

**SPECIFICATION  
OF  
LCD MODULE**

**MODULE NO.: HL123T02C-01**

**Customer Approval:**

☐ **Accept**

☐ **Reject**

|                    | <b>SIGNATURE</b> | <b>DATE</b> |
|--------------------|------------------|-------------|
| <b>PREPARED BY</b> |                  |             |
| <b>CHECKED BY</b>  |                  |             |
| <b>APPROVED BY</b> |                  |             |

## DOCUMENT REVISION HISTORY

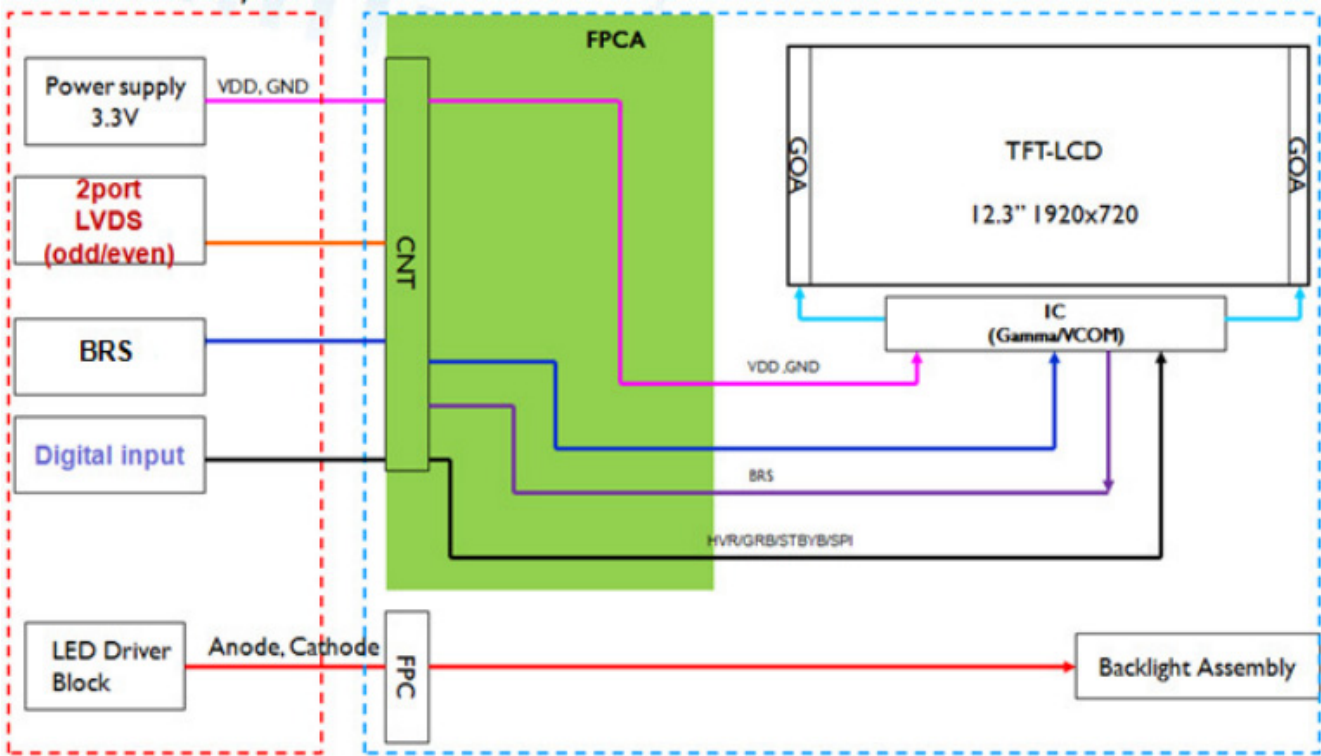
| Sample Version | Doc. Version | DATE       | DESCRIPTION    | CHECKED BY |
|----------------|--------------|------------|----------------|------------|
| 0001           | Y1           | 2022-07-13 | First Release. |            |

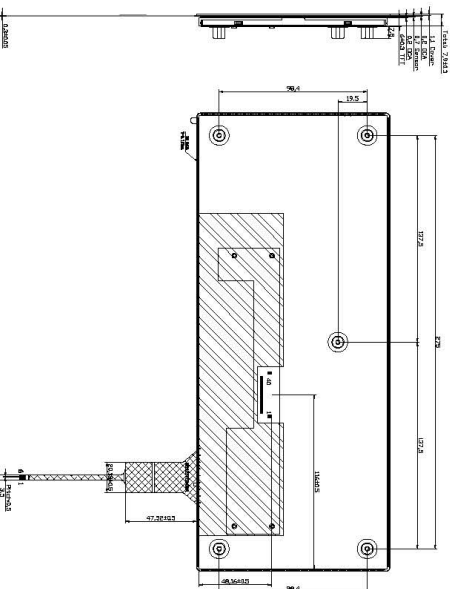
## 1. MECHANICAL SPECIFICATIONS:

| ITEM                  | SPECIFICATION                 | UNIT |
|-----------------------|-------------------------------|------|
| OUTLINE<br>DIMENSIONS | 305.23 (W) X128.51(H) X7.9(D) | mm   |
| ACTIVEAREA            | 292 (W) X109.5(H)             | mm   |
| DISPLAY SIZE          | 12.3                          | inch |
| DOT PITCH             | 0.1521mmX0.1521mm             | mm   |
| NUMBER OF DOTS        | 1920* (RGB) *720              | -    |
| DRIVER IC             | NT51725                       | -    |
| LCD TYPE              | TFT(16.7M) TRANSMISSIVE       | -    |
| BACKLIGHT TYPE        | LED White                     | -    |
| VIEWING DIRECTION     | FREE                          | -    |

**\*See attached drawing for details.**

**2.BLOCK DIAGRAM:**





| RPC ASSIGNMENT |          |
|----------------|----------|
| 1              | GRND     |
| 2              | NO3/HIST |
| 3              | LOC      |
| 4              | VCC      |
| 5              | GRND     |
| 6              | GRND     |
| 7              | GRND     |
| 8              | NC       |
| 9              | GRND     |
| 10             | ORXN00   |
| 11             | ORXN00+0 |
| 12             | ORXN+1   |
| 13             | ORXN+1   |
| 14             | ORXN+2   |
| 15             | ORXN+2   |
| 16             | ORXN+2   |
| 17             | ORXN+2   |
| 18             | ORXN+3   |
| 19             | ORXN+3+0 |
| 20             | ERXN00+0 |
| 21             | ERXN00+0 |
| 22             | ERXN+1   |
| 23             | ERXN+1   |
| 24             | ERXN+2   |
| 25             | ERXN+2   |
| 26             | ERXN+2   |
| 27             | ERXN+2   |
| 28             | ERXN+3   |
| 29             | ERXN+3   |
| 30             | END      |
| 31             | FALLT    |
| 32             | ASSIST   |
| 33             | PH1B3    |
| 34             | NC       |
| 35             | NC       |
| 37             | NC       |
| 38             | END      |
| 39             | END      |
| 40             | NC       |
| 41             | LEDA     |
| 42             | LEDA     |
| 43             | LEDA     |
| 44             | NC       |
| 45             | LEDR     |
| 46             | LEDR     |
| 47             | LEDR     |
| 48             | LEDR     |
| 49             | NVCA     |
| 50             | NVCE     |

|   |     |
|---|-----|
| 1 | RST |
| 2 | VDD |
| 3 | GND |
| 4 | INT |
| 5 | SDA |
| 6 | SCL |



|                       |                                            |
|-----------------------|--------------------------------------------|
| Display Type          | 12.3" TFT-LCD (transmissive, normal black) |
| Display Resolution    | 1920x1080 (HD)                             |
| Interface             | LVDS                                       |
| Logic Voltage         | 3.3V                                       |
| Operation Temperature | -40°C TO 85°C                              |
| Storage Temperature   | -40°C TO 80°C                              |
| Remark                | —————                                      |

|           |                   |            |          |           |  |                                                                                     |  |           |  |
|-----------|-------------------|------------|----------|-----------|--|-------------------------------------------------------------------------------------|--|-----------|--|
|           |                   | TITLE: LCM |          | DIMENSION |  | REV. : 2.0                                                                          |  | SCALE : - |  |
|           |                   | DESIGN     |          |           |  | PROJECTION:                                                                         |  |           |  |
|           |                   | CHECKED    |          |           |  |  |  |           |  |
| 10        | First version     |            |          |           |  |                                                                                     |  |           |  |
| MARK REV. | CONTENTS MODIFIED | DATE       | APPROVED |           |  |                                                                                     |  |           |  |

**HL** 海罗光电有限公司  
Hello Lighting co., LTD

HL123T02C-01

#### **4. PIN DESCRIPTION:**

| NO. | PIN NAME | I/O | Description                                        |
|-----|----------|-----|----------------------------------------------------|
| 1   | GND      | P   | Power ground                                       |
| 2   | NC/BIST  | -   | No connection                                      |
| 3   | VCC      | P   | Power of Logic                                     |
| 4   | VCC      | P   | Power of Logic                                     |
| 5   | GND      | P   | Power ground                                       |
| 6   | GND      | P   | Power ground                                       |
| 7   | NC       | -   | No connection                                      |
| 8   | NC       | -   | No connection                                      |
| 9   | GND      | P   | Power ground                                       |
| 10  | ORxIN0-  | I   | Negative LVDS differential data input(Odd data_0)  |
| 11  | ORxIN0+  | I   | Positive LVDS differential data input(Odd data_0)  |
| 12  | ORxIN1-  | I   | Negative LVDS differential data input(Odd data_1)  |
| 13  | ORxIN1+  | I   | Positive LVDS differential data input(Odd data_1)  |
| 14  | ORxIN2-  | I   | Negative LVDS differential data input(Odd data_2)  |
| 15  | ORxIN2+  | I   | Positive LVDS differential data input(Odd data_2)  |
| 16  | ORxCLK-  | I   | Negative LVDS differential clock input(Odd clock)  |
| 17  | ORxCLK+  | I   | Positive LVDS differential clock input(Odd clock)  |
| 18  | ORxIN3-  | I   | Negative LVDS differential data input(Odd data_3)  |
| 19  | ORxIN3+  | I   | Positive LVDS differential data input(Odd data_3)  |
| 20  | ERxIN0-  | I   | Negative LVDS differential data input(Even data_0) |
| 21  | ERxIN0+  | I   | Positive LVDS differential data input(Even data_0) |
| 22  | ERxIN1-  | I   | Negative LVDS differential data input(Even data_1) |
| 23  | ERxIN1+  | I   | Positive LVDS differential data input(Even data_1) |
| 24  | ERxIN2-  | I   | Negative LVDS differential data input(Even data_2) |
| 25  | ERxIN2+  | I   | Positive LVDS differential data input(Even data_2) |
| 26  | ERxCLK-  | I   | Negative LVDS differential clock input(Even clock) |
| 27  | ERxCLK+  | I   | Positive LVDS differential clock input(Even clock) |
| 28  | ERxIN3-  | I   | Negative LVDS differential data input(Even data_3) |
| 29  | ERxIN3+  | I   | Positive LVDS differential data input(Even data_3) |
| 30  | GND      | P   | Power ground                                       |
| 31  | FAULT    | O   | FAULT signal output(Normal=H,Abnormal=L)           |
| 32  | RESET    | I   | Global reset pin,active low.                       |
| 33  | STBYB    | I   | Standby mode setting pin,active low.               |
| 34  | NC       | -   | No connection                                      |
| 35  | NC       | -   | No connection                                      |
| 36  | NC       | -   | No connection                                      |

|           |      |   |                    |
|-----------|------|---|--------------------|
| <b>37</b> | NC   | - | No connection      |
| <b>38</b> | GND  | P | Power ground       |
| <b>39</b> | GND  | P | Power ground       |
| <b>40</b> | NC   | - | No connection      |
| <b>41</b> | LEDA | P | LED power(Anode)   |
| <b>42</b> | LEDA | P | LED power(Anode)   |
| <b>43</b> | LEDA | P | LED power(Anode)   |
| <b>44</b> | NC   | - | No connection      |
| <b>45</b> | LEDK | P | LED power(Cathode) |
| <b>46</b> | LEDK | P | LED power(Cathode) |
| <b>47</b> | LEDK | P | LED power(Cathode) |
| <b>48</b> | LEDK | P | LED power(Cathode) |
| <b>49</b> | NC   | - | No connection      |
| <b>50</b> | NC   | - | No connection      |

#### Pin define for CTP

| NO.      | PIN NAME | I/O | Description      |
|----------|----------|-----|------------------|
| <b>1</b> | RST      | I   | Reset pin        |
| <b>2</b> | VDD      | P   | Power supply     |
| <b>3</b> | GND      | P   | Power ground     |
| <b>4</b> | INT      | I   | Interrupt output |
| <b>5</b> | SDA      | IO  | Serial data      |
| <b>6</b> | SCL      | I   | Serial clock     |

## 5. MAXIMUM ABSOLTE LIMIT:

| Item                  | Symbol | Value  | Unit |
|-----------------------|--------|--------|------|
| Power Logic           | VDD    | -0.5-5 | V    |
| Operating temperature | Topr   | -40-85 | °C   |
| Storage temperature   | Tstg   | -40-90 | °C   |

\*\*\*Function operating should be restricted under normal ambient temperature 25°C.

## 6.ELECTRICAL CHARACTERISTICS

### 6.1 DC Characteristics ( $V_{DD}=3.3V, T_a=25^{\circ}C$ )

| Item                      | Symbol      | Min      | Type | Max    | Unit | Notes      |
|---------------------------|-------------|----------|------|--------|------|------------|
| Power Supply              | VDD         | 3        | 3.3  | 3.6    | V    | -          |
|                           | IVDD        | -        | 150  | 250    | mA   | 3          |
|                           | IVDD Inrush | -        | 1.3  | 1.5    | A    | Rising 1ms |
| Input high level voltage  | $V_{IH}$    | 0.7VDD   | -    | VDD    | V    | -          |
| Input low level voltage   | $V_{IL}$    | 0        | -    | 0.3VDD | V    |            |
| High level output voltage | $V_{OH}$    | VDD-0.4V | -    | VDD    | V    | -          |
| Low level output voltage  | $V_{OL}$    | GND      | -    | 0.4V   | V-   | -          |

1. All conditions should be set typical value.
2. The panel can operate normally in the recommended operating condition
3. Test pattern is as the following picture



## 6.2 Backlight Electrical-optical Characteristics

### 1. Stander Lamp Styles(Edge Lighting Type):

The LED chips are distributed over the edge light area of the illumination unit, which gives the less power consumption:

### 2. The Main Advantages of the LED Backlight are as following:

2.1 The brightness of the backlight can simply be adjusted by a resistor or a potentiometer.

### 3. Data About LED Backlight:

| Item               | Symbol | MIN   | TYP | MAX | UNIT | Test Condition | Note |
|--------------------|--------|-------|-----|-----|------|----------------|------|
| Supply Voltage     | Vf     | 28    | 32  | 34  | V    | If=320 mA      | -    |
| Supply Current     | If     | -     | 320 | -   | mA   | -              | -    |
| Reverse Voltage    | Vr     | -     | -   | 5   | V    | 10uA           |      |
| Power dissipation  | Pd     | -     | 256 | -   | mW   | -              |      |
| Uniformity for LCM | -      | 80    | -   | -   | %    | If=320mA       | 3    |
| Life Time          | -      | 30000 | -   | -   | Hr   | If=320mA       | -    |
| Backlight Color    | White  |       |     |     |      |                |      |

### NOTE:

1. Average Luminous Intensity of P1-P9

2. Uniformity = Min/Max \* 100%

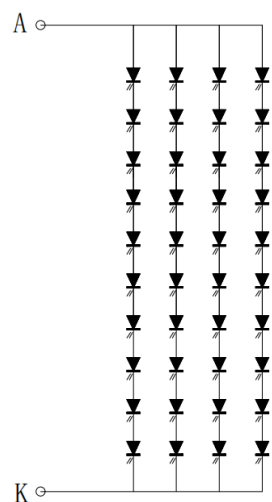
3.LED life time defined as follows: The final brightness is at 70% of original brightness

Measured Method: (X\*Y: Light Area)(Left Draft as follow)

Internal Circuit Diagram(Right Draft as follow)

(Effective spatial Distribution)

Hole Diameter ø 3mm ; 1 to 9 per Position Measured Luminous:



LED Circuit Diagram

## **7.AC TIMING**

**Please refer to IC spec.**

## **8. OPTICAL CHARACTERISTICS:**

Driving the backlight

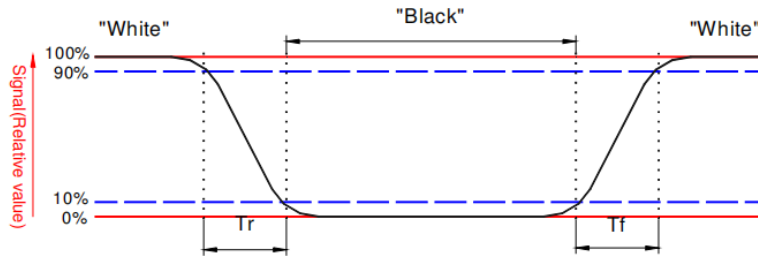
| No. | ITEM            |       | Symbol         | Conditions                                                                         | Specification |             |                  | Unit | Note   |
|-----|-----------------|-------|----------------|------------------------------------------------------------------------------------|---------------|-------------|------------------|------|--------|
|     |                 |       |                |                                                                                    | Min           | Typ         | Max              |      |        |
| 1   | Response Time   |       | Tr+Tf          | $\theta=0^{\circ}$ , 25℃<br>$\theta=0^{\circ}$ , -20℃<br>$\theta=0^{\circ}$ , -30℃ | -<br>-<br>-   | -<br>-<br>- | 25<br>150<br>350 | Ms   | (1)(2) |
| 2   | Contrast Rate   |       | Cr             | $\theta=0$                                                                         | 800           | 1400        | -                | -    | (3)    |
| 3   | Viewing Angle-1 |       | Top            | CR>500,<br>$\Psi=0^{\circ}$ , $90^{\circ}$ ,<br>$180^{\circ}$ , $270^{\circ}$      | 20            | 30          | -                | Deg  | (4)(5) |
|     |                 |       | Bottom         |                                                                                    | 20            | 30          | -                |      |        |
|     |                 |       | Left           |                                                                                    | 20            | 30          | -                |      |        |
|     |                 |       | Right          |                                                                                    | 70            | 80          | -                |      |        |
| 4   | Viewing Angle-2 |       | Top            | CR>500,<br>$\Psi=0^{\circ}$ , $90^{\circ}$ ,<br>$180^{\circ}$ , $270^{\circ}$      | 70            | 80          | -                | Deg  | (4)(5) |
|     |                 |       | Bottom         |                                                                                    | 70            | 80          | -                |      |        |
|     |                 |       | Left           |                                                                                    | 70            | 80          | -                |      |        |
|     |                 |       | Right          |                                                                                    | 70            | 80          | -                |      |        |
| 5   | Transmittance   |       | Y <sub>L</sub> | Perpendicular                                                                      | -             | 4.3%        | -                | %    | (6)    |
| 6   | Chromaticiry    | White | x              | $\theta=0^{\circ}$                                                                 | 0.267         | 0.302       | 0.337            |      | (7)    |
|     |                 |       | y              |                                                                                    | 0.287         | 0.322       | 0.357            |      |        |
|     |                 | Red   | x              |                                                                                    | 0.597         | 0.637       | 0.677            |      |        |
|     |                 |       | y              |                                                                                    | 0.290         | 0.330       | 0.370            |      |        |
|     |                 | Green | x              |                                                                                    | 0.264         | 0.304       | 0.344            |      |        |
|     |                 |       | y              |                                                                                    | 0.555         | 0.595       | 0.635            |      |        |
|     |                 | Blue  | x              |                                                                                    | 0.111         | 0.151       | 0.191            |      |        |
|     |                 |       | y              |                                                                                    | 0.022         | 0.062       | 0.102            |      |        |
| 7   | NTSC            |       | S              |                                                                                    |               | 70          |                  | %    |        |
|     |                 |       |                |                                                                                    |               |             |                  |      |        |
|     |                 |       |                |                                                                                    |               |             |                  |      |        |

\*\* Optical measurement should be performed in the dark room, ambient temperature  $=25^{\circ}\text{C}$ , and

backlight current  $I_L=80\text{ mA}$

\*\*\* To be measured on the center area of panel with a field angle of 1 by Topcon luminance meter SR-3, after 10 minutes operation.

Note 1: 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.

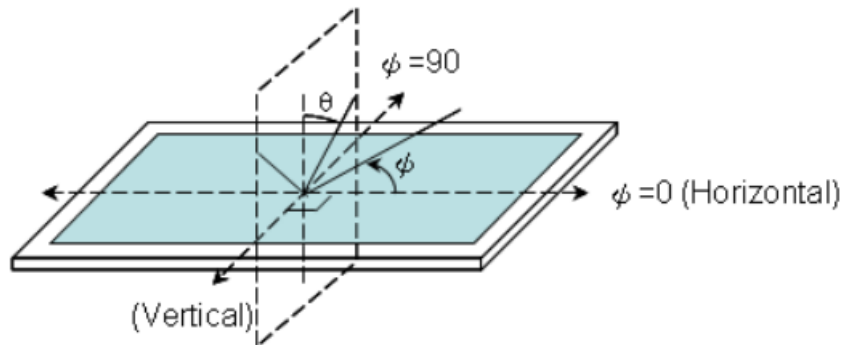


Note 2: From liquid crystal characteristics, response time will become slower and the color of panel will become darker when ambient temperature is below 25° C.

Note 3: Contrast ratio is calculated with the following formula.

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

Note 4: Definition of viewing angle: refer to figure as below.



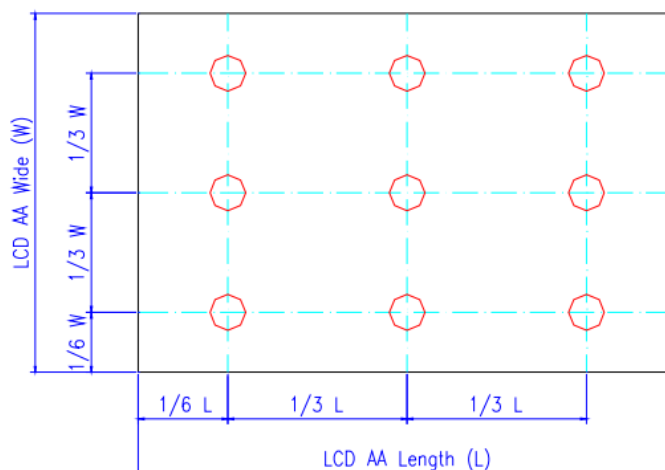
Note 5: The viewing angles are measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

Note 6: Brightness is measured at the center of the display perpendicular to the panel surface.

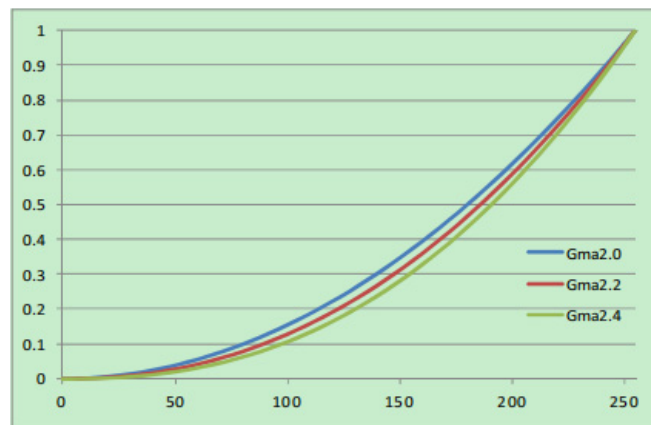
Note 7: The chromaticity of R, G, and B is for reference only. The accurate data will base on the reality test.

Note 8: Luminance Uniformity is defined as following within the 9 measurements (L1-L9)

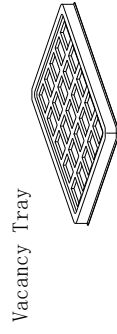
$$\text{Luminance Uniformity(\%)} = \frac{\text{Minimum brightness}}{\text{Maximum brightness}}$$



## Note 9: Gamma distribution

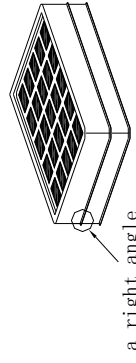


x : gray level   y : Brightness (normalized)



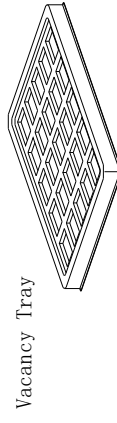
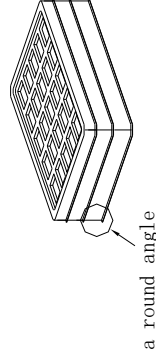
+

LCM Enclose Tray

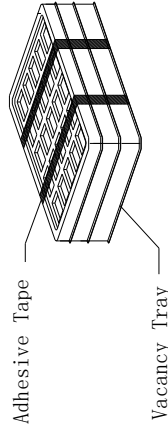


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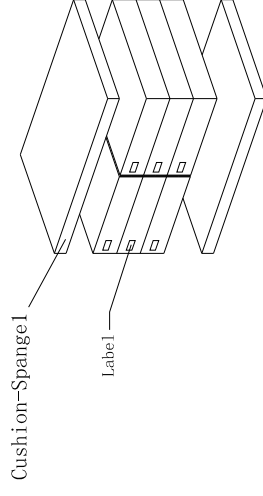
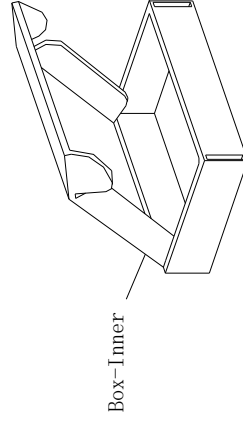
Tray Circumgyrate Nappe



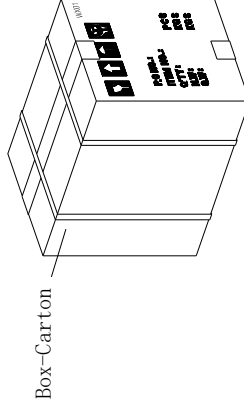
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NOTE:

1. PET Tray Nappe Circumgyrate 180°
2. LCM Panel Packaging Heads

## **10. STANDARD SPECIFICATION FOR RELIABILITY:**

| Item                         | Condition                               |       | Time (hrs) | Assessment                                         |
|------------------------------|-----------------------------------------|-------|------------|----------------------------------------------------|
| High temp. Storage           | 90°C                                    |       | 500        | No abnormalities<br>in functions<br>and appearance |
| High temp. Operating         | 85°C                                    |       | 500        |                                                    |
| Low temp. Storage            | -40°C                                   |       | 500        |                                                    |
| Low temp. Operating          | -30°C                                   |       | 500        |                                                    |
| Humidity                     | 65°C/ 90%RH                             |       | 240        |                                                    |
| Thermal Shock Temp.<br>Cycle | -30°C ← →80°C<br>(0.5hour ← → 0.5 hour) |       | 100cycles  |                                                    |
| ESD Testing                  | Contact:                                | ±8KV  |            | 330Ω/150PF                                         |
|                              | Air:                                    | ±15KV |            | 330Ω/150PF                                         |

Functions, performance, appearance, etc. shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature ( $25\pm10^{\circ}\text{C}$ ), normal humidity ( $45\pm20\%$  RH), and in area not exposed to direct sun light. (Life time of backlight, please refer to Data about backlight.)

### **Testing Conditions and Inspection Criteria:**

For the final test the testing sample must be stored at room temperature for 24 hours, after the tests listed in up Table, Standard specifications for Reliability have been executed in order to ensure stability.

| Item                | Test Model             | In section Criteria                                                                                                |
|---------------------|------------------------|--------------------------------------------------------------------------------------------------------------------|
| Current Consumption | Refer To Specification | The current consumption should conform to the product specification.                                               |
| Contrast            | Refer To Specification | After the tests have been executed, the contrast must be larger than half of its initial value prior to the tests. |
| Appearance          | Visual inspection      | Defect free.                                                                                                       |

## **11.SPECIFICATION OF QUALITY ASSURANCE:**

### **11.1 Purpose**

This standard for Quality Assurance should affirm the quality of LCD Module products to supply.

### **11.2 Standard for Quality Test**

#### **a. Inspection:**

Before delivering, the supplier should take the following tests, and affirm the quality of product.

#### **b. Electro-Optical Characteristics:**

According to the individual specification to test the product.

#### **c. Test of Appearance Characteristics:**

According to the individual specification to test the product.

#### **d. Test of Reliability Characteristics:**

According to the definition of reliability on the specification for testing products.

#### **e. Delivery Test:**

Before delivering, the supplier should take the delivery test.

(i) Test method: According to MIL-STD105E.General Inspection Level II take a single time.

(ii) The defects classify of AQL as following:

Major defect: AQL = 0.65

Minor defect: AQL = 2.5

Total defects: AQL = 2.5

### **11.3. Nonconforming Analysis & Deal With Manners**

#### **a. Nonconforming Analysis:**

(i) Purchaser should supply the detail data of non- conforming sample and the non- conforming.

(ii) After accepting the detail data from purchaser, the analysis of nonconforming should be finished in two weeks.

(iii) If supplier can not finish analysis on time, must announce purchaser before two weeks.

#### **b. Disposition of nonconforming:**

(i) If find any product defect of supplier during assembly time, supplier must change the good product for every defect after recognition.

(ii) Both supplier and customer should analyze the reason and discuss the disposition of nonconforming when the reason of nonconforming is not sure.

### **11.4. Agreement items**

Both sides should discuss together when the following problems happen.

a. There is any problem of standard of quality assurance, and both sides think that it must be modified.

b. There is any argument item which does not record in the standard of quality assurance.

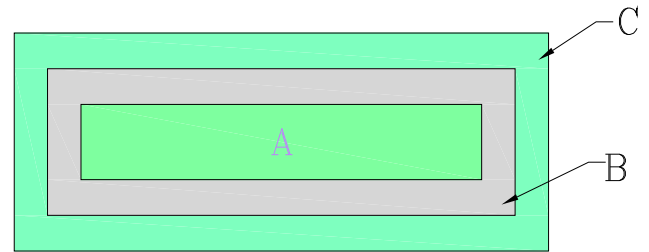
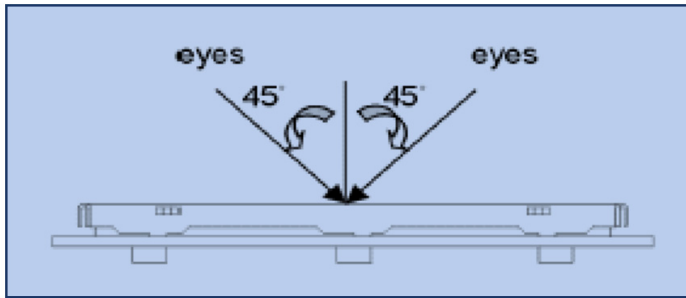
c. Any other special problem.

### **11.5 Standard of The Product Appearance Test**

a. Manner of appearance test: This specification should be applied for both light on and off situation.

(i) The test must be under  $20W \times 2$  or  $40W$  fluorescent light, and the distance of view must be at  $30 \pm 5cm$ .

- (ii) When test the model of transmissive product must add the reflective plate.
- (iii) The test direction is base on about around  $10^\circ$  of vertical line (Left graph)
- (iii) Temperature:  $25 \pm 5^\circ\text{C}$  Humidity:  $65 \pm 10\% \text{RH}$



(iv) Definition of area (Right graph)

A. Area: Viewing area. B. Area: Out of viewing area.(Outside viewing area)

b. Basic principle:

- (i) It will accord to the AQL when the standard can not be described.
- (ii) The sample of the lowest acceptable quality level must be discussed by both supplier and customer when any dispute happened.
- (iii) Must add new item on time when it is necessary.

c. Standard of inspection: (Unit: mm)

Allowable limits defined in follow Dot defect Table should be met for each white, black , R, G, B raster. The limits apply to the entire area. Missing white in 60% or more of typical (one color, R or G or B) pixel aperture is defined as a bright defect, less than 60% is acceptable .Black spot in 60% or more of typical pixel aperture is defined as a dark defect, less than 60% is acceptable.

Dot defect table:

| Item |                        | White dot defect                                                                                                                       | Black dot defect | Total |
|------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------|------------------|-------|
| 1    | Defect counts          | 3                                                                                                                                      | 3                | 3     |
| 2    | Combined defect Counts | No combined dot defect allowed. Two Single dot defect that within 5mm during each dot defect should becounated as combined dot defect. |                  |       |

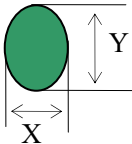
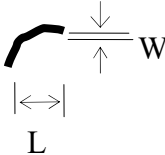
## 11.6 Inspection specification

AQL inspection standard

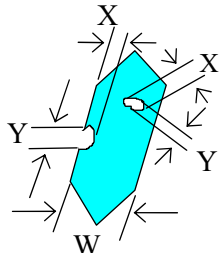
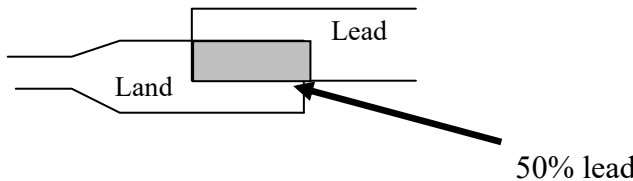
Sampling method: MIL-STD-105E, Level II, single sampling

| Classify | Item          |                              | Note | AQL  |  |
|----------|---------------|------------------------------|------|------|--|
| Major    | Display state | Short or open circuit        | 1    | 0.65 |  |
|          |               | Contrast defect (dim, ghost) |      |      |  |
|          |               | LC leakage                   |      |      |  |
|          |               | Flickering                   |      |      |  |
|          |               | No display                   |      |      |  |
|          |               | Wrong viewing direction      | 2    |      |  |
|          |               | Wrong Back-light             | 7    |      |  |
|          | Non-display   | Flat cable or pin reverse    | 9    |      |  |
|          |               | Wrong or missing component   | 10   |      |  |
| Minor    | Display state | Background color deviation   | 2    | 2.5  |  |
|          |               | Black spot and dust          | 3    |      |  |
|          |               | Line defect                  | 4    |      |  |
|          |               | Scratch                      |      |      |  |
|          |               | Rainbow                      | 5    |      |  |
|          |               | Pin hole                     | 6    |      |  |
|          | Polarizer     | Bubble and foreign material  | 3    |      |  |
|          |               | Scratch                      | 4    |      |  |
|          | PCB,FPC       | Scratch                      | 4    |      |  |
|          | Soldering     | Poor connection              | 8    |      |  |
|          | Wire          | Poor connection              | 9    |      |  |
|          | LCD           | CHIP OUT                     | 11   |      |  |

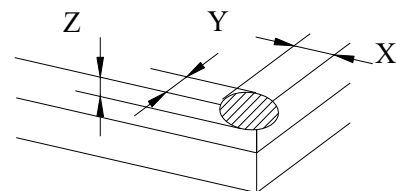
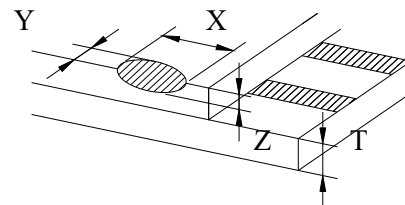
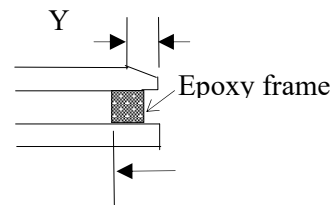
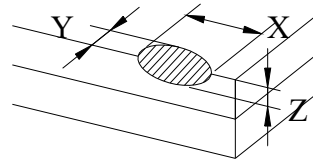
**Note on defect classification:**

| No.                     | Item                                                                                                                                                                       | Criterion                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                 |                  |           |                         |   |                         |                |               |              |               |   |              |               |              |           |   |     |            |                         |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----------------|------------------|-----------|-------------------------|---|-------------------------|----------------|---------------|--------------|---------------|---|--------------|---------------|--------------|-----------|---|-----|------------|-------------------------|
| 1                       | Short or open circuit                                                                                                                                                      | Not allow                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                 |                  |           |                         |   |                         |                |               |              |               |   |              |               |              |           |   |     |            |                         |
|                         | LC leakage                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                 |                  |           |                         |   |                         |                |               |              |               |   |              |               |              |           |   |     |            |                         |
|                         | Flickering                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                 |                  |           |                         |   |                         |                |               |              |               |   |              |               |              |           |   |     |            |                         |
|                         | No display                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                 |                  |           |                         |   |                         |                |               |              |               |   |              |               |              |           |   |     |            |                         |
|                         | Wrong viewing direction                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                 |                  |           |                         |   |                         |                |               |              |               |   |              |               |              |           |   |     |            |                         |
|                         | Wrong Back-light                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                 |                  |           |                         |   |                         |                |               |              |               |   |              |               |              |           |   |     |            |                         |
| 2                       | Contrast defect                                                                                                                                                            | Refer to approval sample                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                 |                  |           |                         |   |                         |                |               |              |               |   |              |               |              |           |   |     |            |                         |
|                         | Background color deviation                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                 |                  |           |                         |   |                         |                |               |              |               |   |              |               |              |           |   |     |            |                         |
| 3                       | Point defect, Black spot, dust (incl. Polarizer) ex.: dirt under polarizer, Pinhole of reflector ,glass scratch, dirt under glass,scratch on polarizer<br>$\phi = (X+Y)/2$ | <div></div> <table><tr><td>Point Size</td><td>Acceptable Qty.</td></tr><tr><td><math>\phi \leq 0.20</math></td><td>Disregard</td></tr><tr><td><math>0.20 &lt; \phi \leq 0.25</math></td><td>3</td></tr><tr><td><math>0.25 &lt; \phi \leq 0.30</math></td><td>2</td></tr><tr><td><math>\phi &gt; 0.30</math></td><td>0</td></tr></table> <div>Unit: mm</div>                                                                                                                                                                                                              | Point Size | Acceptable Qty. | $\phi \leq 0.20$ | Disregard | $0.20 < \phi \leq 0.25$ | 3 | $0.25 < \phi \leq 0.30$ | 2              | $\phi > 0.30$ | 0            |               |   |              |               |              |           |   |     |            |                         |
|                         | Point Size                                                                                                                                                                 | Acceptable Qty.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                 |                  |           |                         |   |                         |                |               |              |               |   |              |               |              |           |   |     |            |                         |
| $\phi \leq 0.20$        | Disregard                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                 |                  |           |                         |   |                         |                |               |              |               |   |              |               |              |           |   |     |            |                         |
| $0.20 < \phi \leq 0.25$ | 3                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                 |                  |           |                         |   |                         |                |               |              |               |   |              |               |              |           |   |     |            |                         |
| $0.25 < \phi \leq 0.30$ | 2                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                 |                  |           |                         |   |                         |                |               |              |               |   |              |               |              |           |   |     |            |                         |
| $\phi > 0.30$           | 0                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                 |                  |           |                         |   |                         |                |               |              |               |   |              |               |              |           |   |     |            |                         |
| 4                       | Line defect                                                                                                                                                                | <div></div> <table><tr><td></td><td>Line</td><td>Acceptable Qty.</td></tr><tr><td>L</td><td>W</td><td></td></tr><tr><td>---</td><td><math>0.015 \geq W</math></td><td>Disregard</td></tr><tr><td><math>3.0 \geq L</math></td><td><math>0.03 \geq W</math></td><td rowspan="2">2</td></tr><tr><td><math>2.0 \geq L</math></td><td><math>0.05 \geq W</math></td></tr><tr><td><math>1.0 \geq L</math></td><td><math>0.1 &gt; W</math></td><td>1</td></tr><tr><td>---</td><td><math>0.05 &lt; W</math></td><td>Applied as point defect</td></tr></table> <div>Unit: mm</div> |            | Line            | Acceptable Qty.  | L         | W                       |   | ---                     | $0.015 \geq W$ | Disregard     | $3.0 \geq L$ | $0.03 \geq W$ | 2 | $2.0 \geq L$ | $0.05 \geq W$ | $1.0 \geq L$ | $0.1 > W$ | 1 | --- | $0.05 < W$ | Applied as point defect |
|                         |                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Line       | Acceptable Qty. |                  |           |                         |   |                         |                |               |              |               |   |              |               |              |           |   |     |            |                         |
| L                       | W                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                 |                  |           |                         |   |                         |                |               |              |               |   |              |               |              |           |   |     |            |                         |
| ---                     | $0.015 \geq W$                                                                                                                                                             | Disregard                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                 |                  |           |                         |   |                         |                |               |              |               |   |              |               |              |           |   |     |            |                         |
| $3.0 \geq L$            | $0.03 \geq W$                                                                                                                                                              | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                 |                  |           |                         |   |                         |                |               |              |               |   |              |               |              |           |   |     |            |                         |
| $2.0 \geq L$            | $0.05 \geq W$                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                 |                  |           |                         |   |                         |                |               |              |               |   |              |               |              |           |   |     |            |                         |
| $1.0 \geq L$            | $0.1 > W$                                                                                                                                                                  | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                 |                  |           |                         |   |                         |                |               |              |               |   |              |               |              |           |   |     |            |                         |
| ---                     | $0.05 < W$                                                                                                                                                                 | Applied as point defect                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                 |                  |           |                         |   |                         |                |               |              |               |   |              |               |              |           |   |     |            |                         |
| 5                       | Rainbow                                                                                                                                                                    | Not more than two color changes across the viewing area                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                 |                  |           |                         |   |                         |                |               |              |               |   |              |               |              |           |   |     |            |                         |

| No. | Item | Criterion |
|-----|------|-----------|
|-----|------|-----------|

| 6                       | <p><b>Segment pattern</b><br/> <b>W = Segment width</b><br/> <math>\phi = (X+Y)/2</math></p> | <p><b>(1) Pin hole</b><br/> <math>\phi &lt; 0.10\text{mm}</math> is acceptable.</p>  <table border="1" data-bbox="968 358 1428 560"> <tr> <th>Point Size</th> <th>Acceptable Qty</th> </tr> <tr> <td><math>\phi \leq 1/4W</math></td> <td>Disregard</td> </tr> <tr> <td><math>1/4W &lt; \phi \leq 1/2W</math></td> <td>1</td> </tr> <tr> <td><math>\phi &gt; 1/2W</math></td> <td>0</td> </tr> </table> <p>Unit: mm</p> | Point Size | Acceptable Qty | $\phi \leq 1/4W$ | Disregard | $1/4W < \phi \leq 1/2W$ | 1 | $\phi > 1/2W$ | 0 |
|-------------------------|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------------|------------------|-----------|-------------------------|---|---------------|---|
| Point Size              | Acceptable Qty                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |                |                  |           |                         |   |               |   |
| $\phi \leq 1/4W$        | Disregard                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |                |                  |           |                         |   |               |   |
| $1/4W < \phi \leq 1/2W$ | 1                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |                |                  |           |                         |   |               |   |
| $\phi > 1/2W$           | 0                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |                |                  |           |                         |   |               |   |
| 7                       | <b>Back-light</b>                                                                            | <p>(1) The color of backlight should correspond its specification.<br/> (2) Not allow flickering</p>                                                                                                                                                                                                                                                                                                                                                                                                     |            |                |                  |           |                         |   |               |   |
| 8                       | <b>Soldering</b>                                                                             | <p>(1) Not allow heavy dirty and solder ball on PCB or FPC.<br/> (The size of dirty refer to point and dust defect)<br/> (2) Over 50% of lead should be soldered on Land.</p>                                                                                                                                                                                                                                         |            |                |                  |           |                         |   |               |   |
| 9                       | <b>Wire</b>                                                                                  | <p>(1) Copper wire should not be rusted<br/> (2) Not allow crack on copper wire connection.<br/> (3) Not allow reversing the position of the flat cable.<br/> (4) Not allow exposed copper wire inside the flat cable.</p>                                                                                                                                                                                                                                                                               |            |                |                  |           |                         |   |               |   |
| 10                      | <b>PCB,FPC</b>                                                                               | <p>(1) Not allow screw rust or damage.<br/> (2) Not allow missing or wrong putting of component.</p>                                                                                                                                                                                                                                                                                                                                                                                                     |            |                |                  |           |                         |   |               |   |

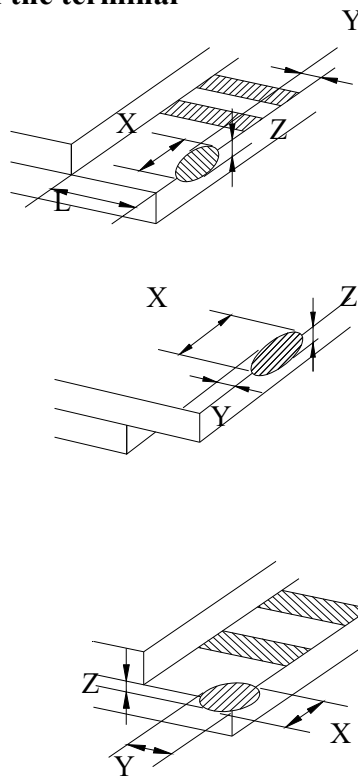
### 2.1.1 chip on the surface



Note: A: LCD Length

| X           | Y                                      | Z           |
|-------------|----------------------------------------|-------------|
| $>1/8A$     | $\leq 0.3\text{mm}$                    | $\leq 1/2T$ |
| $\leq 1/8A$ | Not enter into epoxy frame             | $\leq T$    |
|             | Not enter into the inner edge of epoxy | $\leq 1/2T$ |

### 2.1.2 Chip on the terminal

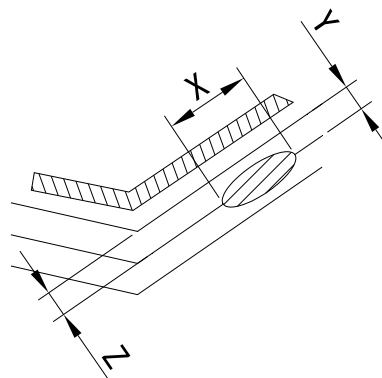


| X                              | Y                   | Z           |
|--------------------------------|---------------------|-------------|
| $>1/8A$                        | $\leq 0.3\text{mm}$ | $\leq 1/2T$ |
| $\leq 1/8A$                    | $\leq 1/2L$         | $\leq T$    |
| $\leq 1/8A \& \leq 1\text{mm}$ | $\leq L$            | $\leq T$    |
| $\leq 1/8A \& \leq 2\text{mm}$ | $\leq L$            | $\leq 1/2T$ |

Note: A: LCD Length.

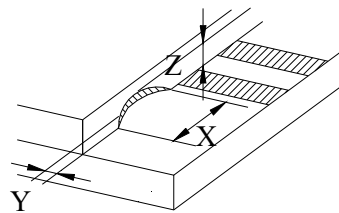
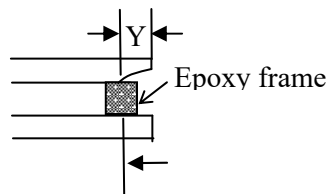
the distance between crack and contact pad must be greater than the width of 1<sup>st</sup> contact pad.

### 2.1.3 Chip out on between side



11

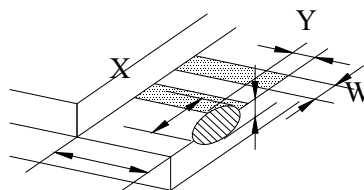
LCD



| X           | Y                              | Z             |
|-------------|--------------------------------|---------------|
| $\leq 1/8A$ | Not enter into epoxy frame     | $Z \leq 2T$   |
|             | Not enter into 1/2 epoxy frame | $Z \leq 1/2T$ |

Note: A : LCD Length

#### 2.1.4 including corner chip and side chip

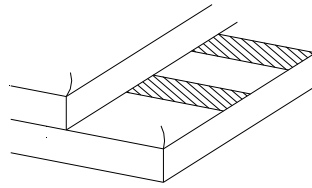


L

Note: A:LCD Length

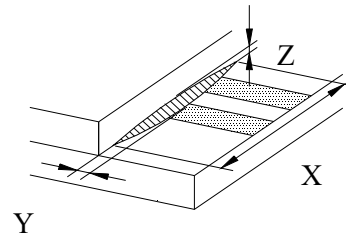
| X           | Y           | Z           |
|-------------|-------------|-------------|
| $>1/8A$     | $\leq 1/6L$ | $\leq 1/2T$ |
| $\leq 1/8A$ | $\leq 1/3L$ |             |
| $\leq 1/4W$ | $\leq 2/3L$ |             |

## 2.2 Chip out



- 1) Chip out is that crackles extend to inner edge.
- 2) Crackles round epoxy frame will be rejected.
- 3) Chip out on the terminal will be rejected:  $Z=T$  length  $>1\text{mm}$  or  $Z<T$  length  $>2\text{mm}$
- 4) The chip out at ITO will be rejected.

## 2.3 Poor cutting



| X               | Y                       | Z                    |
|-----------------|-------------------------|----------------------|
| $>1/8$<br>A     | $\leq 0.3$              | $\leq 1/2T$          |
| $\leq 1/8$<br>A | According<br>to drawing | $1/2T \leq Z \leq T$ |

**Note :** A: LCD Length.

11

LCD

12

SMT

According to the <Acceptable of electronic assemblies>  
IPC-A-610C class 2 stander. Component missing or function defect  
are Major defect ,the others are Minor defect.

**Any one out of the specification will be rejected.**

## **12. GENERAL PRECAUTIONS**

### **(1) Mounting Method**

The panel of the LCD Module consists of two thin glass plates with polarizers which easily get damaged since the Module is fixed by utilizing fitting holes in the printed circuit board. Extreme care should be taken when handling the LCD Modules.

### **(2) Caution of LCD handling & cleaning**

When cleaning the display surface, use soft cloth with solvent (recommended below) and wipe lightly.

- Isopropyl alcohol
- Ethyl alcohol
- Trichlorotrifluoroethane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface. Do not use the following solvent:

- Water
- Ketone
- Aromatics

### **(3) Caution against static charge**

The LCD Module use C-MOS LSI drivers, so we recommend that you connect any unused input terminal to VDD or VSS, do not input any signals before power is turned on. And ground your body, Work/assembly table. And assembly equipment to protect against static electricity.

### **(4) Packaging**

Modules use LCD elements, and must be treated as such. Avoid intense shock and falls from a height.

- To prevent modules from degradation. Do not operate or store them exposed directly to sunshine or high temperature/humidity.

### **(5) Caution for operation**

- It is indispensable to drive LCD's within the specified voltage limit since the higher voltage than the limit shorten LCD life. An electrochemical reaction due to direct current causes LCD deterioration, Avoid the use of direct current drive.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them.

However those phenomena do not mean malfunction or out of order with LCD's which will come back in the specified operating temperature range.

- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- As light dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal

open circuit.

Usage under the relative condition of 40°C, 50%RH or less is required.

(6) Storage

In the case of storing for a long period of time (for instance, for years) for the purpose or replacement use, The following ways are recommended.

- Storage in a polyethylene bag with sealed so as not to enter fresh air outside in it, And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light is.

Keeping temperature in the specified storage temperature range.

- Storing with no touch on polarizer surface by the anything else. (It is recommended to store them as they have been contained in the inner container at the time of delivery)

(7) Safety

- It is recommendable to crash damaged or unnecessary LCD into pieces and wash off liquid crystal by using solvents such as acetone and ethanol which should be burned up later.
- When any liquid crystal leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water.

**Hello Lighting co., ltd reserves the right to change this specification.**  
**[www.hello-lighting.com](http://www.hello-lighting.com)**  
**- END -**