

# **PRODUCT SPECIFICATION** **FOR LCD MODULE**

**Revision:** 1.0

**Model No:** LS0145I08-S-V1

**Module Type:** COG+FPC+B/L

**APPROVED SIGNATURE**

- Approved Product Specification only
- ☐ Approved Product Specification and Samples

| <b><u>Prepared By</u></b> | <b><u>Checked By</u></b> | <b><u>Approved By</u></b> |
|---------------------------|--------------------------|---------------------------|
|                           |                          |                           |

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# 1. General Description

LS0145I08-S-V1 is a transmissive type a-Si TFT-LCD (amorphous silicon thin film transistor liquid crystal display) module, which is composed of a TFT-LCD panel, a driver circuit and a backlight unit. The panel size is 1.45 inch and the resolution is 172(RGB)\*320, the panel can display up to 262k colors.

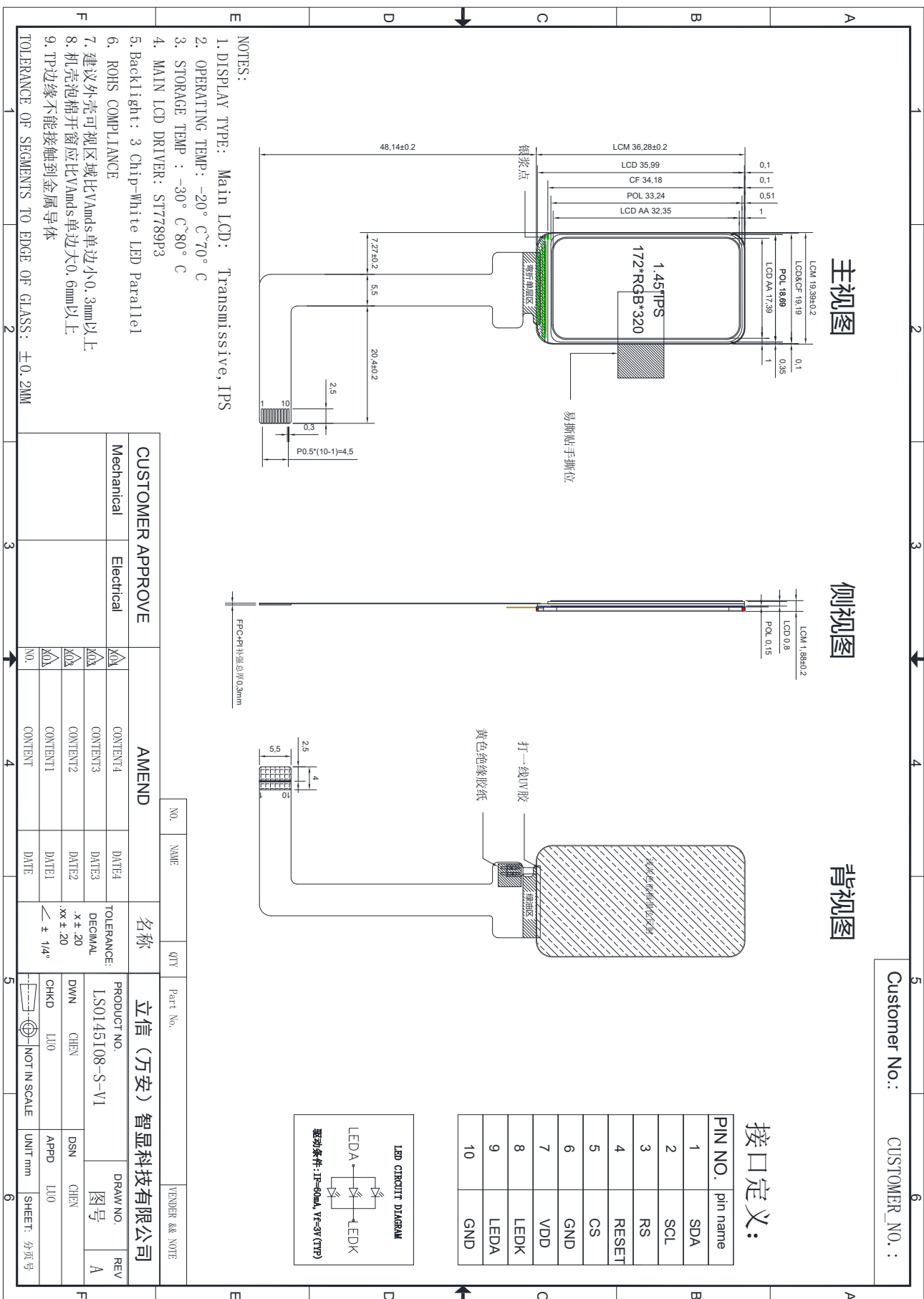
## 2. Physical Features

|                                            |                                      |
|--------------------------------------------|--------------------------------------|
| Display Mode                               | TFT-LCD Module                       |
|                                            | Active matrix TFT, Transmissive type |
| Display Format                             | Graphic 172(RGB)×320 Dot-matrix      |
| Input Data                                 | SPI                                  |
| Viewing Direction<br>(Grayscale Inversion) | IPS                                  |
| Drive                                      | ST7789P3                             |

## 3. Mechanical Specification

| Item                | Specification     | Unit  |
|---------------------|-------------------|-------|
| Module size (H×V×D) | 19.39 ×36.28×1.88 | mm    |
| Number of dots      | 172(RGB) × 320    | pixel |
| Active area (H×V)   | 17.39×32.35       | mm    |

## 4. Outline Dimension



## 5. Absolute Maximum Ratings

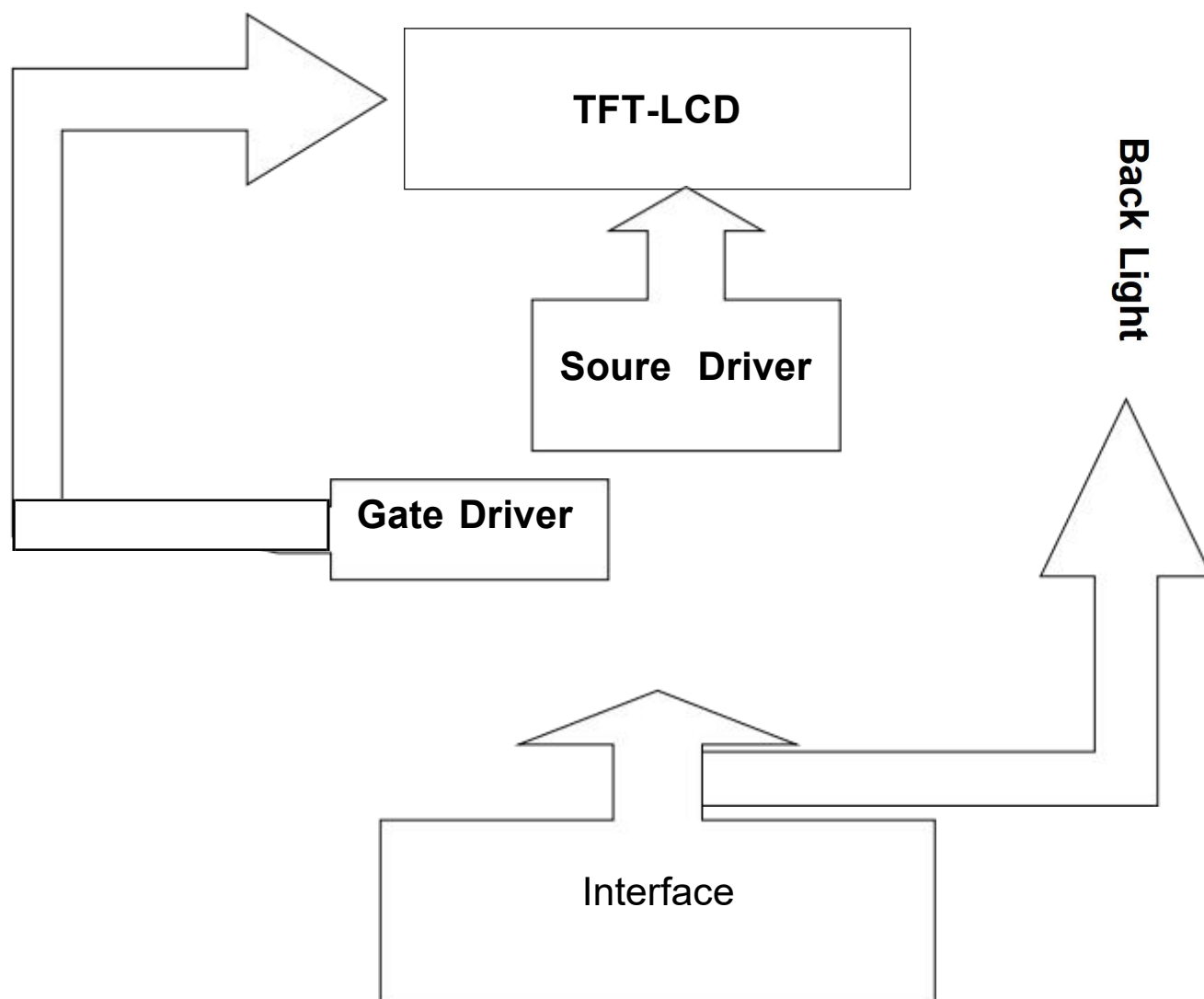
| Item                  | Symbol | Min  | Max | Unit | Remark         |
|-----------------------|--------|------|-----|------|----------------|
| Supply voltage        | VDD    | -0.3 | 4.6 | V    | Note1<br>Note2 |
| Operating temperature | TOPR   | -20  | 70  | °C   |                |
| Storage temperature   | TSTR   | -30  | 80  | °C   |                |

## 6. Electrical Characteristics

| Item           |         | Symbol | Rating    |     |           | Unit | Remark |
|----------------|---------|--------|-----------|-----|-----------|------|--------|
|                |         |        | Min       | Typ | Max       |      |        |
| Supply voltage |         | VDD    | 2.4       | 2.8 | 3.3       | V    | Note1  |
| Input Voltage  | L level | VIL    | 0         | --- | 0.3*IOVCC | V    |        |
|                | H level | VIH    | 0.7*IOVCC | --- | IOVCC     | V    |        |

## 7. Module Function Description

### 7- 1. Block Diagram Of LCM



## 7-2. Pin Description

| PIN NO. | Symbol | I/O | Description                     |
|---------|--------|-----|---------------------------------|
| 1       | SDA    | I/O | Serial data input/output PIN    |
| 2       | SCL    | I   | Serial clock pin                |
| 3       | RS     | I   | Command and Data select pin     |
| 4       | RESET  | I   | Reset pin.                      |
| 5       | CS     | I   | Chip select pin                 |
| 6       | GND    | P   | Ground                          |
| 7       | VDD    | P   | power supply                    |
| 8       | LEDK   | P   | Power for LED backlight cathode |
| 9       | LEDA   | P   | Power for LED backlight anode   |
| 10      | GND    | P   | Ground                          |

## 7-3 Timing Characteristics

### 7.4.3 Serial Interface Characteristics (4-line serial):

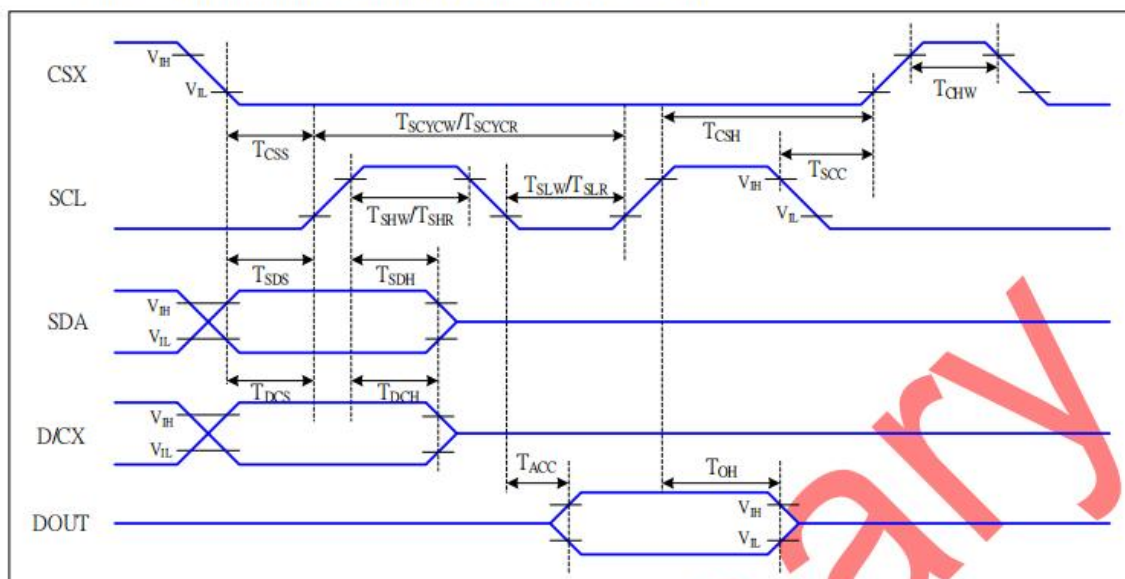


Figure 5 4-line serial Interface Timing Characteristics

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=25 °C

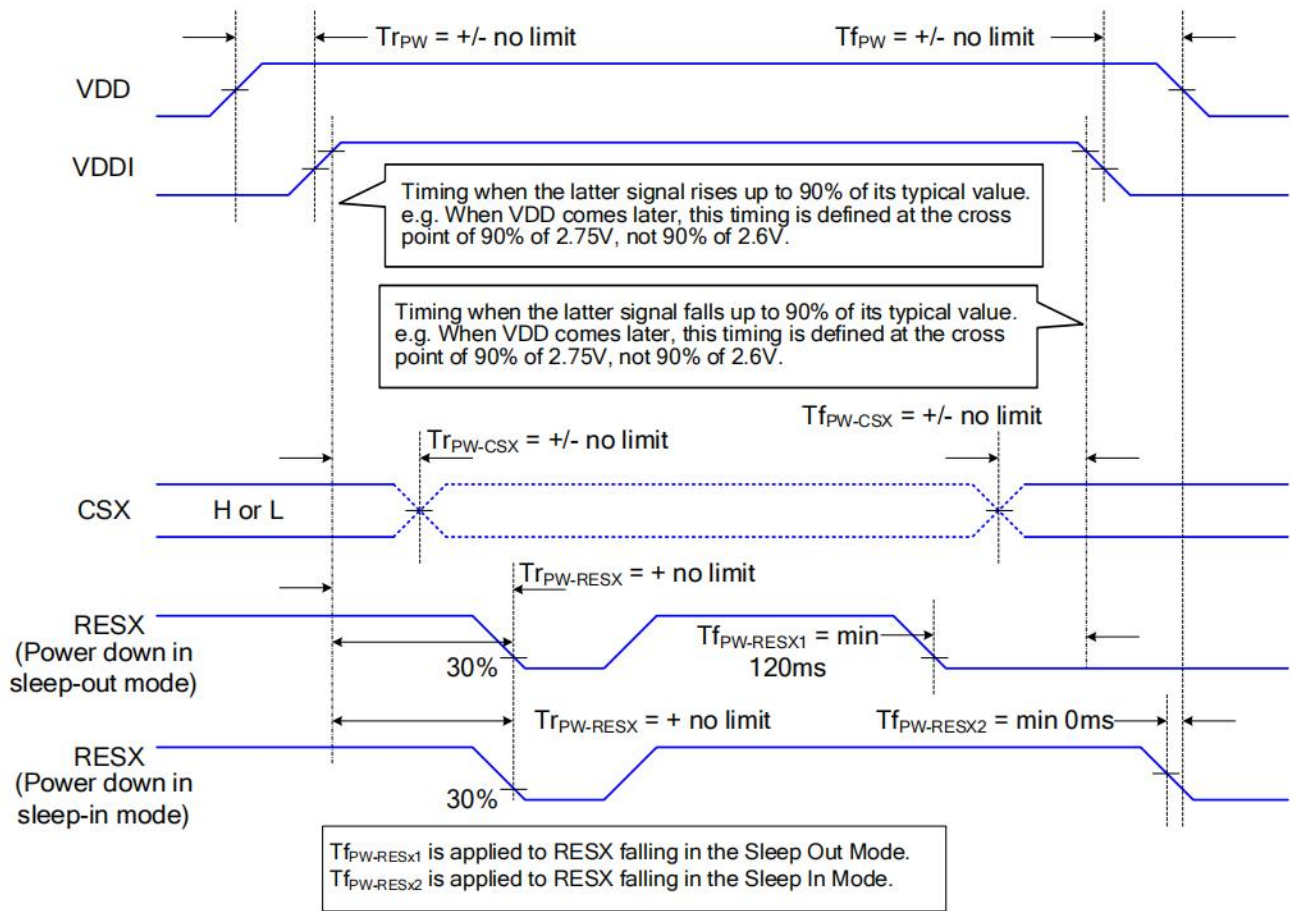
| Signal       | Symbol             | Parameter                      | MIN | MAX | Unit | Description                  |
|--------------|--------------------|--------------------------------|-----|-----|------|------------------------------|
| CSX          | T <sub>CSS</sub>   | Chip select setup time (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<br>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<br>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<br>(DIN) | T <sub>SDS</sub>   | Data setup time                | TBD | -   | ns   |                              |
|              | T <sub>SDH</sub>   | Data hold time                 | TBD | -   | ns   |                              |
| DOUT         | T <sub>ACC</sub>   | Access time                    | TBD | TBD | ns   | For maximum CL=30pF          |
|              | T <sub>OH</sub>    | Output disable time            | TBD | TBD | ns   | For minimum CL=8pF           |

Table 6 4-line serial Interface Characteristics

Note 1 : The rising time and falling time (Tr, Tf) of input signal are specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.



The power on/off sequence is illustrated below

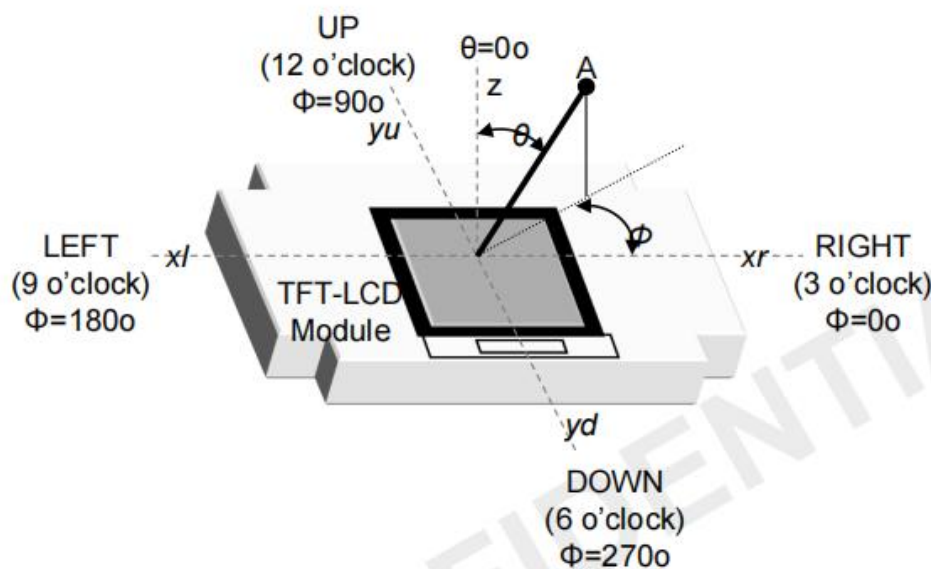


## 8. Electro-Optical Characteristics

| Item                         |            | Symbol | Condition                 | Min. | Typ.  | Max. | Unit | Remark |
|------------------------------|------------|--------|---------------------------|------|-------|------|------|--------|
| Response time                |            | Tr +Tf | $\theta_x = \theta_y = 0$ | ---  | 30    | 40   | ms   | Note 1 |
| Contrast Ratio               |            | CR     |                           | ---  | 1500  | ---  | ---  | Note 2 |
| Transmittance                |            | T%     |                           | 4.25 | 5.0   | ---  | %    |        |
| Color Chromaticity (CIE1931) | White      | W x    | $\theta_x = \theta_y = 0$ | ---  | 0.291 | ---  | ---  |        |
|                              |            | W y    |                           | ---  | 0.314 | ---  | ---  |        |
| Viewing angle                | $\theta_T$ |        | CR > 10                   | ---  | 85    | ---  | Deg. | Note 3 |
|                              | $\theta_B$ |        |                           | ---  | 85    | ---  |      |        |
|                              | $\theta_L$ |        |                           | ---  | 85    | ---  |      |        |
|                              | $\theta_R$ |        |                           | ---  | 85    | ---  |      |        |

**Note 4.1:** Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see Figure 8).

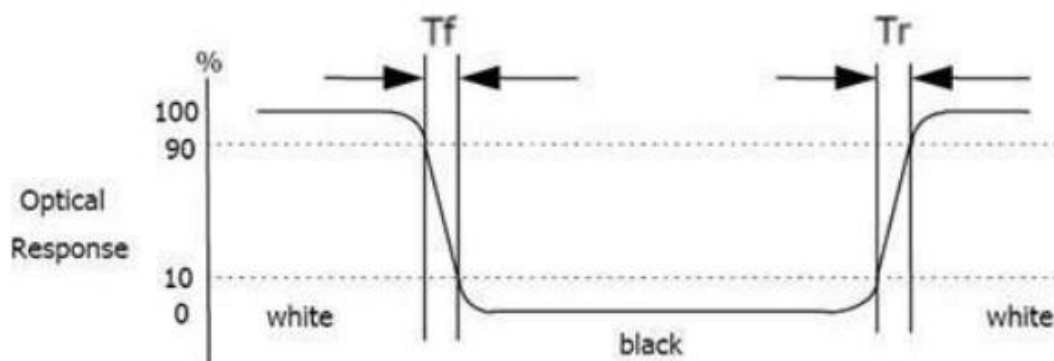
**<Figure 8. Viewing Angle Range Is Defined As Follows>**



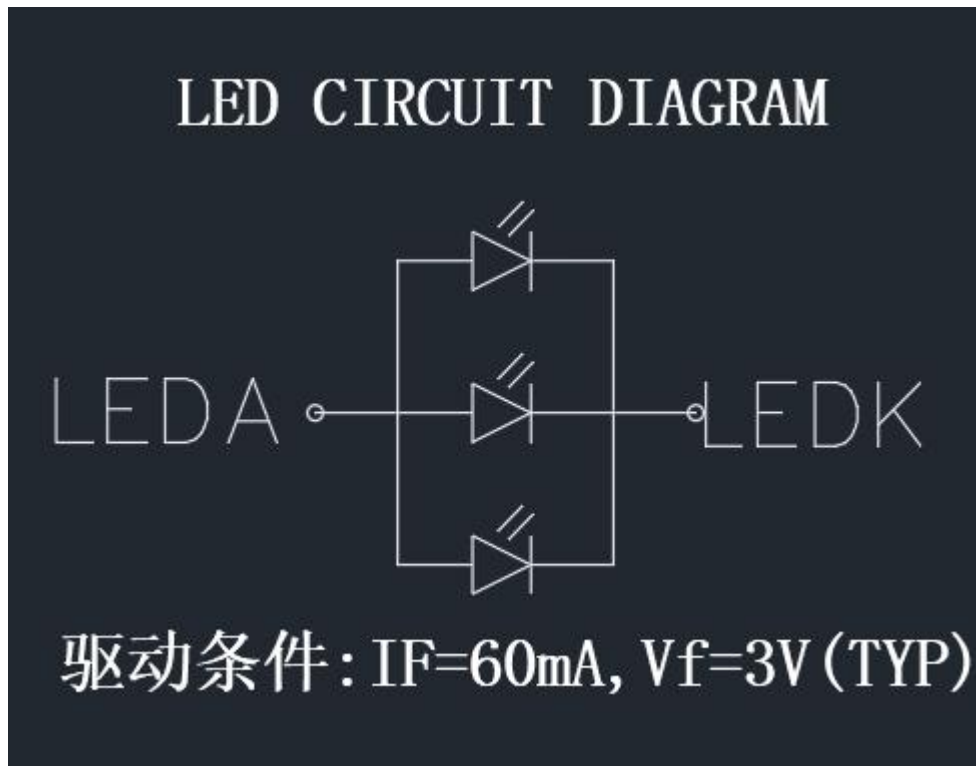
**Note 4.2:** Contrast measurements shall be made at viewing angle of  $\theta=0^\circ$  and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. Luminance Contrast Ratio (CR) is defined mathematically.

**Note 4.5:** The electro-optical response time measurements shall be made as Figure 9 by switching the “data” input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is  $T_r$ , and 90% to 10% is  $T_f$ .

**<Figure 9. Response Time Testing>**



**Note(4) Backlight circuit**



## 9. Inspection Standards

### 1. AQL(Acceptable Quality Level)

AQL of major and minor defect

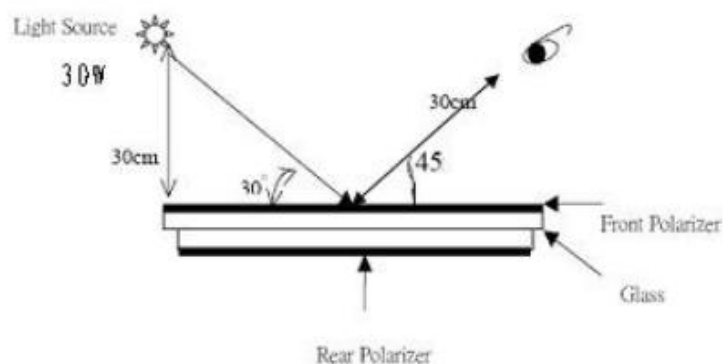
According to GB/T 2828-2003 ; , normal inspection, Class II

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

### 2. Basic conditions for inspection

The LCM face to us, in normal environment, About an angle of incidence 30°, a distance of 30cm with normal eye, with an angle of 45° to check the products without uncovering the film!

(As shown below)

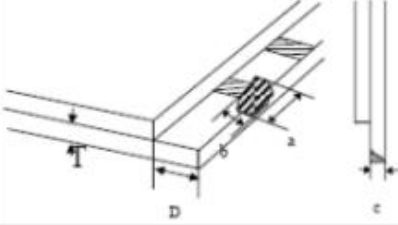
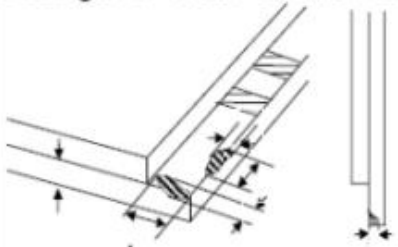


### 3. Inspection item and criteria

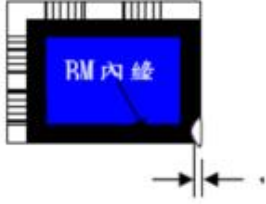
#### 3.1 Visual inspection criterion in immobility

##### 3.1.1 Glass defect

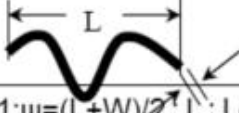
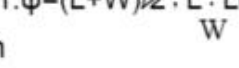
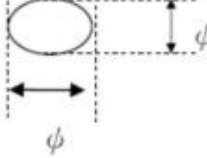
| No | Defect item                              | Criteria               | Remark |
|----|------------------------------------------|------------------------|--------|
| 1  | Dimension Unconformity<br>(Major defect) | By Engineering Drawing |        |

| No | Defect item                                              | Criteria                                                                                                                                                                                                                             | Remark                                                                                                                |
|----|----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| 2  | Cracks<br>(Major defect)                                 | 1.Linear cracks on panel<br>【 Reject】<br>2. Nonlinear crack contrast by limited sample                                                                                                                                               |                                                                                                                       |
| 3  | Glass extrude the conductive area<br>(minor defect)      | a: disregards and no influence assemblage<br>1) $b \leq 1/3$ Pin width(non bonding area)<br>【 Accept】<br>2) bonding area $\leq 0.5\text{mm}$<br>【 Accept】                                                                            | a:Length, b:Width                                                                                                     |
| 4  | Pin-side , conductive area damaged<br>(minor defect)     | (a c : disregards)<br>$b \leq 1/3$ of effective length for bonding electrode<br>【 Accept】                                                                                                                                            | 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 (Inclueing contraposition mark,except scribing mark )<br>【 Accept】<br>2) $c < T$ $b \leq BM$ 1/3 of width<br>【 Accept】<br>3) $c = T$<br>b not touch the seal glue<br>【 Accept】<br>4) a disregards | a:Length·b:Width·c:Thickness<br> |



| No | Defect item                               | Criteria                                                      | Remark                                                                                                                           |
|----|-------------------------------------------|---------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 6  | Non-pin-side damage<br><br>(minor defect) | $c < T$                                                       | $c$ : Thickness $b$ : width of damage<br><br> |
|    |                                           | 1) $b$ exceeds 1/3 BM                                         |                                                                                                                                  |
|    |                                           | <b>【Reject】</b>                                               |                                                                                                                                  |
|    |                                           | $c = T$<br>$b$ not touch the seal glue<br><br><b>【Reject】</b> |                                                                                                                                  |

### 3.1.2 LCD appearance defect (View area)

| No | Defect item                                                               | Criteria                                                        |           | Remark                                                                                                                                                                            |
|----|---------------------------------------------------------------------------|-----------------------------------------------------------------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Fiber 、glass<br>cratch 、polarizer<br>scratch/folded<br><br>(minor defect) | Specification                                                   | Allowable | note1: $L$ : Length , $W$ : Width<br>note2: disregard if out of AA<br>                         |
|    |                                                                           | $0.05\text{mm} < W \leq 0.1\text{mm};$<br>$L \leq 3.0\text{mm}$ | 1         |                                                                                                                                                                                   |
|    |                                                                           | $W > 0.1\text{mm}; L > 3.0\text{mm}$                            | 0         |                                                                                                                                                                                   |
| 2  | Polarizer bubble 、<br>concave and convex<br><br>(minor defect)            | $\psi \leq 0.2\text{mm}$                                        | disregard | note 1: $\psi = (L+W)/2$ ; $L$ : Length , $W$ :<br>Width<br>note2: disregard if out of AA<br> |
|    |                                                                           | $0.2\text{mm} < \psi \leq 0.3\text{mm}$                         | 2         |                                                                                                                                                                                   |
|    |                                                                           | $0.3\text{mm} < \psi \leq 0.5\text{mm}$                         | 1         |                                                                                                                                                                                   |
|    |                                                                           | $0.5\text{mm} < \psi$                                           | 0         |                                                                                                                                                                                   |
| 3  | Black dots 、dirty dots 、<br>impurities 、eyewinker<br><br>(Major defect)   | $\psi \leq 0.15\text{mm}$                                       | disregard | note2: disregard if out of AA<br>                                                            |
|    |                                                                           | $0.15\text{mm} < \psi \leq 0.25\text{mm}$                       | 2         |                                                                                                                                                                                   |
|    |                                                                           | $0.25\text{mm} < \psi \leq 0.3\text{mm}$                        | 1         |                                                                                                                                                                                   |
|    |                                                                           | $0.3\text{mm} < \psi$                                           | 0         |                                                                                                                                                                                   |
| 4  | Polarizer prick<br><br>(Major defect)                                     | $\psi \leq 0.1\text{mm}$                                        | disregard | note1: $\psi = (L+W)/2$ ; $L$ = Length ,<br>$W$ = Width<br>note2: the distance between two<br>dots $> 5\text{mm}$                                                                 |
|    |                                                                           | $0.1\text{mm} < \psi \leq 0.25\text{mm}$                        | 3         |                                                                                                                                                                                   |
|    |                                                                           | $\psi > 0.25\text{mm}$                                          | 0         |                                                                                                                                                                                   |

### 3.1.3 .FPC

| No | Defect item                                                                | Criteria                             |           | Remark                                      |
|----|----------------------------------------------------------------------------|--------------------------------------|-----------|---------------------------------------------|
| 1  | Copper screen peel<br>(Major defect)                                       | Copper screen peel<br>【 Reject】      |           |                                             |
| 2  | No release tape or peel<br>(Major defect)                                  | No release tape or peel<br>【 Reject】 |           |                                             |
| 3  | Dirty dot and impurity of<br>FPC for customer using<br>side (minor defect) | Specification                        | Allowable | note1: Cannot have stride ITO<br>impurities |
|    |                                                                            | $\psi \leq 0.25\text{mm}$            | 2         |                                             |
|    |                                                                            | $\psi > 0.25$                        | 0         |                                             |

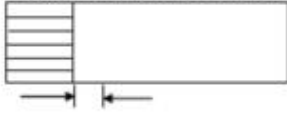
### 3.1.4 Black tape & Mara tape

|   |                                                  |                                                                                                                                                                                           |  |
|---|--------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| 1 | FPC or H/S black tape<br>shift<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<br>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<br>【 Reject】                                                                                                                                                   |  |
| 4 | Mara tape defect<br>(minor defect)               | Peel before pulling the protecting<br>film.<br>【 Reject】                                                                                                                                  |  |

### 3.1.5 Silicon and Tuffy glue

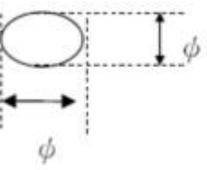
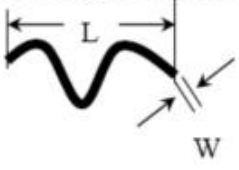
| No | Defect item                           | Criteria                                       | Remark                                    |
|----|---------------------------------------|------------------------------------------------|-------------------------------------------|
| 1  | Quantity of silicon<br>(minor defect) | Uncover the ITO and circuit area.<br>【 Reject】 | note: compared by engineering<br>drawing. |



| No | Defect item                              | Criteria                                                                                      | Remark                                                                                                                                                             |
|----|------------------------------------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2  | Tuffy glue<br>(minor defect)             | 1. Uncover the reveal copper area 【Reject】<br>2. Cover layer 0.3mm(Min) ~ 3.0mm(Max) 【accept】 | note:if customer has special requirement , refer to the technical document.<br> |
| 3  | Depth of glue covering<br>(minor defect) | Depth of glue covering overtop front Polarizer 【Reject】                                       | Except of the special requirement .                                                                                                                                |

### 3.2 Electrical criteria

| No | Defect item                                    | Criteria                              | Remark            |
|----|------------------------------------------------|---------------------------------------|-------------------|
| 1  | No display<br>(Major defect)                   | No display 【Reject】                   |                   |
| 2  | Missing line<br>(Major defect)                 | Missing line 【Reject】                 |                   |
| 3  | Seg-com light and dark<br>(Major defect)       | Seg-com light and dark 【Reject】       | ND filter 2% test |
| 4  | No display in immobility<br>(Major defect)     | No display in immobility 【Reject】     |                   |
| 5  | Flicker of Pattern<br>(Major defect)           | Flicker of Pattern 【Reject】           |                   |
| 6  | Mura<br>(Major defect)                         | ND filter 2% test                     |                   |
| 7  | Over current<br>(Major defect)                 | Over current 【Reject】                 |                   |
| 8  | Voltage out of specification<br>(Major defect) | Voltage out of specification 【Reject】 |                   |
| 9  | Pattern blur ,error code<br>(Major defect)     | Pattern blur ,error code 【Reject】     |                   |
| 10 | Dark light, Flicker<br>(Major defect)          | Dark light, Flicker 【Reject】          |                   |

| No | Defect item                                                                 | Criteria                                                          | Remark    |                                                                                                                                                       |
|----|-----------------------------------------------------------------------------|-------------------------------------------------------------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11 | Black/White dots<br>· Dirty dots · eyewinker<br><br>(Major defect)          | Specification                                                     | Allowable | Note1: disregard if out of AA<br>                                  |
|    |                                                                             | $\psi \leq 0.15\text{mm}$                                         | disregard |                                                                                                                                                       |
|    |                                                                             | $0.15\text{mm} < \psi \leq 0.25\text{mm}$                         | 2         |                                                                                                                                                       |
|    |                                                                             | $0.25\text{mm} < \psi \leq 0.3\text{mm}$                          | 1         |                                                                                                                                                       |
|    |                                                                             | $0.3\text{mm} < \psi$                                             | 0         |                                                                                                                                                       |
| 12 | Fiber · glass cratch ·<br>polarizer<br>scratch/folded<br><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         |                                                                                                                                                       |

## 10.Records Of Version

| Version | Revise Date | Page | Content      |
|---------|-------------|------|--------------|
| 00      | 2026-7-7    | ALL  | New released |
|         |             |      |              |
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