



# 深圳市汉昇实业有限公司

SHENZHEN HANSHENG INDUSTRIAL CO.LTD.,

## HS96S01A

# 规格书

## DA TASHHEET

|          |    |    |    |
|----------|----|----|----|
| 汉昇<br>HS | 制作 | 审核 | 批准 |
|          |    |    |    |

|            |  |
|------------|--|
| 版本：VER 1.0 |  |
|------------|--|

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***Revised History***

| <b>Part Number</b> | <b>Revision</b> | <b>Revision Content</b> | <b>Revised on</b> |
|--------------------|-----------------|-------------------------|-------------------|
| <b>HS96S01A</b>    | <b>A</b>        | <b>New</b>              | <b>2021-04-08</b> |
|                    |                 |                         |                   |
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## 1. General Description

HS96S01A is a 80RGB\*160 dots matrix TFT LCD module. It has a TFT panel composed of 240sources and 160gates. The LCM can be easily accessed by micro-controller.

## 2. Features

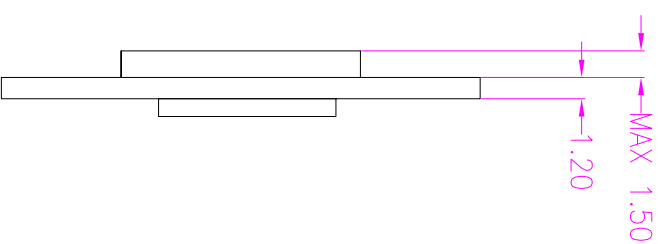
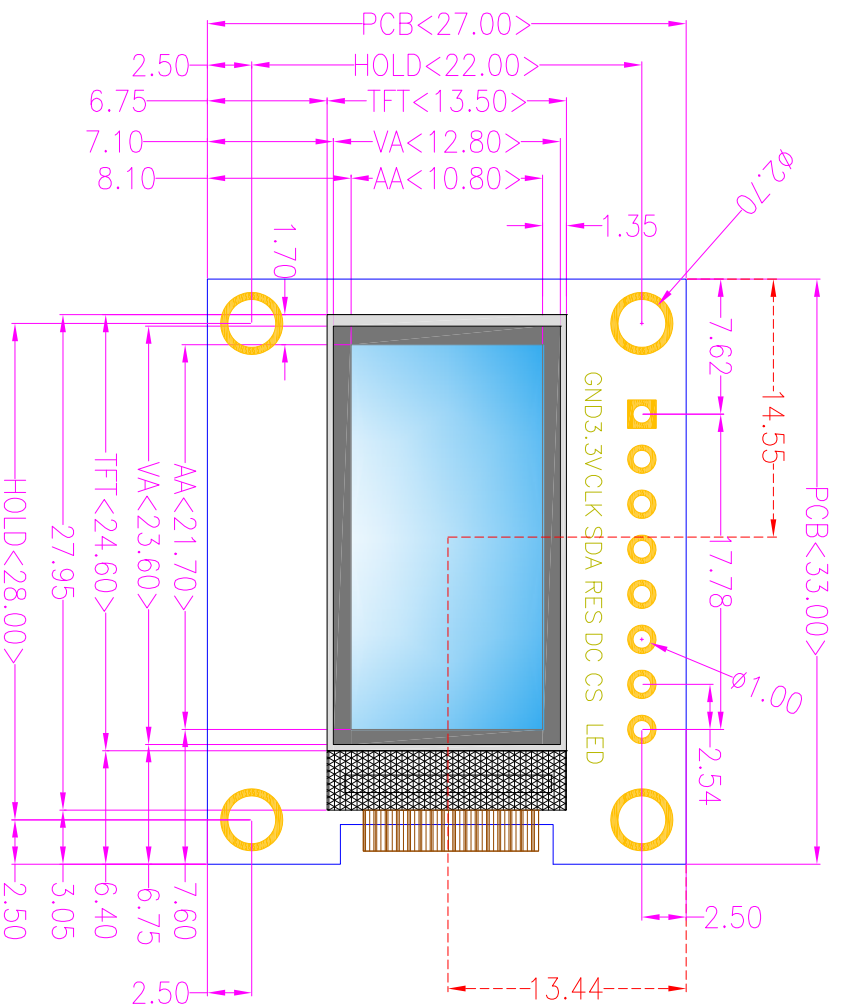
|                   |                              |
|-------------------|------------------------------|
| Display Mode      | Transmissive                 |
|                   | a-TFT                        |
| Display Format    | Graphic 80RGB*160 Dot-matrix |
| Input Data        | SPI-4wire interface          |
| Viewing Direction | 12 o'clock                   |
| Drive             | ST7735S                      |

## 3. Mechanical Specification

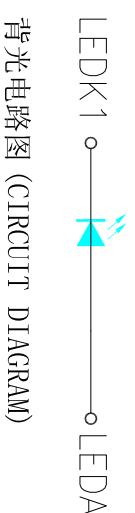
| Item                | Specifications      | Unit |
|---------------------|---------------------|------|
| Dimensional outline | 27(H)*33(V)*3.50MAX | mm   |
| Resolution          | 80(H)RGB x 160(V)   | dots |
| LCD Active area     | 10.8 (H)*21.7 (V)   | mm   |
| Pixel size          | 0.135(H)*0.1356(V)  | mm   |

## 4. Product picture

| 版次  | 描述 | 日期         |
|-----|----|------------|
| #10 | 初版 | 2019/07/20 |
| #11 |    |            |
| #12 |    |            |



| CN1 4SPI |            |
|----------|------------|
| 1        | GND        |
| 2        | VCC        |
| 3        | CLK        |
| 4        | SDA (MOSI) |
| 5        | RES        |
| 6        | DC         |
| 7        | CS1        |
| 8        | BLK        |



14.55和13.44为屏幕中心到PCB边缘的中心距。

NOTE: 1. DISPLAY TYPE: 0.96' TFT

6. OPERATING TEMP: -20°C ~ +70°C.

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2. INTERFACE: 4SPI

7. STORAGE TEMP: -30°C ~ +80°C.

项目名称

LCM图

3. DRIVE METHOD: 80(H)RGB\*160(V)

8. CONNECTOR: ST7735

型号

HS96S01A

4. OPERATING VOLTAGE: VOP=3.3V

9. ALL WITHOUT TOLERANCES. X±0.2

页序:

版本: #A1

单位: mm

比例: 1:1

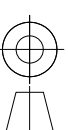
5. POLARIZER MODE: TRANSMISSIVE/NORMALLY BLACK

制图: 1/1

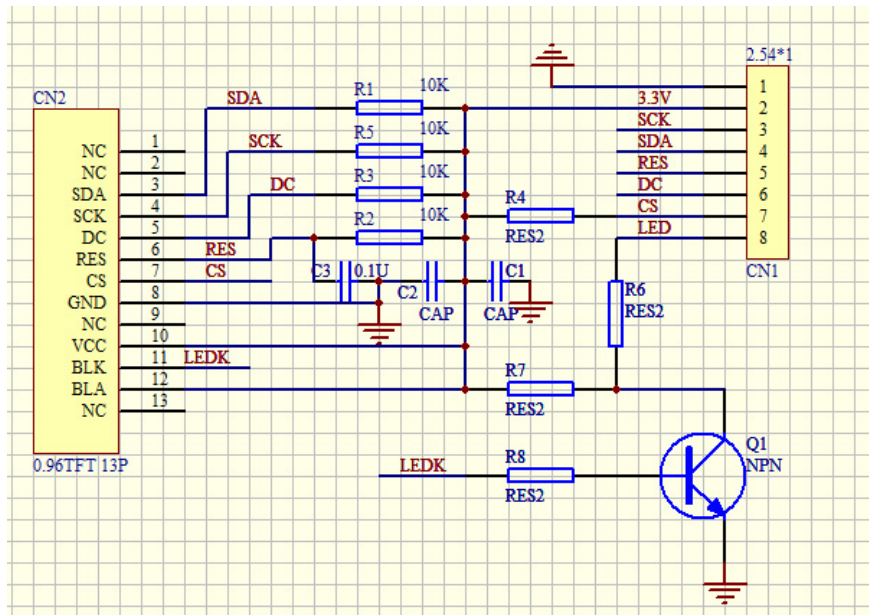
审核:

批准:

日期: 2019/07/20



## 6. Schematic diagram



## 7. Maximum Ratings

| Item                  | Symbol           | Min | Max | Unit | Note |
|-----------------------|------------------|-----|-----|------|------|
| Supply voltage        | VCC              | 2.8 | 3.3 | V    |      |
| Operating temperature | T <sub>OPR</sub> | -20 | 70  | °C   |      |
| Storage temperature   | T <sub>STR</sub> | -30 | 80  | °C   |      |

## 8. Electrical Characteristics

| Item                | Symbol              | Condition  | Min.              | Typ. | Max.              | Unit |
|---------------------|---------------------|--|-------------------|------|-------------------|------|
| Supply voltage      | Logic<br>$V_{CC}$   |  | 2.5               | 2.8  | 3.3               | V    |
| Input Voltage       | H level<br>$T_{IH}$ |  | $0.8 \cdot IOVCC$ |      | $IOVCC$           | V    |
|                     | L level<br>$T_{IL}$ |  | -0.3              |      | $0.2 \cdot IOVCC$ |      |
| Storage temperature | $I_{DD}$            | With internal voltage generation<br>$V_{CC}=2.8V$ ;<br>$T_{emp}=25^{\circ}C$ |                   |      | TBD               | mA   |

## 9. Backlight Characteristic

| Item                              | Symbol    | Min  | Typical | Max | Unit     |
|-----------------------------------|-----------|------|---------|-----|----------|
| LED module Forward voltage        | $V_{LED}$ | 3.0  | 3.3     | 3.5 | V        |
| LED module current                | $V_{LED}$ |      | 30      |     | mA       |
| L/G Surface Luminance ★1          | $L_S$     | 1000 |         |     | $Cd/m^3$ |
| LCM Surface brightness uniform ★2 | $L_D$     | 80   |         |     | %        |

★ 1 Test condition is:

(a) Center point on active area.

(b) Best Contrast.

★ 2 Uniform measure condition:

(1) Measure 9 point. Measure location show below;

(2)  $Uniform = (Min. \text{ brightness} / Max. \text{ brightness}) \cdot 100\%$

(3) Best Contrast.

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## 10. Module Function Description

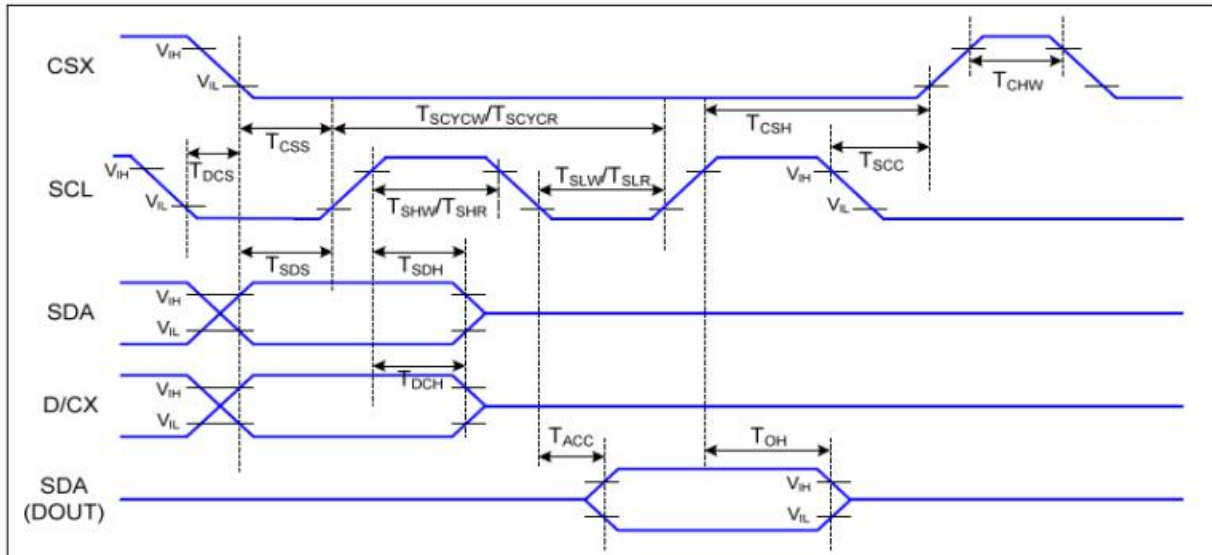
### 10.1 Pin Descriptions

| PIN No. | Symbol | Description  |
|---------|--------|--|
| 1       | GND    | <b>Ground of Logic Circuit</b><br>This is a ground pin. It acts as a reference for the logic pins. It must be connected to external ground   |
| 2       | VCC    | <b>Power Supply for Logic</b><br>This is a voltage supply pin. It must be connected to external source   |
| 3       | SCL    | <b>The serial clock input</b>  |
| 4       | SDA    | <b>The serial data input, MOSI</b>   |
| 5       | RES    | <b>Power Reset for Controller and Driver</b><br>This pin is reset signal input. When the pin is low, initialization of the chip is executed. Keep this pin pull high during normal operation   |
| 6       | DC     | <b>Data/Command Control</b><br>This pin is Data/Command control pin. When the pin is pulled high, the input at SDA is treated as display data. When the pin is pulled low, the input at SDA will be transferred to the command register. |
| 7       | CS     | <b>Chip Select</b><br>This pin is the chip select input. The chip is enabled for MCU communication only when CS# is pulled low.  |
| 8       | BLK    | <b>Backlight control pin</b><br>When the pin is pulled high turn on backlight, When the pin is pulled low turn off backlight   |



## 10.2 Timing characteristics.

**Serial Interface Characteristics (4-line Serial)**



**4-line Serial Interface Timing**

| Signal           | Symbol             | Parameter                      | MIN | MAX | Unit | Description                               |
|------------------|--------------------|--------------------------------|-----|-----|------|---|
| CSX              | T <sub>CSS</sub>   | Chip Select Setup Time (Write) | TBD |     | ns   |   |
|                  | T <sub>CSH</sub>   | Chip Select Hold Time (Write)  | TBD |     | ns   |   |
|                  | T <sub>CSS</sub>   | Chip Select Setup Time (Read)  | TBD |     | ns   |   |
|                  | T <sub>SCC</sub>   | Chip Select Hold Time (Read)   | TBD |     | ns   |   |
|                  | T <sub>CHW</sub>   | Chip Select "H" Pulse Width    | TBD |     | ns   |   |
| SCL              | T <sub>SCYCW</sub> | Serial Clock Cycle (Write)     | TBD |     | ns   | -Write Command & Data Ram                 |
|                  | T <sub>SHW</sub>   | SCL "H" Pulse Width (Write)    | TBD |     | ns   |   |
|                  | T <sub>SLW</sub>   | SCL "L" Pulse Width (Write)    | TBD |     | ns   |   |
|                  | T <sub>SCYCR</sub> | Serial Clock Cycle (Read)      | TBD |     | ns   | -Read Command & Data Ram                  |
|                  | T <sub>SHR</sub>   | SCL "H" Pulse Width (Read)     | TBD |     | ns   |   |
|                  | T <sub>SLR</sub>   | SCL "L" Pulse Width (Read)     | TBD |     | ns   |   |
| D/CX             | T <sub>DCS</sub>   | D/CX Setup Time                | TBD |     | ns   |   |
|                  | T <sub>DCH</sub>   | D/CX Hold Time                 | TBD |     | ns   |   |
| SDA (DIN) (DOUT) | T <sub>SDS</sub>   | Data Setup Time                | TBD |     | ns   | For Maximum CL=30pF<br>For Minimum CL=8pF |
|                  | T <sub>SDH</sub>   | Data Hold Time                 | TBD |     | ns   |   |
|                  | T <sub>ACC</sub>   | Access Time                    | TBD | TBD | ns   |   |
|                  | T <sub>OH</sub>    | Output Disable Time            | TBD | TBD | ns   |   |

**4-line Serial Interface Characteristics**

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## 10.3 Commands

Refer to the Technical Manual for the ST7735S

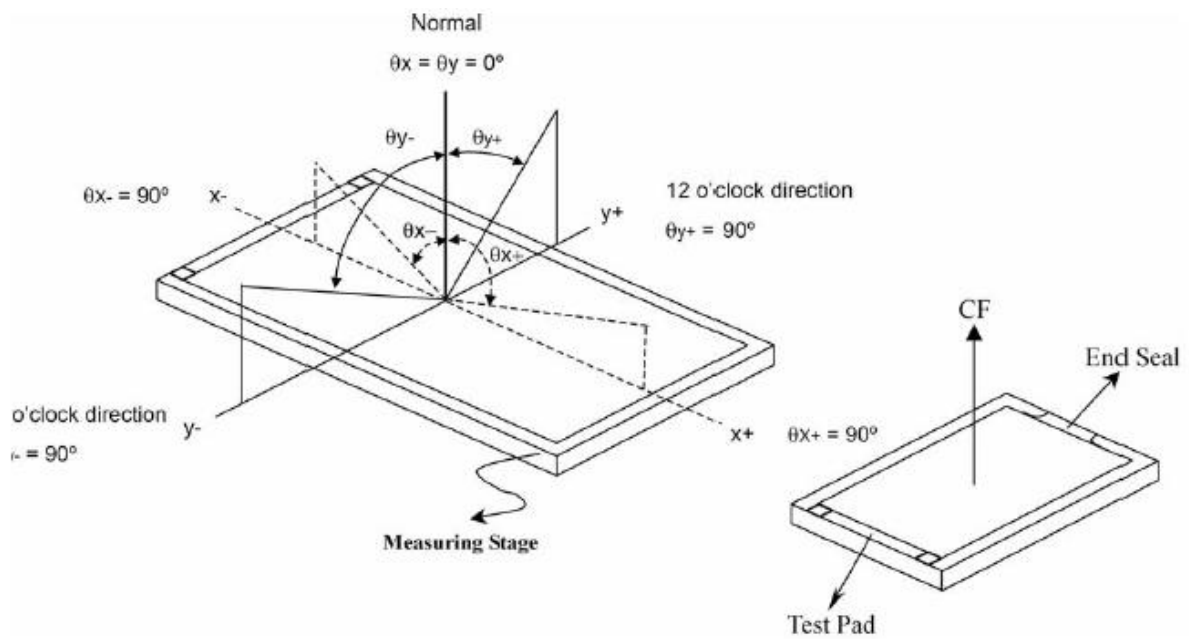
## 11. Electro-optical Characteristics

| Item   | Symbol                  | Conditions               | Temp                       | Min.                      | Typ. | Max. | Unit | Note  |
|--|-------------------------|--------------------------|----------------------------|---------------------------|------|------|------|-------|
| Response Time                                  | $T_R$                   | $\theta = \phi = 0$      | 25°C                       |                           | TBD  | TBD  | msec | NOTE2 |
|  | $T_F$                   |                          |                            |                           | TBD  | TBD  |      |       |
| Viewing Angle Range                            | $\phi = 0^\circ (6'' )$ | $\phi = 90^\circ (3'' )$ | $\phi = 180^\circ (12'' )$ | $\phi = 270^\circ (9'' )$ |      |      |      | NOTE3 |
| $\theta (25^\circ\text{C}) \text{ CR} \geq 10$ | TBD                     | TBD                      | TBD                        | TBD                       |      |      |      | NOTE3 |

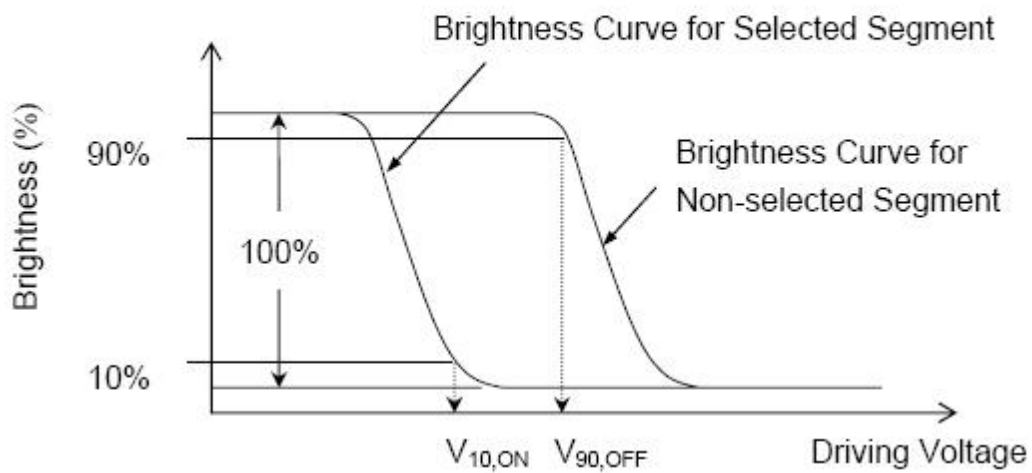
The above “viewing angle” is the measuring position with the largest contrast ratio. Not for good image quality. Viewing direction for good image quality is 12 O'clock.

● For panel only

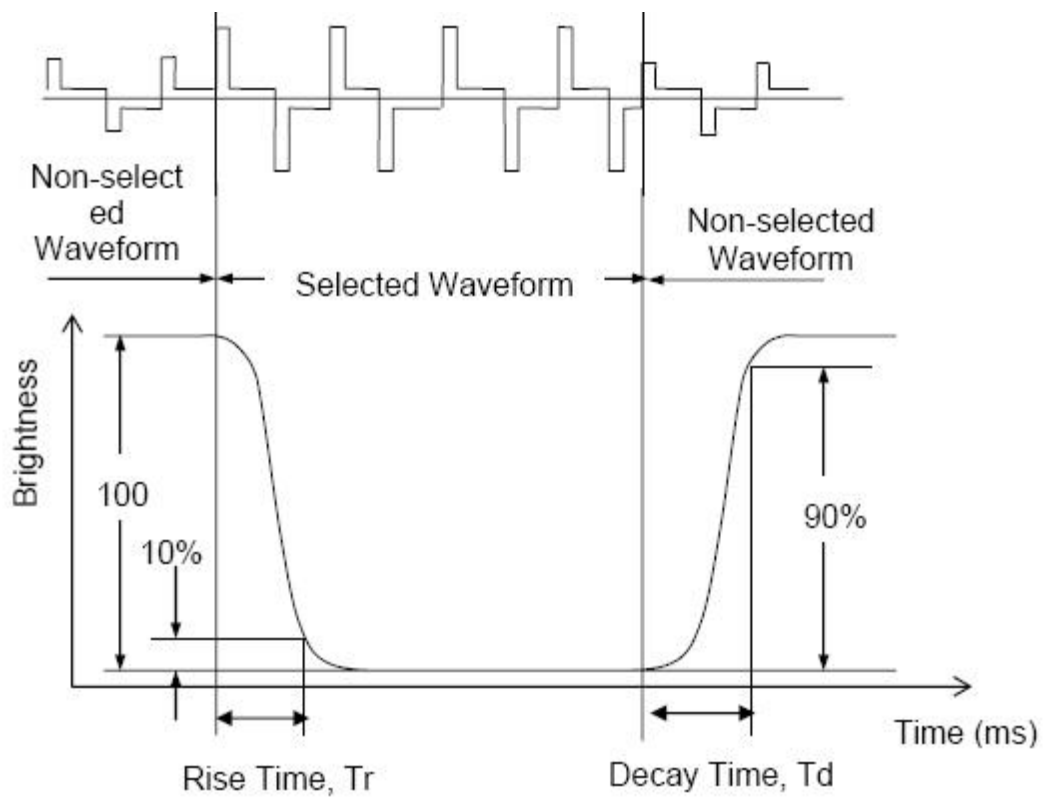
● Electro-Optical Characteristics Test Method



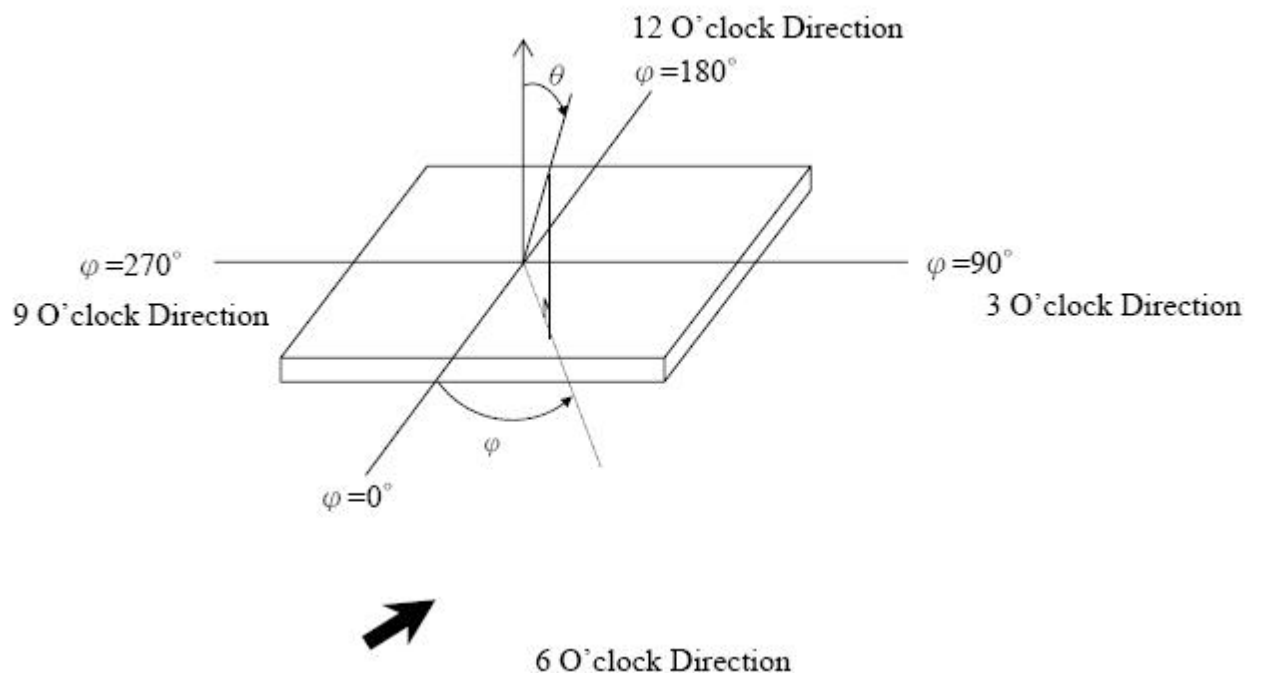
$$V_{op} = (V_{10, ON} + V_{90, OFF})/2$$



**.Note2.Definition of Optical Response Time:**

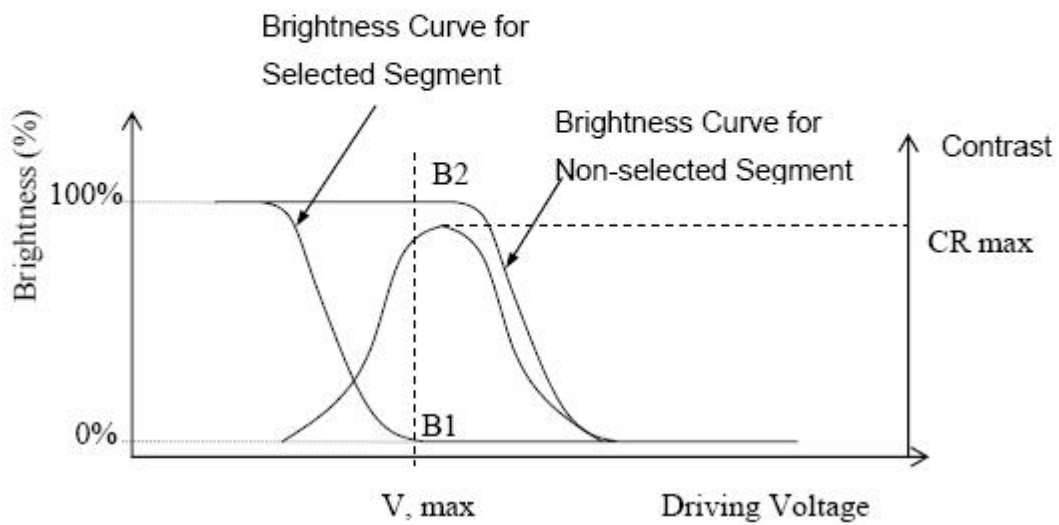


**.Note3.Definition of Viewing Angle  $\theta$  and  $\phi$  :**



**Note4.Definition of Contrast ratio (CR):**

$$CR = \frac{\text{Brightness of Non-selected Segment (B2)}}{\text{Brightness of Selected Segment (B1)}}$$



## 12. Reliability

### 12.1 Mtbf

The LCD module shall be designed to meet a minimum MTBF value of 50000 hours with normal

### 12.2 Test condition

| NO. | ITEM   | CONDITION                                 | CRITERION  |
|-----|--|---|--|
| 1   | High Temperature Non-Operating Test          | 80°C*240Hrs                               | <ul style="list-style-type: none"> <li>◦ No Defect Of Operational Function In Room Temperature Are Allowable</li> <li>◦ IDD of LCM in Pre-and Post-Test Should Follow Specification</li> </ul> |
| 2   | Low Temperature Non-Operating Test           | -30°C*240Hrs                              |  |
| 3   | High Temperature/Humidity Non Operating Test | 60°C*90%RH*240Hrs                         |  |
| 4   | High Temperature Operating Test              | 70°C*240Hrs                               |  |
| 5   | Low Temperature Operating Test               | -20°C*240Hrs                              |  |
| 6   | Thermal Shock Test                           | -20°C (30Min) ↔ 70°C (30Min)<br>*10CYCLES |  |

Notes:

1. Judgments should be made after exposure in room temperature for two hours.
2. The distill water is used for the high temperature/humidity test.
3. The sample above is individually for every reliability tests condition.

## 13. Inspection standards

### 1. AQL (Acceptable Quality Level)

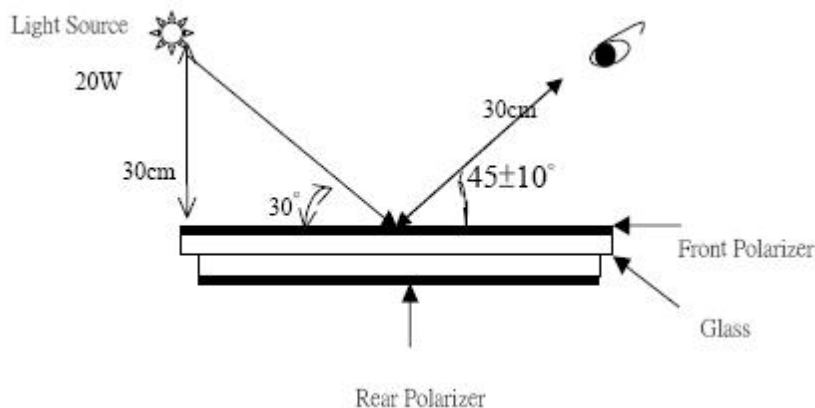
AQL of major and minor defect.

|     | MAJOR DEFECT | MINOR DEFECT |
|-----|--------------|--------------|
| AQL | 0.65         | 1.5          |

### 2. Basic conditions for inspection

The LCM face to us, in normal environment, the lux is  $1000 \pm 200$ . (Darkroom's lux:  $100 \pm 50$ ), About an angle of incidence  $30^\circ$ , a distance of 30 cm with an angle of  $45 \pm 10^\circ$  to check the products without uncovering the film!

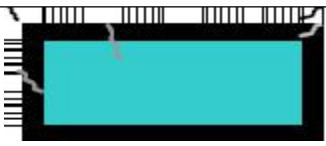
(As shown below)

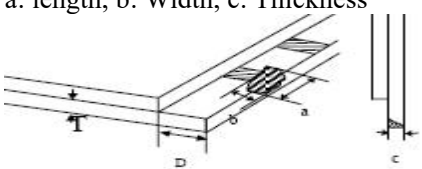
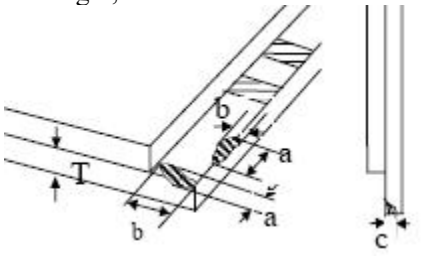
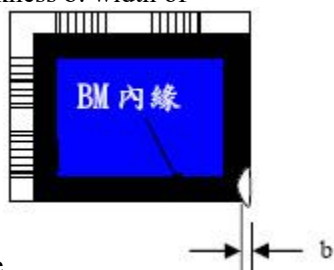


### 3. Inspection item and criteria

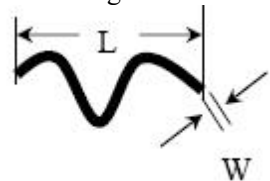
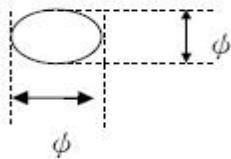
#### 3.1 Visual inspection criterion in immobility

##### 3.1.1 Glass defect

| NO | Defect item                                      | Criteria  | Remark  |
|----|--|---|---|
| 1  | Dimension Unconformity (Major defect)            | By Engineering Drawing  |   |
| 2  | Cracks (Major defect)                            | 1. Linear cracks panel<br>2. Nonlinear crack contrast by limited sample   |  |
| 3  | Glass extrude the conductive area (minor defect) | a: disregards and no influence assemblage.<br>1) $b \leq 1/3$ Pin width (non bonding area)<br>2) bonding area $\leq 0.5$ mm | A: Length, b: Width   |

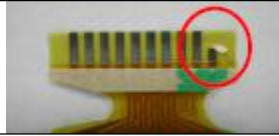
|   |   |   |  |
|---|---|---|--|
|   |   | <b>【Accept】</b>   |  |
| 4 | Pin-side ,conductive area damaged<br>(minor defect)     | (a c: disregards)<br>$b \leq 1/3$ of effective length for bonding electrode<br><b>【Accept】</b>  | a: length, b: Width, c: Thickness<br> |
| 5 | Pin-side, non-conductive area damaged<br>(minor defect) | 1) Damage area don't touch the ITO (Including contraposition mark, except scribing mark) <b>【Accept】</b><br>2) $C < T$ $b \leq BM/3$ of width <b>【Accept】</b><br>3) $c = T$<br>b not touch the seal glue <b>【Accept】</b><br>4) a disregards | a: Length, b: Width c: Thickness<br>  |
| 6 | Non-pin-side damage<br>(minor defect)                   | $c < T$<br>1) b exceeds $1/3 BM$ <b>【Reject】</b><br><br>$c = T$<br>b not touch the seal glue <b>【Reject】</b>  | c: Thickness b: width of<br>         |

### 3.1.2 LCD appearance defect (View area)

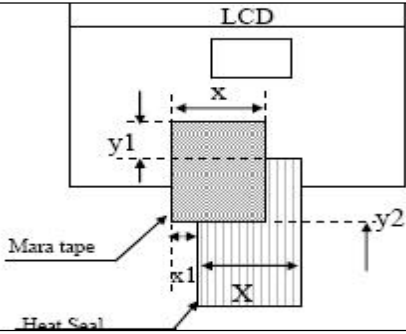
| NO | Defect item  | Criteria   |           | Remark   |
|----|--|--|-----------|--|
|    |  | Specification  | Allowable |  |
| 1  | Fiber, glass cratch、 polarizer scratch/folded<br>(minor defect)  | $W \leq 0.03\text{mm}$   | disregard | note1: L: Length, W: Width<br>note2: disregard if out of AA<br> |
|    |  | $0.03\text{mm} < W \leq 0.05\text{mm};$<br>$L \leq 3.0\text{mm}$ | 2         |  |
|    |  | $0.05\text{mm} < W \leq 0.1\text{mm};$<br>$L \leq 3.0\text{mm}$  | 1         |  |
|    |  | $W > 0.1\text{mm}; L > 3.0\text{mm}$                             | 0         |  |
| 2  | Polarizer bubble、 concave and convex<br>(minor defect)           | $\phi \leq 0.2\text{mm}$   | disregard | note1: $\phi = (L+W)/2$ , L: Length, W: Width<br>note2: disregard if out of AA   |
|    |  | $0.2\text{mm} < \phi \leq 0.3\text{mm}$                          | 2         |  |
|    |  | $0.3\text{mm} < \phi \leq 0.5\text{mm}$                          | 1         |  |
|    |  | $0.5\text{mm} < \phi$  | 0         |  |
| 3  | Black dots、 dirty dots、 impurities、 eye winker<br>(minor defect) | $\phi \leq 0.15\text{mm}$  | disregard | note2: disregard if out of AA<br>                               |
|    |  | $0.15\text{mm} < \phi \leq 0.25\text{mm}$                        | 2         |  |
|    |  | $0.25\text{mm} < \phi \leq 0.3\text{mm}$                         | 1         |  |
|    |  | $0.3\text{mm} < \phi$  | 0         |  |
| 4  | Polarizer prick  | $\phi \leq 0.1\text{mm}$   | disregard | note1: $\phi = (L+W)/2$ , L=Length,  |

|  |                |  |   |  |
|--|----------------|--|---|--|
|  | (minor defect) | $0.1\text{mm} < \phi \leq 0.25\text{mm}$ | 3 | W=Width<br>note2:the distance between two dots>5mm |
|  |                | $\phi > 0.25\text{mm}$                   | 0 |  |

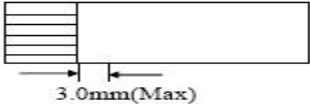
### 3.1.3FPC

| NO | Defect item   | Criteria                            |           | Remark  |
|----|---|-------------------------------------|-----------|---|
| 1  | Copper screen peel<br>(minor defect)                                    | Copper screen peel<br>【Reject】      |           |  |
| 2  | No release tape or peel   | No release tape or peel<br>【Reject】 |           |   |
| 3  | Dirty dot and impurity of FPC for customer using side<br>(minor defect) | Specification                       | Allowable | Note1: Cannot have stride ITO impurities  |
|    |   | $\phi \leq 0.25\text{mm}$           | 2         |   |
|    |   | $\phi > 0.25$                       | 0         |   |

### 3.1.4Black tape & Mara tape

| NO | Defect item                             | Criteria  | Remark  |
|----|---|---|---|
| 1  | FPC or H/S black tape<br>(minor defect) | 1. shift spec:<br>1) glue to the polarize<br>【Reject】<br>2) IC bare<br>【Reject】<br>2. left-and-right spec:<br>1) exceed of FPC edge or H-S edge<br>【Reject】<br>2) IC bare<br>【Reject】 |  |
| 2  | No black tape<br>(major defect)         | No black tape<br>【Reject】   |   |
| 3  | Tape position mistake<br>(minor defect) | Not by engineering drawing  |   |
| 4  | Mara tape defect<br>(minor defect)      | Peel before pulling the protecting film<br>【Reject】   |   |

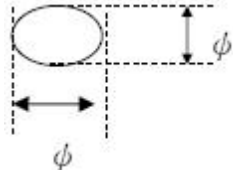
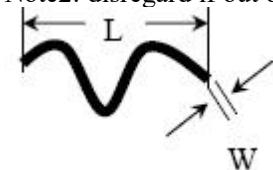
### 3.1.5Silicon and Taffy glue

| NO | Defect item                              | Criteria  | Remark  |
|----|--|---|---|
| 1  | Quantity of silicon<br>(major defect)    | Uncover the ITO and circuit area<br>【Reject】  | note: compared by engineering   |
| 2  | Taffy glue<br>(major defect)             | 1.Uncover the reveal copper area【Reject】<br>2.Cover layer 0.3mm(Min)~3.0mm(Max)<br>【Reject】 | note: if customer has special requirement, refer to the technical document<br> |
| 3  | Depth of glue covering<br>(major defect) | Depth of glue covering otop front Polarizer<br>【Reject】                                     | Except of the special requirement   |

### 3.2Electrical criteria

| NO | Defect item | Criteria | Remark |
|----|-------------|----------|--------|
|----|-------------|----------|--------|



|    |   |   |                   |  |
|----|---|---|-------------------|--|
| 1  | No display<br>(major defect)                                  | No display<br>【Reject】  |                   |  |
| 2  | Missing line<br>(major defect)                                | Missing line<br>【Reject】  |                   |  |
| 3  | Seg-com light and dark<br>(major defect)                      | Seg-com light and dark<br>【Reject】                              | ND filter 2% test |  |
| 4  | No display in immobility<br>(major defect)                    | No display in immobility<br>【Reject】                            |                   |  |
| 5  | Flicker of Pattern<br>(major defect)                          | Flicker of Pattern<br>【Reject】                                  |                   |  |
| 6  | Mura<br>(major defect)  | ND filter 2%test  |                   |  |
| 7  | Over current<br>(major defect)                                | Over current<br>【Reject】  |                   |  |
| 8  | Voltage out of specification<br>(major defect)                | Voltage out of specification<br>【Reject】                        |                   |  |
| 9  | Pattern blur, error code<br>(major defect)                    | Pattern blur, error code<br>【Reject】                            |                   |  |
| 10 | Dark light, Flicker<br>(major defect)                         | Dark light, Flicker<br>【Reject】                                 |                   |  |
| 11 | Black/white dots、 Dirty dots、 eye winker<br>(major defect)    | Specification   | Allowable         | Note 1:disregard if out of AA<br>                               |
|    |   | $\phi \leq 0.15\text{mm}$                                       | disregard         |  |
|    |   | $0.15\text{mm} < \phi \leq 0.25\text{mm}$                       | 2                 |  |
|    |   | $0.25\text{mm} < \phi \leq 0.3\text{mm}$                        | 1                 |  |
|    | $0.3\text{mm} < \phi$   | 0   |                   |  |
| 12 | Fiber、glass crutch、Polarizer scratch/folded<br>(major defect) | $W \leq 0.03\text{mm}$  | disregard         | Note 1:L: Length, W: Width<br>Note2: disregard if out of AA<br> |
|    |   | $0.03\text{mm} < W \leq 0.05\text{mm}$<br>$L \leq 3.0\text{mm}$ | 2                 |  |
|    |   | $0.05\text{mm} < W \leq 0.1\text{mm}$<br>$L \leq 3.0\text{mm}$  | 1                 |  |
|    |   | $W > 0.1\text{mm}; L > 3.0\text{mm}$                            | 0                 |  |

## 14.Precautions for using LCD modules.

### 14.1 Safety

- (1)Do not swallow any liquid crystal ,even if there is no proof that liquid crystal is poisonous.
- (2)If the LCD panel breaks, be careful not to get liquid crystal to touch your skin.
- (3)If skin is exposed to liquid crystal, wash the area thoroughly with alcohol or soap.

---

## 14.2 Srorang Conditions

- (4) Store the panel or module in a dark place where the temperature is  $23 \pm 5^{\circ}\text{C}$  and the humidity is below  $45 \pm 20\% \text{RH}$ .
- (5) Store in anti-static electricity container.
- (6) Store in clean environment, free from dust, active gas, and solvent.
- (7) Do not place the module near organics solvents or corrosive gases.
- (8) Do not crush, shake, or jolt the module.

## 14.3 Handling Precautions

- (9) Avoid static electricity, which can damage the CMOS LSI.
- (10) The polarizing plate of the display is very fragile, please handle it very carefully.
- (11) Do not give external shock.
- (12) Do not apply excessive force on the surface.
- (13) Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
- (14) Do not use ketonic solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.
- (15) Do not operate it above the absolute maximum rating.
- (16) Do not remove the panel or frame from the module.

## 14.4 Warranty

The period is within twelve months since the date of shipping out under normal using and storage conditions.

## 15. Revision history

| Version | Revise record    | Date       |
|---------|------------------|------------|
| v0.0    | Original version | 2021-04-06 |
|         |                  |            |
|         |                  |            |

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## 16. The appendix

### ST7735S\_initial

```
void LCD_Init(void)
{
    LCD_RES_Clr(); //复位
    delay_ms(100);
    LCD_RES_Set();
    delay_ms(100);

    LCD_BLK_Set(); //打开背光
    delay_ms(100);

    LCD_WR_REG(0x11); //Sleep out
    delay_ms(120); //Delay 120ms
    LCD_WR_REG(0xB1); //Normal mode
    LCD_WR_DATA8(0x05);
    LCD_WR_DATA8(0x3C);
    LCD_WR_DATA8(0x3C);
    LCD_WR_REG(0xB2); //Idle mode
    LCD_WR_DATA8(0x05);
    LCD_WR_DATA8(0x3C);
    LCD_WR_DATA8(0x3C);
    LCD_WR_REG(0xB3); //Partial mode
    LCD_WR_DATA8(0x05);
    LCD_WR_DATA8(0x3C);
    LCD_WR_DATA8(0x3C);
    LCD_WR_DATA8(0x05);
    LCD_WR_DATA8(0x3C);
    LCD_WR_DATA8(0x3C);
    LCD_WR_REG(0xB4); //Dot inversion
    LCD_WR_DATA8(0x03);
    LCD_WR_REG(0xC0); //AVDD GVDD
    LCD_WR_DATA8(0xAB);
    LCD_WR_DATA8(0x0B);
    LCD_WR_DATA8(0x04);
    LCD_WR_REG(0xC1); //VGH VGL
    LCD_WR_DATA8(0xC5); //C0
    LCD_WR_REG(0xC2); //Normal Mode
    LCD_WR_DATA8(0x0D);
    LCD_WR_DATA8(0x00);
    LCD_WR_REG(0xC3); //Idle
    LCD_WR_DATA8(0x8D);
    LCD_WR_DATA8(0x6A);
```

---

```

LCD_WR_REG(0xC4); //Partial+Full
LCD_WR_DATA8(0x8D);
LCD_WR_DATA8(0xEE);
LCD_WR_REG(0xC5); //VCOM
LCD_WR_DATA8(0x0F);
LCD_WR_REG(0xE0); //positive gamma
LCD_WR_DATA8(0x07);
LCD_WR_DATA8(0x0E);
LCD_WR_DATA8(0x08);
LCD_WR_DATA8(0x07);
LCD_WR_DATA8(0x10);
LCD_WR_DATA8(0x07);
LCD_WR_DATA8(0x02);
LCD_WR_DATA8(0x07);
LCD_WR_DATA8(0x09);
LCD_WR_DATA8(0x0F);
LCD_WR_DATA8(0x25);
LCD_WR_DATA8(0x36);
LCD_WR_DATA8(0x00);
LCD_WR_DATA8(0x08);
LCD_WR_DATA8(0x04);
LCD_WR_DATA8(0x10);
LCD_WR_REG(0xE1); //negative gamma
LCD_WR_DATA8(0x0A);
LCD_WR_DATA8(0x0D);
LCD_WR_DATA8(0x08);
LCD_WR_DATA8(0x07);
LCD_WR_DATA8(0x0F);
LCD_WR_DATA8(0x07);
LCD_WR_DATA8(0x02);
LCD_WR_DATA8(0x07);
LCD_WR_DATA8(0x09);
LCD_WR_DATA8(0x0F);
LCD_WR_DATA8(0x25);
LCD_WR_DATA8(0x35);
LCD_WR_DATA8(0x00);
LCD_WR_DATA8(0x09);
LCD_WR_DATA8(0x04);
LCD_WR_DATA8(0x10);

LCD_WR_REG(0xFC);
LCD_WR_DATA8(0x80);

LCD_WR_REG(0x3A);
LCD_WR_DATA8(0x05);

```

---

```
LCD_WR_REG(0x36);
LCD_WR_DATA8(0x78);
//LCD_WR_REG(0x21); //Display inversion
LCD_WR_REG(0x29); //Display on
LCD_WR_REG(0x2A); //Set Column Address
LCD_WR_DATA8(0x00);
LCD_WR_DATA8(0x1A); //26
LCD_WR_DATA8(0x00);
LCD_WR_DATA8(0x69); //105
LCD_WR_REG(0x2B); //Set Page Address
LCD_WR_DATA8(0x00);
LCD_WR_DATA8(0x01); //1
LCD_WR_DATA8(0x00);
LCD_WR_DATA8(0xA0); //160
LCD_WR_REG(0x2C);
}
```