



深圳市一众显示科技有限公司

SHEN ZHEN TEAM SOURCE DISPLAY TECH. CO, LTD.

# TFT-LCD Module Specification

Distributed by:



**Module NO.: TST028CMIL-02P**

**Version: V1.0**

☐ APPROVAL FOR SPECIFICATION

☐ APPROVAL FOR SAMPLE

**For Customer' s Acceptance:**

| Approved by | Comment |
|-------------|---------|
|             |         |

**Team Source Display:**

| Presented by | Reviewed by | Organized by |
|--------------|-------------|--------------|
|              |             |              |

| Version No. | Date      | Content         | Remark |
|-------------|-----------|-----------------|--------|
| V1.0        | 2012-5-18 | Initial Release |        |
|             |           |                 |        |

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# 1. SPECIFICATIONS

## 1.1 Features

### Main LCD panel

| Item                        | Standard Value                        |
|-----------------------------|---------------------------------------|
| Display Type                | 240*(R、G、B)*320 Dots                  |
| LCD Type                    | a-si TFT, Positive, Transmissive type |
| Screen size(inch)           | 2.8" (Diagonal)                       |
| Viewing Direction           | 6 O'Clock                             |
| Color configuration         | R.G.B. vertical stripe                |
| Backlight Type              | White LED B/L                         |
| Interface                   | 8080 8/16Bit data bus                 |
| Other(controller/driver IC) | ILI9341                               |

## 1.2 Mechanical Specifications

| Item              | Standard Value                 | Unit |
|-------------------|--------------------------------|------|
| Outline Dimension | 50.00(W) *69.2 (L) *3.6max (H) | mm   |

### LCD panel

| Item        | Standard Value     | Unit |
|-------------|--------------------|------|
| Active Area | 43.2 (W) *57.6 (L) | mm   |

### Touch panel

| Item              | Standard Value | Unit |
|-------------------|----------------|------|
| Outline Dimension | 49.5*68.75*1.2 | 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 | V <sub>CI</sub>     | -         | -0.3 | +4.6                 | V    |
|                             | V <sub>GH-VSS</sub> | -         | -0.3 | +18.5                | V    |
|                             | V <sub>SS-VGL</sub> | -         | -0.3 | +18.5                | V    |
| Input Voltage               | V <sub>IN</sub>     | -         | -0.3 | V <sub>CI</sub> +0.3 | V    |
| Operating Temperature       | T <sub>OP</sub>     | -         | -20  | +70                  | °C   |
| Storage Temperature         | T <sub>ST</sub>     | -         | -30  | +80                  | °C   |
| Storage Humidity            | H <sub>D</sub>      | Ta < 40°C | 20   | 90                   | %RH  |

## 1.4 DC Electrical Characteristics

### Module

VSS= 0V, Ta = 25°C

| Item                 | Symbol          | Condition  | Min.                | Typ. | Max.                | Unit |
|----------------------|-----------------|--|---------------------|------|---------------------|------|
| Power Supply Voltage | V <sub>CI</sub> | -  | 2.6                 | 2.8  | 3.3                 | V    |
| Input High Voltage   | V <sub>IH</sub> | -  | 0.8*V <sub>CI</sub> | -    | V <sub>CI</sub>     | V    |
| Input Low Voltage    | V <sub>IL</sub> | -  | -0.3                | -    | 0.2*V <sub>CI</sub> | V    |
| Output High Voltage  | V <sub>OH</sub> | -  | 0.8*V <sub>CI</sub> | -    | -                   | V    |
| Output Low Voltage   | V <sub>OL</sub> | -  | -                   | -    | 0.2*V <sub>CI</sub> | V    |
| Supply Current       | I <sub>CC</sub> | V <sub>CI</sub> =2.8 V<br>Pattern=full display*1 | -                   | TBD  | -                   | mA   |

Note1:Maximum current display

## 1.5 Optical Characteristics

### TFT LCD panel

VCC=2.8V, Ta=25°C

| Item  | Symbol | Condition                | Min.  | Typ.  | Max.  | unit              |       |
|---|--------|--------------------------|-------|-------|-------|-------------------|-------|
| Response time   | Tr+Tf  | Ta = 25°C<br>θX, θY = 0° | -     | 30    | -     | ms                | Note2 |
| Contrast ratio  | CR     |                          |       | 250   | -     | -                 | Note3 |
| Color of CIE<br>Coordinate<br>(With B/L)              | White  | 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>(main) | IV     | IF= 60mA                 | -     | 150   | -     | cd/m <sup>2</sup> | Note1 |
| Uniformity  | △B     | IF= 60mA                 | 80    | -     | -     | %                 | Note1 |

Note1:

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

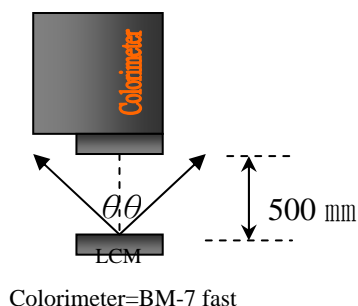
2 : Measurement Condition for Optical Characteristics:

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.

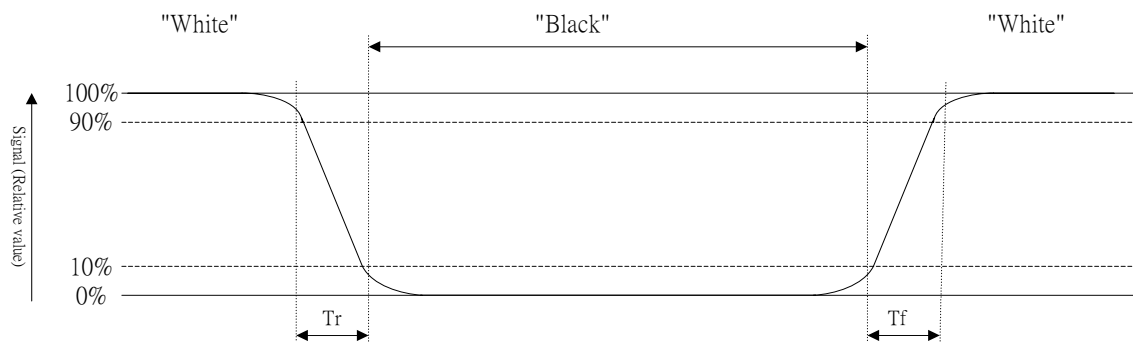
d : The uncertainty of the C.I.E coordinate measurement ±0.01 , Average Brightness ± 4%



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:



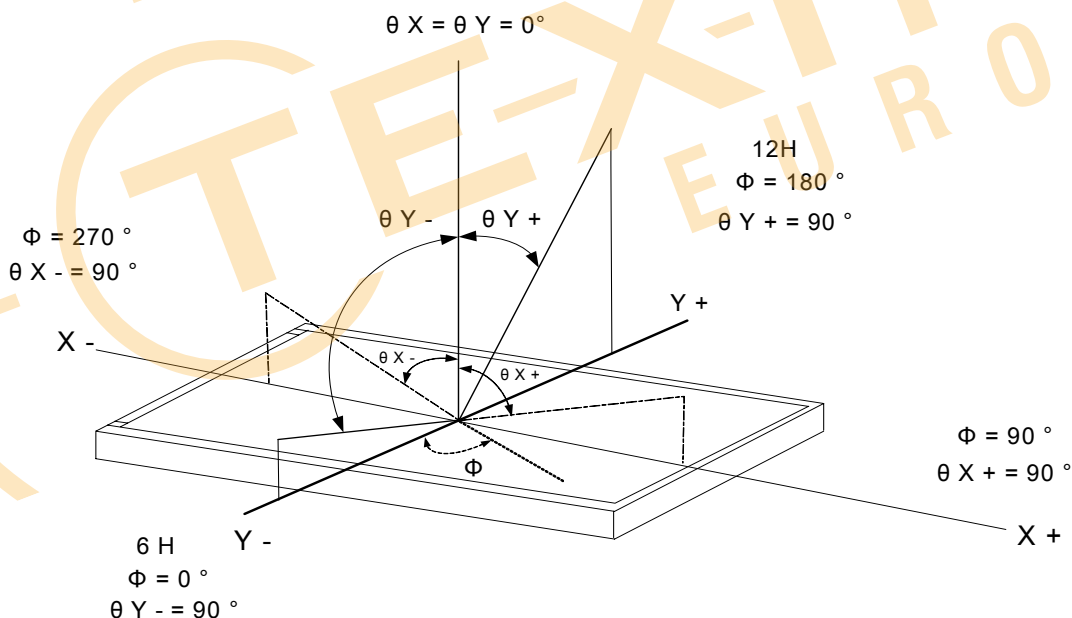
Note3: Definition of contrast ratio:

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 & LED Characteristics

### LCD Module with LED Backlight

#### Maximum Ratings

| Item              | Symbol | Conditions | Min. | Max. | Unit |
|-------------------|--------|------------|------|------|------|
| Forward Current   | IF     | Ta =25°C   | -    | 60   | mA   |
| Forward Voltage   | VF     | Ta =25°C   | -    | 3.5  | V    |
| Power Dissipation | PD     | Ta =25°C   | -    | 210  | mW   |

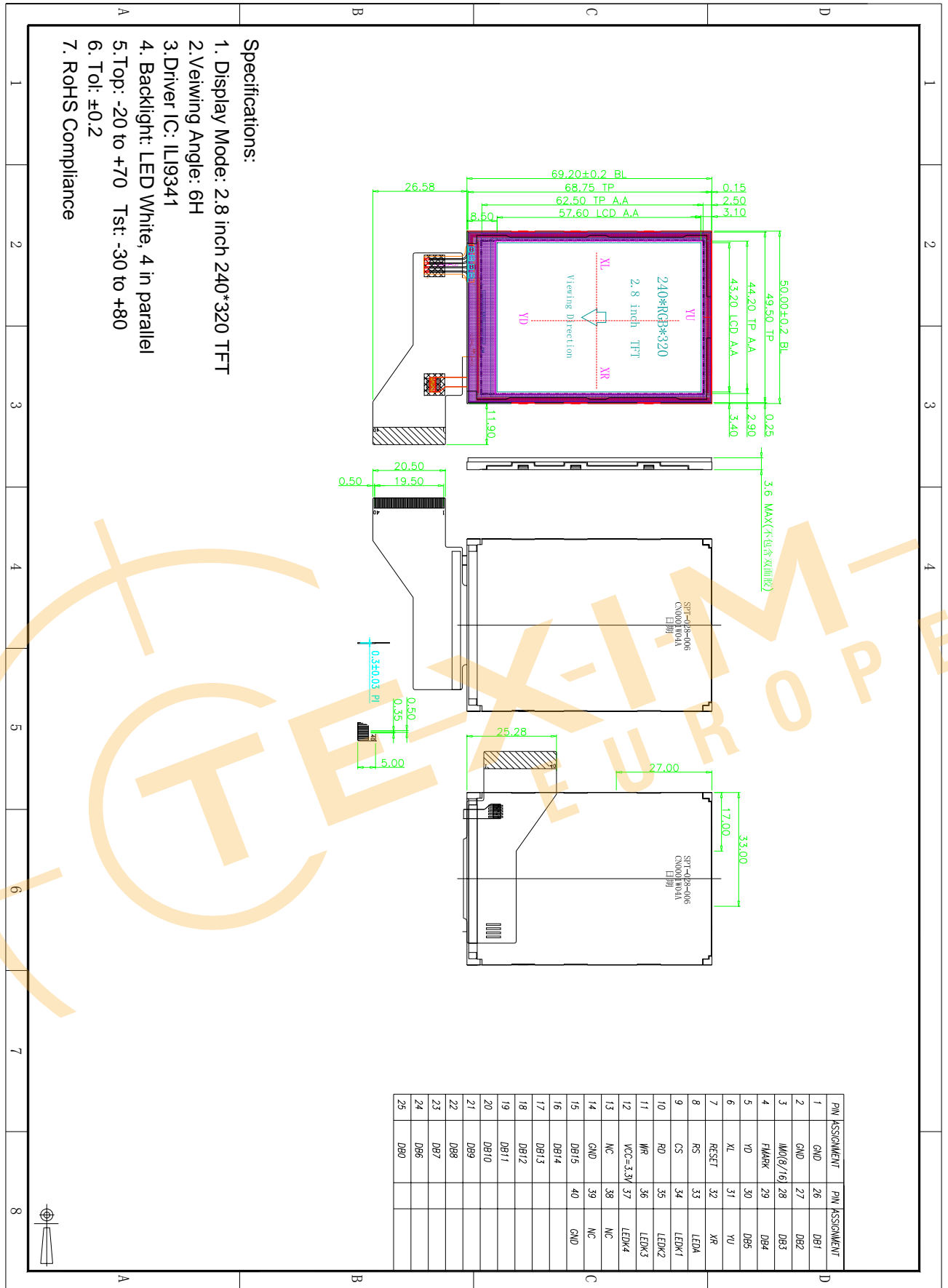
#### Electrical / Optical Characteristics

| Electrical / Optical Characteristics      |        |   |      |      |      |                   |
|---|--------|---|------|------|------|-------------------|
| Item                                      | Symbol | Conditions                                      | Min. | Typ. | Max. | Unit              |
| Forward Voltage                           | VF     | IF=60mA<br>VF=3.2 V<br>4 white leds<br>Ta =25°C | 2.8  | 3.2  | 3.5  | V                 |
| Average Brightness<br>( Without LCD )     | IV     |   | 3500 | -    | -    | cd/m <sup>2</sup> |
| Color of CIE Coordinate<br>(without LCD ) | X      |   | 0.26 | -    | 0.31 | -                 |
|   | Y      |   | 0.26 | -    | 0.31 |                   |
| Color                                     | White  |   |      |      |      |                   |

## 2. MODULE STRUCTURE

### 2.1 Counter Drawing

#### 2.1.1 LCM Mechanical Diagram





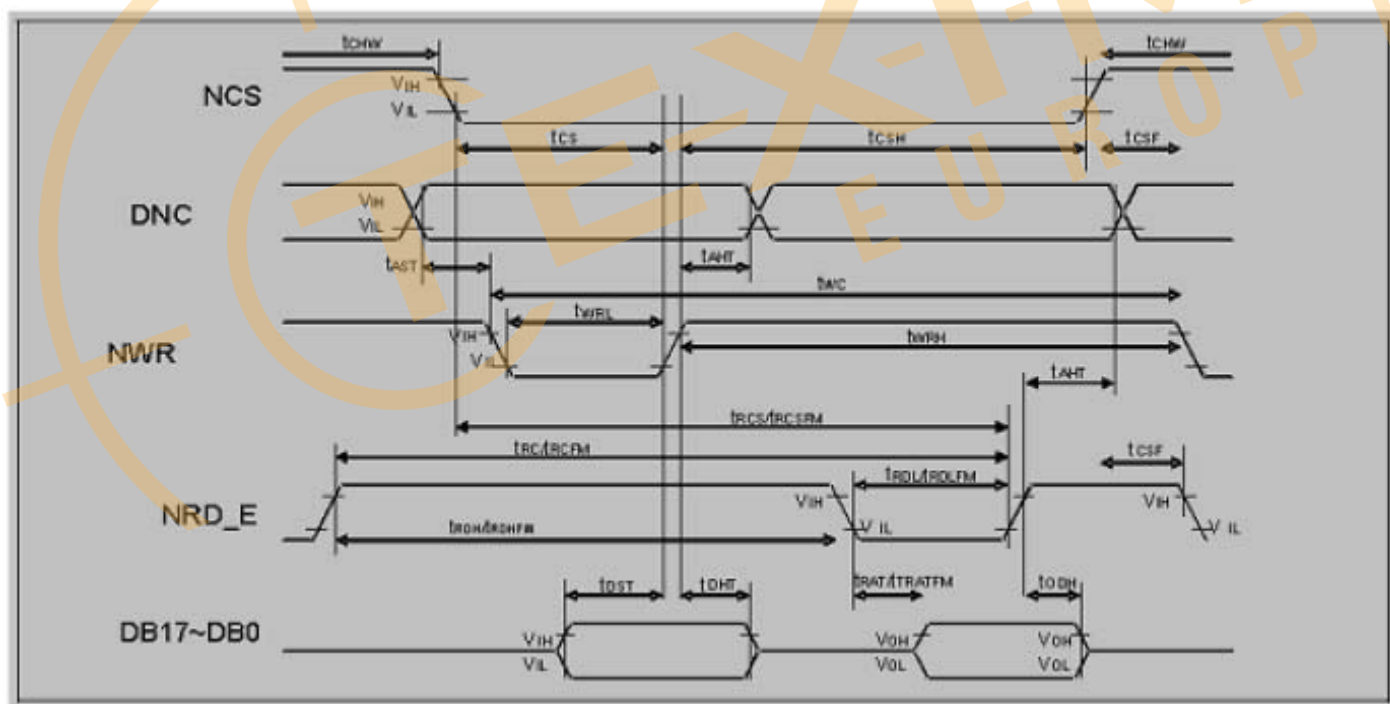
## 2.2 Interface Pin Description

| Pin No. | Symbol    | Function                          |
|---------|-----------|-----------------------------------|
| 1       | GND       | System Ground.(0V)                |
| 2       | GND       | System Ground.(0V)                |
| 3       | IM0(8/16) | Interface Mode                    |
| 4       | FMARK     | Output a frame head pulse signal. |
| 5       | YD        | TOUCH PANEL SIGNAL OUTPUT PIN     |
| 6       | XL        | TOUCH PANEL SIGNAL OUTPUT PIN     |
| 7       | RESET     | RESET SIGNAL                      |
| 8       | RS        | Register selecte siganl           |
| 9       | CS        | Chip selecte signal               |
| 10      | RD        | Read signal                       |
| 11      | WR        | Write signal                      |
| 12      | VCC=3.3V  | Analog power supply.              |
| 13      | NC        | NO Connection                     |
| 14      | GND       | System Ground.(0V)                |
| 15~22   | DB15~DB8  | Data Bus Bit                      |
| 23      | DB7       | Data Bus Bit                      |
| 24      | DB6       | Data Bus Bit                      |
| 25      | DB0       | Data Bus Bit                      |
| 26      | DB1       | Data Bus Bit                      |
| 27      | DB2       | Data Bus Bit                      |
| 28      | DB3       | Data Bus Bit                      |
| 29      | DB4       | Data Bus Bit                      |
| 30      | DB5       | Data Bus Bit                      |
| 31      | YU        | TOUCH PANEL SIGNAL OUTPUT PIN     |
| 32      | XR        | TOUCH PANEL SIGNAL OUTPUT PIN     |
| 33      | LEDA      | POWER SUPPLYFOR LED BACKLIGHT+    |
| 34      | LEDK1     | POWER SUPPLYFOR LED BACKLIGHT-    |
| 35      | LEDK2     | POWER SUPPLYFOR LED BACKLIGHT-    |

|    |       |                                |
|----|-------|--------------------------------|
| 36 | LEDK3 | POWER SUPPLYFOR LED BACKLIGHT- |
| 37 | LEDK4 | POWER SUPPLYFOR LED BACKLIGHT- |
| 38 | NC    | NO Connection                  |
| 39 | NC    | NO Connection                  |
| 40 | GND   | System Ground.(0V)             |

## 2.3 Timing Characteristics

### 2.3.1 Parallel 8080 Timing Characteristics



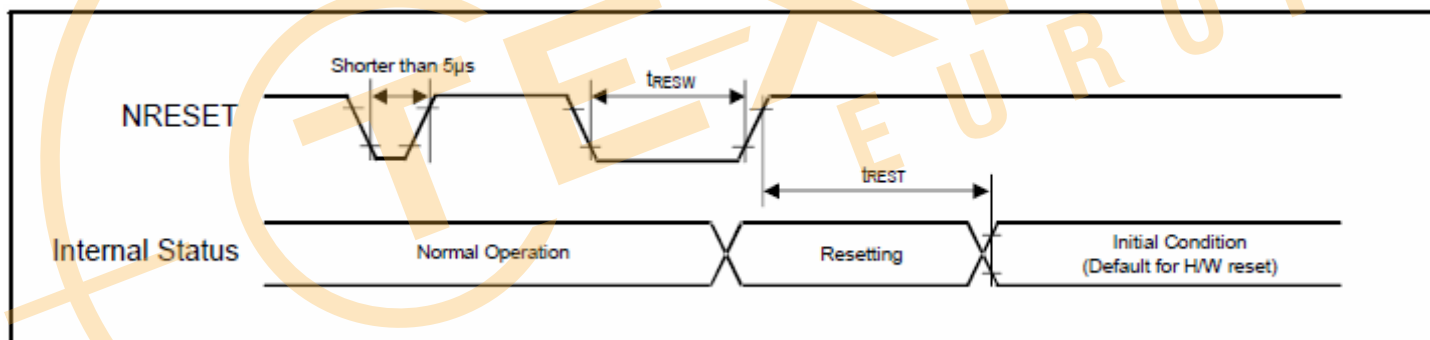
(VSSA=0V, IOVCC=1.65V to 3.6V, VCI=2.5V to 3.6V, Ta = -30 to 70°C)

| Signal     | Symbol | Parameter                          | Min. | Max. | Unit | Description                               |
|------------|--------|------------------------------------|------|------|------|---|
| DNC        | tAST   | Address setup time                 | 0    | -    | ns   | -   |
|            | tAHT   | Address hold time (Write/Read)     | 10   | -    |      |   |
| NCS        | tCHW   | Chip select "H" pulse width        | 0    | -    | ns   | -   |
|            | tCS    | Chip select setup time (Write)     | 15   | -    |      |   |
|            | tRCS   | Chip select setup time (Read ID)   | 45   | -    |      |   |
|            | tRCSFM | Chip select setup time (Read FM)   | 355  | -    |      |   |
|            | tCSF   | Chip select wait time (Write/Read) | 10   | -    |      |   |
|            | tCSH   | Chip select hold time              | 10   | -    |      |   |
| NWR_RNW    | tWC    | Write cycle                        | 66   | -    | ns   | -   |
|            | tWRH   | Control pulse "H" duration         | 15   | -    |      |   |
|            | tWRL   | Control pulse "L" duration         | 15   | -    |      |   |
| NRD_E (ID) | tRC    | Read cycle (ID)                    | 160  | -    | ns   | When read ID data                         |
|            | tRDH   | Control pulse "H" duration (ID)    | 90   | -    |      |   |
|            | tRDL   | Control pulse "L" duration (ID)    | 45   | -    |      |   |
| NRD_E (FM) | tRCFM  | Read cycle (FM)                    | 450  | -    | ns   | When read from frame memory               |
|            | tRDHFM | Control pulse "H" duration (FM)    | 90   | -    |      |   |
|            | tRDLFM | Control pulse "L" duration (FM)    | 355  | -    |      |   |
| D15 to D0  | tDST   | Data setup time                    | 10   | -    | ns   | For maximum CL=30pF<br>For minimum CL=8pF |
|            | tDHT   | Data hold time                     | 10   | -    |      |   |
|            | tRAT   | Read access time (ID)              | -    | 40   |      |   |
|            | tRATFM | Read access time (FM)              | -    | 340  |      |   |
|            | tODH   | Output disable time                | 20   | 80   |      |   |
|            |        |                                    |      |      |      |   |

**Note:** The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.

Logic high and low levels are specified as 30% and 70% of IOVCC for Input signals.

### 2.3.2 Reset Timing Characteristics

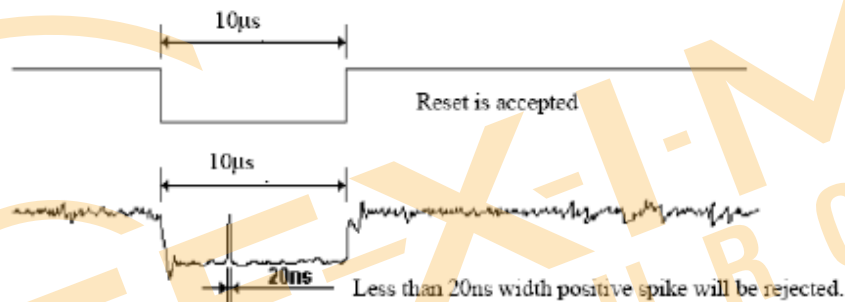


| Symbol            | Parameter                            | Related Pins | Min. | Typ. | Max. | Note                                     | Unit |
|-------------------|--------------------------------------|--------------|------|------|------|--|------|
| t <sub>RESW</sub> | Reset low pulse width <sup>(1)</sup> | NRESET       | 10   | -    | -    | -  | μs   |
| t <sub>REST</sub> | Reset complete time <sup>(2)</sup>   | -            | -    | -    | 5    | When reset applied during Sleep In mode  | ms   |
|                   |                                      | -            | -    | -    | 120  | When reset applied during Sleep Out mode | ms   |

**Note:** (1) Spike due to an electrostatic discharge on !RES line does not cause irregular system reset according to the following table.

| NRESET Pulse         | Action         |
|----------------------|----------------|
| Shorter than 5μs     | Reset Rejected |
| Longer than 10μs     | Reset          |
| Between 5μs and 10μs | Reset Start    |

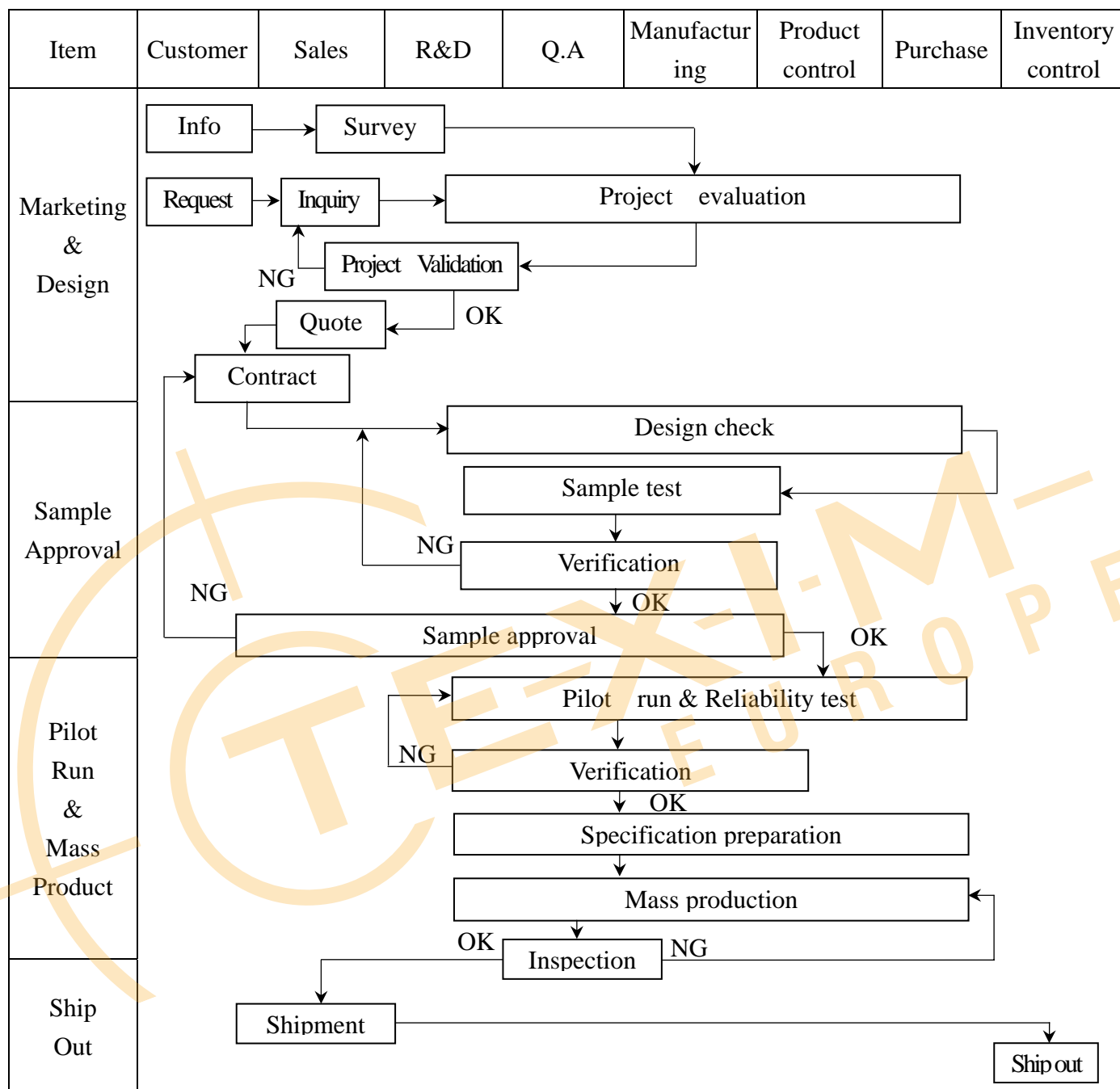
- (2) During the resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep out –mode). The display remains the blank state in Sleep In –mode) and then return to Default condition for H/W reset.
- (3) During Reset Complete Time, ID2 and VCOMOF value in OTP will be latched to internal register during this period. This loading is done every time when there is H/W reset complete time (t<sub>REST</sub>) within 5ms after a rising edge of RESET.
- (4) Spike Rejection also applies during a valid reset pulse as shown as below:



- (5) It is necessary to wait 5msec after releasing RESET before sending commands. Also Sleep Out command cannot be sent for 120ms.

## 3. QUALITY ASSURANCE SYSTEM

### 3.1 Quality Assurance Flow Chart



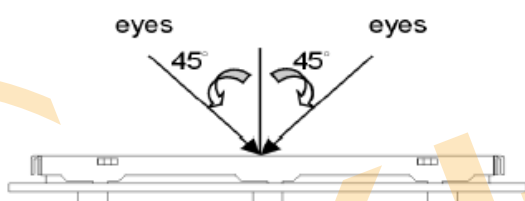
| Item          | Customer   | Sales | R&D | Q.A | Manufacturing | Product control | Purchase | Inventory control |
|---------------|--|-------|-----|-----|---------------|-----------------|----------|-------------------|
| Sales Service | <pre> graph TD     Info[Info] --&gt; Claim[Claim]     Claim --&gt;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

## 3.2 Inspection Specification

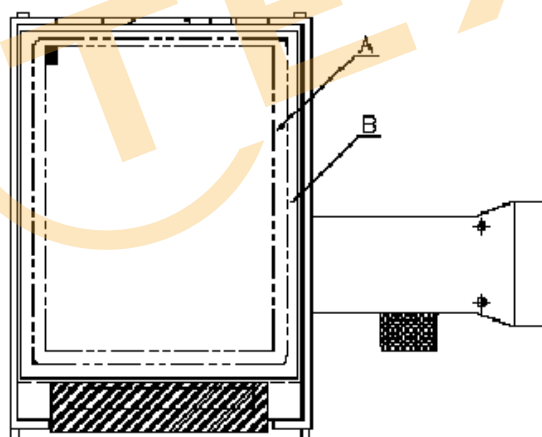
- ◆Scope : The document shall be applied to TFT-LCD Module for less than 3.5" (Ver.02).
- ◆Inspection Standard : MIL-STD-105E Table Normal Inspection Single Sampling Level II.
- ◆Equipment : Gauge 、 MIL-STD 、 Powertip Tester 、 Sample
- ◆Defect Level : Major Defect AQL : 0.4 ; Minor Defect AQL : 1.5
- ◆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" :

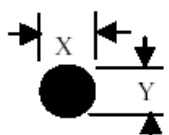

(Ver. 02)

| NO         | Item  | Criterion   | Level |  |                   |            |            |     |          |     |           |     |       |     |       |
|------------|---|---|-------|--|-------------------|------------|------------|-----|----------|-----|-----------|-----|-------|-----|-------|
| 01         | Product condition   | 1. 1The 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. 1The 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         | Dot defect<br><br>(Bright dot 、<br>Dark dot)<br><br>On -display | <table><tr><th colspan="2">Item</th><th>Acceptance (Q'ty)</th></tr><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></table><br>5. 1 Inspection pattern : full white , full black , Red , Green and blue screens.<br>5. 2 It is defined as dot defect if defect area >1/2 dot.<br>5. 3 The distance between two dot defect ≥5 mm. | 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   |       |  |                   |            |            |     |          |     |           |     |       |     |       |



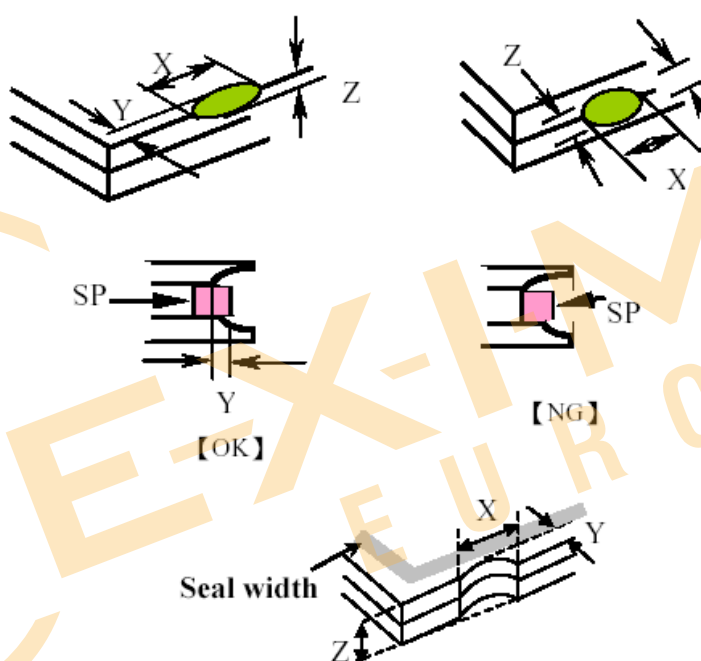
◆Specification For TFT-LCD Module Less Than 3.5" :

(Ver. 02)

| 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><tr><th>Dimension (diameter : <math>\Phi</math>)</th><th>Acceptance (Q'ty)</th></tr><tr><td><math>\Phi \leq 0.15</math></td><td>Ignore</td></tr><tr><td><math>0.15 &lt; \Phi \leq 0.20</math></td><td>2</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>Total</td><td>3</td></tr></table> <p>6. 2 Line type( Non-display or display ) :</p> <table><tr><th>Length (L)</th><th>Width (W)</th><th>Acceptance (Q'ty)</th></tr><tr><td>---</td><td><math>W \leq 0.03</math></td><td>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">Total</td><td>3</td></tr></table> | Dimension (diameter : $\Phi$ ) | Acceptance (Q'ty) | $\Phi \leq 0.15$ | Ignore                  | $0.15 < \Phi \leq 0.20$ | 2             | $0.20 < \Phi \leq 0.30$ | 2     | $\Phi > 0.30$ | 0     | Total | 3 | Length (L) | Width (W) | Acceptance (Q'ty) | --- | $W \leq 0.03$ | Ignore | $L \leq 5.0$ | $0.03 < W \leq 0.05$ | 3 | --- | $W > 0.05$ | As round type | Total |  | 3 | Minor |
|                                |  | Dimension (diameter : $\Phi$ )  | Acceptance (Q'ty)              |                   |                  |                         |                         |               |                         |       |               |       |       |   |            |           |                   |     |               |        |              |                      |   |     |            |               |       |  |   |       |
| $\Phi \leq 0.15$               | Ignore   |   |                                |                   |                  |                         |                         |               |                         |       |               |       |       |   |            |           |                   |     |               |        |              |                      |   |     |            |               |       |  |   |       |
| $0.15 < \Phi \leq 0.20$        | 2  |   |                                |                   |                  |                         |                         |               |                         |       |               |       |       |   |            |           |                   |     |               |        |              |                      |   |     |            |               |       |  |   |       |
| $0.20 < \Phi \leq 0.30$        | 2  |   |                                |                   |                  |                         |                         |               |                         |       |               |       |       |   |            |           |                   |     |               |        |              |                      |   |     |            |               |       |  |   |       |
| $\Phi > 0.30$                  | 0  |   |                                |                   |                  |                         |                         |               |                         |       |               |       |       |   |            |           |                   |     |               |        |              |                      |   |     |            |               |       |  |   |       |
| Total                          | 3  |   |                                |                   |                  |                         |                         |               |                         |       |               |       |       |   |            |           |                   |     |               |        |              |                      |   |     |            |               |       |  |   |       |
| Length (L)                     | Width (W)  | Acceptance (Q'ty)   |                                |                   |                  |                         |                         |               |                         |       |               |       |       |   |            |           |                   |     |               |        |              |                      |   |     |            |               |       |  |   |       |
| ---                            | $W \leq 0.03$  | Ignore  |                                |                   |                  |                         |                         |               |                         |       |               |       |       |   |            |           |                   |     |               |        |              |                      |   |     |            |               |       |  |   |       |
| $L \leq 5.0$                   | $0.03 < W \leq 0.05$   | 3   |                                |                   |                  |                         |                         |               |                         |       |               |       |       |   |            |           |                   |     |               |        |              |                      |   |     |            |               |       |  |   |       |
| ---                            | $W > 0.05$   | As round type   |                                |                   |                  |                         |                         |               |                         |       |               |       |       |   |            |           |                   |     |               |        |              |                      |   |     |            |               |       |  |   |       |
| Total                          |  | 3   |                                |                   |                  |                         |                         |               |                         |       |               |       |       |   |            |           |                   |     |               |        |              |                      |   |     |            |               |       |  |   |       |
| 07                             | <p>Polarizer Bubble</p> <table><tr><th>Dimension (diameter : <math>\Phi</math>)</th><th>Acceptance (Q'ty)</th></tr><tr><td><math>\Phi \leq 0.20</math></td><td>Ignore</td></tr><tr><td><math>0.20 &lt; \Phi \leq 0.50</math></td><td>3</td></tr><tr><td><math>\Phi &gt; 0.50</math></td><td>0</td></tr><tr><td>Total</td><td>3</td></tr></table> | Dimension (diameter : $\Phi$ )  | Acceptance (Q'ty)              | $\Phi \leq 0.20$  | Ignore           | $0.20 < \Phi \leq 0.50$ | 3                       | $\Phi > 0.50$ | 0                       | Total | 3             | Minor |       |   |            |           |                   |     |               |        |              |                      |   |     |            |               |       |  |   |       |
| Dimension (diameter : $\Phi$ ) | Acceptance (Q'ty)  |   |                                |                   |                  |                         |                         |               |                         |       |               |       |       |   |            |           |                   |     |               |        |              |                      |   |     |            |               |       |  |   |       |
| $\Phi \leq 0.20$               | Ignore   |   |                                |                   |                  |                         |                         |               |                         |       |               |       |       |   |            |           |                   |     |               |        |              |                      |   |     |            |               |       |  |   |       |
| $0.20 < \Phi \leq 0.50$        | 3  |   |                                |                   |                  |                         |                         |               |                         |       |               |       |       |   |            |           |                   |     |               |        |              |                      |   |     |            |               |       |  |   |       |
| $\Phi > 0.50$                  | 0  |   |                                |                   |                  |                         |                         |               |                         |       |               |       |       |   |            |           |                   |     |               |        |              |                      |   |     |            |               |       |  |   |       |
| Total                          | 3  |   |                                |                   |                  |                         |                         |               |                         |       |               |       |       |   |            |           |                   |     |               |        |              |                      |   |     |            |               |       |  |   |       |

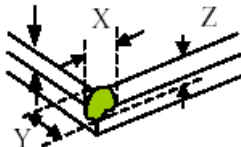
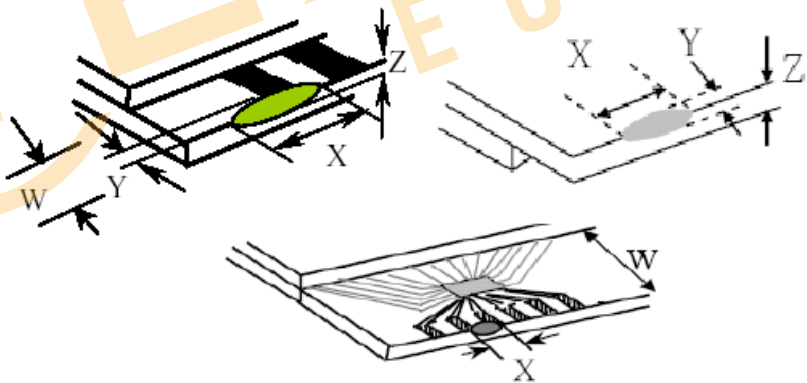
◆Specification For TFT-LCD Module Less Than 3,5" :

(Ver. 02)

| NO       | Item                                     | Criterion   | Level |   |   |   |          |                                |              |
|----------|--|---|-------|---|---|---|----------|--------------------------------|--------------|
| 08       | The crack of glass                       | <p><b>Symbols :</b></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>   | Minor |   |   |   |          |                                |              |
|          |  | <p>8.1 General glass chip :</p> <p>8.1.1 Chip on panel surface and crack between panels:</p> <div></div> <table><tr><th>X</th><th>Y</th><th>Z</th></tr><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></table> |       | X | Y | Z | $\leq a$ | Crack can't enter viewing area | $\leq 1/2 t$ |
| 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. | $1/2 t < Z \leq 2 t$  |       |   |   |   |          |                                |              |

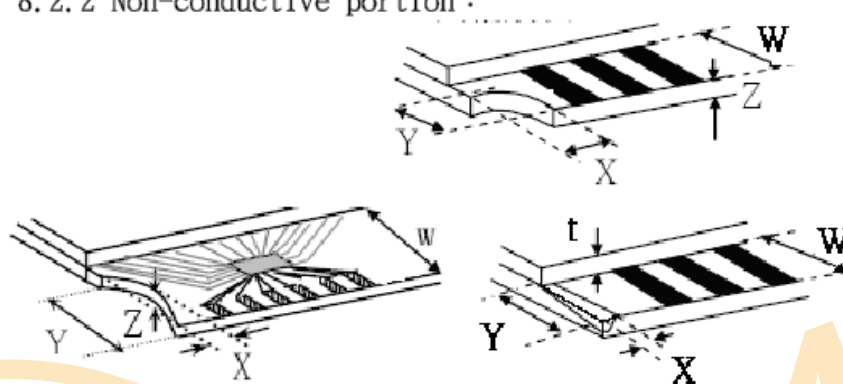
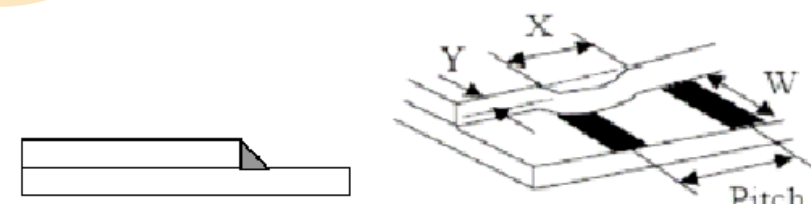
◆Specification For TFT-LCD Module Less Than 3.5" :

(Ver. 02)

| NO           | Item                                     | Criterion  | Level        |   |   |              |                                |                |              |  |                      |          |          |              |  |
|--------------|--|--|--------------|---|---|--------------|--------------------------------|----------------|--------------|--|----------------------|----------|----------|--------------|--|
| 08           | The crack of glass                       | <p><b>Symbols :</b></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>  |              |   |   |              |                                |                |              |  |                      |          |          |              |  |
|              |  | <p>8.1.2 Corner crack :</p>  <table><tr><th>X</th><th>Y</th><th>Z</th></tr><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></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><tr><th></th><th>X</th><th>Y</th><th>Z</th></tr><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></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" :

(Ver. 02)

| NO           | Item               | Criterion  | Level |   |   |              |          |          |   |   |   |          |              |
|--------------|--------------------|--|-------|---|---|--------------|----------|----------|---|---|---|----------|--------------|
| 08           | The crack of glass | <p><b>Symbols :</b></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>  |       |   |   |              |          |          |   |   |   |          |              |
|              |                    | <p>8.2.2 Non-conductive portion :</p>  <table border="1"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td><math>\leq 1/3 a</math></td> <td><math>\leq W</math></td> <td><math>\leq t</math></td> </tr> </tbody> </table> <p>⊙ If the chipped area touches the ITO terminal, over 2/3 of the ITO must remain and be inspected according to electrode terminal specifications.</p> <p>8.2.3 Glass remain :</p>  <table border="1"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td><math>\leq a</math></td> <td><math>\leq 1/3 W</math></td> <td><math>\leq t</math></td> </tr> </tbody> </table> | X     | Y | Z | $\leq 1/3 a$ | $\leq W$ | $\leq t$ | X | Y | Z | $\leq a$ | $\leq 1/3 W$ |
| X            | Y                  | Z  |       |   |   |              |          |          |   |   |   |          |              |
| $\leq 1/3 a$ | $\leq W$           | $\leq t$   |       |   |   |              |          |          |   |   |   |          |              |
| X            | Y                  | Z  |       |   |   |              |          |          |   |   |   |          |              |
| $\leq a$     | $\leq 1/3 W$       | $\leq t$   |       |   |   |              |          |          |   |   |   |          |              |
|              |                    |  |       |   |   |              |          |          |   |   |   |          |              |

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

(Ver. 02)

| 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 |

## 4.1 Reliability Test Condition

| NO.                 | TEST ITEM                                     | TEST CONDITION   |  |                     |                  |          |     |             |    |            |    |          |    |
|---------------------|---|--|--|---------------------|------------------|----------|-----|-------------|----|------------|----|----------|----|
| 1                   | High Temperature Storage Test                 | Keep in +80 ±2℃ 96 hrs<br>Surrounding temperature, then storage at normal condition 4hrs.  |  |                     |                  |          |     |             |    |            |    |          |    |
| 2                   | Low Temperature Storage Test                  | Keep in -30 ±2℃ 96 hrs<br>Surrounding temperature, then storage at normal condition 4hrs.  |  |                     |                  |          |     |             |    |            |    |          |    |
| 3                   | High Temperature / High Humidity Storage Test | Keep in +60℃ / 90% R.H duration for 96 hrs<br>Surrounding temperature, then storage at normal condition 4hrs.<br>(Excluding the polarizer & T/P)   |  |                     |                  |          |     |             |    |            |    |          |    |
| 4                   | ESD Test                                      | Air Discharge:<br>(include mobile phone)<br>Apply 2 KV with 5 times<br>Discharge for each polarity +/-   | Contact Discharge:<br>(include mobile phone)<br>Apply 250V with 5 times<br>discharge for each polarity +/- |                     |                  |          |     |             |    |            |    |          |    |
|                     |   | 1. Temperature ambience:15℃ ~35℃<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 s)<br>(Tolerance if the output voltage indication: ±5%) |  |                     |                  |          |     |             |    |            |    |          |    |
| 5                   | Temperature Cycling Storage Test              | <div>-20℃ → +25℃ → +70℃ → +25℃<br/>(30mins) (30mins) (30mins) (30mins)<br/>← 10 Cycle →</div><br>Surrounding temperature, then storage at normal condition 4hrs.   |  |                     |                  |          |     |             |    |            |    |          |    |
| 6                   | Vibration Test (Packaged)                     | 1. Sine wave 10~55 Hz frequency (1 min)<br>2. The amplitude of vibration :1.5 mm<br>3. Each direction (X、Y、Z) duration for 2 Hrs   |  |                     |                  |          |     |             |    |            |    |          |    |
| 7                   | Drop Test (Packaged)                          | <table><tr><th>Packing Weight (Kg)</th><th>Drop Height (cm)</th></tr><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></table><br>Drop direction :※ 1 corner / 3 edges / 6 sides each 1times                      |  | 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  |  |  |                     |                  |          |     |             |    |            |    |          |    |

## 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  $320 \pm 10^{\circ}\text{C}$  and 3-5 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.

### Packing

| PARAMETER                      | Specification            | Unit |
|--------------------------------|--------------------------|------|
| Outside box                    | 390(L) x 350(W) x 480(H) | mm   |
| Inside pearl wool box          | 330(L)x185(W)x110(H)     | mm   |
| Product quantity of Inside box | 64                       | pcs  |
| Total product quantity         | 64*8=512                 | pcs  |
| Total weight                   | 13.5 $\pm$ 0.5           | Kg   |



## **Disclaimer**

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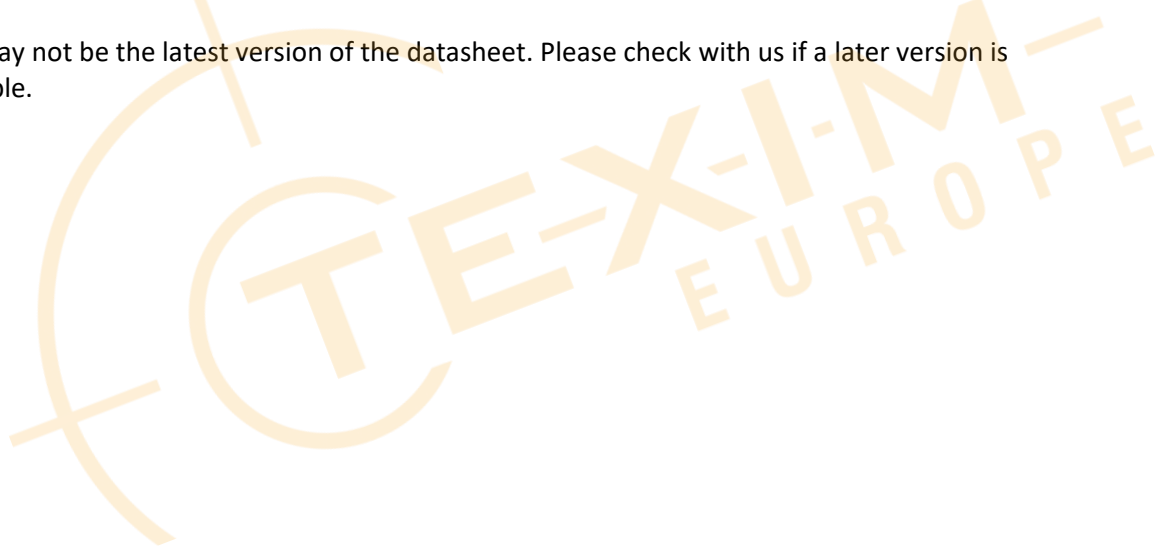
It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application.

Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time.

All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts.

Please contact us if you have any questions about the contents of the datasheet.

This may not be the latest version of the datasheet. Please check with us if a later version is available.







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