | | ns | |
| | T_{RCS} | Chip select setup time (Read ID) | 45 | | ns | |
| | T_{RCSFM} | Chip select setup time (Read FM) | 355 | | ns | |
| | T_{CSF} | Chip select wait time (Write/Read) | 10 | | ns | |
| | T_{CSH} | Chip select hold time | 10 | | ns | |
| WRX | T_{WC} | Write cycle | 66 | | ns | |
| | T_{WRH} | Control pulse "H" duration | 15 | | ns | |
| | T_{WRL} | Control pulse "L" duration | 15 | | ns | |
| RDX (ID) | T_{RC} | Read cycle (ID) | 160 | | ns | When read ID data |
| | T_{RDH} | Control pulse "H" duration (ID) | 90 | | ns | |
| | T_{RDL} | Control pulse "L" duration (ID) | 45 | | ns | |
| RDX (FM) | T_{RCFM} | Read cycle (FM) | 450 | | ns | When read from frame memory |
| | T_{RDHFM} | Control pulse "H" duration (FM) | 90 | | ns | |
| | T_{RDLFM} | Control pulse "L" duration (FM) | 355 | | ns | |
| D[17:0] | T_{DST} | Data setup time | 10 | | ns | For CL=30pF |
| | T_{DHT} | Data hold time | 10 | | ns | |
| | T_{RAT} | Read access time (ID) | | 40 | ns | |
| | T_{RATFM} | Read access time (FM) | | 340 | ns | |
| | T_{ODH} | Output disable time | 20 | 80 | ns | |

Fig 5.5.2 8080 Parallel Interface Characteristics

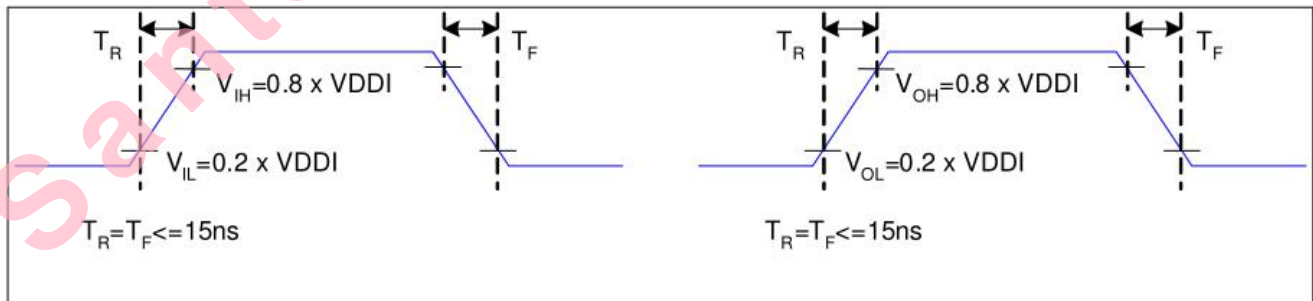
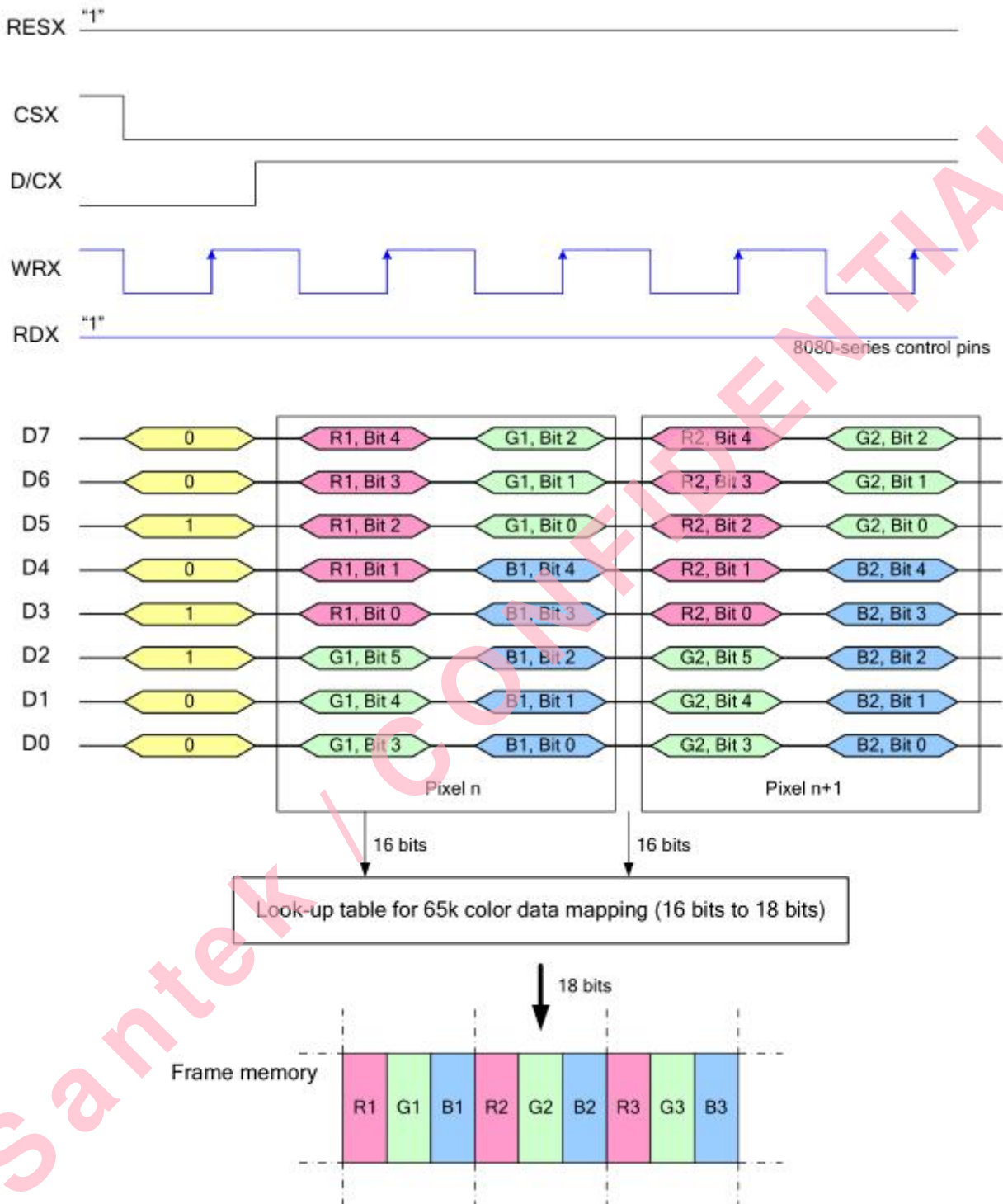


Fig 5.5.3 Rising and Falling Timing for I/O Signal

Note: The rising time and falling time (T_r , T_f) of input signal and fall time are specified at 15 ns or less. Logic high and low levels are specified as 20% and 80% of VDDI for Input signals.

5.5.4 8080-Series 8-Bit Parallel Interface

8-bit data bus for 16-bit/pixel(RGB 5-6-5-bit input), 65K-Colors,3Ah="05h"

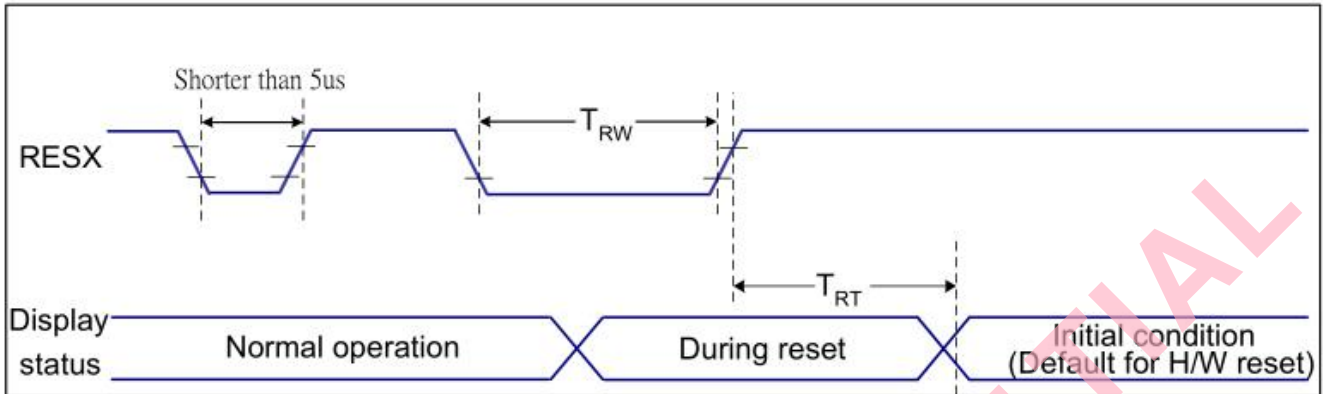


Note 1: The data order is as follows, MSB=D15, LSB=D0 and picture data is MSB=Bit 5, LSB=Bit 0 for Green, and MSB=Bit 4, LSB=Bit 0 for Red and Blue data.

Note 2: 2-times transfer is used to transmit 1 pixel data with the 16-bit color depth information.

Note 3: '-' = Don't care – Can be set to '0' or '1'

5.6. TFT RESET TIMING CHARACTERISTICS



Reset Timing

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=-30 ~ 70 °C

| Related Pins | 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 |

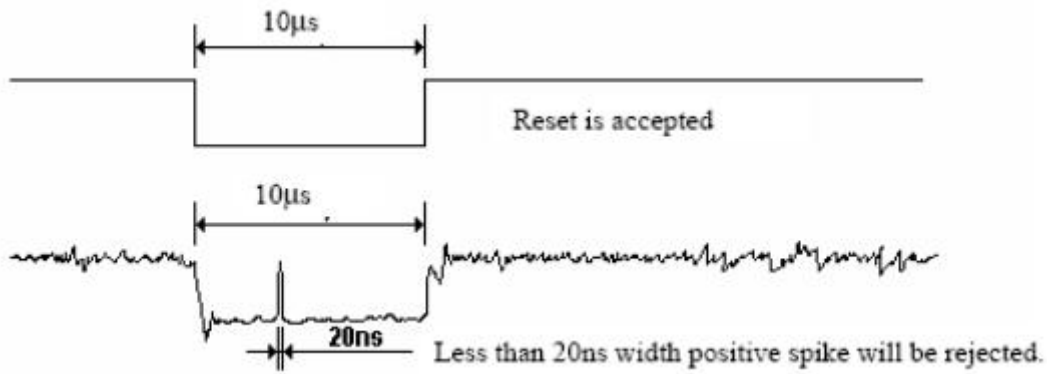
Table Reset Timing

Notes:

- The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.
- Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below:

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

- During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In –mode.) and then return to Default condition for Hardware Reset.
- Spike Rejection also applies during a valid reset pulse as shown below:



- 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 RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

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6.OPTICAL CHARACTERISTICS

(T_a=+25°C, VCI=+2.85V IOVCC=+1.8V, I_B=20mA)

| Item | Symbol | Condition | Values | | | Unit | Remark | |
|------------------------------|-----------------------------------|----------------|---------------|-------|-------|-------------------|------------------|--------|
| | | | Min. | Typ. | Max. | | | |
| Viewing Angle Range | Left | θ _L | CR ≥ 10 | - | 80 | - | degree | Note 1 |
| | Right | θ _R | | - | 80 | - | | |
| | Top | Φ _T | | - | 80 | - | | |
| | Bottom | Φ _B | | - | 80 | - | | |
| Response Time | T _{on} +T _{off} | Normal θ=φ=0° | - | 30 | - | ms | Note 2 | |
| Contrast Ratio | CR | Normal θ=φ=0° | 640 | 800 | - | - | Note 3 | |
| Luminance | L | Normal θ=φ=0° | 330 | 450 | -- | cd/m ² | Note 4 | |
| Color Chromaticity (CIE1931) | White | X | Normal θ=φ=0° | -0.03 | 0.296 | +0.03 | - | Note 5 |
| | | Y | | | 0.310 | | | |
| | Red | X | | | 0.620 | | | |
| | | Y | | | 0.350 | | | |
| | Green | X | | | 0.320 | | | |
| | | Y | | | 0.590 | | | |
| | Blue | X | | | 0.140 | | | |
| | | Y | | | 0.070 | | | |
| Transmittance | Trans | | - | 4.5% | | - | Note7 Normal POL | |

Judgement criterion:

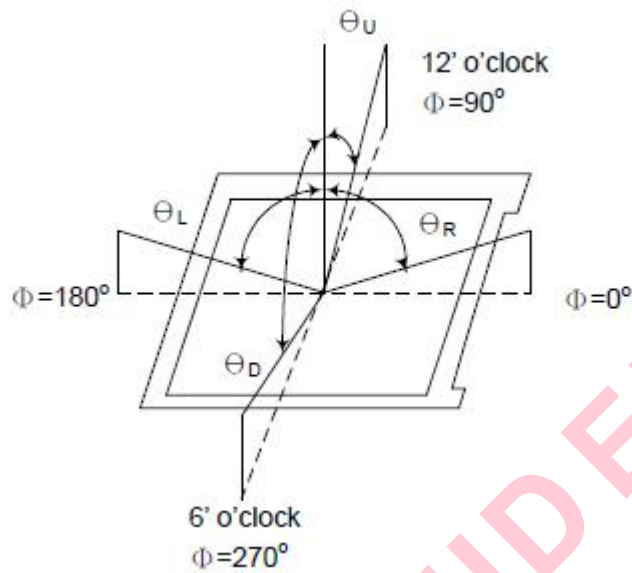
$$\Delta c_{白}' = \sqrt{(\Delta u')^2 + (\Delta v'/1.5)^2} = \sqrt{(u'_{白} - u'_{白0})^2 + [(v'_{白} - v'_{白0})/1.5]^2}$$

, the "u'_{白0}" and "v'_{白0}" is the type value in the Figure 1.

the error of the Red、Green and Blue must be controlled as follow

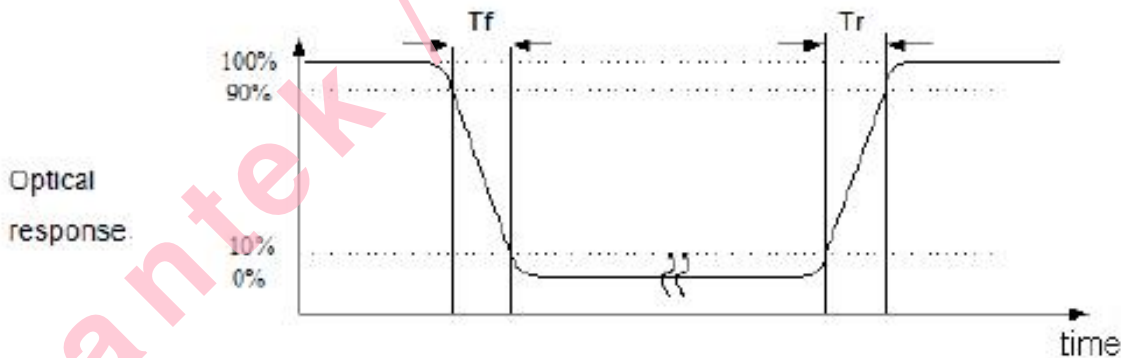
$$\Delta c_{白}' \leq 0.0115, \Delta c_{红}' \leq 0.0230, \Delta c_{绿}' \leq 0.0230, \Delta c_{蓝}' \leq 0.0230。$$

Note 1: Definition of viewing angle range



Note 2: 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 3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

Note 4: Definition of luminance

Measured at the center area of the panel when LCD panel is driven at “white” state.

Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at the center point of LCD when panel is driven at “White”, “Red”, “Green” and “Blue” state respectively.

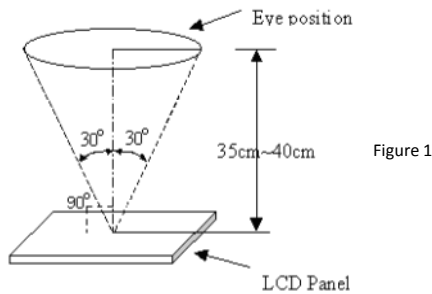
Note 7 : CDY shipping status is cell without polarizer. Transmittance of specification is cell with polarizer.

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7.THE STANDARD OF INSPECTION FOR TFT

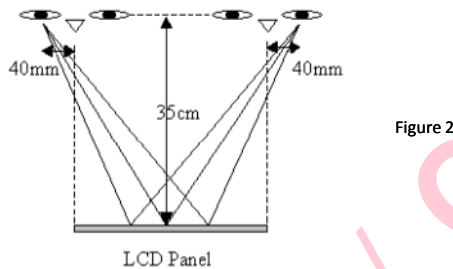
7.1 INSPECTION CONDITIONS IS AS FOLLOWS:

- (1) Viewing distance is approximately 30~ 40 cm
- (2) Viewing angle is normal to the LCD panel as Figure 1(30°)
- (3) Ambient temperature is approximately $25 \pm 5^{\circ}\text{C}$
- (4) Ambient humidity is $60 \pm 5\% \text{ RH}$
- (5) Ambient luminance is about 700 ~ 1000 Lux under 40W daylight lamp.
- (6) Input signal timing should be typical value.
- (7) Mura & Light leakage inspection at ND-Filter 5%



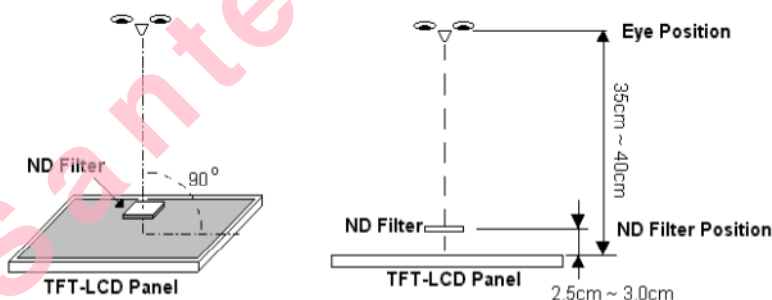
Note 1: Special condition

- (1) Viewing distance is close for inspection of adjacent dots and distance between defect dots.
- (2) Viewing condition of "Shot block non-uniformity from oblique angle" is as Figure 2.
- (3) Exceptional case: View angle $\pm 40^{\circ}$ while inspected image-sticking.

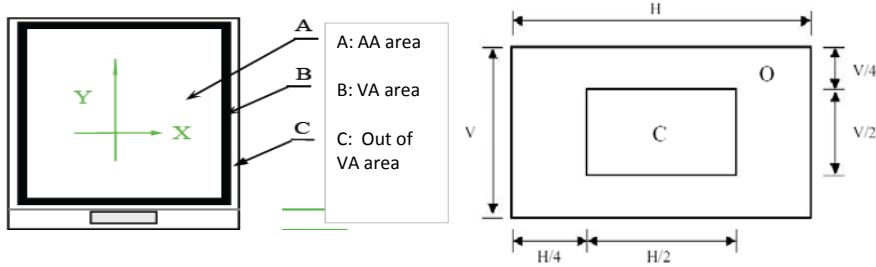


Note 2: The definition of bright dot

- (1)The defective area of the dot is larger than 50% of one sub-pixel area.
- (2)The bright dot shall be visible under ND-Filter 5% as following.

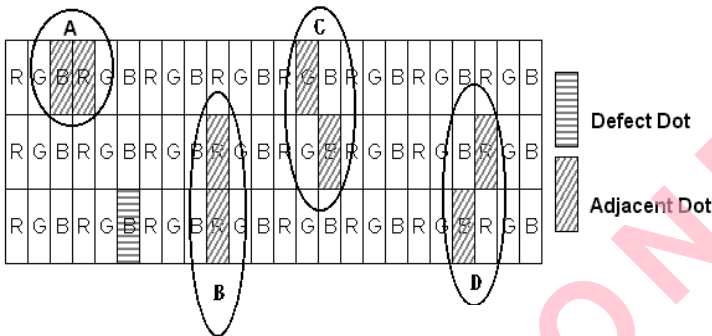


Note 3: Definition of AA, VA and Out of VA



Note 4: Judgment for defect and adjacent dots in display:

Judge defect dot and adjacent dot as following. Allow below (as A, B, C and D status) adjacent defect dots, including bright and dart adjacent dot. And they will be counted 2 defect dots in total quantity.



Note 5: Other condition

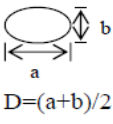
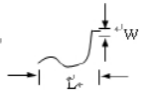
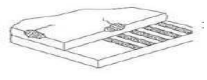
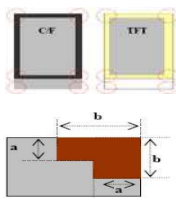



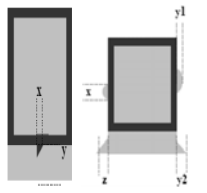
- (1) The defects that are not defined above and considered to be problem shall be reviewed and discussed by both parties.
- (2) Defects on the Black Matrix, out of Display area, are not considered as a defect or counted.

7.2 SAMPLING PLAN/ALLOWED STANDARD IN INSPECTION:

MIL-STD-105E, SAMPLING PLAN: LEVEL II:

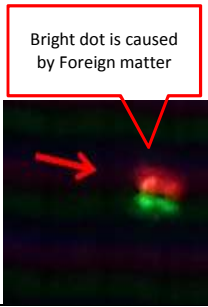
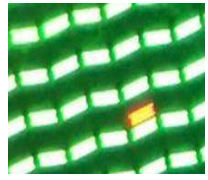

- AQL 0.65 ----- Display inspection
- AQL 1.0 ----- Appearance inspection

7.3 APPEARANCE INSPECTION:

| No. | Defect items | Photos | Tools | Standards | | | Judge | Remark |
|-----|---|---|--------------------------|---|----------------------------|--------------------------|-------|--|
| | | | | Dimension(mm) | AA/VA area | Out of VA | | |
| 1 | Foreign matter/ Black/White/Brigh t Spot/ Polarizer Dent/Polarizer Bubbles |  <p>$D=(a+b)/2$</p> | Film gauge | $D \leq 0.15$ | Ignore (Not gathered) | Ignore (Not gathered) | OK | D=diameter L=length W=width T=thickness |
| | | | | $0.15 \leq D \leq 0.25$ | $N \leq 2$ | | OK | |
| | | | | $0.25 \leq D \leq 0.3$ Distance ≥ 20 | $N \leq 1$ | | OK | |
| | | | | $D > 0.3$ | Not accepted | | NG | |
| 2 | Foreign matter/ Black/White/Brigh t Line Polarizer Scratches |  | Film gauge | $W \leq 0.05$ | Ignore (Not gathered) | Ignore | OK | |
| | | | | $0.05 \leq W \leq 0.1$ $L \leq 2$ | $N \leq 3$ | | OK | |
| | | | | $W > 0.1$ | Follow spec of dot defects | | NG | |
| 3 | Class crack |  | Naked eyes | Any extended crack is not accepted | | | NG | |
| 4 | Corner chipping |  | Naked eyes Film gauge | $a \leq 2\text{mm}, b \leq 4\text{mm}, t < T$ $a \leq 1\text{mm}, b \leq 2\text{mm}, t = T$ | | | OK | |
| 5 | Corner chipping at class |  | Naked eyes Film gauge | $a < 1\text{mm}$ ignore W, $t < T$ $1 \leq a \leq 2\text{mm}$ or $w \leq 4\text{mm}$, $t < T$ $a \leq 1\text{mm}$ or $w \leq 4\text{mm}$, $t = T$ | | | OK | |
| 6 | Chipping on contacting pads |  | Naked eyes Film gauge | $a \leq 1\text{mm}$ ignore W, $t \leq T$ (On the contact pin) $a \leq 1\text{mm}$ $w \leq 4\text{mm}$, $t = T$ (Outside of the contact pin) | | | OK | Basically, it mustn't affect the function of product |
| 7 | Chipping on rear side of glass |  | Naked eyes Film gauge | $a < 1\text{mm}$ ignore W, $t < T$ $1 \leq a \leq 2\text{mm}$ or $w \leq 4\text{mm}$, $t < T$ $a \leq 1\text{mm}$ or $w \leq 4\text{mm}$, $t = T$ | | | OK | |
| 8 | Cutting residue out of glass edge |  | Naked eyes Film gauge | If it doesn't affect assembly or operation, follow the spec below: X ignore, $Y2 \leq 0.5\text{mm}$, $Y2 + Z \leq 0.5$ | | | OK | |
| 9 | Stain on surface | | Naked eyes | Stain that is removable by soft cloth or air blow is acceptable, it doesn't affect production characteristic | | | OK | |

| No. | Defect items | Photos | Tools | Standards | | | Judge | Remark |
|-----|--|--------|---|---|------------|-----------|-------|--------|
| | | | | Dimension(mm) | AA/VA area | Out of VA | | |
| 10 | Any dirt or scratch or bubbles or any defects on protective film | | Naked eyes | Ignore if it doesn't affect the product | | | OK | |
| 11 | FPC | | Naked eyes | The folding trace is visible but it doesn't affect circuit connection | | | OK | |
| | | | | Not allowed to have oxidation, copper exposed and scratches with copper exposed at golden finger | | | NG | |
| | | | | There is scratch visibly but no copper exposed | | | OK | |
| | | | | Any scratches or testing trace on gold fingers, if they don't affect the function, they are acceptable | | | OK | |
| | | | | Dirty on the gold fingers | | | NG | |
| 12 | Color / Printing color Front view side | | Naked eyes, Color meter, Pantone standard | a. Control with color meter, Spec of $\Delta E \leq 3$; b. If the area is smaller than 10mm ² , cannot use color meter, we use naked eyes and judge color under light box. | | | OK | |
| 13 | B/L Metal frame | | Naked eyes | Surface scratches doesn't expose base material, just ignore | | | OK | |
| | | | | Deformation and affect the assembly | | | NG | |
| | | | | Clips are loose and affect assembly | | | NG | |

7.4 DISPLAY INSPECTION:

| No. | Defect items | Photos | Tools | Standards | | | Judge | Remark | |
|-----|--|--|-------------------------------|--|-------------------------------|--------------------------|-------|--|----|
| | | | | Dimension(mm) | AA/VA area | Out of VA | | | |
| 1 | Circular defects Foreign matter/ black dots/ bubbles and etc |  | Naked eyes | $D \leq 0.15$ | Ignore (Not gathered) | Ignore (Not gathered) | OK | Use microscope to identify the defects if necessary 1 pixel = 3 sub-pixel, RGB, 1 sub- pixel is called 1 dot. | |
| | | | | $0.15 \leq D \leq 0.25$ | $N \leq 2$ | | OK | | |
| | | | | $0.25 \leq D \leq 0.3$ Distance ≥ 20 | $N \leq 1$ | | OK | | |
| | | | | $D > 0.3$ | Not accepted | | NG | | |
| 2 | Pixel spot bright dot |  | Naked eyes | $D \leq 1/2$ dot | Ignore | distance \geq | OK | | |
| | | | | $D > 1/2$ dot | $N \leq 2$ | | 2dots | | OK |
| | | | | | $N \leq 1$ | | 3dots | | OK |
| | | | | | $N \leq 0$ | | | | OK |
| 3 | Pixel spot dark dots |  | Naked eyes | $D \leq 1/2$ dot | Ignore | distance \geq | OK | | |
| | | | | $D > 1/2$ dot | $N \leq 2$ | | 2dots | | OK |
| | | | | | $N \leq 0$ | | 3dots | OK | |
| | | | | | $N \leq 0$ | | | OK | |
| 4 | Linear defects Black/White Line/ fibers | | Naked eyes Film gauge | $W \leq 0.05$ | Ignore (Not gathered) | Ignore | OK | | |
| | | | | $0.05 \leq W \leq 0.1$ $L \leq 2$ | $N \leq 3$ | | OK | | |
| | | | | $W > 0.1$ | Follow spec of dot defects | | NG | | |
| 5 | MURA white/black spot and other visible vague defects | | Naked eyes 5% ND filter | Mura is invisible with 5% ND filter | | | OK | | |
| | | | | Visible with 5% ND filter | | | NG | | |
| 6 | Uneven color when display in grey/black or TFT off conditions | | Naked eyes 5% ND filter | This situation is always happening at VA edge, it only happens in Grey/Black or TFT off conditions, if it is invisible in RGB or other color photos, OK. otherwise, NG | | | OK | | |
| 7 | Light leakage from Backlight | | Naked eyes | Viewing from topside view (0 degree), Light leakage happens out of VA area, or invisible | | | OK | | |
| | | | | Viewing from topside view (0 degree), Light leakage happens inside VA area | | | NG | | |
| 8 | Abnormal color | | Naked eyes | Not accepted | | | NG | | |
| 9 | No display | | Naked eyes / Under 40W | Not accepted | | | NG | | |
| 10 | Irregular display | | | Not accepted | | | NG | | |
| 11 | Missing line | | | Not accepted | | | NG | | |
| 12 | Short circuit | | | Not accepted | | | NG | | |
| 13 | Flicker | | | Not accepted | | | NG | | |
| | | | | Not accepted | | | NG | | |

7.5 MECHANICAL:

- (1) Don't disassemble and reassemble the module by self.
- (2) Acid, alkali, alcohol or touched directly by hand will damage the display.
- (3) Static electricity will damage the module. Please configure grounding device.
- (4) The strong vibration, shock, twist or bend will cause material damage, even module broken.
- (5) It is easy to cause image sticking while displaying the same pattern for very long time.
- (6) The response time, brightness and performance will vary from different temperature.
- (7) LCD Devices are made of fragile material such as Glass and may be broken or cracked if dropped it, so please handle them with care. Please be careful not to cut your hand if you break the glass.
- (8) Do not stack the LCDs to avoid the LCDs damage and contamination.
- (9) Before using the LCDs, please check the specification.
- (10) LCDs contain a small amount of Liquid Crystal. Please follow local ordinances or regulations for disposal.
- (11) LCD shall be stored in same packing material during import, and under the condition of room temperature (20-30 degree C).
- (12) Please do not leave LCD modules under the direct sunlight or strong infra-red radiation for a long period time to prevent liquid crystal deteriorating.
- (13) Please turn off the power supply before plugging or unplugging LCD module.
- (14) Please do not rub, push, or hit LCD surface with hard tool etc. Film on surface is easily scratched, when droplets of water or dirt are on the surface, please gently remove them with soft fabric.
- (15) Handling of main and LED FPC (Flexible Printed Circuit), please be careful, do not strongly pull or scratch FPC, to avoid failure of the components and bonding part.

8. RELIABILITY TESTS

| ITEM | CONDITION | CRITERION |
|----------------------------|--|---|
| Operating Temperature Test | High Temperature: +70 °C, 96 hrs | No defects in display and operational functions |
| | Low Temperature: -20 °C, 96 hrs | |
| Storage Temperature Test | High Temperature: +80 °C, 96 hrs | No defects in display and operational functions |
| | Low Temperature: -30 °C, 96 hrs | |
| Humidity Endurance Test | 60°C, 90%RH, 96 hrs | No defects in display and operational functions |
| Thermal Shock Test | -20 °C (30mins) ~ +70 °C (30mins) 10 cycles | No defects in display and operational functions |
| Electro Static Discharge | ± 4KV, Human Body Mode, 150pF/330Ω; ± 8KV, Air Mode, 150pF/330Ω | No defects in display and operational functions |

NOTE:

- 1) The samples must be free from defect before test, must be restored at room condition at least for 2 hours after reliability test before any inspection.
- 2) Before test the function of TP, the sample must be placed in room temperature for 24hrs after RA test.

9. PRECAUTIONS

9.1. HANDLING

- 10.1.1. Polarizer Cleaning, Petroleum ether (or N-hexane) is recommended for cleaning the front/rear polarizers and reflectors, acetone, toluene and ethanol are not allowed to avoid damaging the surface.
- 10.1.2. Body grounding, must wear Anti-ESD wrist strap while pick up LCDs.
- 10.1.3. FPC Soldering, less than 300°C/3S, solder must be grounding on grounding bench.
- 10.1.4. If use electric Screwdriver to do assembly, screwdriver must be grounding.

9.2. STORAGE

- 11.2.1. Keep in a sealed polyethylene bag.
- 11.2.2. Keep in a dark place.
- 11.2.3. Keep in temperature between 0°C and 35°C.
Not allowed at 70°C for more than 160 Hours, or at -20°C for more than 48 Hrs.

9.3. SAFETY

If liquid crystal leak out of a damaged glass cell, Do not put it in your mouth or touch eyes, if the liquid crystal touch your skin or clothes, please wash it off immediately using soap and water.

10. LIMITED WARRANTY

Unless otherwise agreed between Superview and customer, Superview will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with Superview LCD acceptance standards (copies available upon request) for a period of one year from date of shipments. Cosmetic/visual defects over specs must be returned to Superview within 30 days of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of Superview limited to repair and/or replacement on the terms set forth above. Superview shall not be responsible for any subsequent or consequential events.

10.1. RETURNING LCM UNDER WARRANTY – TERMS AND CONDITIONS

10.1.1. No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are :

- Broken LCD glass.
- Circuit modified in any way, including addition of components.

10.1.2. Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB's eyelet, conductors and terminals.