



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.:** TST050WVHI-12

**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        | 2017-9-20 | Initial Release |        |
|             |           |                 |        |
|             |           |                 |        |
|             |           |                 |        |

## Contents

|             |                                   |             |
|-------------|-----------------------------------|-------------|
| <b>1.0</b>  | <b>General description</b>        | <b>p.5</b>  |
| <b>2.0</b>  | <b>Absolute maximum ratings</b>   | <b>p.6</b>  |
| <b>3.0</b>  | <b>Optical characteristics</b>    | <b>p.7</b>  |
| <b>4.0</b>  | <b>Block diagram</b>              | <b>p.10</b> |
| <b>5.0</b>  | <b>Interface pin connection</b>   | <b>p.11</b> |
| <b>6.0</b>  | <b>Electrical characteristics</b> | <b>p.12</b> |
| <b>7.0</b>  | <b>Reliability test items</b>     | <b>p.15</b> |
| <b>8.0</b>  | <b>Inspection Criterion</b>       | <b>P.16</b> |
| <b>9.0</b>  | <b>Outline dimension</b>          | <b>P.21</b> |
| <b>10.0</b> | <b>Package specification</b>      | <b>P.22</b> |
| <b>11.0</b> | <b>General precaution</b>         | <b>P.23</b> |

## 1.0 GENERAL DESCRIPTION

### 1.1 Introduction

Team Source Display model TST050WVHI-12 is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT LCD panel, a driving circuit, and a backlight system. This TFT LCD has a 5.0 (16:9) inch diagonally measured active display area with WVGA (800 horizontal by 480 vertical pixel) resolution.

### 1.2 Features

- 5.0 (16:9 diagonal) inch configuration
- 6 bits +FRC driver with 1 channel TTL interface
- ROHS and Halogen-Free Compliance

### 1.3 Applications

- Personal Navigation Device
- Multimedia applications and Others AV system

### 1.4 General information

| Item              | Specification            | Unit   | Note      |
|-------------------|--------------------------|--------|-----------|
| Outline Dimension | 120.7x 75.8 x 3.0 (Typ.) | mm     |           |
| Display area      | 108.0(H) x 64.8(V)       | mm     |           |
| Number of Pixel   | 800 RGB (H) x 480(V)     | pixels | 16:9WVGA  |
| Pixel pitch       | 0.135(H) x 0.135(V)      | mm     |           |
| Pixel arrangement | RGB Vertical stripe      | --     |           |
| Display mode      | Normally white           | --     | TN Model  |
| Surface Treatment | Antiglare                | --     |           |
| Dirver Element    | a-Si TFT                 | --     |           |
| LED               | 12                       | PCS    | Establish |

## 2.0 ABSOLUTE MAXIMUM RATINGS

### 2.1 Electrical Absolute Rating

#### 2.1.1 TFT LCD Module

| Item                     | Symbol   | Min. | Max.           | Unit | Note  |
|--------------------------|----------|------|----------------|------|-------|
| Power supply voltage     | $V_{DD}$ | -0.5 | 5.0            | V    | GND=0 |
| Logic Signal Input Level | $V_i$    | -0.3 | $V_{DD} + 0.3$ | V    |       |

## 2.1.2 Back-Light Unit

| Item               | Symbol           | MIN | TYP. | Max. | U                 | Note      |
|--------------------|------------------|-----|------|------|-------------------|-----------|
| LED current        | I <sub>L</sub>   |     | 40   | 45   | mA                | (1)(2)(3) |
| LED voltage        | V                | 18  | 19.2 | 20.4 | V                 | (1)(2)(3) |
| LED Uniformity     | Δ I <sub>v</sub> | 80  | 85   | --   | %                 |           |
| (LED+LCD)Luminance | L <sub>v</sub>   | 900 | 1000 | --   | Cd/m <sup>2</sup> |           |

### Note

- (1) Permanent damage may occur to the LCD module if beyond this specification. Functional operation should be restricted to the conditions described under normal operating conditions.
- (2) T<sub>a</sub> =25±2℃
- (3) Test Condition: LED current 60 mA. The LED lifetime could be decreased if operating I<sub>L</sub> is larger than 70 mA.

## 2.2 Environment Absolute Rating

| Item                  | Symbol           | Min. | Max. | Unit | Note |
|-----------------------|------------------|------|------|------|------|
| Operating Temperature | T <sub>opa</sub> | -20  | 60   | ℃    |      |
| Storage Temperature   | T <sub>stg</sub> | -30  | 70   | ℃    |      |

## 3.0 OPTICAL CHARACTERISTICS

### 3.1 Optical specification

| Item                               |         | Symbol         | Condition                         | Min.  | Typ.  | Max.  | Unit              | Note                       |
|------------------------------------|---------|----------------|-----------------------------------|-------|-------|-------|-------------------|----------------------------|
| Threshold voltage                  |         | Vsat           |                                   | —     | 2.4   | —     |                   | (6)                        |
|                                    |         | Vth            |                                   | —     | 1.4   | —     |                   | (6)                        |
| Transmittance<br>(With PZ)         |         | T              |                                   | —     | 6.78  | —     |                   |                            |
| Contrast                           |         | CR             | Θ=0<br>Normal<br>viewing<br>angle | 480   | 600   | —     |                   | (1)(2)                     |
| Response<br>time                   | Rising  | TR             |                                   | —     | 3     | 6     | msec              | (1)(3)                     |
|                                    | Falling | TF             |                                   | —     | 7     | 14    |                   |                            |
| White luminance(center)            |         | YL             |                                   | 450   | 500   | -     | cd/m <sup>2</sup> | I=40mA                     |
| Color gamut                        |         | S              |                                   | —     | 50    | —     | %                 | C light                    |
| Color<br>chromaticity<br>(CIE1931) | White   | W <sub>x</sub> |                                   | 0.292 | 0.307 | 0.322 |                   | (1)(4) CF<br>Glass C light |
|                                    |         | W <sub>y</sub> |                                   | 0.333 | 0.348 | 0.363 |                   |                            |
|                                    | Red     | R <sub>x</sub> |                                   | 0.611 | 0.626 | 0.657 |                   |                            |
|                                    |         | R <sub>y</sub> |                                   | 0.327 | 0.342 | 0.361 |                   |                            |
|                                    | Green   | G <sub>x</sub> | 0.306                             | 0.321 | 0.336 |       |                   |                            |
|                                    |         | G <sub>y</sub> | 0.538                             | 0.553 | 0.568 |       |                   |                            |
|                                    | Blue    | B <sub>x</sub> | 0.134                             | 0.149 | 0.164 |       |                   |                            |
|                                    |         | B <sub>y</sub> | 0.168                             | 0.183 | 0.198 |       |                   |                            |
| Viewing angle                      | Hor.    | Θ L            | CR>10                             | 65    | 75    | —     |                   |                            |
|                                    |         | Θ R            |                                   | 65    | 75    | —     |                   |                            |
|                                    | Ver.    | Θ U            |                                   | 60    | 70    |       |                   |                            |
|                                    |         | Θ D            |                                   | 50    | 60    |       |                   |                            |
| Optima View Direction              |         | 12 O' clock    |                                   |       |       |       |                   | (5)                        |

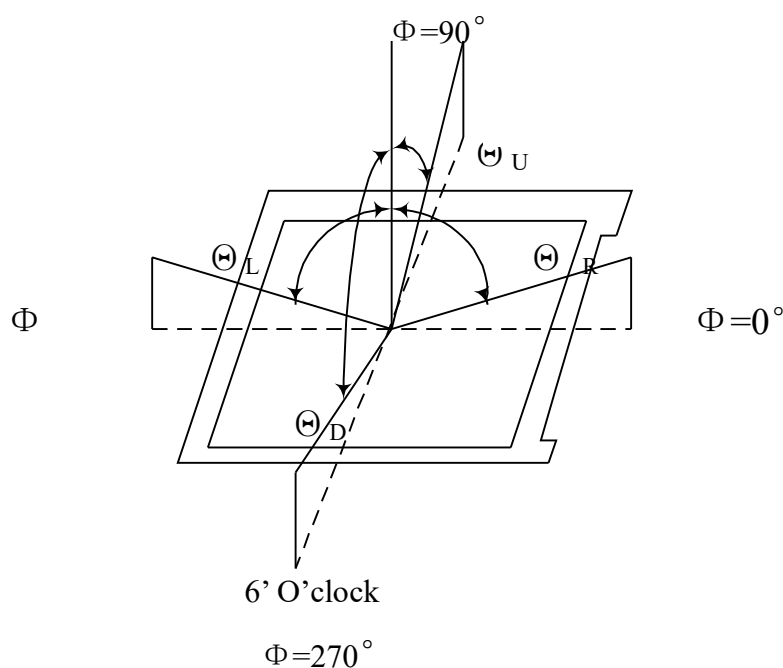
### 3.2 Measuring Condition

- Measuring surrounding: dark room
- LED current  $I_L$ : 40mA
- Ambient temperature:  $25 \pm 2^\circ\text{C}$
- 15min. warm-up time.

### 3.3 Measuring Equipment

- FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.
- Measuring spot size: 20 ~ 21m

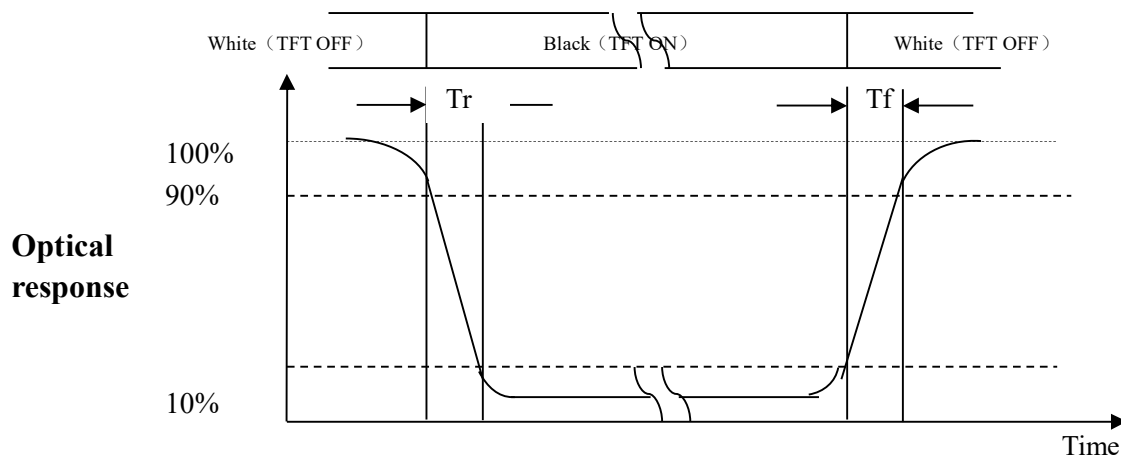
Note (1) Definition of Viewing Angle: 12' O'clock



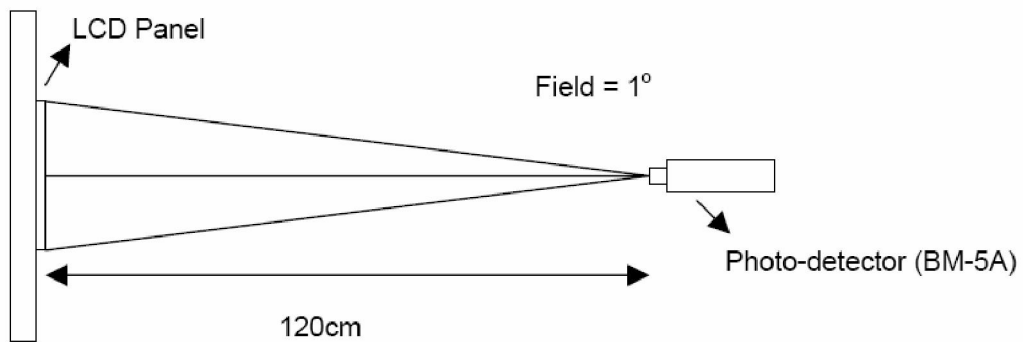
Note (2) Definition of Contrast Ratio (CR):  
measured at the center point of pane

$$\text{CR} = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note (3) Definition of Response Time: Sum of  $T_R$  and  $T_F$

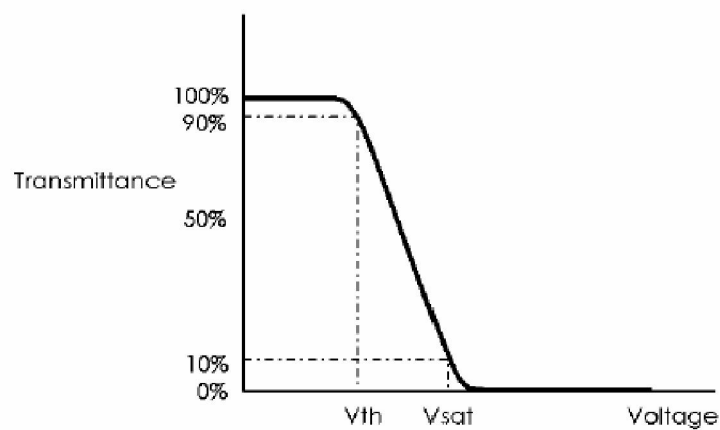


Note (4) Definition of optical measurement setup



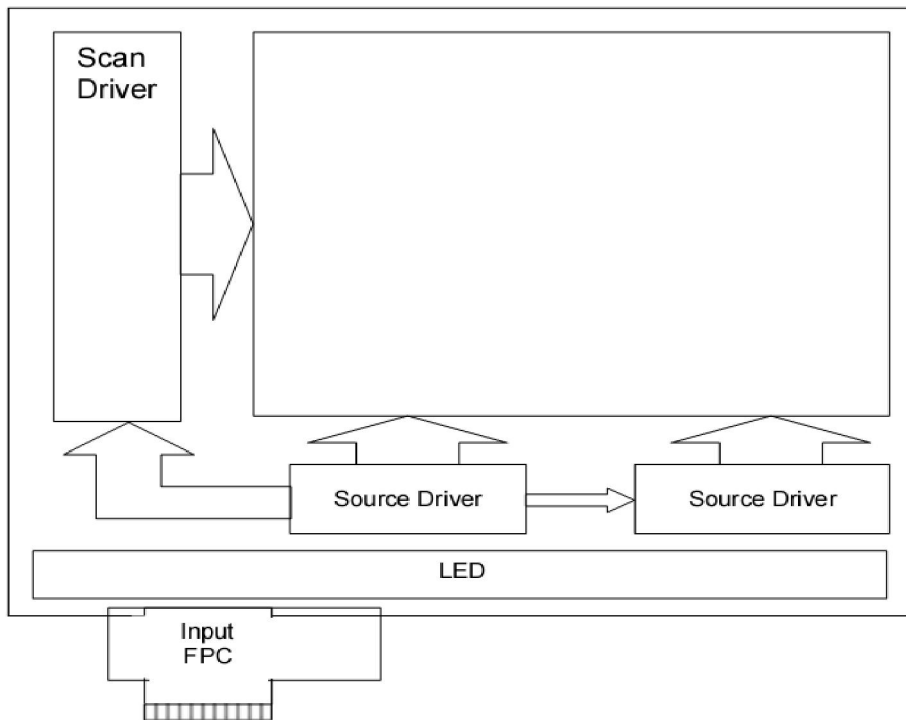
Note (5) Rubbing Direction (The different Rubbing Direction will cause the different optimal view direction.

Note (6) Definition of  $V_{sat}$  and  $V_{th}$  (at 20°C

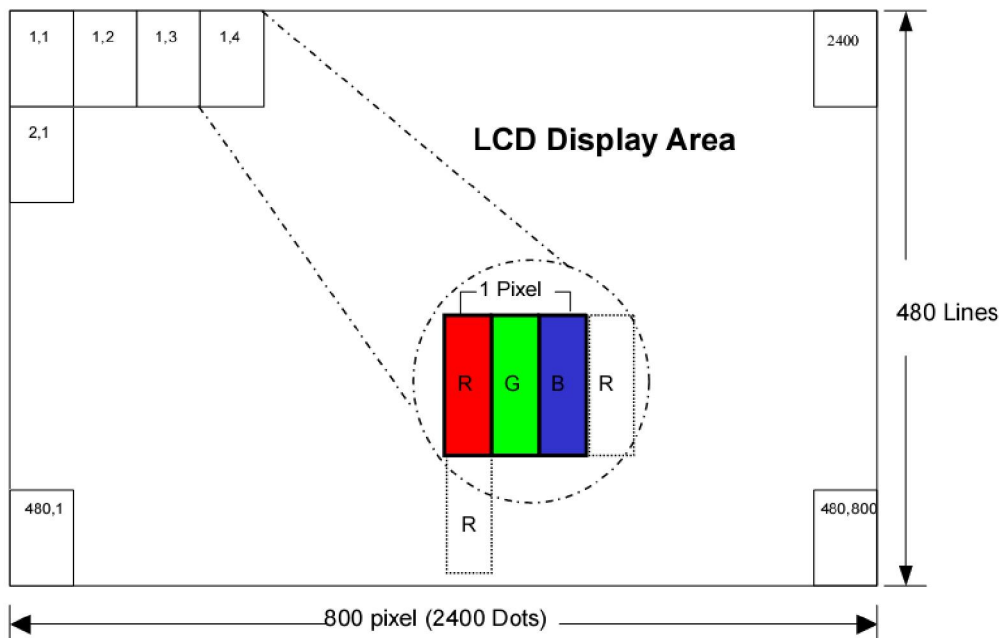


## 4.0 BLOCK DIAGRAM

### 4.1 TFT LCD Module



### 4.2 Pixel Format



## 5.0 INPUT INTERFACE PIN ASSIGNMENT

FPC connector is used for electronics interface.

The recommended model is FH19SC-40S-0.5SH (51) manufactured by HIROSE.

| Pin No. | Symbol          | I/O | Function                               |
|---------|-----------------|-----|----------------------------------------|
| 1       | LED-            | P   | Power for LED backlight cathode        |
| 2       | LED+            | P   | Power for LED backlight anode          |
| 3       | GND             | P   | Power ground                           |
| 4       | V <sub>DD</sub> | P   | Power voltage                          |
| 5       | R0              | I   | Red data (LSB)                         |
| 6       | R1              | I   | Red data                               |
| 7       | R2              | I   | Red data                               |
| 8       | R3              | I   | Red data                               |
| 9       | R4              | I   | Red data                               |
| 10      | R5              | I   | Red data                               |
| 11      | R6              | I   | Red data                               |
| 12      | R7              | I   | Red data (MSB)                         |
| 13      | G0              | I   | Green data (LSB)                       |
| 14      | G1              | I   | Green data                             |
| 15      | G2              | I   | Green data                             |
| 16      | G3              | I   | Green data                             |
| 17      | G4              | I   | Green data                             |
| 18      | G5              | I   | Green data                             |
| 19      | G6              | I   | Green data                             |
| 20      | G7              | I   | Green data (MSB)                       |
| 21      | B0              | I   | Blue data (LSB)                        |
| 22      | B1              | I   | Blue data                              |
| 23      | B2              | I   | Blue data                              |
| 24      | B3              | I   | Blue data                              |
| 25      | B4              | I   | Blue data                              |
| 26      | B5              | I   | Blue data                              |
| 27      | B6              | I   | Blue data                              |
| 28      | B7              | I   | Blue data (MSB)                        |
| 29      | DGND            | I   | Digital ground                         |
| 30      | DCLK            | I   | Pixel clock                            |
| 31      | DISP            | I   | Display on/ off                        |
| 32      | HSYNC           | I   | Horizontal sync signal                 |
| 33      | VSNC            | I   | Vertical sync signal                   |
| 34      | DE              | I   | Data enable                            |
| 35      | NC              | -   | No Connect                             |
| 36      | GND             | P   | Power ground                           |
| 37      | X_R             | I/O | Right electrode - differential analog  |
| 38      | Y_B             | I/O | Bottom electrode - differential analog |
| 39      | X_L             | I/O | Left electrode - differential analog   |
| 40      | Y_T             | I/O | Top electrode - differential analog    |

I/O: I: input, O: output, P: power

## 6.0 ELECTRICAL CHARACTERISTICS

### 6.1 TFT LCD Module

| Item                    | Symbol   | Min.         | Typ. | Max.         | Unit | Note            |
|-------------------------|----------|--------------|------|--------------|------|-----------------|
| Supply voltage          | $V_{DD}$ | 3.0          | 3.3  | 3.6          | V    |                 |
| Input signal voltage    | $V_{IH}$ | $0.7 V_{DD}$ | -    | $V_{DD}$     | V    | Note (1)        |
|                         | $V_{IL}$ | GND          | -    | $0.3 V_{DD}$ | V    | Note (1)        |
| Current of power supply | $I_{DD}$ | -            | -    | 220          | mA   | $V_{DD} = 3.3V$ |

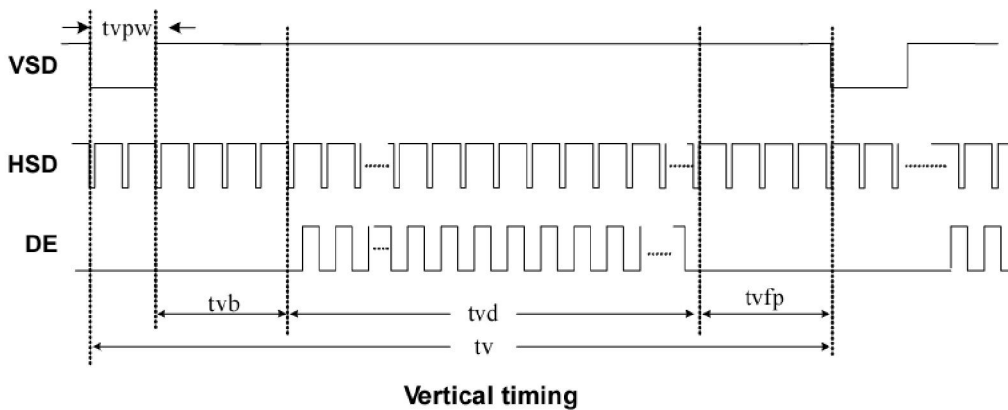
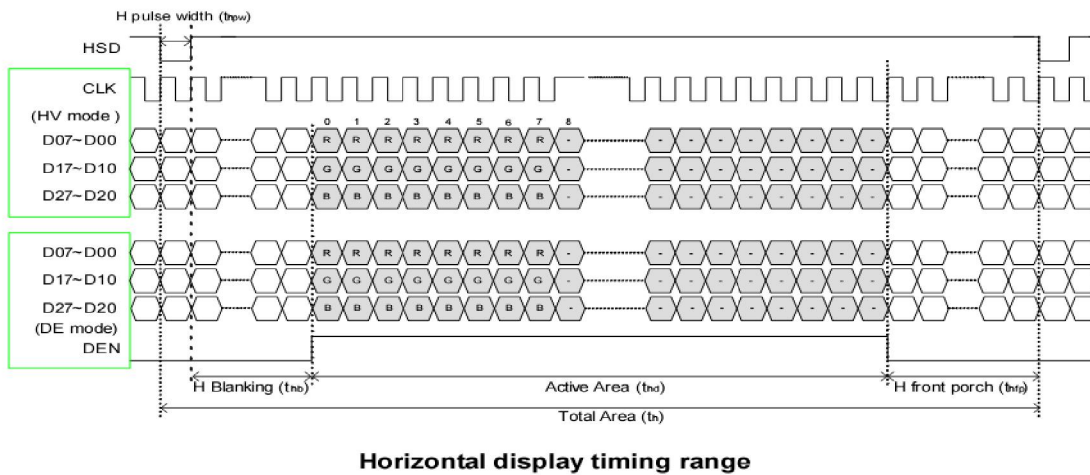
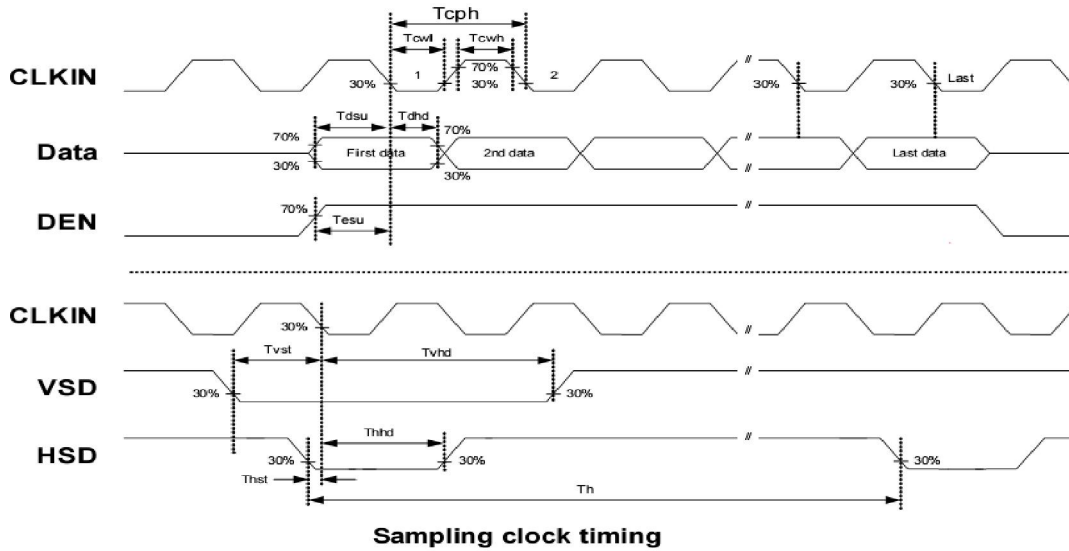
Note (1): HSYNC, VSYNC, DE, R/G/B Data

Note (2): GND=0V

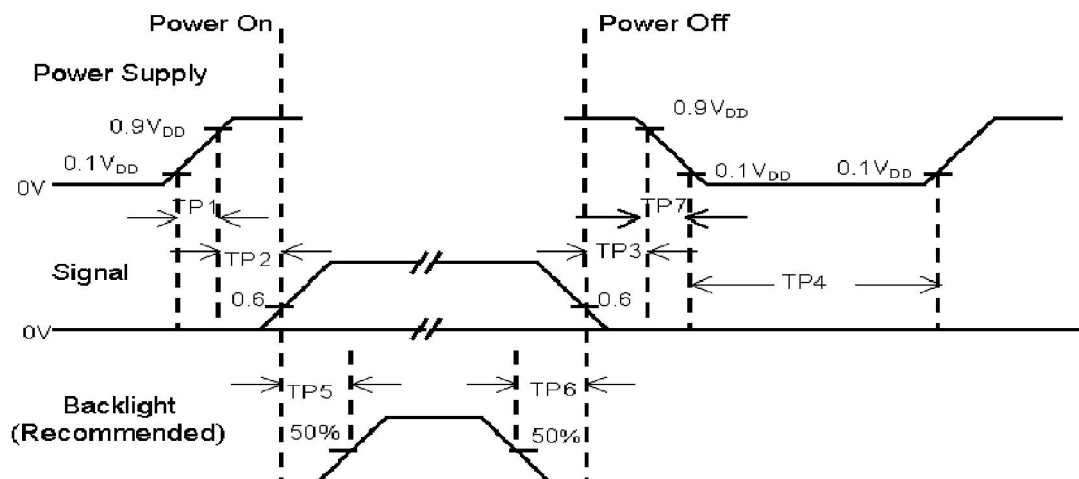
### 6.2 AC Characteristics

| Item                    | Symbol | Min. | Typ. | Max. | Unit | Note |
|-------------------------|--------|------|------|------|------|------|
| DCLK cycle time         | Tclk   | 25   |      |      | ns   |      |
| DCLK frequency          | fclk   |      | 33   | 40   | MHz  |      |
| DCLK pulse duty         | Tcwh   | 40   | 50   | 60   | %    |      |
| VSYNC setup time        | Tvst   | 8    |      |      | ns   |      |
| VSYNC hold time         | Tvhd   | 8    |      |      | ns   |      |
| HSYNC setup time        | Thst   | 8    |      |      | ns   |      |
| HSYNC hold time         | Thhd   | 8    |      |      | ns   |      |
| Data setup time         | Tdasu  | 8    |      |      | ns   |      |
| Data hold time          | Tdahd  | 8    |      |      | ns   |      |
| DE setup time           | Tdesu  | 8    |      |      | ns   |      |
| DE hold time            | Tdehd  | 8    |      |      | ns   |      |
| Horizontal display area | Thd    |      | 800  |      | Tcph |      |
| HSYNC period time       | Th     |      | 928  |      | Tcph |      |
| HSYNC width             | Thwh   | 1    | 48   |      | Tcph |      |
| HSYNC back porch        | Thbp   |      | 40   |      | Tcph |      |
| HSYNC front porch       | Thfp   |      | 40   |      | Tcph |      |
| Vertical display area   | Tvd    |      | 480  |      | th   |      |
| VSYNC period time       | Tv     |      | 525  |      | th   |      |
| VSYNC width             | Tvwh   |      | 3    |      | th   |      |
| VSYNC back porch        | Tvbp   |      | 29   |      | th   |      |
| VSYNC front porch       | Tvfp   |      | 13   |      | th   |      |

### 6.3 Timing Diagram of interface Signal



## 6.4 Power Sequence



| Item | Min. | Typ. | Max. | Unit | Remark |
|------|------|------|------|------|--------|
| TP1  | 0.5  | --   | 10   | msec |        |
| TP2  | 0    | --   | 50   | msec |        |
| TP3  | 0    | --   | 50   | msec |        |
| TP4  | 1000 | --   | --   | msec |        |
| TP5  | 200  | --   | --   | msec |        |
| TP6  | 200  | --   | --   | msec |        |
| TP7  | 0.5  | --   | 10   | msec |        |

**Note: (1)** The supply voltage of the external system for the module input should be the same as the definition of  $V_{DD}$ .

**(2)** Apply the lamp voltage within the LCD operation range. When the back-light turns on before the LCD operation or the LCD turns off before the back-light turns off, the display may momentarily become white.

**(3)** In case of  $V_{DD}$  = off level, please keep the level of input signal on the low or keep a high impedance.

**(4)** TP4 should be measured after the module has been fully discharged between power off and on period.

**(5)** Interface signal shall not be kept at high impedance when the power is on.

## 7.0 RELIABILITY TEST ITEMS

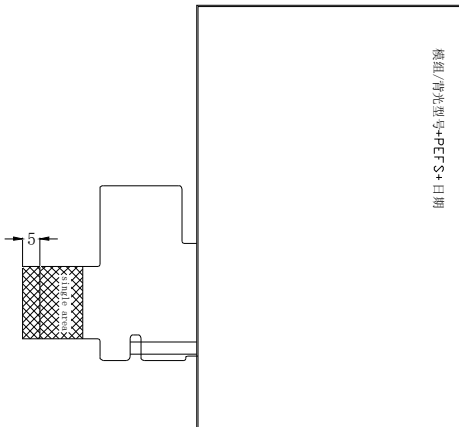
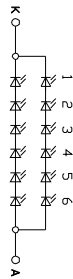
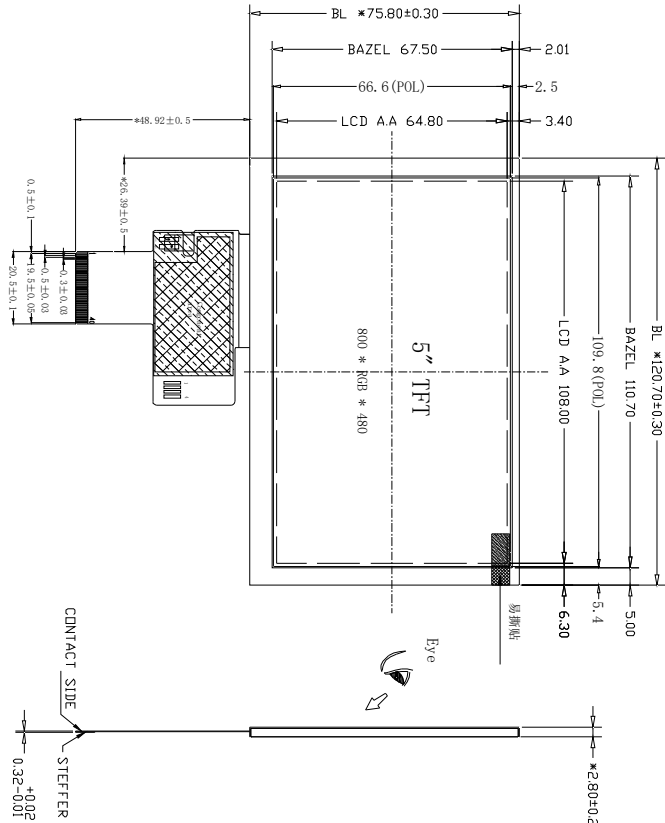
| No. | Item                                           | Conditions                                                                                                                                                                     | Remark                           |
|-----|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| 1   | High Temperature Storage                       | Ta=+70oC, 240hrs                                                                                                                                                               |                                  |
| 2   | Low Temperature Storage                        | Ta=-30oC, 240hrs                                                                                                                                                               |                                  |
| 3   | High Temperature Operation                     | Ta=+60oC, 240hrs                                                                                                                                                               |                                  |
| 4   | Low Temperature Operation                      | Ta=-20oC, 240hrs                                                                                                                                                               |                                  |
| 5   | High Temperature and High Humidity (operation) | Ta=+60oC, 90%RH, 240hrs                                                                                                                                                        |                                  |
| 6   | Thermal Cycling Test (non operation)           | -30oC(30min) → +70oC(30min), 200cycles                                                                                                                                         |                                  |
| 7   | Electrostatic Discharge                        | ± 200V,200pF(0Ω) 1 time/each terminal                                                                                                                                          |                                  |
| 8   | Vibration                                      | 1.Random:<br>1.04Grms, 5~500Hz, X/Y/Z,<br>30min/each direction<br>2. Sine:<br>Freq. Range: 8~33.3Hz<br>Stoke: 1.3mm<br>Sweep: 2.9G, 33.3~400Hz<br>X/Z: 2hr, Y: 4hr, cyc: 15min |                                  |
| 9   | Shock                                          | 100G, 6ms, ±X, ±Y, ±Z<br>3 time for each direction                                                                                                                             | JIS C7021, A-10<br>(Condition A) |
| 10  | Vibration (with carton)                        | Random: 0.015G <sup>2</sup> /Hz, 5~200Hz<br>-6dB/Octave, 200~400Hz<br>XYZ each direction: 2hr                                                                                  |                                  |
| 11  | Drop (with carton)                             | Height: 60cm<br>1 corner, 3 edges, 6 surfaces                                                                                                                                  | JIS Z0202                        |

Note: There is no display function NG issue occurred, all the cosmetic specification is judged before the reliability stress.

## 8.0 OUTLINE DIMENSION

|                       |                                               |
|-----------------------|-----------------------------------------------|
| LCD Type              | 5.0" TFT, Transmissive,<br>Normally white, TN |
| Resolution            | 800(RGB)*480                                  |
| View Direction        | 12 O'CLOCK                                    |
| Driver IC             | ILI5480*1/ILI6123H*2                          |
| Color Depth           | 16.7M                                         |
| Interface Types       | TTTL(RGB24-bit)                               |
| Operating voltage     | 3.3V                                          |
| TP/Lens               | Without                                       |
| Backlight LEDs        | 12 LEDs, 40mA, 18.6V                          |
| Surface luminance     | 500 cd/m <sup>2</sup>                         |
| Operating temperature | -20 °C~70 °C                                  |
| Storage Temperature   | -30 °C~80 °C                                  |
| Storage Humidity      | 60%~90% max                                   |

GENERAL TOLERANCE:±0.2



| Pin | NAME  |
|-----|-------|
| 1   | VLED- |
| 2   | VLED+ |
| 3   | GND   |
| 4   | VDD   |
| 5   | R0    |
| 6   | R1    |
| 7   | R2    |
| 8   | R3    |
| 9   | R4    |
| 10  | R5    |
| 11  | R6    |
| 12  | R7    |
| 13  | G0    |
| 14  | G1    |
| 15  | G2    |
| 16  | G3    |
| 17  | G4    |
| 18  | G5    |
| 19  | G6    |
| 20  | G7    |
| 21  | B0    |
| 22  | B1    |
| 23  | B2    |
| 24  | B3    |
| 25  | B4    |
| 26  | B5    |
| 27  | B6    |
| 28  | B7    |
| 29  | GND   |
| 30  | CLK   |
| 31  | DISP  |
| 32  | HSYNC |
| 33  | VSYNC |
| 34  | DE    |
| 35  | NC    |
| 36  | GND   |
| 37  | XK    |
| 38  | YD    |
| 39  | YL    |
| 40  | YU    |

| Need to pay attention to |                       | the key size with * |                 | DONG GUAN TEAM SOURCE DISPLAY TECH. CO., LTD. |            | 设计        |            | 审核         |  | 批准 |  |
|--------------------------|-----------------------|---------------------|-----------------|-----------------------------------------------|------------|-----------|------------|------------|--|----|--|
| 版本 (Version)             | 变更记录 (Change History) | 日期 (Date)           | 比例 (Proportion) | 单位 (Unit)                                     | 页 面 (Page) | (DESIGN)  | (AUDITING) | (APPROVED) |  |    |  |
| V1                       |                       |                     | 1:1             | M M                                           | 1 / 1      | Aron      | Penix      |            |  |    |  |
| V2                       |                       |                     |                 |                                               |            | 2017.9.16 | 2017.9.16  |            |  |    |  |

## 9.0 PACKAGE SPECIFICATION

| PARAMETER                      | Specification            | Unit |
|--------------------------------|--------------------------|------|
| Outside box                    | 390(L) x 350(W) x 480(H) | mm   |
| Inside box                     | 375(L) x 340(W) x 10(H)  | mm   |
| Product quantity of Inside box | 36                       | pcs  |
| Total product quantity         | 36*4=144                 | pcs  |
| Total weight                   | 11±0.5                   | KG   |

## 10.0 GENERAL PRECAUTION

### 10.1 Use Restriction

This product is not authorized for use in life supporting systems, aircraft navigation control systems, military systems and any other application where performance failure could be life-threatening or otherwise catastrophic.

### 10.2 Disassembling or Modification

Do not disassemble or modify the module. It may damage sensitive parts inside LCD module, and may cause scratches or dust on the display. XUTONG does not warrant the module, if customers disassemble or modify the module.

### 10.3 Breakage of LCD Panel

**10.3.1** If LCD panel is broken and liquid crystal spills out, do not ingest or inhale liquid crystal, and do not contact liquid crystal with skin.

**10.3.2** If liquid crystal contacts mouth or eyes, rinse out with water immediately.

**10.3.3** If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and rinse thoroughly with water.

**10.3.4** Handle carefully with chips of glass that may cause injury, when the glass is broken.

### 10.4 Electric Shock

**10.4.1** Disconnect power supply before handling LCD module.

**10.4.2** Do not pull or fold the LED cable.

**10.4.3** Do not touch the parts inside LCD modules and the fluorescent LED's connector or cables in order to prevent electric shock.

### 10.5 Absolute Maximum Ratings and Power Protection Circuit

**10.5.1** Do not exceed the absolute maximum rating values, such as the supply voltage variation, input voltage variation, variation in parts' parameters, environmental temperature, etc., otherwise LCD module may be damaged.

**10.5.2** Please do not leave LCD module in the environment of high humidity and high temperature for a long time.

**10.5.3** It's recommended to employ protection circuit for power supply.

### 10.6 Operation

**10.6.1** Do not touch, push or rub the polarizer with anything harder than HB pencil lead.

**10.6.2** Use fingerstalls of soft gloves in order to keep clean display quality, when persons handle the LCD module for incoming inspection or assembly.

**10.6.3** When the surface is dusty, please wipe gently with absorbent cotton or other soft material.