

**MODEL NO. : TM070RVHG01**

**ISSUED DATE: 2013-12-11**

**VERSION : Ver 1.3**

- Preliminary Specification
- Final Product Specification

**Customer :**

| Approved by | Notes |
|-------------|-------|
|             |       |

**TIANMA Confirmed :**

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This technical specification is subjected to change without notice.

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# 1 General Specifications

TM070RVHG01 is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver IC with CABC function, FPC, a back light unit and CTP (Capacitive Touch Panel) with Multi-Touch function. The mounting method is with optical bonding . This product accords with RoHS environmental criterion.

| Item                           | Feature                         | Spec                      | Unit                 | Note |
|--------------------------------|---------------------------------|---------------------------|----------------------|------|
| TFT                            | Size                            | 7                         | inch                 | --   |
|                                | Resolution                      | 800(RGB) x 480            | --                   | --   |
|                                | Interface                       | RGB 24 bits               | --                   | --   |
|                                | Color Depth                     | 16.7M                     | --                   | --   |
|                                | Technology Type                 | a-Si                      | --                   | --   |
|                                | Pixel Pitch                     | 0.1926x0.179              | mm                   | --   |
|                                | Pixel Configuration             | R.G.B. Vertical Stripe    | --                   | --   |
|                                | Display Mode                    | TM with Normally White    | --                   | --   |
|                                | Surface Treatment(Up Polarizer) | Anti-Glare(3H)            | --                   | --   |
|                                | Viewing Direction               | 12 o'clock                | --                   | 1    |
|                                | Gray Scale Inversion Direction  | 6 o'clock                 | --                   | --   |
|                                | LCM (W x H x D)                 | 164.90x100x5.7            | mm                   | --   |
|                                | TP                              | Operation Technology      | Projected capacitive | --   |
| Control IC                     |                                 | SSD2543                   | --                   | --   |
| Input Method                   |                                 | Bare finger               | --                   | --   |
| Number of simultaneous touches |                                 | 2 points                  | --                   | --   |
| Surface hardness               |                                 | --                        | --                   | --   |
| Minimum Touch Area             |                                 | Φ6                        | mm                   | --   |
| Finger Pitch                   |                                 | 13                        | mm                   | --   |
| Product structure              |                                 | Glass Lens – Glass Sensor | --                   | 2    |
| Interface                      |                                 | I2C                       |                      |      |
| Mechanical Characteristics     | TFT Active Area                 | 154.08x85.92              | mm                   | --   |
|                                | TP Active Area                  | 157.00(W) x 92.80(H)      | mm                   | --   |
|                                | LED Numbers                     | 24 LEDs                   | --                   | --   |
|                                | Weight                          | --                        | g                    | --   |

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|                                    |                       |        |    |    |
|------------------------------------|-----------------------|--------|----|----|
| <b>Reliability Characteristics</b> | Operation temperature | -20~70 | °C | -- |
|                                    | Storage temperature   | -30~80 | °C | -- |

Note 1: Viewing direction for best image quality is different from Gray Scale Inversion Direction, there is a 180 degree shift.

Note 2: Requirements on Environmental Protection: RoHS

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## 2. Input/Output Terminals

### 2.1 TFT CN1 pin assignment

Connector type: FH28-60S-0.5SH

| PIN | Symbol | I/O | Description  | Remark |
|-----|--------|-----|--|--------|
| 1   | VLED+  | P   | Led anode  |        |
| 2   | VLED+  | P   | Led anode  |        |
| 3   | VLED-  | P   | Led cathode  |        |
| 4   | VLED-  | P   | Led cathode  |        |
| 5   | GND    | P   | Ground   |        |
| 6   | VCOM   | P   | Common voltage input   |        |
| 7   | VCC    | P   | Digital power supply   |        |
| 8   | MODE   | I   | DE/SYNC mode select. H:DE mode, L:SYNC mode                                  |        |
| 9   | DE     | I   | Data enable signal, active high to enable data, if not used, please pull low |        |
| 10  | VSYNC  | I   | Vertical sync input, negative polarity, if not used, please pull High        |        |
| 11  | HSYNC  | I   | Horizontal sync input, negative polarity, if not used, please pull High      |        |
| 12  | B7     | I   | Blue data (MSB)  |        |
| 13  | B6     | I   | Blue data  |        |
| 14  | B5     | I   | Blue data  |        |
| 15  | B4     | I   | Blue data  |        |
| 16  | B3     | I   | Blue data  |        |
| 17  | B2     | I   | Blue data  |        |
| 18  | B1     | I   | Blue data  |        |
| 19  | B0     | I   | Blue data (LSB)  |        |
| 20  | G7     | I   | Green data (MSB)   |        |
| 21  | G6     | I   | Green data   |        |
| 22  | G5     | I   | Green data   |        |
| 23  | G4     | I   | Green data   |        |
| 24  | G3     | I   | Green data   |        |
| 25  | G2     | I   | Green data   |        |
| 26  | G1     | I   | Green data   |        |
| 27  | G0     | I   | Green data (LSB)   |        |
| 28  | R7     | I   | Red data (MSB)   |        |
| 29  | R6     | I   | Red data   |        |
| 30  | R5     | I   | Red data   |        |
| 31  | R4     | I   | Red data   |        |
| 32  | R3     | I   | Red data   |        |
| 33  | R2     | I   | Red data   |        |
| 34  | R1     | I   | Red data   |        |
| 35  | R0     | I   | Red data (LSB)   |        |
| 36  | GND    | P   | Ground   |        |
| 37  | DCLK   | I   | Clock for input data   |        |
| 38  | GND    | P   | Ground   |        |
| 39  | LR     | I   | Source left or right sequence control  |        |

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|    |       |    |  |  |
|----|-------|----|--|--|
| 40 | UD    | I  | Gate up or down scan control                                 |  |
| 41 | VGH   | P  | Positive power of TFT  |  |
| 42 | VGL   | P  | Negative power of TFT  |  |
| 43 | AVDD  | P  | Analog power supply  |  |
| 44 | RESET | I  | Global reset pin   |  |
| 45 | NC    | NC |  |  |
| 46 | VCOM  | P  | Common voltage input   |  |
| 47 | DITHB | I  | Dithering setting.<br>H: 6bit resolution, L: 8bit resolution |  |
| 48 | GND   | P  | Ground   |  |
| 49 | NC    | NC |  |  |
| 50 | NC    | NC |  |  |

Note1: I/O definition.

I---Input, O---Output, P--- Power/Ground, N--- No connection

Note2:

| Scan control input |     | Scanning direction        |
|--------------------|-----|---------------------------|
| UD                 | LR  |                           |
| GND                | VCC | Up to down, left to right |
| VCC                | GND | Down to up, right to left |
| GND                | GND | Up to down, right to left |
| VCC                | VCC | Down to up, left to right |

## 2.2 TP pin assignment Connector type: FH19S-10S-0.5SH

| Pin No. | Symbol | I/O | Description                      | Remark |
|---------|--------|-----|----------------------------------|--------|
| 1       | SCL    | I   | I2C clock input                  |        |
| 2       | SDA    | I/O | I2C data input and output        |        |
| 3       | GND    | P   | Ground                           |        |
| 4       | GND    | P   | Ground                           |        |
| 5       | ATTN   | I/O | External interrupt to the host   |        |
| 6       | GND    | P   | Ground                           |        |
| 7       | VPP    | I/O | External interrupt from the host |        |
| 8       | VDD    | P   | CTP power supply                 |        |
| 9       | GND    | P   | Ground                           |        |
| 10      | GND    | P   | Ground                           |        |

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### 3. Absolute Maximum Ratings

 $T_a = 25^{\circ}\text{C}$ 

| Item                      | Symbol           | Min   | Max   | Unit | Remark |
|---------------------------|------------------|-------|-------|------|--------|
| Power Voltage             | VDD              | -0.50 | 5.00  | V    |        |
|                           | AVDD             | -0.50 | 15.00 | V    |        |
|                           | VGH              | -0.30 | 42.00 | V    |        |
|                           | VGL              | -20.0 | 0.30  | V    |        |
|                           | VGH-VGL          | -0.30 | 40.00 | V    |        |
| Backlight Forward Current | I <sub>LED</sub> | -     | 200   | mA   |        |
| Operating Temperature     | TOPR             | -20   | 70    | °C   | Note2  |
| Storage Temperature       | TSTG             | -30   | 80    | °C   |        |

**Table 3.1 absolute maximum rating**

Note1: The parameter is for driver IC (gate driver, source driver) only

Note2: 80°C is the surface temperature of module

### 4 Electrical Characteristics

#### 4.1 .1 Driving TFT LCD Panel

 $T_a = 25^{\circ}\text{C}$ 

| Item                            | Symbol     | Min             | Typ     | Max   | Unit    | Remark |  |
|---------------------------------|------------|-----------------|---------|-------|---------|--------|--|
| Voltage for logic circuit       | VCC        | 3.00            | 3.30    | 3.60  | V       |        |  |
| Analog Supply Voltage           | AVDD       | 9.88            | 10.4    | 10.92 | V       |        |  |
| Gate On Voltage                 | VGG        | 14.4            | 16      | 17.6  | V       |        |  |
| Gate Off Voltage                | VEE        | -7.70           | -7.00   | -6.30 | V       |        |  |
| Common Electrode Driving Signal | VCOM       | 3.68            | 3.70    | 3.72  | V       |        |  |
| Input Signal Voltage            | Low Level  | V <sub>IL</sub> | 0       | -     | 0.3xVCC | V      |  |
|                                 | High Level | V <sub>IH</sub> | 0.7xVCC | -     | VCC     | V      |  |

**Table 4.1 LCD module electrical characteristics**

Note1: For different LCM, the value may have a bit of difference.

Note2: To test the current dissipation, use "all Black Pattern".

#### 4.1.2 TFT Driving Backlight

| Item                        | Symbol           | Condition             | Min    | Typ  | Max  | Unit | Remark |
|-----------------------------|------------------|-----------------------|--------|------|------|------|--------|
| Forward Voltage             | V <sub>LED</sub> | I <sub>F</sub> =160mA | --     | 9.6  | 10.8 | V    |        |
| Forward Current             | I <sub>F</sub>   | -                     | -      | 160  | 200  | mA   | Note 1 |
| Backlight Power Consumption | W <sub>BL</sub>  | I <sub>F</sub> =160mA | --     | 1536 | 2160 | mW   |        |
| Life Time                   | -                | I <sub>F</sub> =160mA | 10,000 | -    | -    | Hrs  | Note 3 |

**Table 4.2 LED backlight characteristics**

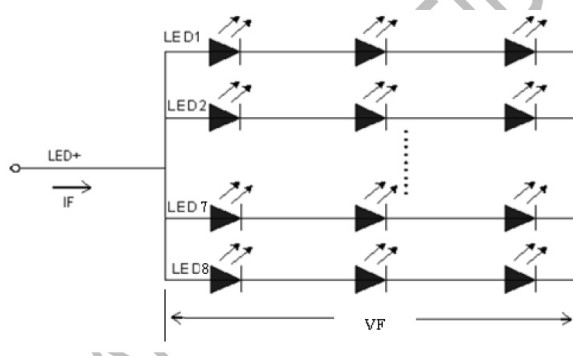
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Note 1:  $I_F$  is defined for one channel LED. There are total three LED channels in back light unit. Under LCM operating, the stable forward current should be inputted.

Note 2: Optical performance should be evaluated at  $T_a=25^\circ\text{C}$  only.

Note 3: If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.



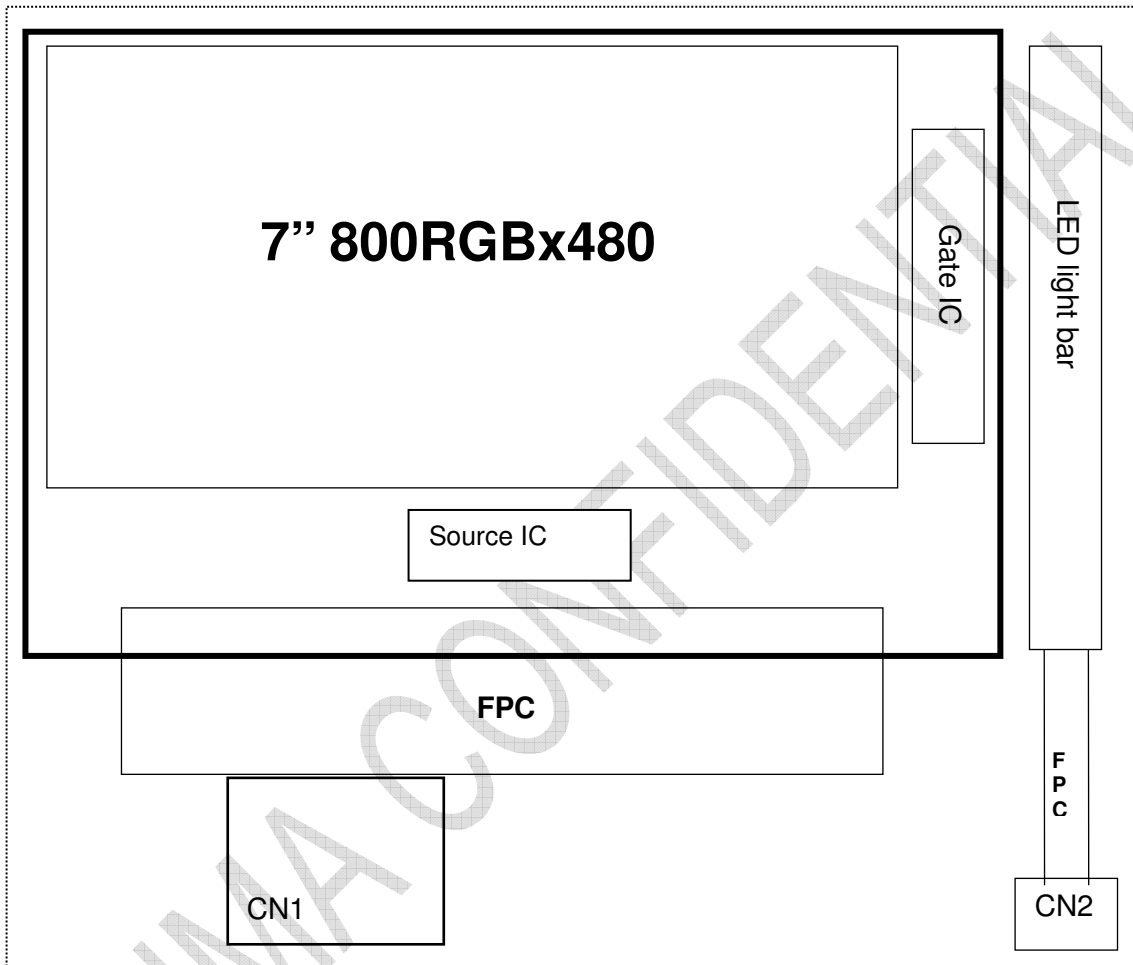
**Figure 4.2 LED connection of backlight**

**4.2 TP DC Characteristics**

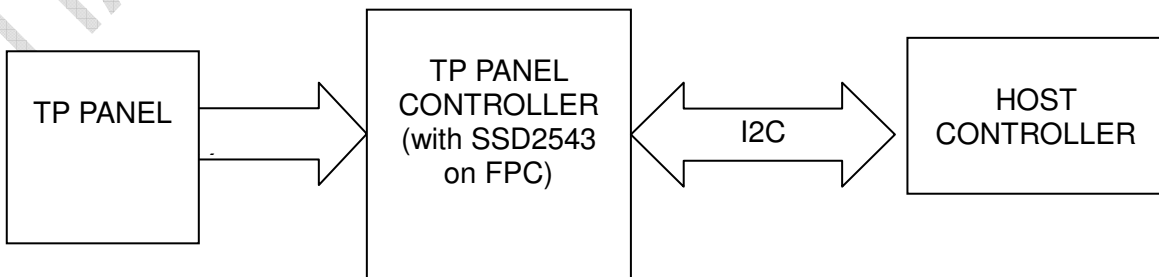
( $T_A= 25^\circ\text{C}$ ,  $V_{DD}=3.3\text{V}$ )

| Item                 | Min | Typ | Max | Unit | Note                            |
|----------------------|-----|-----|-----|------|---------------------------------|
| power supply voltage | 2.7 | 3.3 | 3.6 | V    | DC(noise should be under 100mV) |
| Power supply current | --  | --  | 10  | mA   |                                 |

**4.3.1 TFT Block Diagram**



**4.3.2 TP Circuit Block Diagram**



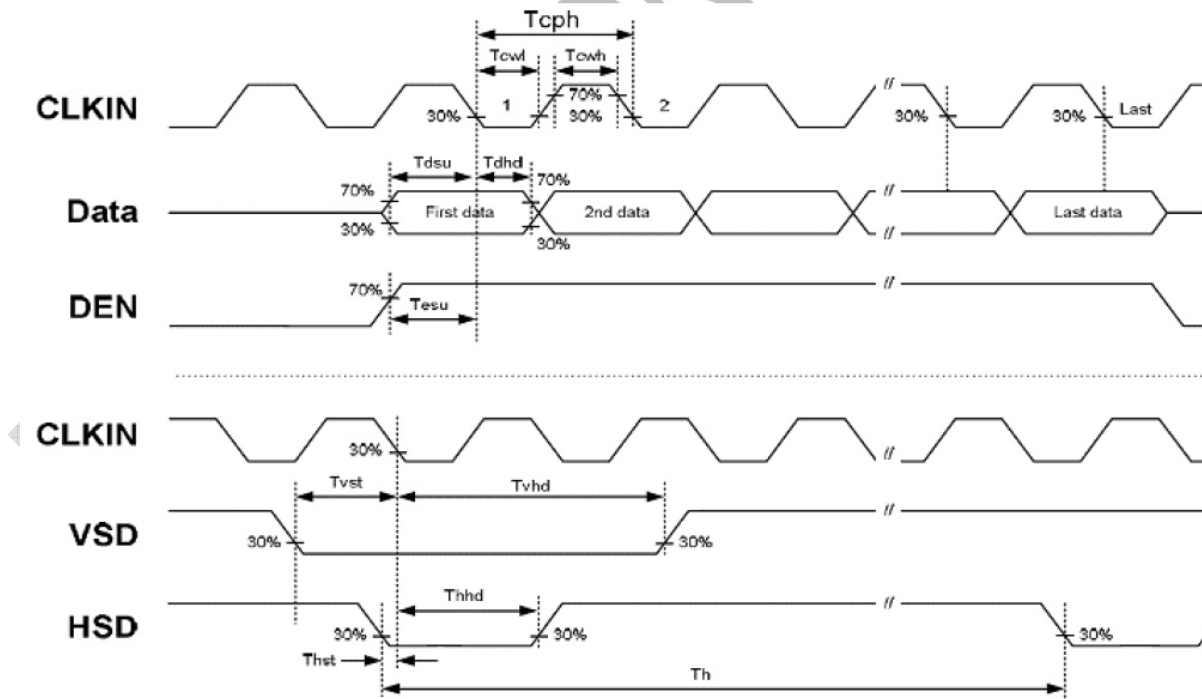
## 5. Timing Chart

### 5.1 TFT-LCD Input Timing

VCC=3.3V, GND=0V, Ta=25°C

| Parameter        | Symbol           | Min | Typ  | Max  | Unit             | Remark       |
|------------------|------------------|-----|------|------|------------------|--------------|
| DCLK frequency   | F <sub>clk</sub> | 28  | 30.0 | 40.0 | MHz              |              |
| DCLK cycle time  | T <sub>cph</sub> | 25  | 33.3 | 36   | ns               |              |
| DCLK pulse width | T <sub>cw</sub>  | 40% | 50%  | 60%  | T <sub>cph</sub> |              |
| VS setup time    | T <sub>vst</sub> | 8   |      |      | ns               |              |
| VS hold time     | T <sub>vhd</sub> | 8   | -    | -    | ns               |              |
| HS setup time    | T <sub>hst</sub> | 8   |      |      | ns               |              |
| HS hold time     | T <sub>hhd</sub> | 8   | -    | -    | ns               |              |
| Data setup time  | T <sub>dsu</sub> | 8   |      |      | ns               | Data to DCLK |
| Data hold time   | T <sub>dhd</sub> | 8   | -    | -    | ns               | Data to DCLK |
| DE setup time    | T <sub>esu</sub> | 8   | -    | -    | ns               |              |
| DE hold time     | T <sub>ehd</sub> | 8   | -    | -    | ns               |              |

Input Clock and Data timing Diagram:



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**5.2 Recommended Timing Setting Of TCON**

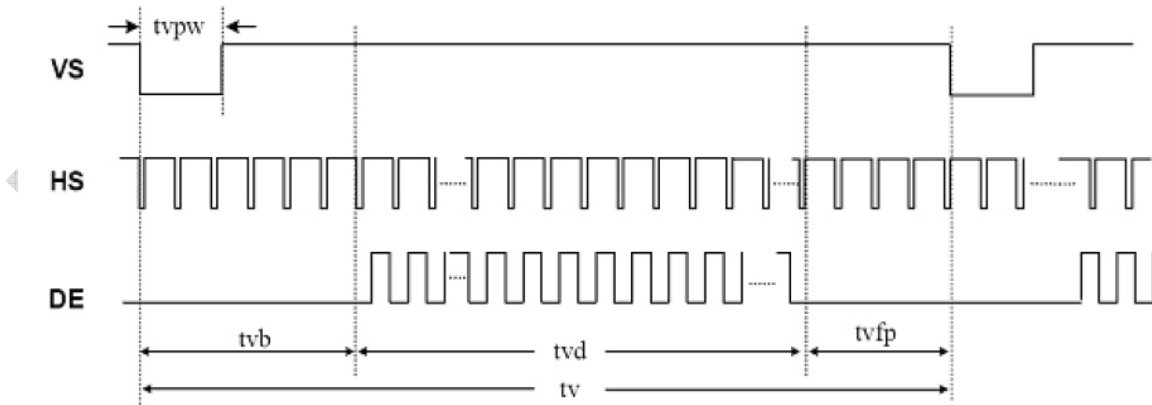
**TCON (Embedded In Source IC) Input Timing (DCLK, HS, VS, DE)**

VCC=3.3V, GND=0V, Ta=25°C

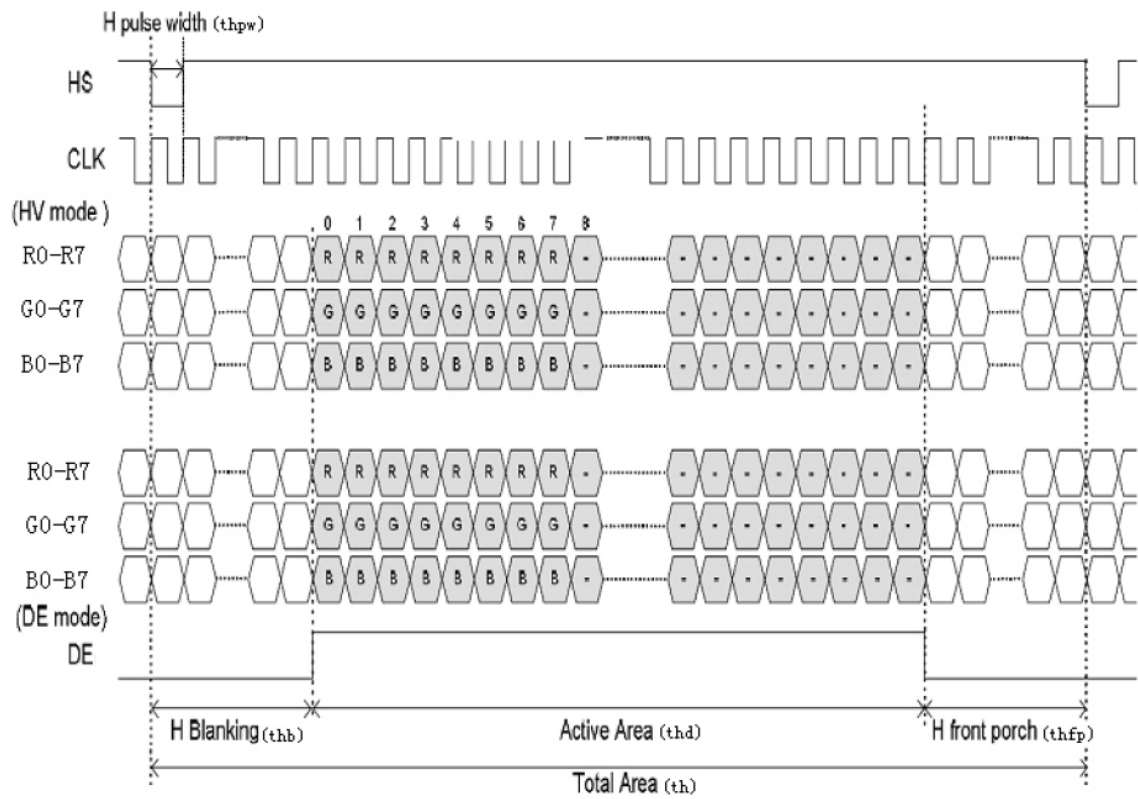
| Parameter | Symbol | Min | Typ  | Max  | Unit | Remark |
|-----------|--------|-----|------|------|------|--------|
| DCLK      | Fclk   | 28  | 30   | 40   | MHZ  |        |
|           | tclk   | 20  | 33.3 | 36   | ns   |        |
| HSD       | th     | 862 | 1056 | 1200 | tclk |        |
|           | thd    | 800 | 800  | 800  | tclk |        |
|           | thpw   | 1   | -    | 40   | tclk |        |
|           | thb    | 46  | 46   | 46   | tclk |        |
|           | thfp   | 16  | 210  | 354  | tclk |        |
| VSD       | tv     | 510 | 525  | 650  | th   |        |
|           | tvd    | 480 | 480  | 480  | th   |        |
|           | tvpw   | 1   | 3    | 20   | th   |        |
|           | tvb    | 23  | 23   | 23   | th   |        |
|           | tvfp   | 7   | 22   | 147  | th   |        |

Note 1: DE timing refer to HS, VS input timing.

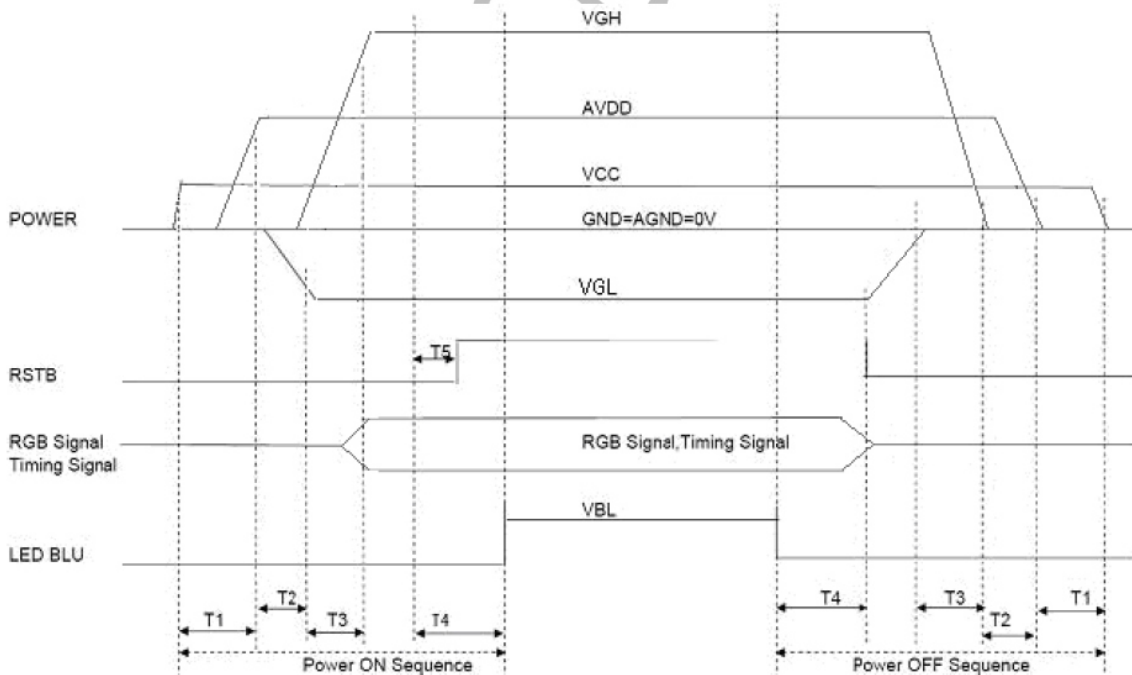
**TCON Vertical Input Timing Diagram HV**



TCON Horizontal Input Timing Diagram



5.3 POWER ON/OFF SEQUENCE



Note 1:  $T_1 \geq 20ms$ ,  $T_2 \geq 20ms$ ,  $T_3 \geq 5ms$ ,  $T_4 \geq 100ms$ ,  $T_5 \geq 5ms$ .

**.6. Optical Characteristics**  
**6.1 TFT Optical Characteristics**

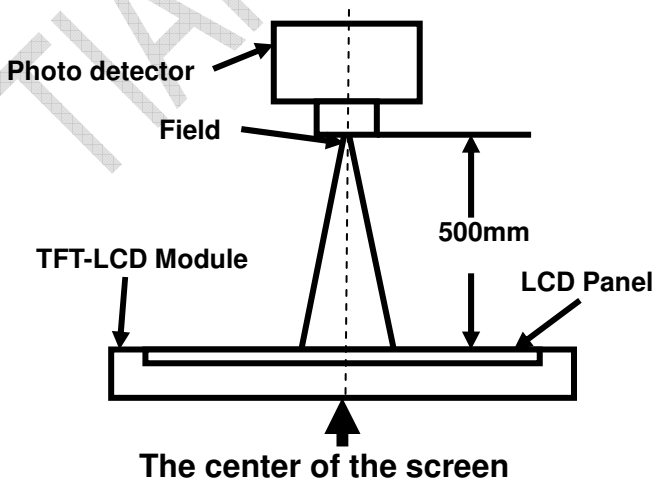
| Item           | Symbol     | Condition        | Min | Typ   | Max   | Unit              | Remark                                       |
|----------------|------------|------------------|-----|-------|-------|-------------------|--|
| View Angles    | $\theta T$ | $CR \geq 10$     | 55  | 60    | --    | Degree            | Note 2                                       |
|                | $\theta B$ |                  | 65  | 70    | --    |                   |  |
|                | $\theta L$ |                  | 65  | 70    | --    |                   |  |
|                | $\theta R$ |                  | 65  | 70    | --    |                   |  |
| Contrast Ratio | CR         | $\theta=0^\circ$ | 400 | 500   | --    |                   | Left/right $0^\circ$<br>Top/bottom $5^\circ$ |
| Response Time  | $T_{ON}$   | $25^\circ C$     | --  | 20    | 30    | ms                | Note1<br>Note4                               |
|                | $T_{OFF}$  |                  |     |       |       |                   |  |
| Chromaticity   | White      | Backlight is on  | x   | 0.265 | 0.315 | 0.365             | Note5<br>Note1                               |
|                |            |                  | y   | 0.280 | 0.330 | 0.380             |  |
|                | Red        |                  | x   | 0.541 | 0.591 | 0.641             |  |
|                |            |                  | y   | 0.300 | 0.350 | 0.390             |  |
|                | Green      |                  | x   | 0.298 | 0.348 | 0.388             |  |
|                |            |                  | y   | 0.521 | 0.571 | 0.621             |  |
|                | Blue       |                  | x   | 0.101 | 0.151 | 0.211             |  |
|                |            |                  | y   | 0.051 | 0.101 | 0.151             |  |
| Uniformity     | U          |                  | --  | 75    | --    | %                 | Note1、 Note6                                 |
| NTSC           |            |                  | --  | 50    | --    | %                 |  |
| Luminance      | L          |                  | 240 | 300   | --    | cd/m <sup>2</sup> | Note7  |

Test Conditions:

- $I_F = 20mA$ (one channel), the ambient temperature is  $25^\circ C$ .
- The test systems refer to Note 1 and Note 2.

Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 10 Minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.

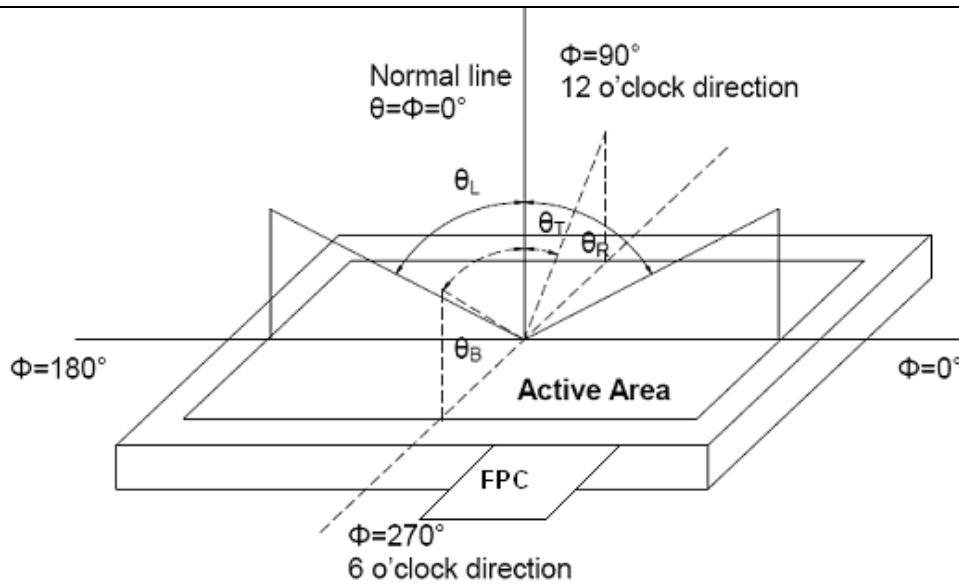


| Item           | Photo detector | Field     |
|----------------|----------------|-----------|
| Contrast Ratio | SR-3A          | $1^\circ$ |
| Luminance      |                |           |
| Chromaticity   |                |           |
| Lum Uniformity |                |           |
| Response Time  | BM-7A          | $2^\circ$ |

Note 2: Definition of viewing angle range and measurement system.

viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80).

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Note 3: Definition of contrast ratio

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

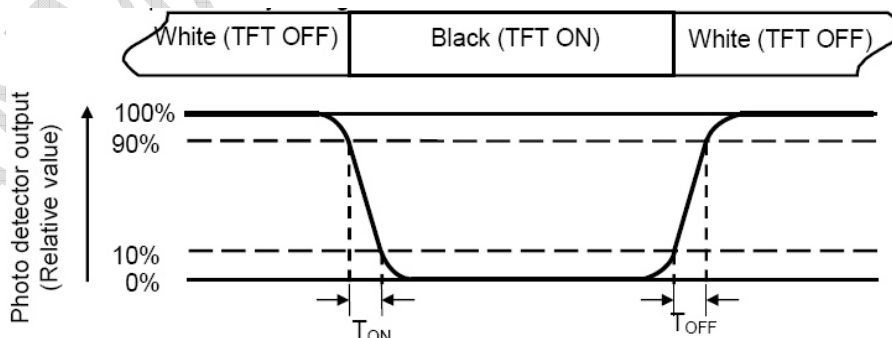
“White state “: The state is that the LCD should drive by V<sub>white</sub>.

“Black state”: The state is that the LCD should drive by V<sub>black</sub>.

V<sub>white</sub>: To be determined    V<sub>black</sub>: To be determined.

Note 4: Definition of Response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (T<sub>ON</sub>) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T<sub>OFF</sub>) is the time between photo detector output intensity changed from 10% to 90%.



Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

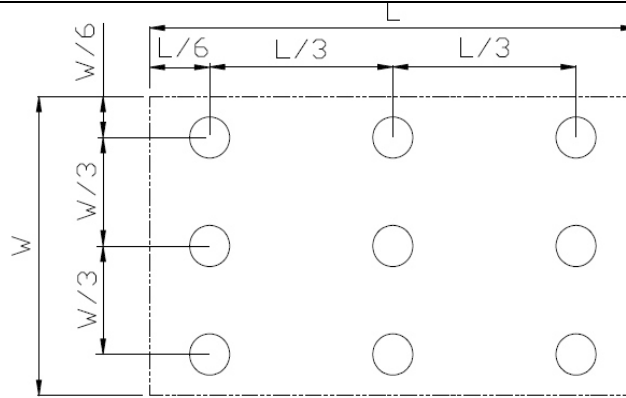
Note 6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (U)} = \text{Lmin} / \text{Lmax}$$

L-----Active area length W----- Active area width





Lmax: The measured Maximum luminance of all measurement position.

Lmin: The measured Minimum luminance of all measurement position.

Note 7: Definition of Luminance:

Measure the luminance of white state at center point.

### 6.2 TP Optical Characteristics

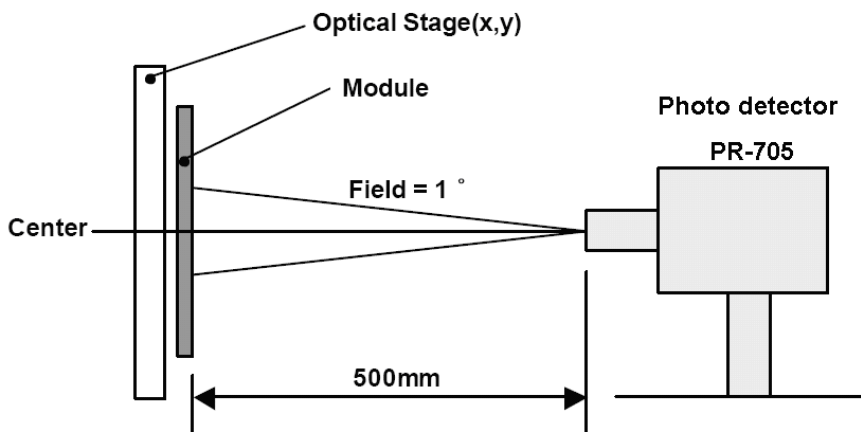
(Ta = 25 °C)

| No. | Item         | Min. | Typ. | Max. | Unit | Remark         |
|-----|--------------|------|------|------|------|----------------|
| 1   | Transmission | 86   | 88   |      | %    | Note 1         |
| 2   | Reflectivity |      |      | 4    | %    | Note 1, Note 2 |
| 3   | HAZE         |      |      | 2    | %    |                |

Note1: Measuring equipments: DMS-501, PR-705. @550nm

Measuring condition:

6. After stabilizing and leaving the panel alone at a given temperature for 30 min, the measurement should be executed,
7. Measuring surroundings: a stable, windless and dark room,
8. Measuring temperature: Ta=25°C,
9. 30 min after lighting the back-light.



Note2: conform to National standard GB2410—80 /ASTM D1003—61(1997)



## 7. Reliability Test

| No | Test Item                                | Condition   | Remarks   |
|----|--|---|---|
| 1  | High Temperature Operation               | Ta = +70°C, 240 hours   | Note1, Note6, Note7<br>IEC60068-2-1, GB2423.2   |
| 2  | Low Temperature Operation                | Ta = -20°C, 240 hours   | Note1, Note7, IEC60068-2-1<br>GB2423.1  |
| 3  | High Temperature Storage                 | Ta = +80°C, 240 hours   | Note1, Note7, Note8<br>IEC60068-2-1<br>GB2423.2   |
| 4  | Low Temperature Storage                  | Ta = -30°C, 240 hours   | Note1, Note7, IEC60068-2-1<br>GB2423.1  |
| 5  | High Temperature & Humidity Storage      | Ta = +65°C, RH = 90%, 240 hours   | Note1, Note3, Note4, Note7<br>IEC60068-2-78<br>GB/T2423.3   |
| 6  | Thermal Shock/<br>Solder Joint Life Test | -30°C (30min) ⇌ 80°C (30min), Change<br>Time: 5min, 100cycle  | Note1, Note9<br>Start with cold temperature<br>End with high temperature,<br>IEC60068-2-14, GB2423.22 |
| 12 | ESD                                      | C = 150pF, R = 330Ω<br>Air: ±8KV Contact: ±8KV<br>5times<br>(Environment: 15°C ~ 35°C,<br>30% ~ 60% RH, 86Kpa ~ 106Kpa) | Note2, Note5,<br>IEC61000-4-2<br>GB/T17626.2  |
| 13 | Shock Test                               | Half Sine Wave<br>100G, 6ms, ±X, ±Y, ±Z<br>3times for each direction  | Note2   |
| 14 | Drop Test (package state)                | Height: 60cm,<br>1corner, 3edges, 6surfaces   | Note2, IEC60068-2-32<br>GB/T2423.8  |

### Notes:

1. The test result shall be evaluated after the sample has been left at room temperature and humidity for 2 hours without load. No condensation shall be accepted. The sample will not be accepted if appear these defects:

- 1). Air bubble in the LCD;
- 2). Seal leak
- 3). Non-display
- 4). missing segments
- 5). Glass crack
- 6). CR reduction >40%
- 7). IDD increase >100%
- 8). Brightness reduction >50%
- 9). Color coordinate tolerance >0.05

2. The samples of these tests will not be accepted if appear these defects:

- 1). Air bubble in the LCD;

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- 2). Seal leak
  - 3). Non-display
  - 4). missing segments
  - 5). Glass crack
3. Each test item applies for a test sample only once, The test sample can not be used again in any other test item.
4. For Damp Proof Test, Pure water (Resistance  $> 10M\Omega$ ) should be used.
5. In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.
6. In the test of High Temperature Operation and High Temperature & Humidity Operation, the operation temperature is the surface temperature of module
7. High Temperature Operation、Low Temperature Operation、High Temperature Storage、Low Temperature Storage、High Temperature & Humidity Operation、High Temperature & Humidity Storage will be increased the test time to 1000hours in the same conditions to test out the ability of module, and we can not guarantee that the module will not fail during 1000hours. These items test only once
8. Thermal Shock will be changed the cycle to 1000cycles to test out the ability of module, and we can not guarantee that the module will not fail after the test. This item test only once

# 8. Mechanical Drawing

|      |             |      |
|------|-------------|------|
| REV. | DESCRIPTION | DATE |
|      |             |      |

**TIANMA**

TM070RVHG01-00

LOH-TP

UNIT: mm

SCALE: 1:1

PAGE: 1

**重要提示**  
Important Notice

DETAIL: B  
SCALE: 5:1

CONTROL DIMENSION: ( )

| LEVEL | GENERAL TOLERANCE | REFERENCE DIMENSION | APPROVED  | DESIGNED  |
|-------|-------------------|---------------------|-----------|-----------|
| 1     | 1                 | Dakai Chen          | 2013-5-27 | Jiyan Bai |
| 2     | 2                 | Bingqian Chen       | 2013-5-27 | Jiyan Bai |
| 3     | 3                 |                     |           |           |

NOTES:

1. GENERAL TOLERANCE:  $\pm 0.3$
2. DISPLAY TYPE: a-si TFT
3. GRAY SCALE INVERSION DIRECTION: 6:00 o'clock
4. OPERATION TEMPERATURE:  $-20^{\circ}\text{C} \sim 70^{\circ}\text{C}$
5. STORAGE TEMPERATURE:  $-30^{\circ}\text{C} \sim 80^{\circ}\text{C}$
6. CNI RECOMMENDED CONNECTOR: HIROSE FHI2A-50S-0.5H
7. REQUIREMENT ON ENVIRONMENT PROTECTION: Q/S0002

| NO. | NAME                | QTY |
|-----|---------------------|-----|
| 1   | 110.3 (Cover, 0.1D) | 1   |
| 2   | 112.8 (TP, 4(A, H)) | 1   |
| 3   | 87.12 (TP, 1(A, H)) | 1   |
| 4   | 88.52 (TP, 1(A, H)) | 1   |
| 5   | 112.8 (TP, 1(A, H)) | 1   |
| 6   | 112.8 (TP, 1(A, H)) | 1   |
| 7   | 112.8 (TP, 1(A, H)) | 1   |
| 8   | 112.8 (TP, 1(A, H)) | 1   |
| 9   | 112.8 (TP, 1(A, H)) | 1   |
| 10  | 112.8 (TP, 1(A, H)) | 1   |
| 11  | 112.8 (TP, 1(A, H)) | 1   |
| 12  | 112.8 (TP, 1(A, H)) | 1   |
| 13  | 112.8 (TP, 1(A, H)) | 1   |
| 14  | 112.8 (TP, 1(A, H)) | 1   |
| 15  | 112.8 (TP, 1(A, H)) | 1   |
| 16  | 112.8 (TP, 1(A, H)) | 1   |
| 17  | 112.8 (TP, 1(A, H)) | 1   |
| 18  | 112.8 (TP, 1(A, H)) | 1   |
| 19  | 112.8 (TP, 1(A, H)) | 1   |
| 20  | 112.8 (TP, 1(A, H)) | 1   |
| 21  | 112.8 (TP, 1(A, H)) | 1   |
| 22  | 112.8 (TP, 1(A, H)) | 1   |
| 23  | 112.8 (TP, 1(A, H)) | 1   |
| 24  | 112.8 (TP, 1(A, H)) | 1   |
| 25  | 112.8 (TP, 1(A, H)) | 1   |
| 26  | 112.8 (TP, 1(A, H)) | 1   |
| 27  | 112.8 (TP, 1(A, H)) | 1   |
| 28  | 112.8 (TP, 1(A, H)) | 1   |
| 29  | 112.8 (TP, 1(A, H)) | 1   |
| 30  | 112.8 (TP, 1(A, H)) | 1   |
| 31  | 112.8 (TP, 1(A, H)) | 1   |
| 32  | 112.8 (TP, 1(A, H)) | 1   |
| 33  | 112.8 (TP, 1(A, H)) | 1   |
| 34  | 112.8 (TP, 1(A, H)) | 1   |
| 35  | 112.8 (TP, 1(A, H)) | 1   |
| 36  | 112.8 (TP, 1(A, H)) | 1   |
| 37  | 112.8 (TP, 1(A, H)) | 1   |
| 38  | 112.8 (TP, 1(A, H)) | 1   |
| 39  | 112.8 (TP, 1(A, H)) | 1   |
| 40  | 112.8 (TP, 1(A, H)) | 1   |
| 41  | 112.8 (TP, 1(A, H)) | 1   |
| 42  | 112.8 (TP, 1(A, H)) | 1   |
| 43  | 112.8 (TP, 1(A, H)) | 1   |
| 44  | 112.8 (TP, 1(A, H)) | 1   |
| 45  | 112.8 (TP, 1(A, H)) | 1   |
| 46  | 112.8 (TP, 1(A, H)) | 1   |
| 47  | 112.8 (TP, 1(A, H)) | 1   |
| 48  | 112.8 (TP, 1(A, H)) | 1   |
| 49  | 112.8 (TP, 1(A, H)) | 1   |
| 50  | 112.8 (TP, 1(A, H)) | 1   |

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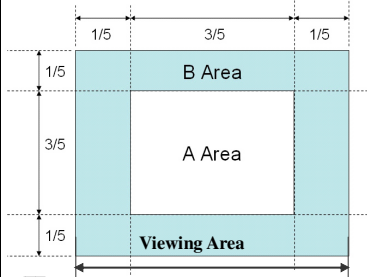
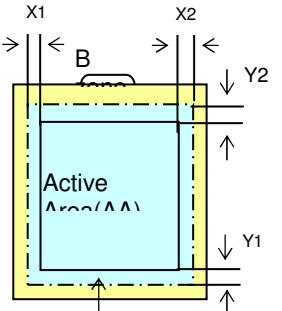
## 9. Product Inspection Criteria

### 9.1 Classification of defects

Major defects (MA): A major defect refers to a defect that may substantially degrade usability for product applications, including all functional defects (such as no display, abnormal display, open or missing segment, short circuit, missing component), outline dimension beyond the drawing, progressive defects and those affecting reliability.

Minor defects (MI): A minor defect refers to a defect which is not considered to be able to substantially degrade the product application or a defect that deviates from existing standards almost unrelated to the effective use of the product or its operation, such as black spot, white spot, bright spot, pinhole, black line, white line, contrast variation, glass defect, polarizer defect, etc.

### 9.2 Definition of inspection range

|  |  |
|--|--|
| <p>For dot defect of TFT LCD which is not smaller than 3 inches, dividing three areas to make a judgment (according to figure 1).</p> <p>A area : center of viewing area<br/>                 B area : periphery of viewing area<br/>                 C area : Outside viewing area</p> <p>For other defects, dividing two areas to make a judgment (according figure 2).</p> <p>A zone : Inside Viewing area<br/>                 B zone : Outside Viewing area</p> <p>X1(A.A~V.A): 0mm    X2(A.A~V.A): 0mm<br/>                 Y1(A.A~V.A): 0mm    Y2(A.A~V.A): 0mm</p> |  <p>Figure 1</p>  <p>Figure 2</p> |
|--|--|

### 9.3 Inspection items and general notes

|                  |  |   |
|------------------|--|---|
| General notes    | <p>① Should any defects which are not specified in this standard happen, additional standard shall be determined by mutual agreement between customer and TIANMA.</p> <p>② Viewing area should be the area which TIANMA guarantees.</p> <p>③ Limit sample should be prior to this Inspection standard.</p> <p>④ Viewing judgment should be under static pattern.</p> <p>⑤ Inspection conditions</p> <p style="padding-left: 40px;">Inspection distance: 250 mm (from the sample)      Temperature : 25±5 °C</p> <p style="padding-left: 40px;">Inspection angle : 45 degrees in 12 o'clock direction (all defects in viewing area should be inspected from this direction)</p> |   |
| Inspection items | Pinhole, Bright spot, Black spot, White spot, Black line, White Line, Foreign particle, Bubble   | The color of a small area is different from the remainder. The phenomenon doesn't change with voltage |
|                  | Contrast variation   | The color of a small area is different from the remainder. The phenomenon changes with voltage        |
|                  | Polarizer defect   | Scratch, Dirt, Particle, Bubble on polarizer or between polarizer and glass                           |
|                  | Dot defect (TFT LCD)   | The pixel appears bright or dark abnormally when display  |
|                  | Functional defect  | No display, Abnormal display, Open or missing segment, Short circuit, False viewing direction         |

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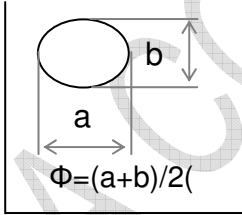
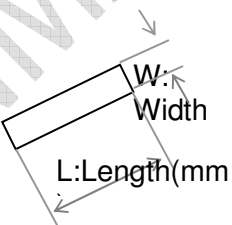
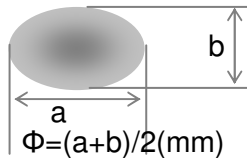
|  |              |  |
|--|--------------|--|
|  | Glass defect | Glass crack, Shaved corner of glass, Surplus glass |
|  | PCB defect   | Components assembly defect                         |

**9.4 Outgoing Inspection level**

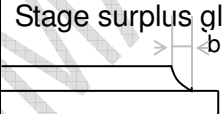
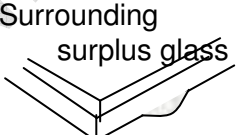
| Outgoing Inspection standard | Inspection conditions | Inspection |      |      |    |      |
|------------------------------|-----------------------|------------|------|------|----|------|
|                              |                       | Min.       | Max. | Unit | IL | AQL  |
| Major Defects                | See 9.3 general notes | See        | 9.5  |      | II | 0.65 |
| Minor Defects                | See 9.3 general notes | See        | 9.5  |      | II | 1.5  |

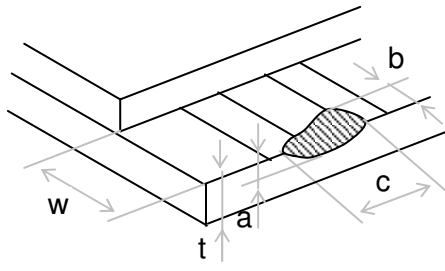
Note : Sampling standard conforms to GB2828

**9.5 Inspection Items and Criteria**

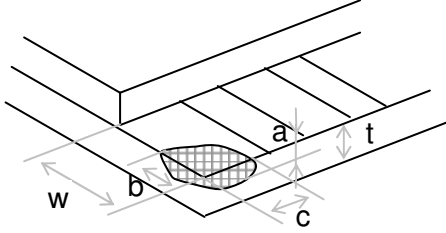
| Inspection items           |   |   | Judgment standard          |  |   |           |
|----------------------------|---|---|----------------------------|--|---|-----------|
|                            |   |   | Category                   |  | Acceptable number   |           |
|                            |   |   |                            |  | A zone  | B zone    |
| 1                          | Black spot, White spot, Bright Spot, Pinhole, Foreign Particle, Particle in or on glass, Scratch on glass |   | A                          | $\Phi \leq 0.10$   | Neglected   | Neglected |
|                            |   |   | B                          | $0.10 < \Phi \leq 0.15$  | 2   |           |
|                            |   |   | C                          | $0.15 < \Phi \leq 0.20$  | 1   |           |
|                            |   |   | D                          | $0.20 < \Phi$  | 0   |           |
|                            |   |   | Total defective point(B,C) |  | 3   |           |
|                            |   |   | 2                          | Black line, White line, and Particle Between Polarizer and glass, Scratch on glass |  |           |
| B                          | $0.01 < W \leq 0.03$<br>$L \leq 3.0$  | 2   |                            |  |   |           |
| C                          | $0.03 < W \leq 0.05$<br>$L \leq 3.0$  | 1   |                            |  |   |           |
| D                          | $0.05 < W$  | 0   |                            |  |   |           |
| Total defective point(B,C) |   | 3   |                            |  |   |           |
| 3                          | Contrast variation  |  |                            |  |   | A         |
|                            |   |   | B                          | $0.2 < \Phi \leq 0.3$  | 2   |           |
|                            |   |   | C                          | $0.3 < \Phi \leq 0.4$  | 1   |           |
|                            |   |   | D                          | $0.4 < \Phi$   | 0   |           |
|                            |   |   | Total defective point(B,C) |  | 3   |           |
|                            |   |   | 4                          | Dot defect (if   | TFT LCD is smaller  | LCD Class |

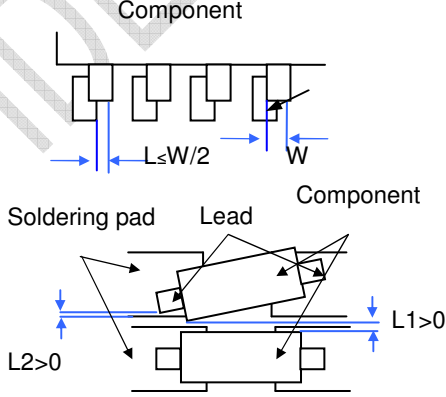
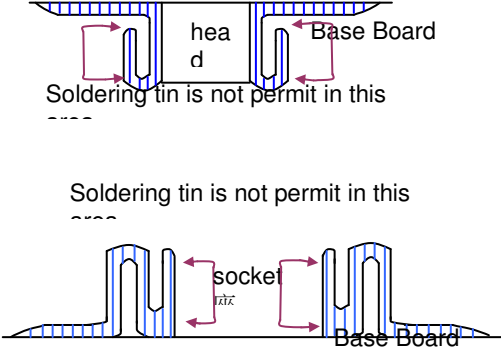
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|   |   |   |  |                       |                 |           |           |
|---|---|---|--|-----------------------|-----------------|-----------|-----------|
|   | TFT LCD is used)                        | than 3 inches   | A  | Bright dot            | 1               |           | Neglected |
|   |   |   |  | Dark dot              | 2               |           |           |
|   |   |   |  | Total                 | 2               |           |           |
|   |   |   | B  | Bright dot            | 2               |           |           |
|   |   |   |  | Dark dot              | 3               |           |           |
|   |   |   |  | Total                 | 4               |           |           |
|   | TFT LCD between 3~10.4 inches           | LCD Class   | Defect   | A area                | B area          | C area    |           |
|   |   |   | A  | Bright dot            | 1               | 1         | Neglected |
|   |   | Dark dot  |  | 1                     | 2               |           |           |
|   |   | Total   |  | 4                     |                 |           |           |
| B   |   | Bright dot  | 2  | 2                     |                 |           |           |
|   |   | Dark dot  | 2  | 3                     |                 |           |           |
|   | Total                                   | 6   |  |                       |                 |           |           |
| Notes:<br>Bright dot: in R、G、B or dark display figure, the pixel appears bright.<br>Dark dot: in R、G、B or white display figure, the pixel appears dark.<br>Defect area must be less than an half size of the dot. |   |   |  |                       |                 |           |           |
| 5   | Bubble inside cell                      | any size  |  | none                  | none            |           |           |
| 6   | Polarizer defect (if Polarizer is used) | Scratch ,damage on polarizer, Particle on polarizer or between polarizer and glass. | Refer to item 1 and item 2.  |                       |                 |           |           |
|   |   |   | Bubble, dent and convex  | A                     | $\Phi \leq 0.3$ | Neglected |           |
|   |   | B   |  | $0.3 < \Phi \leq 0.7$ | 2               |           |           |
|   |   | C   |  | $0.7 < \Phi$          | 0               |           |           |
| 7   | Surplus glass                           | Stage surplus glass   |  $b \leq 0.3\text{mm}$                                  |                       |                 |           |           |
|   |   | Surrounding surplus glass   |  Should not influence outline dimension and assembling. |                       |                 |           |           |
| 8   | Open segment or open common             | Not permitted   |  |                       |                 |           |           |
| 9   | Short circuit                           | Not permitted   |  |                       |                 |           |           |
| 10  | False viewing direction                 | Not permitted   |  |                       |                 |           |           |
| 11  | Contrast ratio uneven                   | According to the limit specimen   |  |                       |                 |           |           |
| 12  | Crosstalk                               | According to the limit specimen   |  |                       |                 |           |           |
| 13  | Black /White spot(display)              | Refer to item 1   |  |                       |                 |           |           |
| 14  | Black /White line(display)              | Refer to item 2   |  |                       |                 |           |           |

| Inspection items |                    | Judgment standard   |  | Acceptable number   |                       |   |
|------------------|--------------------|---|--|---|-----------------------|---|
|                  |                    | Category(application: B zone)   |  |   |                       |   |
| 15               | Glass defect crack | ①The front of lead terminals  | A                                      | $a \leq t, b \leq 1/5W, c \leq 3\text{mm}$  | Max.3 defects allowed |   |
|                  |                    |  | B                                      | Crack at two sides of lead terminals should not cover patterns and alignment mark |                       |   |
|                  |                    |   | ②Surrounding crack—non-contact side    |   |                       | $b < \text{Inner borderline of the seal}$ |
|                  |                    |   | ③ Surrounding crack— contact side seal |   |                       | $b < \text{Outer borderline of the seal}$ |
|                  | ④Corner            | A   | $a \leq t, b \leq 3.0, c \leq 3.0$     |   |                       |   |

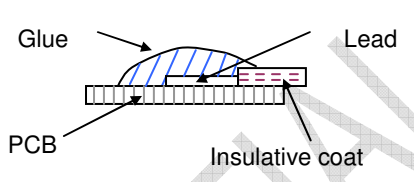


|  |  |   |   |  |
|--|--|---|---|--|
|  |  |  | <p>B Glass crack should not cover patterns u and alignment mark and patterns.</p> |  |
|--|--|---|---|--|

| Inspection items |            | Judgment standard   |  |
|------------------|------------|---|--|
|                  |            | Category(application: B zone)   |  |
| 16               | PCB defect | <p>Component soldering:<br/>No cold soldering · short · open circuit · burr · tin ball<br/>The flat encapsulation component position deviation must be less than 1/3 width of the pin (Pic.1) ;<br/>the sheet component deviation:<br/>Pin deviates from the pad and contact with the near components is not permitted ( Pic.2)</p> |   |
|                  |            | <p>lead defect:<br/>The lead lack must be less than 1/3 of its width;<br/>The lead burr must be less than 1/3 of the seam;<br/>Impurities connect with the near leads is not permitted</p>  |  |
|                  |            | <p>Connector soldering:<br/>Soldering tin is at contact position of the plug and socket is not permitted<br/>No foundation is scald<br/>Serious cave distortion on plug and socket contact pin is not permitted</p>   |  |

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|  |   |  |
|--|---|--|
|  | <p>Glue on root of the speaker receiver and motor lead:<br/>The insulative coat of the lead must join into the PCB; the protected glue must envelop to the insulative coat.</p> |  |
|--|---|--|

## 10. Precautions for Use of LCD Modules

### 10.1 Handling Precautions

- 10.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- 10.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.
- 10.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- 10.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- 10.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:
  - Isopropyl alcohol
  - Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer.

Especially, do not use the following:

  - Water
  - Ketone
  - Aromatic solvents
- 10.1.6 Do not attempt to disassemble the LCD Module.
- 10.1.7 If the logic circuit power is off, do not apply the input signals.
- 10.1.8 To prevent destruction of the elements by static electricity, be careful to maintain

an optimum work environment.

- a. Be sure to ground the body when handling the LCD Modules.
- b. Tools required for assembly, such as soldering irons, must be properly ground.
- c. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
- d. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

## 10.2 Storage precautions

10.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

10.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature :        0°C ~ 40°C

Relatively humidity: ≤80%

10.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

**10.3 The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.**