






# SPECIFICATIONS

**CUSTOMER** : \_\_\_\_\_  
**MODEL NO.** : **GFTO0177CA128160**  
**VERSION** : **B**  
**DATE** : **2023.03.02**  
**CERTIFICATION** : **ROHS**

| Customer Sign | Approved By   | Prepared By  | Prepared By   |
|---------------|---|--|---|
|               |  |  |  |

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# 1.SPECIFICATIONS

## 1.1 Features

### Main LCD Panel

| Item                          | Standard Value                                   |
|-------------------------------|--|
| Display Resolution            | 128 * (R · G · B) * 160 Dots                     |
| Display Mode                  | a-Si TFT , Normally White TN mode , Transmissive |
| Screen size(inch)             | 1.77" (Diagonal)                                 |
| Viewing Direction             | 12 O'clock                                       |
| Color configuration           | R.G.B. vertical stripe                           |
| Backlight                     | White LED  |
| Interface                     | 4LINE SPI Interface                              |
| Other(controller / driver IC) | ST7735S  |
| RoHS                          | YES  |

## 1.2 Mechanical Specifications

| Item              | Standard Value                | Unit |
|-------------------|-------------------------------|------|
| Outline Dimension | 34 (W) *43.78(L) * 2.6MAX (H) | mm   |

### LCD Panel

| Item              | Standard Value        | Unit |
|-------------------|-----------------------|------|
| Active Area (LCD) | 28.03 (W) * 35.04 (L) | mm   |

Note: For detailed information please refer to LCM drawing.



### 1.3 Absolute Maximum Ratings

#### Module

| Item                        | Symbol          | Condition | Min. | Max.  | Unit |
|-----------------------------|-----------------|-----------|------|-------|------|
| System Power Supply Voltage | VDD             | -         | -0.3 | +4.8  | V    |
|                             | VGH-VGL         | -         | -0.3 | +30.0 | V    |
| Operating Temperature       | T <sub>OP</sub> | -         | -20  | +70   | °C   |
| Storage Temperature         | T <sub>ST</sub> | -         | -30  | +80   | °C   |

### 1.4 DC Electrical Characteristics

#### Module

V<sub>CC</sub> = 1.65~3.3V, T<sub>a</sub> = 25°C

| Item                        | Symbol           | Condition                      | Min.    | Typ. | Max.    | Unit |
|-----------------------------|------------------|--------------------------------|---------|------|---------|------|
| System voltage              | VDD              |                                | 2.5     | 3.0  | 3.3     | V    |
| Interface operation voltage | VDDI             |                                | 1.65    | 1.8  | 3.3     | V    |
| TFT Gate ON voltage         | VGH              |                                |         | 15   |         | V    |
| TFT Gate OFF voltage        | VGL              |                                |         | -7.5 |         | V    |
| TFT Common voltage          | V <sub>com</sub> |                                | -1.5    |      | 3.5     | V    |
| Input High Voltage          | V <sub>IH</sub>  | -                              | 0.7*VDD | -    | VDD     | V    |
| Input Low Voltage           | V <sub>IL</sub>  | -                              | GND     | -    | 0.3*VDD | V    |
| Output High Voltage         | V <sub>OH</sub>  | I <sub>OH</sub> =-1.0mA        | 0.8*VDD | -    | VDD     | V    |
| Output Low Voltage          | V <sub>OL</sub>  | I <sub>OL</sub> =+1.0mA        | GND     | -    | 0.2*VDD | V    |
| Supply Current              | I <sub>DD</sub>  | VDD= 3.0V,<br>Pattern= Black*1 | -       | 10   | -       | mA   |

Note1 : Maximum current display.



### 1.5 Optical Characteristics

#### TFT LCD Panel

VDD = 2.8V, Ta=25°C

| Item  | Symbol | Condition                | Min. | Typ.  | Max.  | unit  |       |       |
|---|--------|--------------------------|------|-------|-------|-------|-------|-------|
| Response time   | Tr     | Ta = 25°C<br>θX, θY = 0° |      | 2     | 4     | ms    | Note2 |       |
|   | Tf     |                          | -    | 6     | 12    |       |       |       |
| Viewing angle   | Top    | CR ≥ 10                  | 35   | 45    | -     | Deg.  | Note4 |       |
|   | Bottom |                          | 10   | 20    | -     |       |       |       |
|   | Left   |                          | 35   | 45    | -     |       |       |       |
|   | Right  |                          | 35   | 45    | -     |       |       |       |
| Contrast ratio  | CR     |                          | 400  | 500   | -     | -     | Note3 |       |
| Color of CIE Coordinate<br>(With B/L)                     | White  | Ta = 25°C<br>θX, θY = 0° | X    | 0.283 | 0.303 | 0.323 | -     | Note1 |
|   |        |                          | Y    | 0.305 | 0.325 | 0.345 |       |       |
|   | Red    |                          | X    | 0.606 | 0.626 | 0.646 |       |       |
|   |        |                          | Y    | 0.314 | 0.334 | 0.354 |       |       |
|   | Green  |                          | X    | 0.257 | 0.277 | 0.297 |       |       |
|   |        |                          | Y    | 0.529 | 0.549 | 0.569 |       |       |
|   | Blue   |                          | X    | 0.122 | 0.142 | 0.162 |       |       |
|   |        |                          | Y    | 0.102 | 0.122 | 0.142 |       |       |
| Average Brightness<br>Pattern=white display<br>(With B/L) | IV     | IF= 30mA                 | 150  | 220   | -     | cd/m2 |       |       |
| Uniformity(With B/L)                                      | ΔB     | IF= 30mA                 | 75   | -     | -     | %     |       |       |

Note1:

1 :  $\Delta B = B(\min) / B(\max) \times 100\%$ .

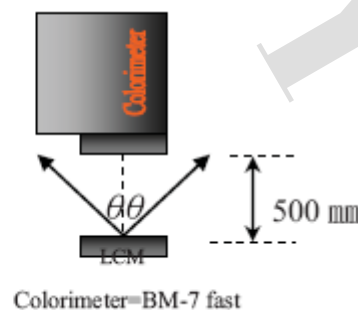
2 : Measurement Condition for Optical Characteristics:

a : Environment: 25°C±5°C / 60±20%R.H, no wind, dark room below 10 Lux at typical lamp current and typical operating frequency.

b : Measurement Distance: 500 ± 50 mm, (θ= 0°).

c : Equipment: TOPCON BM-7 fast, (field 1°), after 10 minutes operation.

d : The uncertainty of the C.I.E coordinate measurement ±0.01, Average Brightness ± 4%.



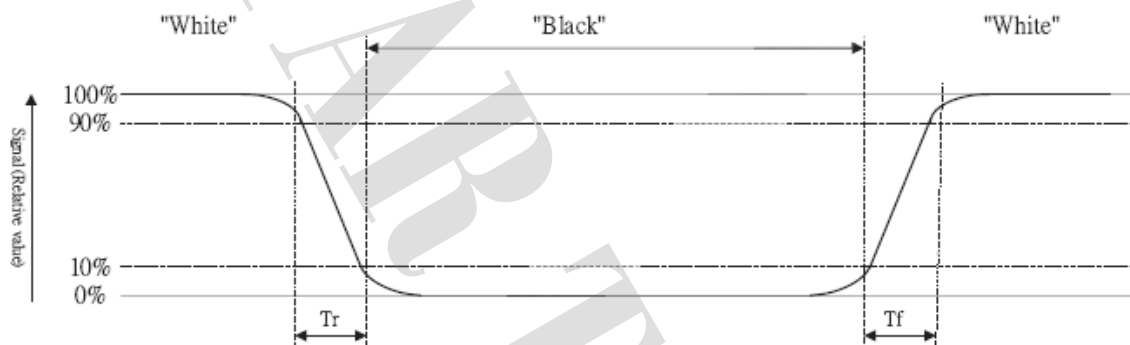


Note2: Definition of response time:

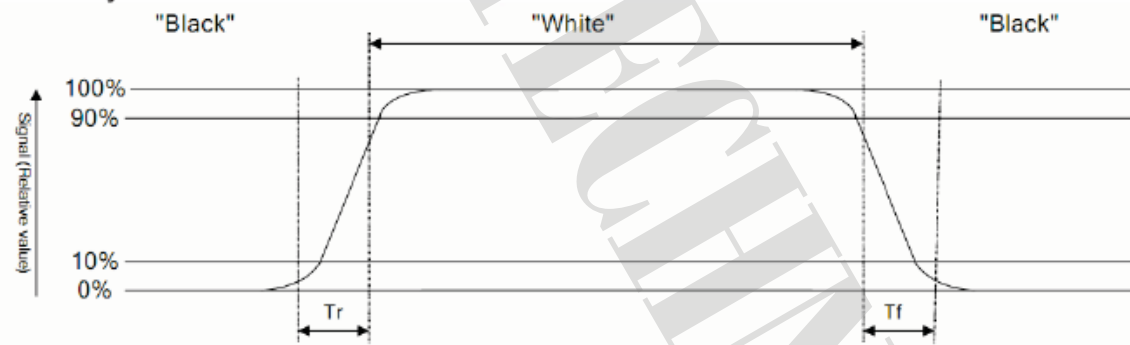
The output signals of photo detector are measured when the input signals are changed from “black” to “white”(falling time) and from “white” to “black”(rising time), respectively. The response time is defined as the time interval between the 10% and 90% of Amplitudes.

Refer to figure as below:

Normally White



Normally Black



Note3: Definition of contrast ratio:

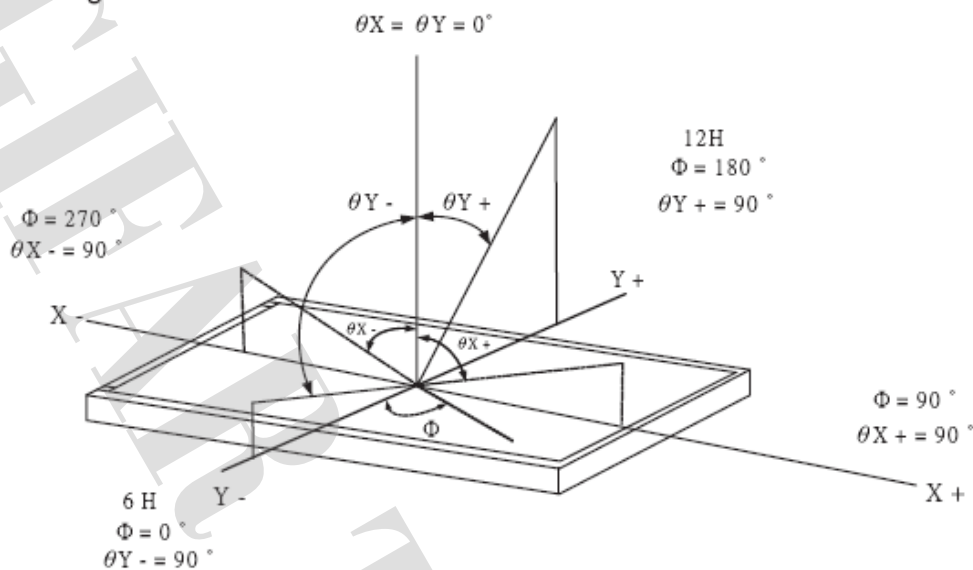
Contrast ratio is calculated with the following formula

$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output when LCD is at "White" state}}{\text{Photo detector output when LCD is at "Black" state}}$$



Note4: Definition of viewing angle:

Refer to figure as below:



## 1.6 Backlight Characteristics

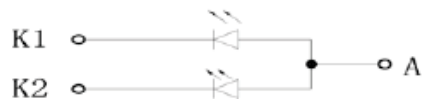
### 1.6.1 Electrical / Optical Characteristics

| Item                                     | Symbol | Conditions | Min.         | Typ.         | Max. | Unit              |
|--|--------|------------|--------------|--------------|------|-------------------|
| Forward Voltage                          | VF     | IF=30mA    | 2.9          | 3.0          | 3.1  | V                 |
| Average Brightness<br>(without LCD)      | IV     | IF=30mA    | 3000         | 3500         | -    | cd/m <sup>2</sup> |
| Color of CIE Coordinate<br>(without LCD) | X<br>Y |            | 0.24<br>0.24 | 0.29<br>0.29 | -    |                   |
| Color                                    |        | White      |              |              |      |                   |

\*1: This value will be changed while mass production.

\*2:  $\Delta B = B(\min)/B(\max) * 100\%$

B/L Internal Circuit Diagram



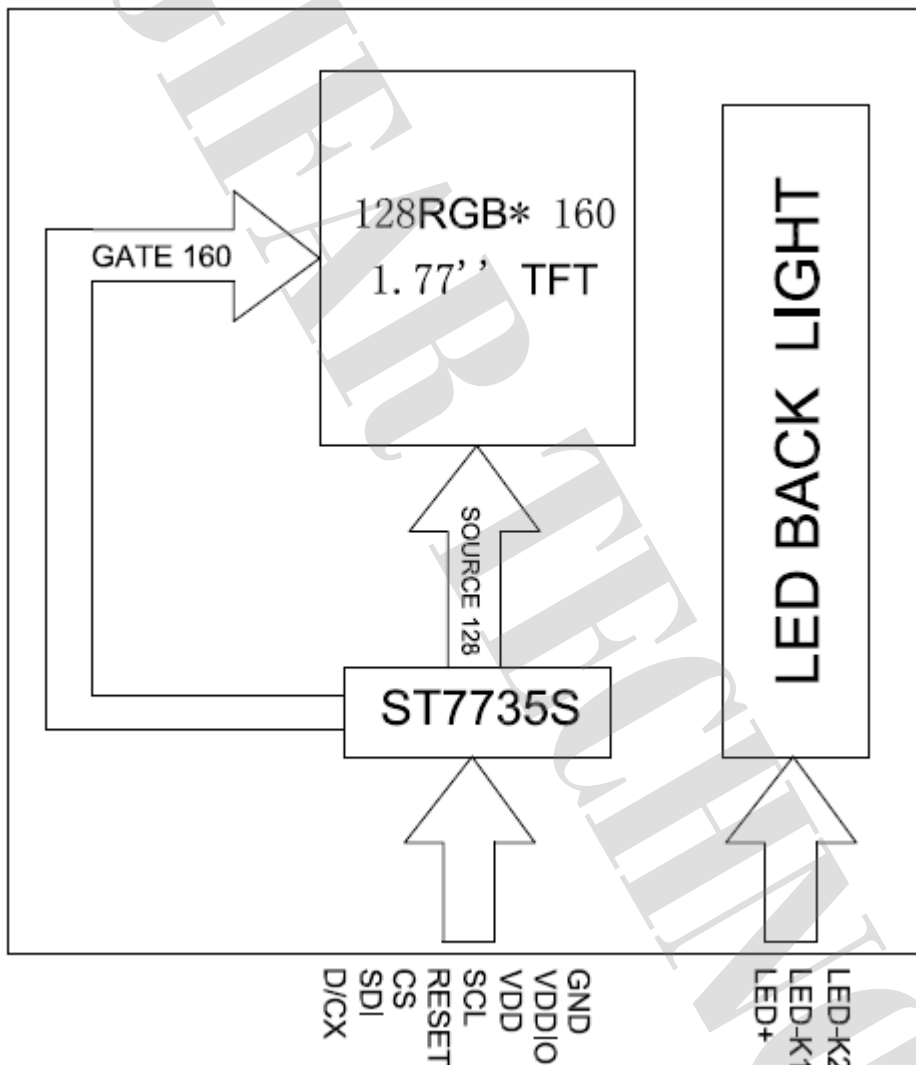
LED CIRCUIT:





## 2. MODULE STRUCTURE

### 2.1 Block Diagram

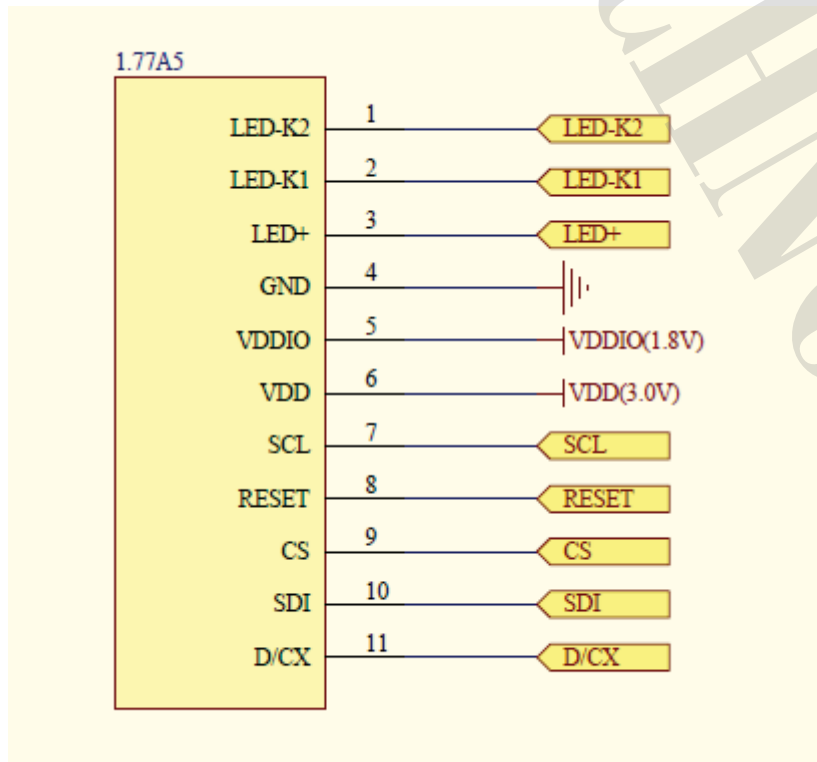




## 2.2 Interface Pin Description

| Pin NO. | Symbol | Description                               |
|---------|--------|---|
| 1       | LED-K2 | Back light cathode                        |
| 2       | LED-K1 | Back light cathode                        |
| 3       | LED+   | Back light anode                          |
| 4       | GND    | Ground                                    |
| 5       | VDDIO  | Power supply 1.8V                         |
| 6       | VDD    | Power supply 3.0V                         |
| 7       | SCL    | Synchronors clock signal                  |
| 8       | RESET  | Reset signal input terminal.Active at “L” |
| 9       | CS     | Chip select signal input pin              |
| 10      | SDI    | Input/output signal                       |
| 11      | D/CX   | Register select signal.                   |

### 2.2.1 Refer Initial code:





## 2.3 Refer Initial code:

### Init code on D63x

```
p_lcdspi_LcdResetHigh();
delayMs(10);
p_lcdspi_LcdResetLow();
delayMs(10);
p_lcdspi_LcdResetHigh();
delayMs(120);

p_LcdDriver_SendCmd(DRLCDC_CMD_SW_RESET); //0x01
delayMs(120);

p_LcdDriver_SendCmd(DRLCDC_CMD_SLEEP_OUT_BOOST_ON); //0x11
delayMs(120);

p_LcdDriver_SendCmd(DRLCDC_CMD_FRM_CTR1); //0xB1
p_LcdDriver_SendData(DRLCDC_DATA_FRMCTR1_RTNA); //0x01
p_LcdDriver_SendData(DRLCDC_DATA_FRMCTR1_FPA); //0x2c
p_LcdDriver_SendData(DRLCDC_DATA_FRMCTR1_BPA); //0x2d

p_LcdDriver_SendCmd(DRLCDC_CMD_FRM_CTR2); //0xB2
p_LcdDriver_SendData(DRLCDC_DATA_FRMCTR2_RTNB); //0x01
p_LcdDriver_SendData(DRLCDC_DATA_FRMCTR2_FPB); //0x2c
p_LcdDriver_SendData(DRLCDC_DATA_FRMCTR2_BPB); //0x2d

p_LcdDriver_SendCmd(DRLCDC_CMD_FRM_CTR3); //0xB3
p_LcdDriver_SendData(DRLCDC_DATA_FRMCTR3_RTNC); //0x01
p_LcdDriver_SendData(DRLCDC_DATA_FRMCTR3_FPC); //0x2c
p_LcdDriver_SendData(DRLCDC_DATA_FRMCTR3_BPC); //0x2d
p_LcdDriver_SendData(DRLCDC_DATA_FRMCTR3_RTND); //0x01
p_LcdDriver_SendData(DRLCDC_DATA_FRMCTR3_FPD); //0x2c
p_LcdDriver_SendData(DRLCDC_DATA_FRMCTR3_BPD); //0x2d

//Display Inversion Control
p_LcdDriver_SendCmd(DRLCDC_CMD_INVCTR); //0xB4
p_LcdDriver_SendData(DRLCDC_DATA_INVCTR_NL); //0x03
```



```
p_LcdDriver_SendCmd(DRLCDC_CMD_DISSET5); //0xB6
    p_LcdDriver_SendData(DRLCDC_DATA_DISSET5_D1); //0xB4
    p_LcdDriver_SendData(DRLCDC_DATA_DISSET5_D2); //0xF0
    //Power Control-1
    p_LcdDriver_SendCmd(DRLCDC_CMD_PWCTR1); //0xC0
    p_LcdDriver_SendData(DRLCDC_DATA_PWCTR1_D1); //0x22
    p_LcdDriver_SendData(DRLCDC_DATA_PWCTR1_D2); //0x02
    p_LcdDriver_SendData(DRLCDC_DATA_PWCTR1_D3); //0x84
    delayMs(5);
    //Power Control-2
    p_LcdDriver_SendCmd(DRLCDC_CMD_PWCTR2); //0xC1
    p_LcdDriver_SendData(DRLCDC_DATA_PWCTR2_D1); //0xC5
    delayMs(5);
    //Power Control-3
    p_LcdDriver_SendCmd(DRLCDC_CMD_PWCTR3); //0xC2
    p_LcdDriver_SendData(DRLCDC_DATA_PWCTR3_D1); //0x0A
    p_LcdDriver_SendData(DRLCDC_DATA_PWCTR3_D2); //0x00
    delayMs(5);
    //Power Control-4
    p_LcdDriver_SendCmd(DRLCDC_CMD_PWCTR4); //0xC3
    p_LcdDriver_SendData(DRLCDC_DATA_PWCTR4_D1); //0x8A
    p_LcdDriver_SendData(DRLCDC_DATA_PWCTR4_D2); //0x2A
    delayMs(5);
    //Power Control-5
    p_LcdDriver_SendCmd(DRLCDC_CMD_PWCTR5); //0xC4
    p_LcdDriver_SendData(DRLCDC_DATA_PWCTR5_D1); //0x8A
    p_LcdDriver_SendData(DRLCDC_DATA_PWCTR5_D2); //0xEE
    delayMs(5);
    //VMCTR1
    p_LcdDriver_SendCmd(DRLCDC_CMD_VMCTR1); //0xC5
    p_LcdDriver_SendData(DRLCDC_DATA_VMCTR1_D1); //0x18
```



delayMs (5) ;

```
//Setup Gamma
p_LcdDriver_SendCmd(DRLCDC_CMD_GAMCTR1); //0xE0
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D1); //0x03
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D2); //0x0a
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D3); //0x08
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D4); //0x0a
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D5); //0x3a
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D6); //0x35
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D7); //0x2c
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D8); //0x2e
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D9); //0x2b
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D10); //0x26
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D11); //0x2c
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D12); //0x3c
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D13); //0x00
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D14); //0x01
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D15); //0x03
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D16); //0x10
p_LcdDriver_SendCmd(DRLCDC_CMD_GAMCTR1); //0xE1
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D1); //0x04
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D2); //0x0a
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D3); //0x08
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D4); //0x0a
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D5); //0x24
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D6); //0x22
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D7); //0x1f
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D8); //0x26
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D9); //0x28
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D10); //0x29
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D11); //0x33
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D12); //0x3c
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D13); //0x00
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D14); //0x01
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D15); //0x03
p_LcdDriver_SendData(DRLCDC_DATA_GAMCTR1_D16); //0x10
```



```
p_LcdDriver_SendCmd(DRLCDC_CMD_EXTCTRL);           //0xF0
p_LcdDriver_SendData(DRLCDC_DATA_EXTCTRL_D1);       //0x01

p_LcdDriver_SendCmd(DRLCDC_CMD_RAM_POWERSAVE);      //0xF6
p_LcdDriver_SendData(DRLCDC_DATA_RAM_POWERSAVE_D1); //0x00

// Pixel Format:
p_LcdDriver_SendCmd(DRLCDC_CMD_INT_PIXEL_FORMAT);   //0x3A
p_LcdDriver_SendData(DRLCDC_DATA_INT_PIXEL_FORMAT_D1); //0x05

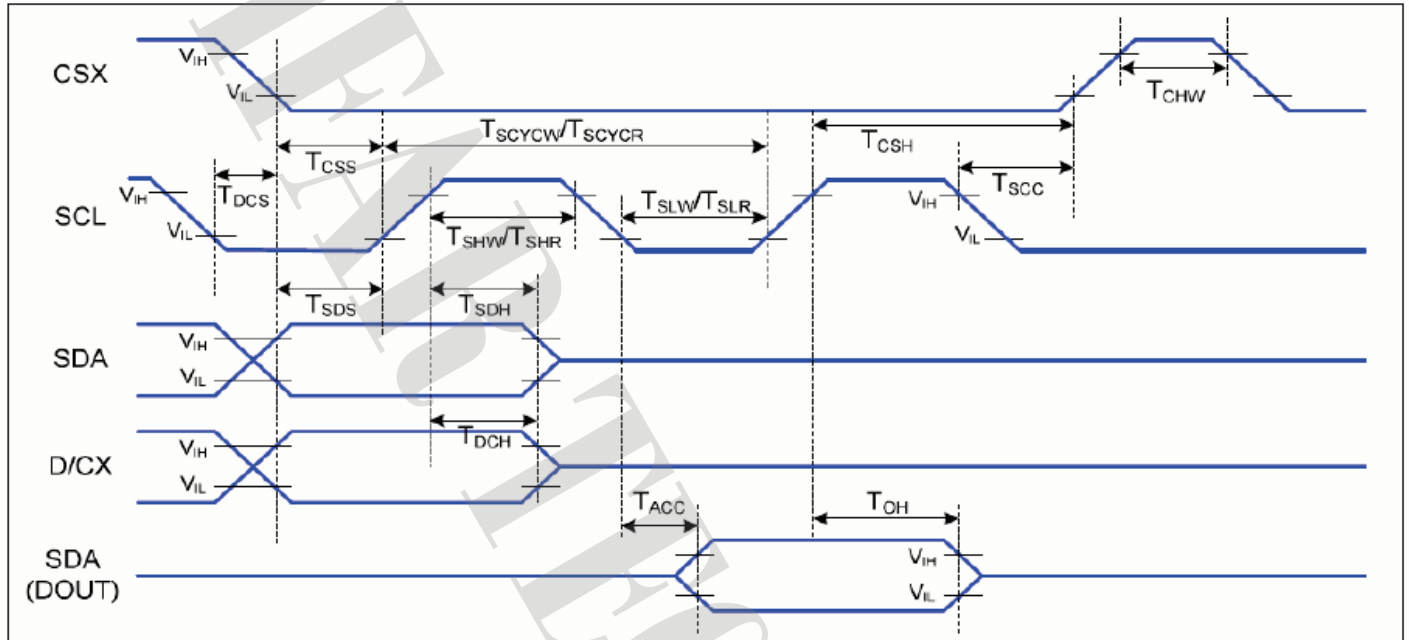
//Memory access control
p_LcdDriver_SendCmd(DRLCDC_CMD_MEM_ACCESS_CTL);     //0x36
p_LcdDriver_SendData(DRLCDC_DATA_MEM_ACCESS_CTL_D1); //0xc8
delayMs(5);

p_LcdDriver_SendCmd(DRLCDC_CMD_SLEEPOUT_BOOST_ON); //0x11
delayMs(120);
```



## 2.4 Timing Characteristics

### 2.4.1 4LINE SPI I TYPE

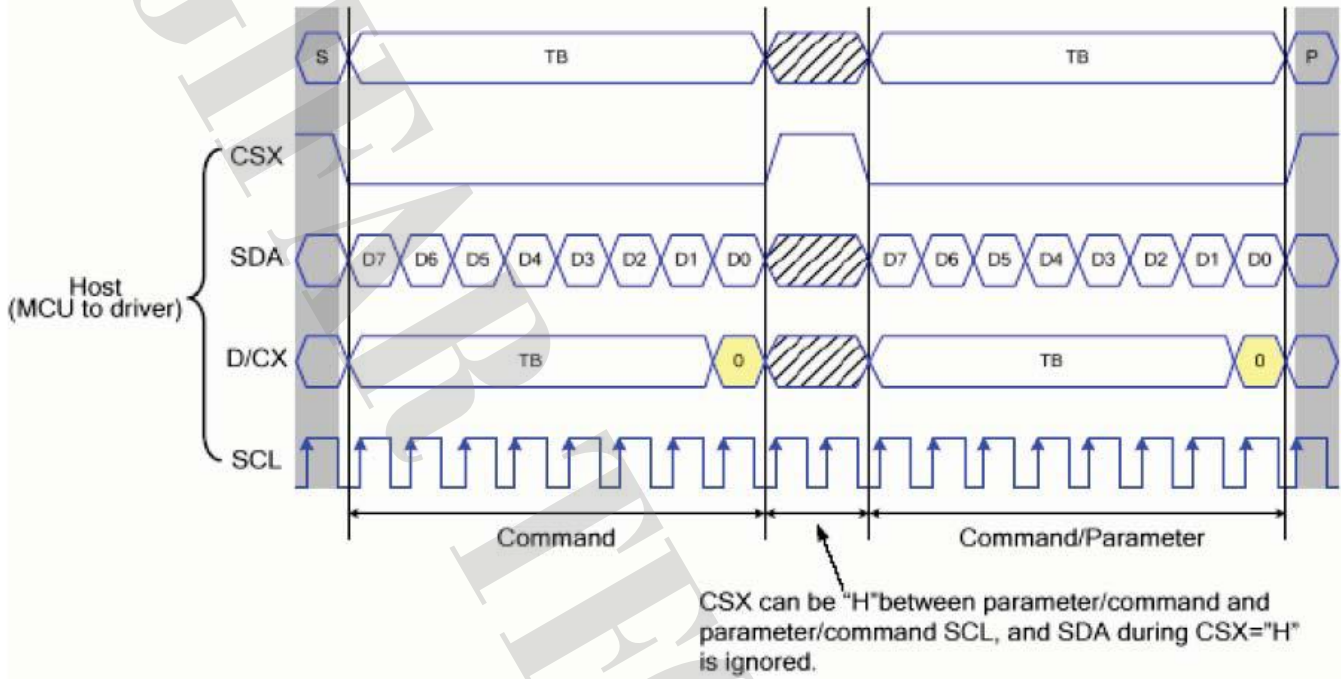


| Signal           | Symbol | Parameter                      | MIN | MAX | Unit | Description                               |
|------------------|--------|--------------------------------|-----|-----|------|---|
| CSX              | TCSS   | Chip Select Setup Time (Write) | 45  |     | ns   |   |
|                  | TCSH   | Chip Select Hold Time (Write)  | 45  |     | ns   |   |
|                  | TCSS   | Chip Select Setup Time (Read)  | 60  |     | ns   |   |
|                  | TSCC   | Chip Select Hold Time (Read)   | 65  |     | ns   |   |
|                  | TCHW   | Chip Select "H" Pulse Width    | 40  |     | ns   |   |
| SCL              | TSCYCW | Serial Clock Cycle (Write)     | 66  |     | ns   | -Write Command & Data Ram                 |
|                  | TSHW   | SCL "H" Pulse Width (Write)    | 15  |     | ns   |   |
|                  | TSLW   | SCL "L" Pulse Width (Write)    | 15  |     | ns   |   |
|                  | TSCYCR | Serial Clock Cycle (Read)      | 150 |     | ns   | -Read Command & Data Ram                  |
|                  | TSHR   | SCL "H" Pulse Width (Read)     | 60  |     | ns   |   |
|                  | TSLR   | SCL "L" Pulse Width (Read)     | 60  |     | ns   |   |
| D/CX             | TDCS   | D/CX Setup Time                | 10  |     | ns   |   |
|                  | TDCH   | D/CX Hold Time                 | 10  |     | ns   |   |
| SDA (DIN) (DOUT) | TSDS   | Data Setup Time                | 10  |     | ns   | For Maximum CL=30pF<br>For Minimum CL=8pF |
|                  | TSDH   | Data Hold Time                 | 10  |     | ns   |   |
|                  | TACC   | Access Time                    | 10  | 50  | ns   |   |
|                  | TOH    | Output Disable Time            | 15  | 50  | ns   |   |

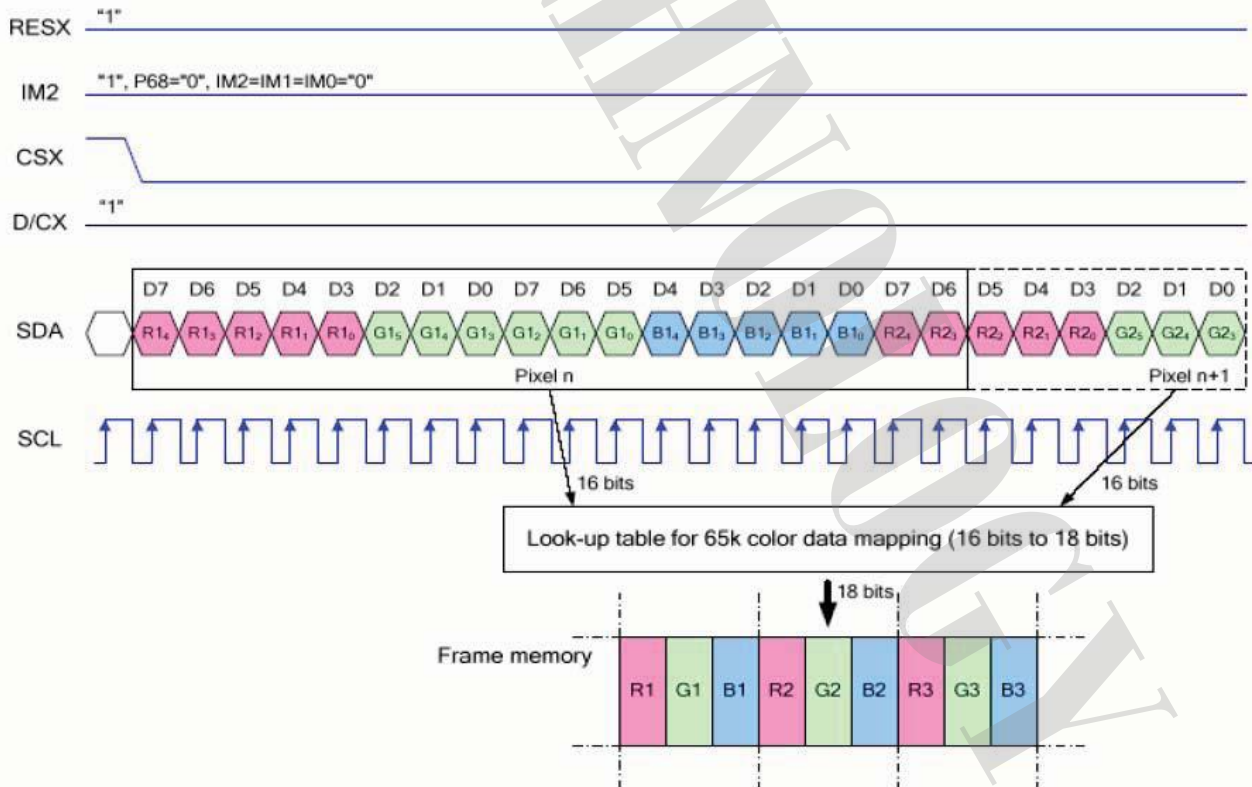


### 2.4.2 4line SPI Write Protocol

Write to Register with Control Bit in Transmission



### 2.4.3 4line write Data for 16-bit/Pixel



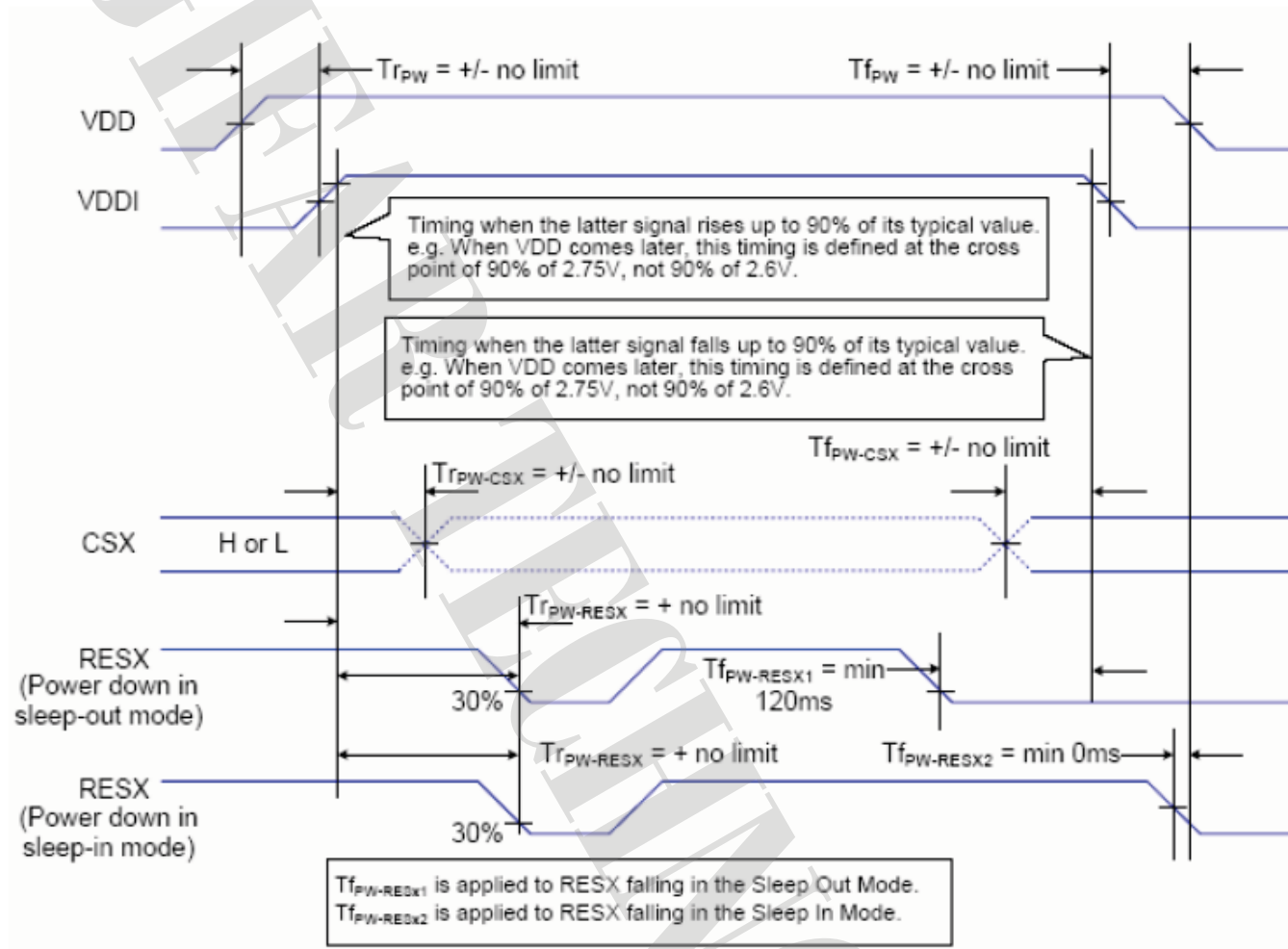
- Note 1. pixel data with the 16-bit color depth information
- Note 2. The most significant bits are: Rx4, Gx5 and Bx4
- Note 3. The least significant bits are: Rx0, Gx0 and Bx0





## 2.5 Power On/Off Sequence

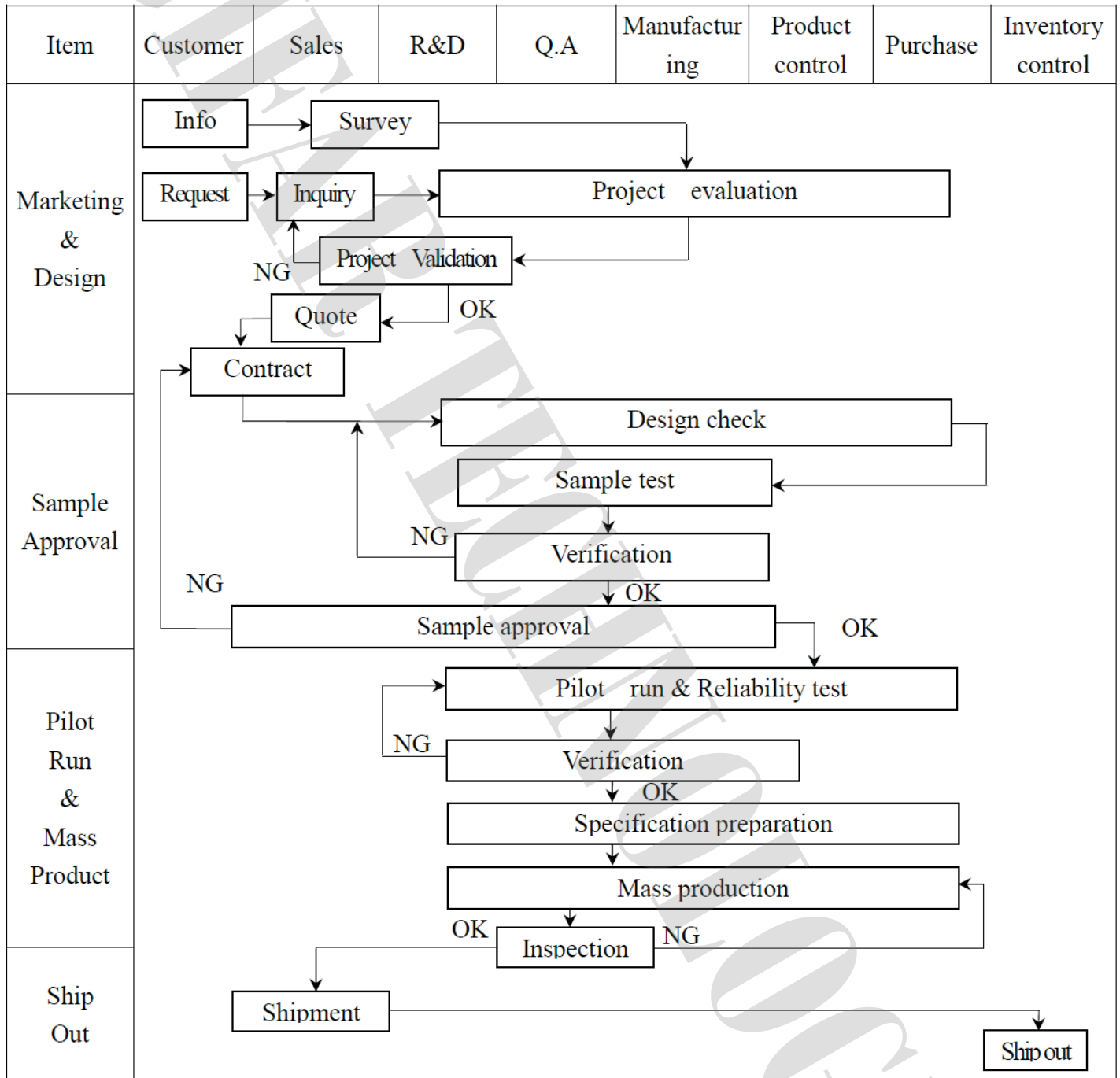
### 2.5.1 Power On/Off sequence





### 3. QUALITY ASSURANCE SYSTEM

#### 3.1 Quality Assurance Flow Chart





| Item          | Customer   | Sales | R&D | Q.A | Manufacturing   | Product control | Purchase | Inventory control |
|---------------|--|-------|-----|-----|---|-----------------|----------|-------------------|
| Sales Service | <pre> graph TD     Info[Info] --&gt; Claim[Claim]     Claim --&gt; Analysis[Failure analysis]     Claim --&gt; Report[Analysis report]     Analysis --&gt; Action[Corrective action]     Action --&gt; Tracking[Tracking]           </pre> |       |     |     |   |                 |          |                   |
| Q.A Activity  | 1. ISO 9001 Maintenance Activities<br>3. Equipment calibration<br>5. Standardization Management  |       |     |     | 2. Process improvement proposal<br>4. Education And Training Activities |                 |          |                   |

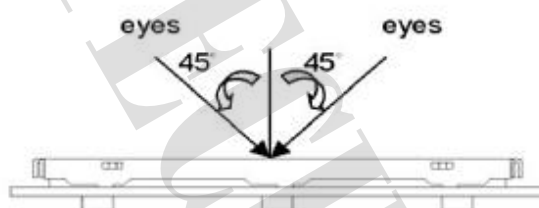


### 3.2. Inspection Specification

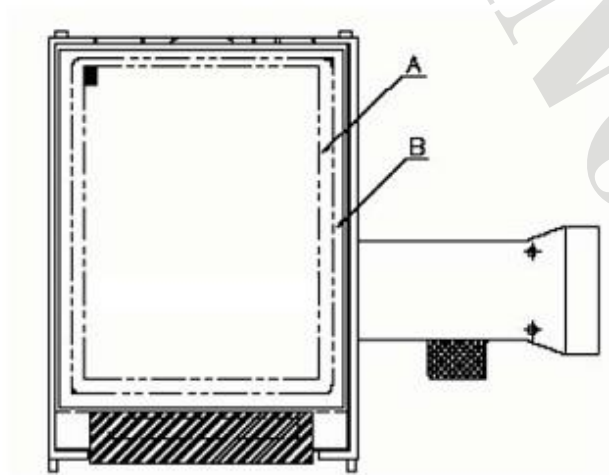
- ◆ Scope : The document shall be applied to TFT-LCD Module for less than 3.5"
- ◆ Inspection Standard : MIL-STD-105E Table Normal Inspection Single Sampling Level II.
- ◆ Equipment : Gauge 、 MIL-STD 、 Sample
- ◆ Defect Level : Major Defect AQL : 0.4 ; Minor Defect AQL : 1.5
- ◆ OUT Going Defect Level : Sampling.
- ◆ Standard of the product appearance test :

#### a. Manner of appearance test :

- (1). The test best be under 20W×2 fluorescent light , and distance of view must be at 30 cm.
- (2). The test direction is base on about around 45° of vertical line.



#### (3). Definition of area.



A area : viewing area

B area : Outside of viewing area

#### (4). Standard of inspection : (Unit : mm)

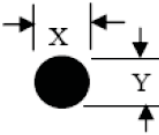
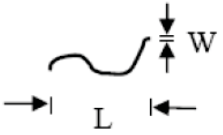


◆ Specification For TFT-LCD Module Less Than 3.5" :

| NO  | Item   | Criterion   | Level      |                   |                   |            |            |     |          |     |           |     |       |     |       |
|---|--|---|------------|-------------------|-------------------|------------|------------|-----|----------|-----|-----------|-----|-------|-----|-------|
| 01  | Product condition  | 1. 1 The part number is inconsistent with work order of production.   | Major      |                   |                   |            |            |     |          |     |           |     |       |     |       |
|   |  | 1. 2 Mixed product types.   | Major      |                   |                   |            |            |     |          |     |           |     |       |     |       |
|   |  | 1. 3 Assembled in inverse direction.  | Major      |                   |                   |            |            |     |          |     |           |     |       |     |       |
| 02  | Quantity   | 2. 1 The quantity is inconsistent with work order of production.  | Major      |                   |                   |            |            |     |          |     |           |     |       |     |       |
| 03  | Outline dimension  | 3. 1 Product dimension and structure must conform to structure diagram.   | Major      |                   |                   |            |            |     |          |     |           |     |       |     |       |
| 04  | Electrical Testing   | 4. 1 Missing line character and icon.   | Major      |                   |                   |            |            |     |          |     |           |     |       |     |       |
|   |  | 4. 2 No function or no display.   | Major      |                   |                   |            |            |     |          |     |           |     |       |     |       |
|   |  | 4. 3 Display malfunction.   | Major      |                   |                   |            |            |     |          |     |           |     |       |     |       |
|   |  | 4. 4 LCD viewing angle defect.  | Major      |                   |                   |            |            |     |          |     |           |     |       |     |       |
|   |  | 4. 5 Current consumption exceeds product specifications.  | Major      |                   |                   |            |            |     |          |     |           |     |       |     |       |
| 05  | <b>Dot defect</b><br><br>(Bright dot 、<br>Dark dot)<br><br>On -display | <table border="1"> <thead> <tr> <th></th> <th>Item</th> <th>Acceptance (Q'ty)</th> </tr> </thead> <tbody> <tr> <td rowspan="4">Dot Defect</td> <td>Bright Dot</td> <td>≤ 2</td> </tr> <tr> <td>Dark Dot</td> <td>≤ 3</td> </tr> <tr> <td>Joint Dot</td> <td>≤ 2</td> </tr> <tr> <td>Total</td> <td>≤ 3</td> </tr> </tbody> </table> |            | Item              | Acceptance (Q'ty) | Dot Defect | Bright Dot | ≤ 2 | Dark Dot | ≤ 3 | Joint Dot | ≤ 2 | Total | ≤ 3 | Minor |
|   |  |   | Item       | Acceptance (Q'ty) |                   |            |            |     |          |     |           |     |       |     |       |
|   |  | Dot Defect  | Bright Dot | ≤ 2               |                   |            |            |     |          |     |           |     |       |     |       |
|   |  |   | Dark Dot   | ≤ 3               |                   |            |            |     |          |     |           |     |       |     |       |
|   |  |   | Joint Dot  | ≤ 2               |                   |            |            |     |          |     |           |     |       |     |       |
| Total   | ≤ 3  |   |            |                   |                   |            |            |     |          |     |           |     |       |     |       |
| 5. 1 Inspection pattern : full white , full black , Red , Green and blue screens. |  |   |            |                   |                   |            |            |     |          |     |           |     |       |     |       |
| 5. 2 It is defined as dot defect if defect area > 1/2 dot.                        |  |   |            |                   |                   |            |            |     |          |     |           |     |       |     |       |
| 5. 3 The distance between two dot defect ≥ 5 mm.                                  |  |   |            |                   |                   |            |            |     |          |     |           |     |       |     |       |
|   |  |   |            |                   |                   |            |            |     |          |     |           |     |       |     |       |

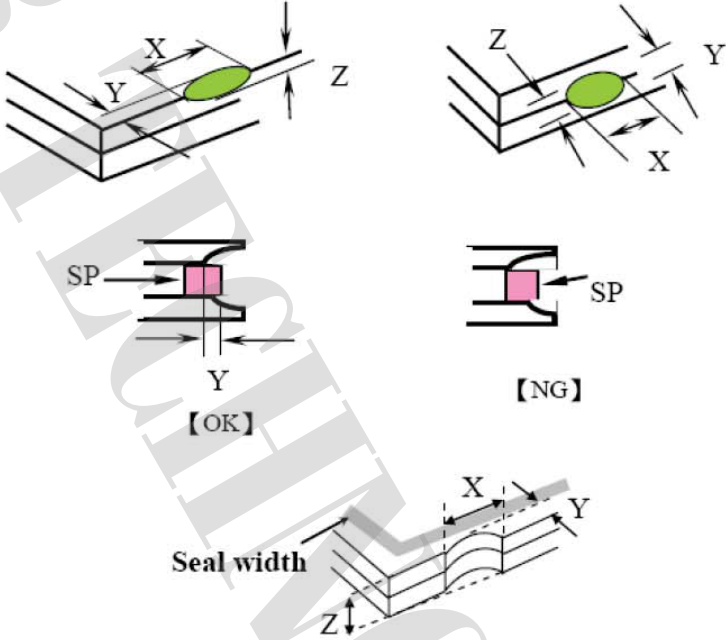


◆Specification For TFT-LCD Module Less Than 3.5" :

| NO                                | Item  | Criterion  | Level                             |                   |  |        |        |                  |        |  |                         |   |        |                         |   |               |   |              |       |  |           |  |                   |  |            |           |        |        |     |               |        |        |              |                      |   |     |            |               |              |  |   |  |       |
|-----------------------------------|---|--|-----------------------------------|-------------------|--|--------|--------|------------------|--------|--|-------------------------|---|--------|-------------------------|---|---------------|---|--------------|-------|--|-----------|--|-------------------|--|------------|-----------|--------|--------|-----|---------------|--------|--------|--------------|----------------------|---|-----|------------|---------------|--------------|--|---|--|-------|
| 06                                | <p>Black or white dot、scratch、contamination</p> <p>Round type</p>  <p><math>\Phi = (x + y) / 2</math></p> <p>Line type</p>  | <p>6.1 Round type ( Non-display or display ) :</p> <table border="1"> <thead> <tr> <th rowspan="2">Dimension<br/>(diameter : <math>\Phi</math>)</th> <th colspan="2">Acceptance (Q'ty)</th> </tr> <tr> <th>A area</th> <th>B area</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.15</math></td> <td colspan="2">Ignore</td> </tr> <tr> <td><math>0.15 &lt; \Phi \leq 0.20</math></td> <td>2</td> <td rowspan="3">Ignore</td> </tr> <tr> <td><math>0.20 &lt; \Phi \leq 0.30</math></td> <td>2</td> </tr> <tr> <td><math>\Phi &gt; 0.30</math></td> <td>0</td> </tr> <tr> <td><b>Total</b></td> <td colspan="2">3</td> </tr> </tbody> </table> <p>6.2 Line type( Non-display or display ) :</p> <table border="1"> <thead> <tr> <th colspan="2">Dimension</th> <th colspan="2">Acceptance (Q'ty)</th> </tr> <tr> <th>Length (L)</th> <th>Width (W)</th> <th>A area</th> <th>B area</th> </tr> </thead> <tbody> <tr> <td>---</td> <td><math>W \leq 0.03</math></td> <td>Ignore</td> <td rowspan="3">Ignore</td> </tr> <tr> <td><math>L \leq 5.0</math></td> <td><math>0.03 &lt; W \leq 0.05</math></td> <td>3</td> </tr> <tr> <td>---</td> <td><math>W &gt; 0.05</math></td> <td>As round type</td> </tr> <tr> <td colspan="2"><b>Total</b></td> <td colspan="2">3</td> </tr> </tbody> </table> | Dimension<br>(diameter : $\Phi$ ) | Acceptance (Q'ty) |  | A area | B area | $\Phi \leq 0.15$ | Ignore |  | $0.15 < \Phi \leq 0.20$ | 2 | Ignore | $0.20 < \Phi \leq 0.30$ | 2 | $\Phi > 0.30$ | 0 | <b>Total</b> | 3     |  | Dimension |  | Acceptance (Q'ty) |  | Length (L) | Width (W) | A area | B area | --- | $W \leq 0.03$ | Ignore | Ignore | $L \leq 5.0$ | $0.03 < W \leq 0.05$ | 3 | --- | $W > 0.05$ | As round type | <b>Total</b> |  | 3 |  | Minor |
| Dimension<br>(diameter : $\Phi$ ) | Acceptance (Q'ty)   |  |                                   |                   |  |        |        |                  |        |  |                         |   |        |                         |   |               |   |              |       |  |           |  |                   |  |            |           |        |        |     |               |        |        |              |                      |   |     |            |               |              |  |   |  |       |
|                                   | A area  | B area   |                                   |                   |  |        |        |                  |        |  |                         |   |        |                         |   |               |   |              |       |  |           |  |                   |  |            |           |        |        |     |               |        |        |              |                      |   |     |            |               |              |  |   |  |       |
| $\Phi \leq 0.15$                  | Ignore  |  |                                   |                   |  |        |        |                  |        |  |                         |   |        |                         |   |               |   |              |       |  |           |  |                   |  |            |           |        |        |     |               |        |        |              |                      |   |     |            |               |              |  |   |  |       |
| $0.15 < \Phi \leq 0.20$           | 2   | Ignore   |                                   |                   |  |        |        |                  |        |  |                         |   |        |                         |   |               |   |              |       |  |           |  |                   |  |            |           |        |        |     |               |        |        |              |                      |   |     |            |               |              |  |   |  |       |
| $0.20 < \Phi \leq 0.30$           | 2   |  |                                   |                   |  |        |        |                  |        |  |                         |   |        |                         |   |               |   |              |       |  |           |  |                   |  |            |           |        |        |     |               |        |        |              |                      |   |     |            |               |              |  |   |  |       |
| $\Phi > 0.30$                     | 0   |  |                                   |                   |  |        |        |                  |        |  |                         |   |        |                         |   |               |   |              |       |  |           |  |                   |  |            |           |        |        |     |               |        |        |              |                      |   |     |            |               |              |  |   |  |       |
| <b>Total</b>                      | 3   |  |                                   |                   |  |        |        |                  |        |  |                         |   |        |                         |   |               |   |              |       |  |           |  |                   |  |            |           |        |        |     |               |        |        |              |                      |   |     |            |               |              |  |   |  |       |
| Dimension                         |   | Acceptance (Q'ty)  |                                   |                   |  |        |        |                  |        |  |                         |   |        |                         |   |               |   |              |       |  |           |  |                   |  |            |           |        |        |     |               |        |        |              |                      |   |     |            |               |              |  |   |  |       |
| Length (L)                        | Width (W)   | A area   | B area                            |                   |  |        |        |                  |        |  |                         |   |        |                         |   |               |   |              |       |  |           |  |                   |  |            |           |        |        |     |               |        |        |              |                      |   |     |            |               |              |  |   |  |       |
| ---                               | $W \leq 0.03$   | Ignore   | Ignore                            |                   |  |        |        |                  |        |  |                         |   |        |                         |   |               |   |              |       |  |           |  |                   |  |            |           |        |        |     |               |        |        |              |                      |   |     |            |               |              |  |   |  |       |
| $L \leq 5.0$                      | $0.03 < W \leq 0.05$  | 3  |                                   |                   |  |        |        |                  |        |  |                         |   |        |                         |   |               |   |              |       |  |           |  |                   |  |            |           |        |        |     |               |        |        |              |                      |   |     |            |               |              |  |   |  |       |
| ---                               | $W > 0.05$  | As round type  |                                   |                   |  |        |        |                  |        |  |                         |   |        |                         |   |               |   |              |       |  |           |  |                   |  |            |           |        |        |     |               |        |        |              |                      |   |     |            |               |              |  |   |  |       |
| <b>Total</b>                      |   | 3  |                                   |                   |  |        |        |                  |        |  |                         |   |        |                         |   |               |   |              |       |  |           |  |                   |  |            |           |        |        |     |               |        |        |              |                      |   |     |            |               |              |  |   |  |       |
| 07                                | Polarizer Bubble  | <table border="1"> <thead> <tr> <th rowspan="2">Dimension<br/>(diameter : <math>\Phi</math>)</th> <th colspan="2">Acceptance (Q'ty)</th> </tr> <tr> <th>A area</th> <th>B area</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.20</math></td> <td colspan="2">Ignore</td> </tr> <tr> <td><math>0.20 &lt; \Phi \leq 0.50</math></td> <td>3</td> <td rowspan="2">Ignore</td> </tr> <tr> <td><math>\Phi &gt; 0.50</math></td> <td>0</td> </tr> <tr> <td><b>Total</b></td> <td colspan="2">3</td> </tr> </tbody> </table>   | Dimension<br>(diameter : $\Phi$ ) | Acceptance (Q'ty) |  | A area | B area | $\Phi \leq 0.20$ | Ignore |  | $0.20 < \Phi \leq 0.50$ | 3 | Ignore | $\Phi > 0.50$           | 0 | <b>Total</b>  | 3 |              | Minor |  |           |  |                   |  |            |           |        |        |     |               |        |        |              |                      |   |     |            |               |              |  |   |  |       |
| Dimension<br>(diameter : $\Phi$ ) | Acceptance (Q'ty)   |  |                                   |                   |  |        |        |                  |        |  |                         |   |        |                         |   |               |   |              |       |  |           |  |                   |  |            |           |        |        |     |               |        |        |              |                      |   |     |            |               |              |  |   |  |       |
|                                   | A area  | B area   |                                   |                   |  |        |        |                  |        |  |                         |   |        |                         |   |               |   |              |       |  |           |  |                   |  |            |           |        |        |     |               |        |        |              |                      |   |     |            |               |              |  |   |  |       |
| $\Phi \leq 0.20$                  | Ignore  |  |                                   |                   |  |        |        |                  |        |  |                         |   |        |                         |   |               |   |              |       |  |           |  |                   |  |            |           |        |        |     |               |        |        |              |                      |   |     |            |               |              |  |   |  |       |
| $0.20 < \Phi \leq 0.50$           | 3   | Ignore   |                                   |                   |  |        |        |                  |        |  |                         |   |        |                         |   |               |   |              |       |  |           |  |                   |  |            |           |        |        |     |               |        |        |              |                      |   |     |            |               |              |  |   |  |       |
| $\Phi > 0.50$                     | 0   |  |                                   |                   |  |        |        |                  |        |  |                         |   |        |                         |   |               |   |              |       |  |           |  |                   |  |            |           |        |        |     |               |        |        |              |                      |   |     |            |               |              |  |   |  |       |
| <b>Total</b>                      | 3   |  |                                   |                   |  |        |        |                  |        |  |                         |   |        |                         |   |               |   |              |       |  |           |  |                   |  |            |           |        |        |     |               |        |        |              |                      |   |     |            |               |              |  |   |  |       |

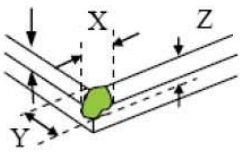
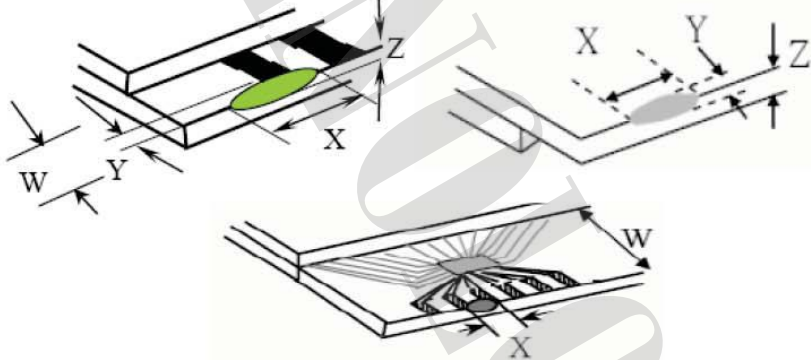


◆ Specification For TFT-LCD Module Less Than 3.5" :

| NO       | Item                                     | Criterion   | Level |   |   |          |                                |              |          |  |                      |       |
|----------|--|---|-------|---|---|----------|--------------------------------|--------------|----------|--|----------------------|-------|
| 08       | The crack of glass                       | <p>Symbols :</p> <p>X : The length of crack<br/>Z : The thickness of crack<br/>t : The thickness of glass</p> <p>Y : The width of crack.<br/>W : terminal length<br/>a : LCD side length</p> <hr/> <p>8.1 General glass chip :</p> <p>8.1.1 Chip on panel surface and crack between panels:</p>  <table border="1" data-bbox="555 1447 1334 1722"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td><math>\leq a</math></td> <td>Crack can't enter viewing area</td> <td><math>\leq 1/2 t</math></td> </tr> <tr> <td><math>\leq a</math></td> <td>Crack can't exceed the half of SP width.</td> <td><math>1/2 t &lt; Z \leq 2 t</math></td> </tr> </tbody> </table> | X     | Y | Z | $\leq a$ | Crack can't enter viewing area | $\leq 1/2 t$ | $\leq a$ | Crack can't exceed the half of SP width. | $1/2 t < Z \leq 2 t$ | Minor |
| X        | Y  | Z   |       |   |   |          |                                |              |          |  |                      |       |
| $\leq a$ | Crack can't enter viewing area           | $\leq 1/2 t$  |       |   |   |          |                                |              |          |  |                      |       |
| $\leq a$ | Crack can't exceed the half of SP width. | $1/2 t < Z \leq 2 t$  |       |   |   |          |                                |              |          |  |                      |       |



◆ Specification For TFT-LCD Module Less Than 3.5" :

| NO           | Item                                     | Criterion  | Level        |   |   |              |                                |                |              |  |                      |          |          |              |  |
|--------------|--|--|--------------|---|---|--------------|--------------------------------|----------------|--------------|--|----------------------|----------|----------|--------------|--|
| 08           | The crack of glass                       | <p>Symbols :</p> <p><b>X</b> : The length of crack<br/> <b>Z</b> : The thickness of crack<br/> <b>t</b> : The thickness of glass</p> <p><b>Y</b> : The width of crack.<br/> <b>W</b> : terminal length<br/> <b>a</b> : LCD side length</p> <hr/> <p>8.1.2 Corner crack :</p>  <table border="1" data-bbox="550 810 1332 1093"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td><math>\leq 1/5 a</math></td> <td>Crack can't enter viewing area</td> <td><math>Z \leq 1/2 t</math></td> </tr> <tr> <td><math>\leq 1/5 a</math></td> <td>Crack can't exceed the half of SP width.</td> <td><math>1/2 t &lt; Z \leq 2 t</math></td> </tr> </tbody> </table> | X            | Y | Z | $\leq 1/5 a$ | Crack can't enter viewing area | $Z \leq 1/2 t$ | $\leq 1/5 a$ | Crack can't exceed the half of SP width. | $1/2 t < Z \leq 2 t$ | Minor    |          |              |  |
|              |  | X  | Y            | Z |   |              |                                |                |              |  |                      |          |          |              |  |
| $\leq 1/5 a$ | Crack can't enter viewing area           | $Z \leq 1/2 t$   |              |   |   |              |                                |                |              |  |                      |          |          |              |  |
| $\leq 1/5 a$ | Crack can't exceed the half of SP width. | $1/2 t < Z \leq 2 t$   |              |   |   |              |                                |                |              |  |                      |          |          |              |  |
|              |  | <p>8.2 Protrusion over terminal :</p> <p>8.2.1 Chip on electrode pad :</p>  <table border="1" data-bbox="582 1675 1340 1848"> <thead> <tr> <th></th> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>Front</td> <td><math>\leq a</math></td> <td><math>\leq 1/2 W</math></td> <td><math>\leq t</math></td> </tr> <tr> <td>Back</td> <td><math>\leq a</math></td> <td><math>\leq W</math></td> <td><math>\leq 1/2 t</math></td> </tr> </tbody> </table>  |              | X | Y | Z            | Front                          | $\leq a$       | $\leq 1/2 W$ | $\leq t$                                 | Back                 | $\leq a$ | $\leq W$ | $\leq 1/2 t$ |  |
|              | X  | Y  | Z            |   |   |              |                                |                |              |  |                      |          |          |              |  |
| Front        | $\leq a$                                 | $\leq 1/2 W$   | $\leq t$     |   |   |              |                                |                |              |  |                      |          |          |              |  |
| Back         | $\leq a$                                 | $\leq W$   | $\leq 1/2 t$ |   |   |              |                                |                |              |  |                      |          |          |              |  |







◆Specification For TFT-LCD Module Less Than 3.5" :

| NO | Item               | Criterion  | Level |
|----|--------------------|--|-------|
| 09 | Backlight elements | 9.1 Backlight can't work normally.   | Major |
|    |                    | 9.2 Backlight doesn't light or color is wrong.   | Major |
|    |                    | 9.3 Illumination source flickers when lit.   | Major |
| 10 | General appearance | 10.1 Pin type、quantity、dimension must match type in structure diagram.   | Major |
|    |                    | 10.2 No short circuits in components on PCB or FPC .   | Major |
|    |                    | 10.3 Parts on PCB or FPC must be the same as on the production characteristic chart .There should be no wrong parts , missing parts or excess parts. | Major |
|    |                    | 10.4 Product packaging must the same as specified on packaging specification sheet.  | Minor |
|    |                    | 10.5 The folding and peeled off in polarizer are not acceptable.   | Minor |
|    |                    | 10.6 The PCB or FPC between B/L assembled distance(PCB or FPC ) is $\leq 1.5$ mm.  | Minor |



## 4. RELIABILITY TEST

### 4.1 Reliability Test Condition

| NO.                                      | TEST ITEM                                     | TEST CONDITION  |  |                     |                  |          |     |             |    |            |    |          |    |
|--|---|---|--|---------------------|------------------|----------|-----|-------------|----|------------|----|----------|----|
| 1  | High Temperature Operation Test               | Keep in +70°C ±2°C 96 hrs<br>Surrounding temperature, then storage at normal condition 4hrs.  |  |                     |                  |          |     |             |    |            |    |          |    |
| 2  | High Temperature Storage Test                 | Keep in +80°C ±2°C 240 hrs<br>Surrounding temperature, then storage at normal condition 4hrs.   |  |                     |                  |          |     |             |    |            |    |          |    |
| 3  | Low Temperature Operation Test                | Keep in -20°C ±2°C 96 hrs<br>Surrounding temperature, then storage at normal condition 4hrs.  |  |                     |                  |          |     |             |    |            |    |          |    |
| 4  | Low Temperature Storage Test                  | Keep in -30°C ±2°C 240 hrs<br>Surrounding temperature, then storage at normal condition 4hrs.   |  |                     |                  |          |     |             |    |            |    |          |    |
| 5  | High Temperature / High Humidity Storage Test | Keep in +60°C / 90% R.H duration for 240 hrs<br>Surrounding temperature, then storage at normal condition 4hrs.<br>(Excluding the polarizer)  |  |                     |                  |          |     |             |    |            |    |          |    |
| 6  | Temperature Cycling Storage Test              | $\begin{array}{ccccccc} -30^{\circ}\text{C} & \rightarrow & +25^{\circ}\text{C} & \rightarrow & +80^{\circ}\text{C} & \rightarrow & +25^{\circ}\text{C} \\ (30\text{mins}) & & (5\text{mins}) & & (30\text{mins}) & & (5\text{mins}) \\ & & & & \leftarrow & & \rightarrow \\ & & & & 10 \text{ Cycle} & & \end{array}$ Surrounding temperature, then storage at normal condition 4hrs. |  |                     |                  |          |     |             |    |            |    |          |    |
| 7  | ESD Test                                      | <b>Air Discharge:</b><br>Apply 2 KV with 5 times<br>Discharge for each polarity +/-   | <b>Contact Discharge:</b><br>Apply 250 V with 5 times<br>discharge for each polarity +/- |                     |                  |          |     |             |    |            |    |          |    |
|  |   | 1. Temperature ambience : 15°C ~ 35°C<br>2. Humidity relative : 30% ~ 60%<br>3. Energy Storage Capacitance(Cs+Cd) : 150pF±10%<br>4. Discharge Resistance(Rd) : 330Ω±10%<br>5. Discharge, mode of operation :<br>Single Discharge (time between successive discharges at least 1 sec)<br>(Tolerance if the output voltage indication : ±5%)  |  |                     |                  |          |     |             |    |            |    |          |    |
| 8  | Vibration Test (Packaged)                     | 1. Sine wave 10~55 Hz frequency (1 min/sweep)<br>2. The amplitude of vibration :1.5 mm<br>3. Each direction (X、Y、Z) duration for 2 Hrs  |  |                     |                  |          |     |             |    |            |    |          |    |
| 9  | Drop Test (Packaged)                          | <table border="1"> <thead> <tr> <th>Packing Weight (Kg)</th> <th>Drop Height (cm)</th> </tr> </thead> <tbody> <tr> <td>0 ~ 45.4</td> <td>122</td> </tr> <tr> <td>45.4 ~ 90.8</td> <td>76</td> </tr> <tr> <td>90.8 ~ 454</td> <td>61</td> </tr> <tr> <td>Over 454</td> <td>46</td> </tr> </tbody> </table>   |  | Packing Weight (Kg) | Drop Height (cm) | 0 ~ 45.4 | 122 | 45.4 ~ 90.8 | 76 | 90.8 ~ 454 | 61 | Over 454 | 46 |
|  |   | Packing Weight (Kg)   | Drop Height (cm)   |                     |                  |          |     |             |    |            |    |          |    |
| 0 ~ 45.4                                 | 122   |   |  |                     |                  |          |     |             |    |            |    |          |    |
| 45.4 ~ 90.8                              | 76  |   |  |                     |                  |          |     |             |    |            |    |          |    |
| 90.8 ~ 454                               | 61  |   |  |                     |                  |          |     |             |    |            |    |          |    |
| Over 454                                 | 46  |   |  |                     |                  |          |     |             |    |            |    |          |    |
| Drop                                     |   | Direction :   |  |                     |                  |          |     |             |    |            |    |          |    |
| ※1 corner / 3 edges / 6 sides each 1time |   |   |  |                     |                  |          |     |             |    |            |    |          |    |

Note: The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.



## 5. PRECAUTION RELATING PRODUCT HANDLING

### 5.1 SAFETY

5.1.1 If the LCD panel breaks , be careful not to get the liquid crystal to touch your skin.

5.1.2 If the liquid crystal touches your skin or clothes , please wash it off immediately by using soap and water.

### 5.2 HANDLING

5.2.1 Avoid any strong mechanical shock which can break the glass.

5.2.2 Avoid static electricity which can damage the CMOS LSI—When working with the module , be sure to ground your body and any electrical equipment you may be using.

5.2.3 Do not remove the panel or frame from the module.

5.2.4 The polarizing plate of the display is very fragile. So , please handle it very carefully, do not touch , push or rub the exposed polarizing with anything harder than an HB pencil lead (glass , tweezers , etc.)

5.2.5 Do not wipe the polarizing plate with a dry cloth , as it may easily scratch the surface of plate.

5.2.6 Do not touch the display area with bare hands , this will stain the display area.

5.2.7 Do not use ketonics solvent & aromatic solvent. Use with a soft cloth soaked with a cleaning naphtha solvent.

5.2.8 To control temperature and time of soldering is  $260 \pm 5^{\circ}\text{C}$  and 3 sec.

5.2.9 To avoid liquid (include organic solvent) stained on LCM

### 5.3 STORAGE

5.3.1 Store the panel or module in a dark place where the temperature is  $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$  and the humidity is below 65% RH.

5.3.2 Do not place the module near organics solvents or corrosive gases.

5.3.3 Do not crush , shake , or jolt the module.

### 5.4 TERMS OF WARRANTY

5.4.1 Applicable warrant period

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

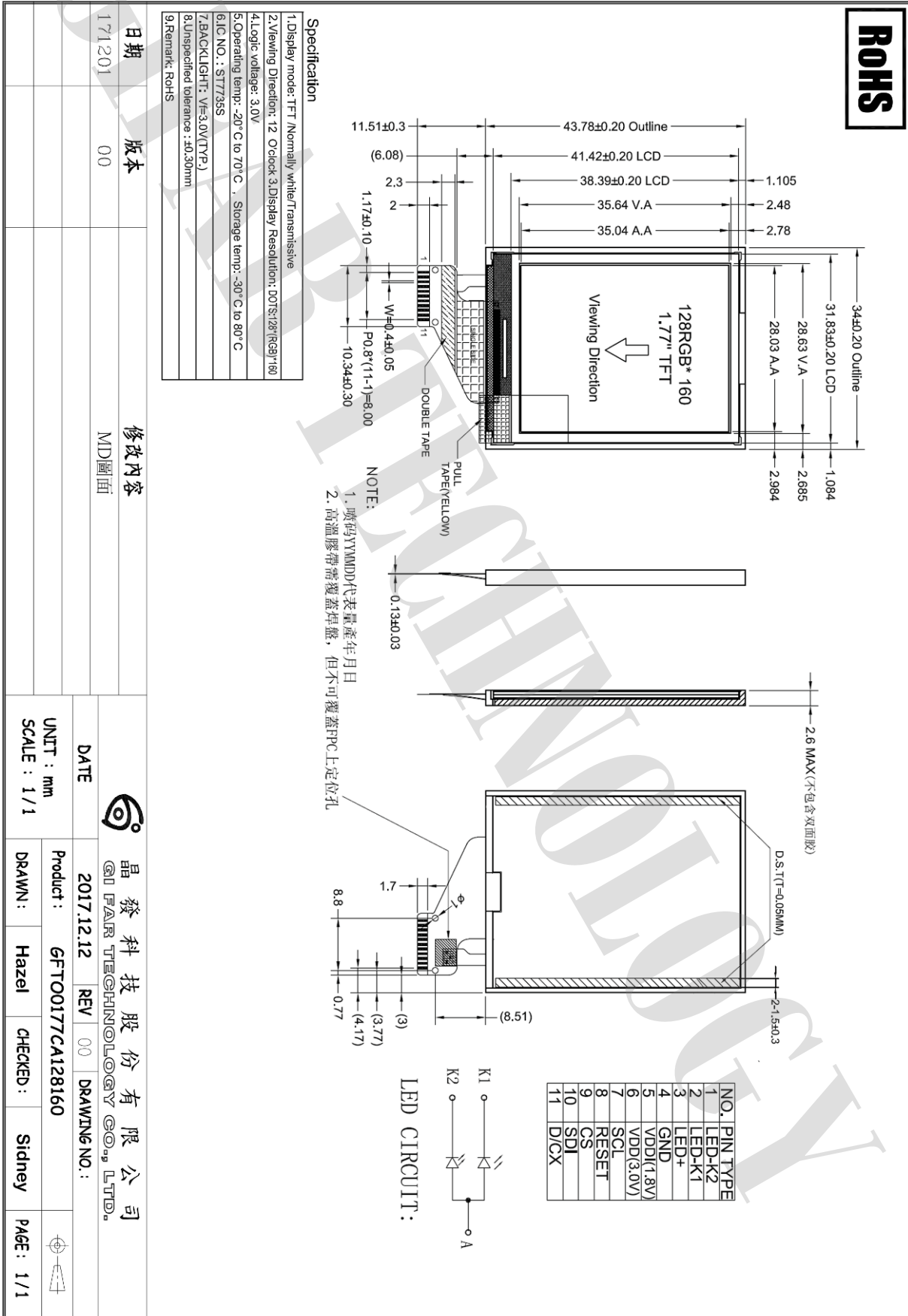
5.4.2 Unaccepted responsibility

This product has been manufactured to your company's specification as a part for use in your company's general electronic products. It is guaranteed to perform according to delivery specifications. For any other use apart from general electronic equipment, we cannot take responsibility if the product is used in nuclear power control equipment, aerospace equipment , fire and security systems or any other applications in which there is a direct risk to human life and where extremely high levels of reliability are required.



## 6. Appendix

### 6.1 LCM Drawing



|    |        |    |    |      |      |
|----|--------|----|----|------|------|
| 日期 | 171201 | 版本 | 00 | 修改內容 | MD圖面 |
|----|--------|----|----|------|------|

|           |             |           |                  |              |   |
|-----------|-------------|-----------|------------------|--------------|---|
| DATE      | 2017.12.12  | REV       | 00               | DRAWING NO.: | 晶發科技股份有限公司<br>GI FAR TECHNOLOGY CO., LTD. |
| UNIT : mm | SCALE : 1/1 | Product : | GFT00177CA128160 | DRAWN :      | Hazel                                     |
|           |             | CHECKED : |                  | Sidney       | PAGE : 1/1                                |