



INNOVATIVE DISPLAY TECHNOLOGIES

17171 MURPHY AVENUE

IRVINE, CALIFORNIA 92614-5915

P: 949-417-8070/F: 949-417-8075

E-mail: [info@shellyinc.com](mailto:info@shellyinc.com)

Website: [www.shellyinc.com](http://www.shellyinc.com)

### Specification

**Part Number** : SCA02810-TFN-LNN

**Customer** : \_\_\_\_\_

|   |   |
|---|---|
| <p style="text-align: center;"><b>APPROVED BY:</b></p> <p>( FOR CUSTOMER USE ONLY )</p> | <p style="text-align: center;"><b>PCB VERSION:</b> _____</p> <p style="text-align: right;"><b>DATE:</b> _____</p> |
|---|---|

| SOLD BY | APPROVED BY | CHECKED BY | ISSUE DATE |
|---------|-------------|------------|------------|
|         |             |            |            |
|         |             |            |            |

CONTENTS

| <i>NO.</i> | <i>ITEM</i>                              | <i>PAGE</i> |
|------------|--|-------------|
| 1.         | <b>Cover</b>                             | 1           |
| 2.         | <b>Record of Revision</b>                | 2           |
| 3.         | <b>LCD Module Physical Data</b>          | 3           |
| 4.         | <b>External Dimensions</b>               | 4           |
| 5.         | <b>Block Diagram</b>                     | 5~6         |
| 6.         | <b>Absolute Maximum Ratings</b>          | 6           |
| 7.         | <b>Electrical Characteristics</b>        | 7           |
| 8.         | <b>Touch Screen Panel Specifications</b> | 8           |
| 9.         | <b>Interface PIN Connections</b>         | 9           |
| 10.        | <b>Recommend Initial Code</b>            | 10~11       |
| 11.        | <b>Electro-Optical Characteristics</b>   | 12~17       |
| 12.        | <b>Inspection Criterion</b>              | 18~21       |
| 13.        | <b>Precautions for Using LCD Modules</b> | 22~24       |

ACCEPTED BY: .....

PROPOSED BY : .....

## RECORD OF REVISION

| DATE     | PAGE | SUMMARY                       |
|----------|------|-------------------------------|
| 10/30/09 | 3    | Added version # 602 (ILI9328) |

## ◆ LCD MODULE PHYSICAL DATA

### ● General Description

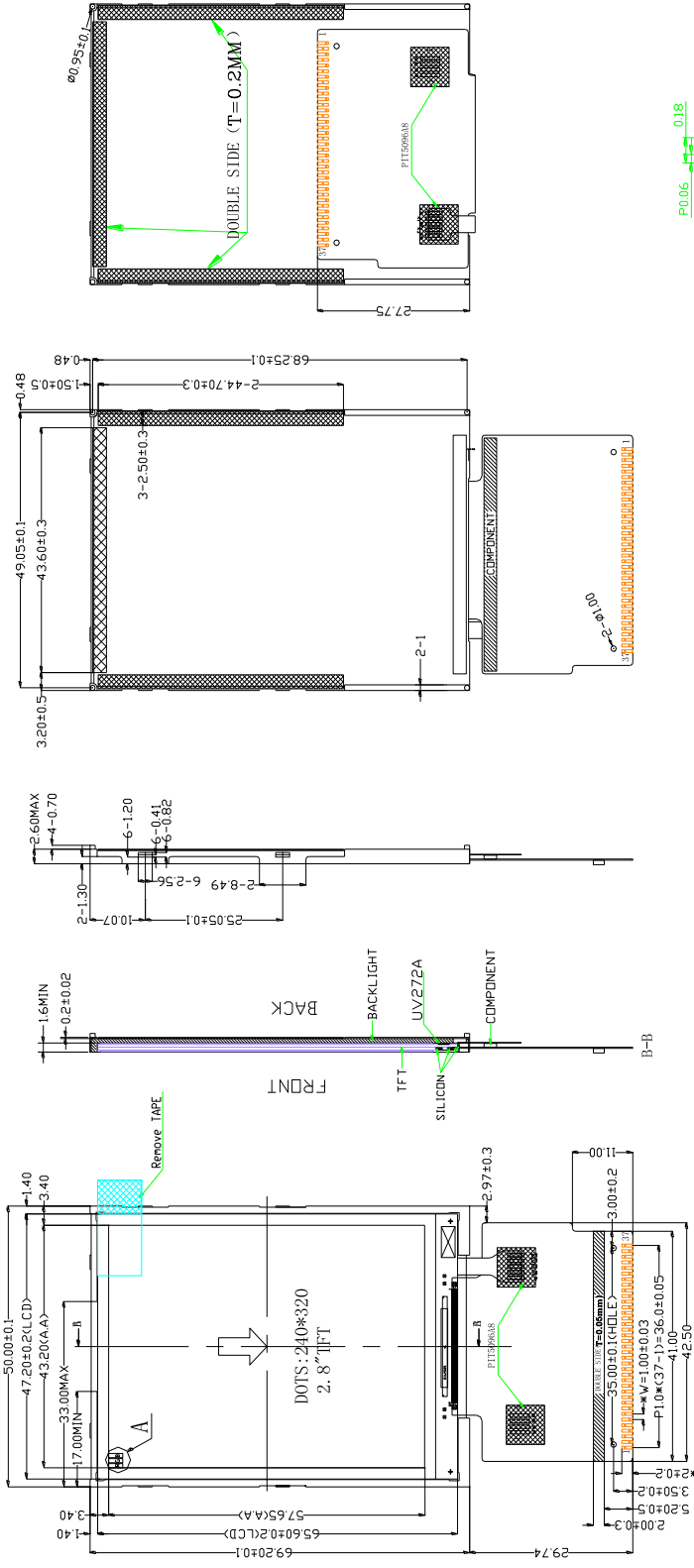
|                              |                   |
|------------------------------|-------------------|
| <b>Size</b>                  | <b>2.8"</b>       |
| <b>Display Type</b>          | <b>262K TFT</b>   |
| <b>Display Mode</b>          | <b>POSITIVE</b>   |
| <b>Viewing Direction</b>     | <b>12 o'clock</b> |
| <b>Connection Type</b>       | <b>COG</b>        |
| <b>Operation temperature</b> | <b>-10°C~60°C</b> |
| <b>Storage temperature</b>   | <b>-30°C~80°C</b> |
| <b>Driving IC</b>            | <b>ILI9328</b>    |

### ● Mechanical Description

| <b>Item</b>           | <b>Standard Value</b>              | <b>Unit</b> |
|-----------------------|------------------------------------|-------------|
| <b>Number of dots</b> | <b>240RGBX 320dots</b>             | <b>-</b>    |
| <b>LCM dimension</b>  | <b>50.00(W) X69.20(H) X2.60(T)</b> | <b>mm</b>   |
| <b>LCD outline</b>    | <b>47.20(W) X65.60(H)</b>          | <b>mm</b>   |
| <b>Active area</b>    | <b>43.20(W) X57.60(H)</b>          | <b>mm</b>   |
| <b>Dot size</b>       | <b>0.17(W) X0.17(H)</b>            | <b>mm</b>   |
| <b>Dot pitch</b>      | <b>0.18(W) X0.18(H)</b>            | <b>mm</b>   |
| <b>Backlight</b>      | <b>4-chip white LED Parallel</b>   | <b>/</b>    |

# ◆ EXTERNAL DIMENSIONS

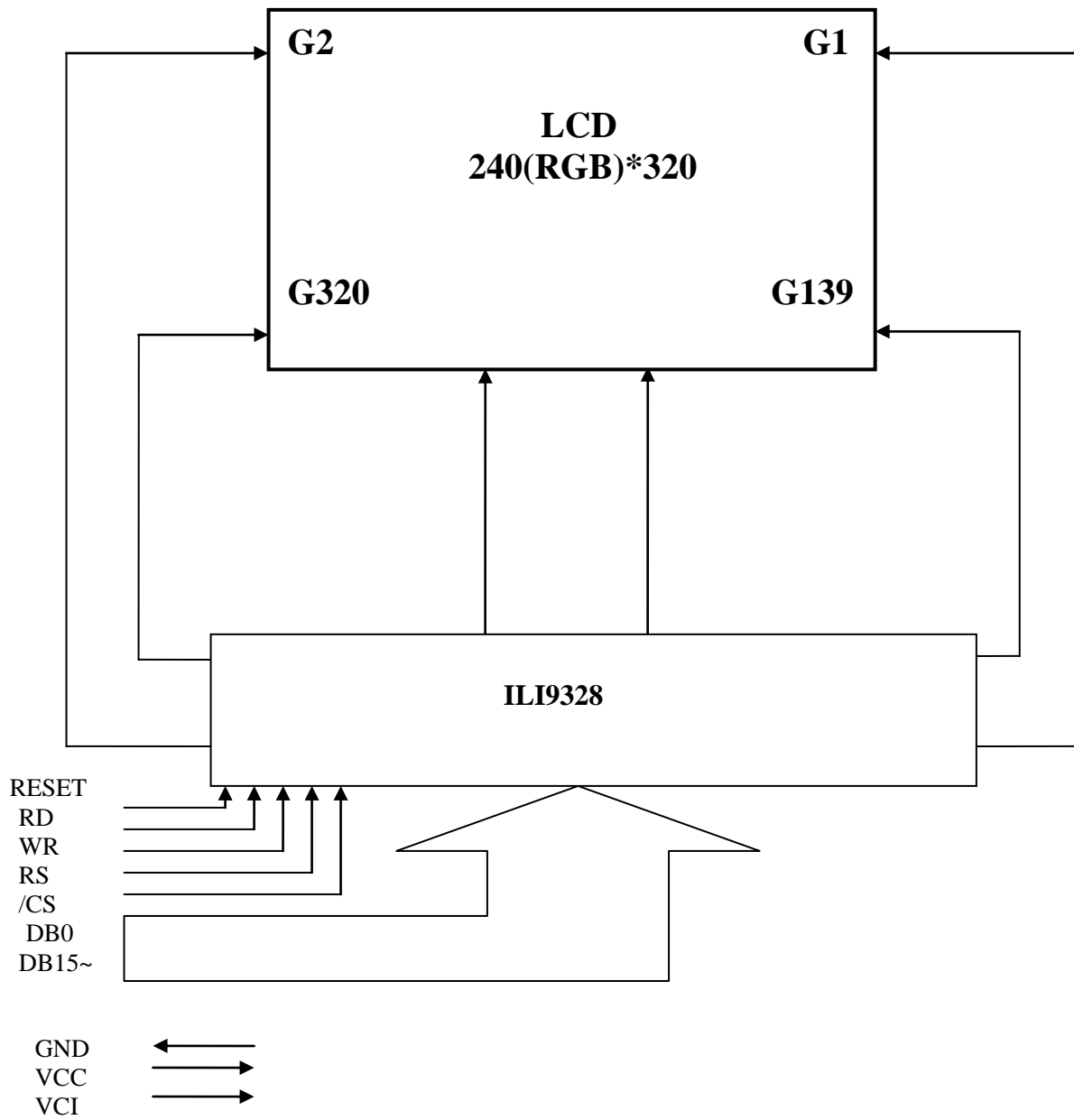
| NO. | PIN NAME |
|-----|----------|
| 1   | DB0      |
| 2   | DB1      |
| 3   | DB2      |
| 4   | DB3      |
| 5   | GND      |
| 6   | VCC      |
| 7   | /CS      |
| 8   | RS       |
| 9   | WR       |
| 10  | RD       |
| 11  | IMD      |
| 12  | XR       |
| 13  | YD       |
| 14  | XL       |
| 15  | YU       |
| 16  | LED-A    |
| 17  | LED-K1   |
| 18  | LED-K2   |
| 19  | LED-K3   |
| 20  | LED-K4   |
| 21  | NC       |
| 22  | DB4      |
| 23  | DB8      |
| 24  | DB9      |
| 25  | DB10     |
| 26  | DB11     |
| 27  | DB12     |
| 28  | DB13     |
| 29  | DB14     |
| 30  | DB15     |
| 31  | RESET    |
| 32  | VCI      |
| 33  | VCC2     |
| 34  | GND      |
| 35  | DB5      |
| 36  | DB6      |
| 37  | DB7      |



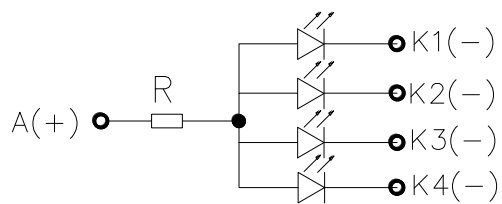
## NOTES:

1. DISPLAY TYPE: TFT 262K
2. VIEWING DIRECTION: 12 O'CLOCK
3. FRONT POLARIZER: TRANSMISSIVE/POSITIVE
4. REAR POLARIZER: TRANSMISSIVE/POSITIVE
5. OPERATING TEMP: -10°C~60°C
6. STORAGE TEMP: -30°C~80°C
7. CONNECTOR: COG(IC:IL19328)
8. BACKLIGHT: 4 CHIP-WHITE LEDS PARALLEL
9. "\*" KEY DIMENSION

◆ **BLOCK DIAGRAM**



● **Black Light Unite**



## ◆ ABSOLUTE MAXIMUM RATINGS

| Item                     | Symbol     | Rating       | Unit |
|--------------------------|------------|--------------|------|
| Operating temperature    | Top        | -10 to 60    | °C   |
| Storage temperature      | Tst        | -30 to 80    | °C   |
| Input voltage            | Vin        | -0.3 to 4.6  | V    |
| Supply voltage for logic | VCC        | -0.3 to 4.6  | V    |
| Supply voltage for LCD   | VGH – VSSA | -0.3 to 18.5 | V    |

### NOTE:

1. If the module is used above these absolute maximum ratings. It may become permanently damaged. Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability.
2. VDD>GND must be maintained.

## ◆ ELECTRICAL CHARACTERISTICS

### ● DC Characteristics

$V_{SS} = 0V$ ,  $T_a = 25^\circ C$

| Item   | Symbol   | Condition          | Min          | Typ | Max      | Unit |
|--|----------|--------------------|--------------|-----|----------|------|
| Input high voltage                           | $V_{IH}$ | -                  | 0.8<br>IOVCC | -   | IOVCC    | V    |
| Input low voltage                            | $V_{IL}$ | -                  | -0.3V        | -   | 0.2IOVCC | V    |
| Output high voltage                          | $V_{OH}$ | -                  | 0.8<br>IOVCC | -   | -        | V    |
| Output low voltage                           | $V_{OL}$ | -                  | -            | -   | 0.2IOVCC | V    |
| Operating voltage                            | VDD3     | $T_a = 25^\circ C$ | -            | 2.8 | -        | V    |
| LCD driving voltage                          | VGH      | $T_a = 25^\circ C$ |              | -   | 16.5     | V    |
| Current consumption for LCD normal operation | IDD      | $V_{DD3} = 3.0V$   | -            | -   | 6        | mA   |

### ● Backlight unit

| Item  | Symbol   | Min  | Typ | Max  | Unit              | Remark                          |
|---|----------|------|-----|------|-------------------|---------------------------------|
| Current   | $I_{BL}$ | -    | 72  | -    | mA                | 4-chip LEDs, parallel, 15mA/LED |
| CIE   | X        | 0.25 | -   | 0.29 | -                 | -                               |
|   | Y        | 0.24 | -   | 0.28 | -                 |                                 |
| Brightness  | -        | 3600 | -   | -    | cd/m <sup>2</sup> | -                               |
| Luminance Uniformity Ratio                              | -        | 80   | -   | -    | %                 | -                               |
| Bezel(BE) must be connected to ground of the main board |          |      |     |      |                   |                                 |

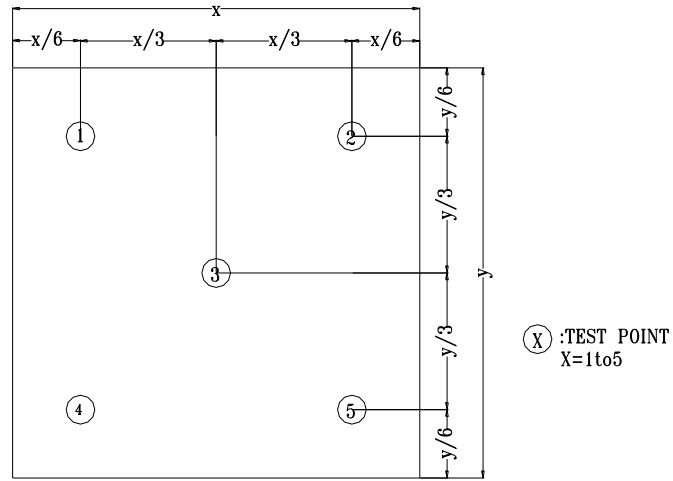
Note:

1: When BL IF is 60mA, VF is 3.3V.

2. Average Luminous Intensity of P1 ~ P5 ( Using a luminance meter BM-7 )

3. Luminous Intensity Ratio =  $\min/\max * 100\%$   
Measured Method (X\*Y: Light Area).





- **AC Characteristics**

Refer to the SPEC of ILI9328

## ◆ INTERFACE PIN CONNECTIONS

| NO. | Symbol | Function  |
|-----|--------|---|
| 1   | DB0    | Data bus  |
| 2   | DB1    |   |
| 3   | DB2    |   |
| 4   | DB3    |   |
| 5   | GND    | Ground  |
| 6   | VCC    | Power supply  |
| 7   | /CS    | Chip select   |
| 8   | RS     | Register select pin   |
| 9   | WR     | Write signal  |
| 10  | RD     | Read signal   |
| 11  | IM0    | MPU interface select  |
| 12  | XR     | TP pin  |
| 13  | YD     |   |
| 14  | XL     |   |
| 15  | YU     |   |
| 16  | LED-A  | Anode of backlight  |
| 17  | LED-K1 | Cathode of backlight  |
| 18  | LED-K2 |   |
| 19  | LED-K3 |   |
| 20  | LED-K4 |   |
| 21  | NC     | No connection   |
| 22  | DB4    | Data bus  |
| 23  | DB8    |   |
| 24  | DB9    |   |
| 25  | DB10   |   |
| 26  | DB11   |   |
| 27  | DB12   |   |
| 28  | DB13   |   |
| 29  | DB14   |   |
| 30  | DB15   |   |
| 31  | /RESET | Reset signal  |
| 32  | VCI    | A supply voltage to the analog circuit. Connect to an external power supply of 2.8V (2.5 ~ 3.3V). |
| 33  | VCC2   |   |
| 34  | GND    | Ground  |
| 35  | DB5    | Data bus  |
| 36  | DB6    |   |
| 37  | DB7    |   |

## ◆ Recommend Initial Code

```
//=====
//      初始化
//=====
void Init()
{
    Reset();

    ***** Start Initial Sequence *****
    Write_Comm(0x00E3);Write_Data(0x3008); // Set internal timing
    Write_Comm(0x00E7);Write_Data(0x0012); // Set internal timing
    Write_Comm(0x00EF);Write_Data(0x1231); // Set internal timing
    Write_Comm(0x0001);Write_Data(0x0100); // set SS and SM bit
    Write_Comm(0x0002);Write_Data(0x0700); // set 1 line inversion
    Write_Comm(0x0003);Write_Data(0x1030); // set GRAM write direction and BGR=1.
    Write_Comm(0x0004);Write_Data(0x0000); // Resize register
    Write_Comm(0x0008);Write_Data(0x0207); // set the back porch and front porch
    Write_Comm(0x0009);Write_Data(0x0000); // set non-display area refresh cycle ISC[3:0]
    Write_Comm(0x000A);Write_Data(0x0000); // FMARK function
    Write_Comm(0x000C);Write_Data(0x0000); // RGB interface setting
    Write_Comm(0x000D);Write_Data(0x0000); // Frame marker Position
    Write_Comm(0x000F);Write_Data(0x0000); // RGB interface polarity
    *****Power On sequence *****
    Write_Comm(0x0010);Write_Data(0x0000); // SAP, BT[3:0], AP, DSTB, SLP, STB
    Write_Comm(0x0011);Write_Data(0x0007); // DC1[2:0], DC0[2:0], VC[2:0]
    Write_Comm(0x0012);Write_Data(0x0000); // VREG1OUT voltage
    Write_Comm(0x0013);Write_Data(0x0000); // VDV[4:0] for VCOM amplitude
    Write_Comm(0x0007);Write_Data(0x0001);
    Delayms(200); // Dis-charge capacitor power voltage
    Write_Comm(0x0010);Write_Data(0x1290); // SAP, BT[3:0], AP, DSTB, SLP, STB
    Write_Comm(0x0011);Write_Data(0x0227); // DC1[2:0], DC0[2:0], VC[2:0]
    Delayms(50); // Delay 50ms
    Write_Comm(0x0012);Write_Data(0x001A); // Internal reference voltage= Vci;
    Delayms(50); // Delay 50ms
    Write_Comm(0x0013);Write_Data(0x1800); // Set VDV[4:0] for VCOM amplitude
    Write_Comm(0x0029);Write_Data(0x001E); // Set VCM[5:0] for VCOMH  23
    Write_Comm(0x002B);Write_Data(0x000b); // Set Frame Rate
    Delayms(50); // Delay 50ms
    Write_Comm(0x0020);Write_Data(0x0000); // GRAM horizontal Address
    Write_Comm(0x0021);Write_Data(0x0000); // GRAM Vertical Address
    // ----- Adjust the Gamma Curve -----//
    Write_Comm(0x0030);Write_Data(0x0000);
    Write_Comm(0x0031);Write_Data(0x0305);
    Write_Comm(0x0032);Write_Data(0x0003);
    Write_Comm(0x0035);Write_Data(0x0304);
    Write_Comm(0x0036);Write_Data(0x000F);
    Write_Comm(0x0037);Write_Data(0x0407);
    Write_Comm(0x0038);Write_Data(0x0204);
    Write_Comm(0x0039);Write_Data(0x0707);
    Write_Comm(0x003C);Write_Data(0x0403);
    Write_Comm(0x003D);Write_Data(0x1604);
    //----- Set GRAM area -----//
    Write_Comm(0x0050);Write_Data(0x0000); // Horizontal GRAM Start Address
    Write_Comm(0x0051);Write_Data(0x00EF); // Horizontal GRAM End Address
    Write_Comm(0x0052);Write_Data(0x0000); // Vertical GRAM Start Address
    Write_Comm(0x0053);Write_Data(0x013F); // Vertical GRAM Start Address
    Write_Comm(0x0060);Write_Data(0xA700); // Gate Scan Line
    Write_Comm(0x0061);Write_Data(0x0001); // NDL,VLE, REV
    Write_Comm(0x006A);Write_Data(0x0000); // set scrolling line
    //----- Partial Display Control -----//
    Write_Comm(0x0080);Write_Data(0x0000);
    Write_Comm(0x0081);Write_Data(0x0000);
```

```
Write_Comm(0x0082);Write_Data(0x0000);
Write_Comm(0x0083);Write_Data(0x0000);
Write_Comm(0x0084);Write_Data(0x0000);
Write_Comm(0x0085);Write_Data(0x0000);
//----- Panel Control -----//
Write_Comm(0x0090);Write_Data(0x0010);
Write_Comm(0x0092);Write_Data(0x0600);
Write_Comm(0x0007);Write_Data(0x0133); // 262K color and display ON
Write_Comm(0x0022);
```

```
}
```

## ◆ ELECTRO-OPTICAL CHARACTERISTICS

Driving condition: VDD=2.8V, I<sub>BL</sub>= 18mA/LED, Temperature =23°C±5°C , Humidity=60%±20%RH

| Item  | Light angle ( ° ) | Temp ( °C ) | Symbol | Specifications |               |      | Unit | Conditions              | Note  |     |   |
|---|-------------------|-------------|--------|----------------|---------------|------|------|-------------------------|---|-----|---|
|   |                   |             |        | Min.           | Typ.          | Max. |      |                         |   |     |   |
| Transmissive                                | 0                 | 25          | -      | -              | 5.8           | -    | %    | (Equipment :BM-7/CS200) | (1)   |     |   |
| Contrast ratio                              | 0                 | 25          | Cr     | -              | TBD           | -    | -    |                         | (2)   |     |   |
| Brightness                                  | 0                 | 25          | -      | 200            | TBD           | -    | -    |                         | -   |     |   |
| Luminance uniformity (surface within panel) | 0                 | 25          | Lu     | 70             | 80-           | -    | %    |                         | (3)   |     |   |
| Cross talk                                  | 0                 | 25          | CTV    | -              | -             | 20   | %    |                         | (4)   |     |   |
| Chromaticity                                | R x               | 0           | 25     | Rx             | -             | TBD  | -    | -                       | -   |     |   |
|   | R y               |             |        | Ry             | -             | TBD  | -    |                         |   |     |   |
|   | G x               |             |        | Gx             | -             | TBD  | -    |                         |   |     |   |
|   | G y               |             |        | Gy             | -             | TBD  | -    |                         |   |     |   |
|   | B x               |             |        | Bx             | -             | TBD  | -    |                         |   |     |   |
|   | B y               |             |        | By             | -             | TBD  | -    |                         |   |     |   |
|   | W x               |             |        | Wx             | -             | TBD  | -    |                         |   |     |   |
|   | W y               |             |        | Wy             | -             | TBD  | -    |                         |   |     |   |
| Color Reproduction Area(NTSC)               |                   | 0           | 25     | -              | -             | TBD  | -    | %                       | CIE1931(x,y)  | (5) |   |
| Response time                               | Tr                | 0           | 25     | -              | -             | 10   | -    | ms                      | Viewing normal angle<br>$\theta_x = \theta_y = 0^0$ | -   |   |
|   | Tf                |             |        |                | -             | 15   | -    |                         |   |     |   |
| Viewing angle                               | Hor.              | 0           | 25     | -              | -             | 50   | -    | deg                     | Center<br>CR≥10                                     | -   |   |
|   |                   |             |        |                | $\theta_{x+}$ | -    | 50   |                         |   |     | - |
|   | Ver.              |             |        |                | $\theta_{y+}$ | -    | 60   |                         |   |     | - |
|   |                   |             |        |                | $\theta_{y-}$ | -    | 55   |                         |   |     | - |

Note:

### (1) .Transmittance

#### Introduction

Transmittance (diffuse transmission factor) is a measure for the LCD panel transparency. The Light Source for this measurement is the accompanying LCD-module backlight system (LEDs, Lightguide...)

**Measurement conditions:**

|                            |                                  |
|----------------------------|----------------------------------|
| Measuring Equipment        | BM-7/CS-200                      |
| Measurement Point Diameter | 3mm                              |
| Measurement Point Location | Active Area Center Point         |
| Light source               | LCD module backlight             |
| Reflectance Plate          | Reflectance Standard(cal. plate) |
| Test pattern               | All pixels white                 |
| Contrast setting           | Maximum                          |

**Measuring procedure:**

**Transmittance:**

The light source is located at the backside of the panel.

- 1、 Measure the light source
- 2、 Place the LCD panel in front of the light source. Measure the luminance on the LCD panel surface

**Definitions**

$$\tau = \frac{L_{LCD-panel}}{L_{lightsource}} * 100\%$$

- (2) **Definition of Contrast Ratio (C/R):** Ratio of gray max (Gmax) & gray min (Gmin) at the center point.

$$CR = \frac{G(Max)}{G(Min)}$$

Where

**Gmax:** Luminance with all pixels white

**Gmin:** Luminance with all pixels black

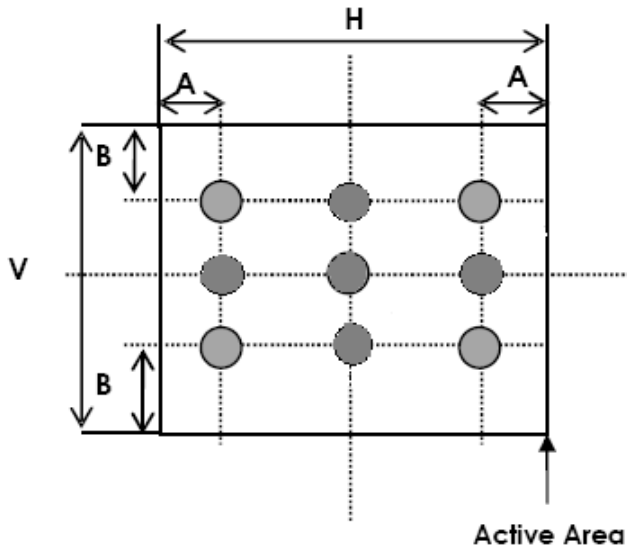
- (3). **Surface luminance uniformity within panel**

**Measurement conditions:**

|                            |   |
|----------------------------|---|
| Measuring Equipment        | CS-200 // BM-7                          |
| Measurement Point Diameter | 3mm // 1mm                              |
| Measurement Point Location | Active Area                             |
| Light Source               | Transmissive Mode: Internal (Backlight) |
| Test pattern               | White                                   |

**Measuring procedure:**

Measure the luminance  $L_i$  with the points in figure 1.



**Figure 1**

A: 5 mm    B: 5 mm  
H, V: Active Area

**Uniformity value ( $L_u$ ):**

$$L_u = \frac{\max(L_i) - \min(L_i)}{\max(L_i)}$$

**(4).CROSS-TALK**

**Introduction :**

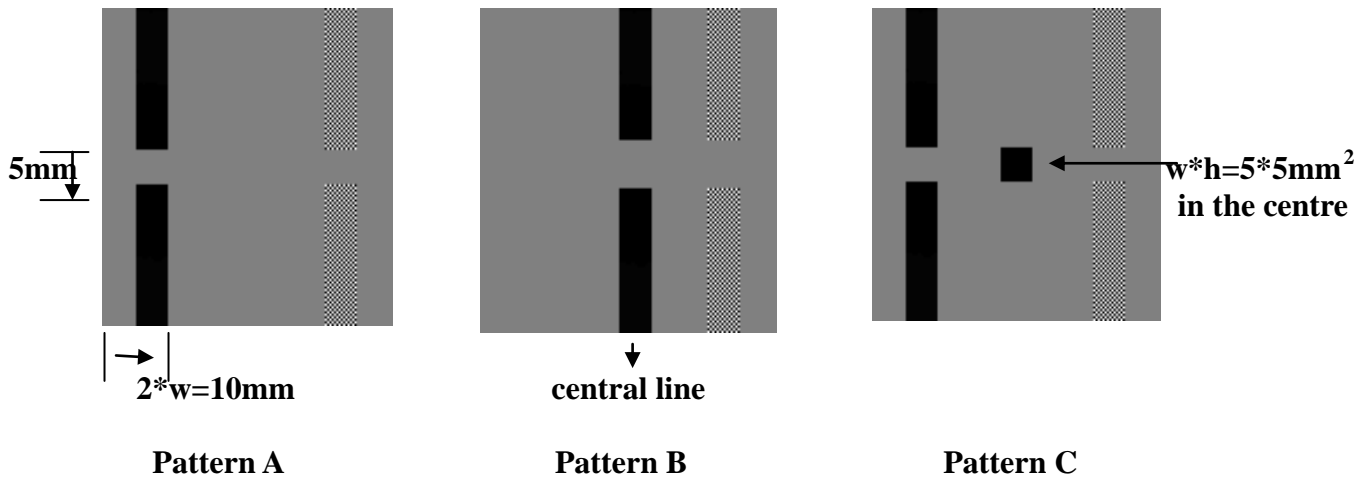
Crosstalk is an effect where the contrast of a display pixel is influenced by the state of the related pixels. A measure for this effect is the Cross Talk Value (CTV)

**Measurement conditions:**

|                            |   |
|----------------------------|---|
| Measuring Equipment        | CS-200 // BM-7                          |
| Measurement Point Diameter | 3mm // 1mm                              |
| Measurement Point Location |   |
| Light Source               | Transmissive Mode: Internal (Backlight) |
| Contrast setting           | Maximum                                 |

**• Test Pattern (valid for all greyscales):**

W: The width of the rectangle in the following pictures;



● Definitions :

Cross Talk Value :

$$CTV = |L_{vA} - L_{vB}| / L_{vA} * 100\%$$

Where :

**L<sub>vA</sub>**: Luminance measured with the centre test point of pattern A

**L<sub>vB</sub>**: Luminance measured with the centre test point of pattern B.

● Measuring procedure :

Adaptation of the display to the highest contrast ratio (CR = L<sub>vA</sub>/L<sub>vC</sub>) as defined by the test patterns and a test area of 14 x 14 dots.

Measurement of Luminance with test point A, B.

Determination of Crosstalk value (CTV)

(5). NTSC

Measurement conditions:

|                          |  |
|--------------------------|--|
| Measuring Equipment      | LCD-5200   |
| Measuring Point Diameter | 3mm//1mm   |
| Measuring point location | Active Area center point   |
| Light source             | Transmissive Mode: internal(Backlight)   |
| Test pattern             | All Pixels White Red.Green.Blue.White:<br>Maximum colour saturation<br>(maximum gradation level) |
| Contrast setting         | Maximum  |



**Definitions**

Panel color coordinates according the CIE colour system (CIE 1931). In general, It is always requested to measure the X, Y and Z values.

Here  $u'$ ,  $v'$  and  $L^*$  are according CIE 1931:

$$x' = \frac{4 \cdot X}{X + 15 \cdot Y + 3 \cdot Z}$$

$$y' = \frac{9 \cdot Y}{X + 15 \cdot Y + 3 \cdot Z}$$

$$L^* = 116 \cdot \left( \frac{Y}{Y_n} \right)^{1/3} - 16$$

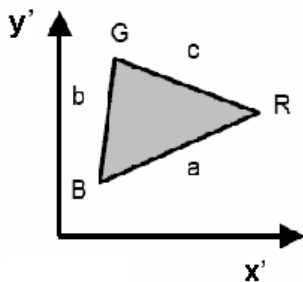
**Colour distance definition (maximum allowed colour distance to specified typical colour coordinate):**

$$\Delta x' y' = \sqrt{\Delta x'^2 + \Delta y'^2}$$

**Where:**

$$\Delta x' = \text{Max} \left| x'_{typ} - x'_{max} \right|, \left| x'_{typ} - x'_{min} \right|$$

$$\Delta y' = \text{Max} \left| y'_{typ} - y'_{max} \right|, \left| y'_{typ} - y'_{min} \right|$$



**Color Gamut definition:**

$$F = \sqrt{s \left( \leftarrow -a \right) \left( \leftarrow -b \right) \left( \leftarrow -c \right)} * 1000$$

**Where**

$$s = \frac{\left( \leftarrow + b + c \right)}{2}$$

$$a = \sqrt{x'_{blue} - x'_{red} \quad ^2 + y'_{blue} - y'_{red} \quad ^2}$$

$$b = \sqrt{x'_{blue} - x'_{green} \quad ^2 + y'_{blue} - y'_{green} \quad ^2}$$

$$c = \sqrt{x'_{red} - x'_{green} \quad ^2 + y'_{red} - y'_{green} \quad ^2}$$

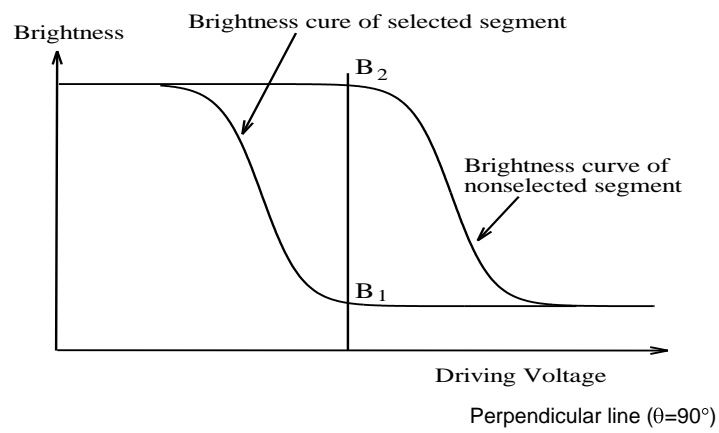
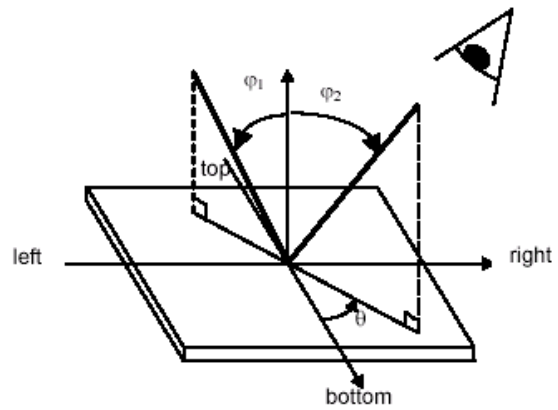
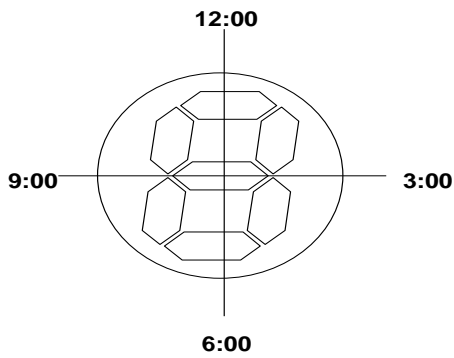
**Color Gamut Ratio (NTSC) related to NTSC':**

NTSC: =F (display)/F (NTSC')

NTSC' primaries:

|              | $x'$        | $y'$        |
|--------------|-------------|-------------|
| <b>Red</b>   | <b>0.67</b> | <b>0.33</b> |
| <b>Green</b> | <b>0.21</b> | <b>0.71</b> |
| <b>Blue</b>  | <b>0.14</b> | <b>0.08</b> |

F (NTSC') =74.42



## ◆ INSPECTION CRITERION

This specification is made to be used as the standard acceptance/rejection criteria for Color mobile phone LCM.

### 1 Sample plan

Sampling method shall be in accordance with MIL-STD-105D, inspection level II and based on:

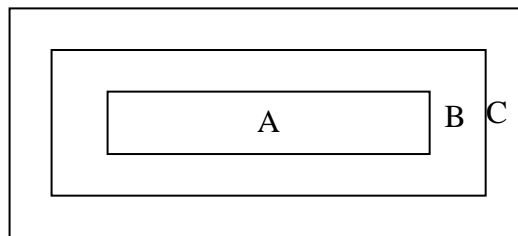
Major defect: AQL 0.65

Minor defect: AQL 1.5

### 2. Inspection condition

Viewing distance for cosmetic inspection is about 30cm with bare eyes, and under an environment of 20~40W light intensity, all directions for inspecting the sample should be within 45° against perpendicular line.

### 3. Definition of inspection zone in LCD.



Zone A: character/Digit area

Zone B: viewing area except Zone A (ZoneA+ZoneB=minimum Viewing area)

Zone C: Outside viewing area (invisible area after assembly in customer's product)

Fig.1 Inspection zones in an LCD.

Note: As a general rule, visual defects in Zone C are permissible, when it is no trouble for quality and assembly of customer's product.

## 4. Inspection standards

### 4.1 Major Defect

| Item No | Items to be inspected  | Inspection Standard  | Classification of defects |
|---------|------------------------|--|---------------------------|
| 4.1.1   | All functional defects | 1) No display<br>2) Display abnormally<br>3) Missing vertical , horizontal segment<br>4) Short circuit<br>5) Back-light no lighting, flickering and abnormal lighting. | Major                     |
| 4.1.2   | Missing                | Missing component  |                           |
| 4.1.3   | Outline dimension      | Overall outline dimension beyond the drawing is not allowed.   |                           |

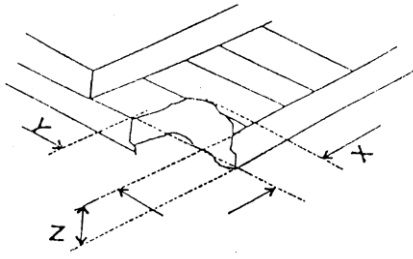
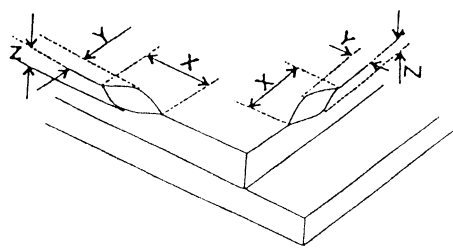
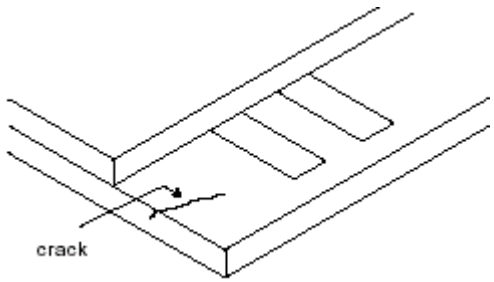
### 4.2 Cosmetic Defect

| Item No                 | Items to be inspected  | Inspection Standard  | Classification of defects |                     |                |  |  |   |   |   |                 |        |  |  |                         |   |  |  |                         |   |  |  |               |   |  |
|-------------------------|--|--|---------------------------|---------------------|----------------|--|--|---|---|---|-----------------|--------|--|--|-------------------------|---|--|--|-------------------------|---|--|--|---------------|---|--|
| 4.2.1                   | Clear Spots  | For dark/white spot, size $\Phi$ is defined<br>as $\Phi = \frac{(x+y)}{2}$   | Minor                     |                     |                |  |  |   |   |   |                 |        |  |  |                         |   |  |  |                         |   |  |  |               |   |  |
|                         | Black and white Spot defect<br>Pinhole,<br>Foreign Particle,<br>Dirt under polarizer | 1 .<br><table border="1"> <thead> <tr> <th rowspan="2">Size(mm)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.1</math></td> <td colspan="3">Ignore</td> </tr> <tr> <td><math>0.10 &lt; \Phi \leq 0.2</math></td> <td colspan="3">3</td> </tr> <tr> <td><math>0.2 &lt; \Phi \leq 0.3</math></td> <td colspan="3">2</td> </tr> <tr> <td><math>\Phi &gt; 0.3</math></td> <td colspan="3">0</td> </tr> </tbody> </table>          |                           | Size(mm)            | Acceptable Qty |  |  | A | B | C | $\Phi \leq 0.1$ | Ignore |  |  | $0.10 < \Phi \leq 0.2$  | 3 |  |  | $0.2 < \Phi \leq 0.3$   | 2 |  |  | $\Phi > 0.3$  | 0 |  |
| Size(mm)                | Acceptable Qty   |  |                           |                     |                |  |  |   |   |   |                 |        |  |  |                         |   |  |  |                         |   |  |  |               |   |  |
|                         | A  | B  | C                         |                     |                |  |  |   |   |   |                 |        |  |  |                         |   |  |  |                         |   |  |  |               |   |  |
| $\Phi \leq 0.1$         | Ignore   |  |                           |                     |                |  |  |   |   |   |                 |        |  |  |                         |   |  |  |                         |   |  |  |               |   |  |
| $0.10 < \Phi \leq 0.2$  | 3  |  |                           |                     |                |  |  |   |   |   |                 |        |  |  |                         |   |  |  |                         |   |  |  |               |   |  |
| $0.2 < \Phi \leq 0.3$   | 2  |  |                           |                     |                |  |  |   |   |   |                 |        |  |  |                         |   |  |  |                         |   |  |  |               |   |  |
| $\Phi > 0.3$            | 0  |  |                           |                     |                |  |  |   |   |   |                 |        |  |  |                         |   |  |  |                         |   |  |  |               |   |  |
|                         | Dim Spots  | 2.   | Minor                     |                     |                |  |  |   |   |   |                 |        |  |  |                         |   |  |  |                         |   |  |  |               |   |  |
|                         | Circle shaped and dim edged defects  | <table border="1"> <thead> <tr> <th rowspan="2">2. Zone<br/>Size(mm)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.2</math></td> <td colspan="3">Ignore</td> </tr> <tr> <td><math>0.20 &lt; \Phi \leq 0.40</math></td> <td colspan="3">2</td> </tr> <tr> <td><math>0.40 &lt; \Phi \leq 0.60</math></td> <td colspan="3">1</td> </tr> <tr> <td><math>0.60 &lt; \Phi</math></td> <td colspan="3">0</td> </tr> </tbody> </table> |                           | 2. Zone<br>Size(mm) | Acceptable Qty |  |  | A | B | C | $\Phi \leq 0.2$ | Ignore |  |  | $0.20 < \Phi \leq 0.40$ | 2 |  |  | $0.40 < \Phi \leq 0.60$ | 1 |  |  | $0.60 < \Phi$ | 0 |  |
| 2. Zone<br>Size(mm)     | Acceptable Qty   |  |                           |                     |                |  |  |   |   |   |                 |        |  |  |                         |   |  |  |                         |   |  |  |               |   |  |
|                         | A  | B  | C                         |                     |                |  |  |   |   |   |                 |        |  |  |                         |   |  |  |                         |   |  |  |               |   |  |
| $\Phi \leq 0.2$         | Ignore   |  |                           |                     |                |  |  |   |   |   |                 |        |  |  |                         |   |  |  |                         |   |  |  |               |   |  |
| $0.20 < \Phi \leq 0.40$ | 2  |  |                           |                     |                |  |  |   |   |   |                 |        |  |  |                         |   |  |  |                         |   |  |  |               |   |  |
| $0.40 < \Phi \leq 0.60$ | 1  |  |                           |                     |                |  |  |   |   |   |                 |        |  |  |                         |   |  |  |                         |   |  |  |               |   |  |
| $0.60 < \Phi$           | 0  |  |                           |                     |                |  |  |   |   |   |                 |        |  |  |                         |   |  |  |                         |   |  |  |               |   |  |

4.2. Cosmetic Defect

| Item No                 | Items to be inspected  | Inspection Standard   | Classification of defects |                |                |  |  |           |          |      |   |                 |        |  |               |                         |   |                     |                      |                         |   |  |              |                      |   |  |  |       |  |            |                       |  |       |
|-------------------------|--|---|---------------------------|----------------|----------------|--|--|-----------|----------|------|---|-----------------|--------|--|---------------|-------------------------|---|---------------------|----------------------|-------------------------|---|--|--------------|----------------------|---|--|--|-------|--|------------|-----------------------|--|-------|
| 4.2.2                   | Line defect<br>Black line,<br>White line,<br>Foreign material under polarizer, | <table border="1"> <thead> <tr> <th colspan="2" data-bbox="438 322 863 376">Size(mm)</th> <th colspan="3" data-bbox="863 322 1201 376">Acceptable Qty</th> </tr> <tr> <th data-bbox="438 376 627 465">L(Length)</th> <th data-bbox="627 376 863 465">W(Width)</th> <th colspan="3" data-bbox="863 376 1201 421">Zone</th> </tr> <tr> <td colspan="2" data-bbox="438 465 627 524">Ignore</td> <td data-bbox="627 465 863 524"><math>W \leq 0.02</math></td> <td colspan="2" data-bbox="863 465 1201 524">Ignore</td> </tr> <tr> <td data-bbox="438 524 627 598"><math>L \leq 3.0</math></td> <td data-bbox="627 524 863 598"><math>0.02 &lt; W \leq 0.03</math></td> <td colspan="3" data-bbox="863 524 1201 598">2</td> </tr> <tr> <td data-bbox="438 598 627 674"><math>L \leq 2.0</math></td> <td data-bbox="627 598 863 674"><math>0.03 &lt; W \leq 0.05</math></td> <td colspan="3" data-bbox="863 598 1201 674">1</td> </tr> <tr> <td colspan="2" data-bbox="438 674 627 757"></td> <td data-bbox="627 674 863 757"><math>0.05 &lt; W</math></td> <td colspan="2" data-bbox="863 674 1201 757">Define as spot defect</td> </tr> </thead> </table>  | Size(mm)                  |                | Acceptable Qty |  |  | L(Length) | W(Width) | Zone |   |                 | Ignore |  | $W \leq 0.02$ | Ignore                  |   | $L \leq 3.0$        | $0.02 < W \leq 0.03$ | 2                       |   |  | $L \leq 2.0$ | $0.03 < W \leq 0.05$ | 1 |  |  |       |  | $0.05 < W$ | Define as spot defect |  | Minor |
| Size(mm)                |  | Acceptable Qty  |                           |                |                |  |  |           |          |      |   |                 |        |  |               |                         |   |                     |                      |                         |   |  |              |                      |   |  |  |       |  |            |                       |  |       |
| L(Length)               | W(Width)   | Zone  |                           |                |                |  |  |           |          |      |   |                 |        |  |               |                         |   |                     |                      |                         |   |  |              |                      |   |  |  |       |  |            |                       |  |       |
| Ignore                  |  | $W \leq 0.02$   | Ignore                    |                |                |  |  |           |          |      |   |                 |        |  |               |                         |   |                     |                      |                         |   |  |              |                      |   |  |  |       |  |            |                       |  |       |
| $L \leq 3.0$            | $0.02 < W \leq 0.03$   | 2   |                           |                |                |  |  |           |          |      |   |                 |        |  |               |                         |   |                     |                      |                         |   |  |              |                      |   |  |  |       |  |            |                       |  |       |
| $L \leq 2.0$            | $0.03 < W \leq 0.05$   | 1   |                           |                |                |  |  |           |          |      |   |                 |        |  |               |                         |   |                     |                      |                         |   |  |              |                      |   |  |  |       |  |            |                       |  |       |
|                         |  | $0.05 < W$  | Define as spot defect     |                |                |  |  |           |          |      |   |                 |        |  |               |                         |   |                     |                      |                         |   |  |              |                      |   |  |  |       |  |            |                       |  |       |
| 4.2.3                   | Polarizer scratch  | <p>If the Polarizer scratch can be seen after mobile phone cover assembling or in the operating condition, judge by the line defect of 4.2.2.</p> <p>If the Polarizer scratch can be seen only in non-operating condition or some special angle, judge by the following.</p> <table border="1"> <thead> <tr> <th colspan="2" data-bbox="421 1034 842 1088">Size(mm)</th> <th colspan="3" data-bbox="842 1034 1137 1088">Acceptable Qty</th> </tr> <tr> <th data-bbox="421 1088 619 1205">L(Length)</th> <th data-bbox="619 1088 842 1205">W(Width)</th> <th colspan="3" data-bbox="842 1088 1137 1133">Zone</th> </tr> <tr> <td colspan="2" data-bbox="421 1205 619 1263">Ignore</td> <td data-bbox="619 1205 842 1263"><math>W \leq 0.03</math></td> <td colspan="2" data-bbox="842 1205 1137 1263">Ignore</td> </tr> <tr> <td data-bbox="421 1263 619 1339"><math>5.0 &lt; L \leq 10.0</math></td> <td data-bbox="619 1263 842 1339"><math>0.03 &lt; W \leq 0.05</math></td> <td colspan="3" data-bbox="842 1263 1137 1339">2</td> </tr> <tr> <td data-bbox="421 1339 619 1415"><math>L \leq 5.0</math></td> <td data-bbox="619 1339 842 1415"><math>0.05 &lt; W \leq 0.08</math></td> <td colspan="3" data-bbox="842 1339 1137 1415">1</td> </tr> <tr> <td colspan="2" data-bbox="421 1415 619 1487"></td> <td data-bbox="619 1415 842 1487"><math>0.08 &lt; W</math></td> <td colspan="2" data-bbox="842 1415 1137 1487">0</td> </tr> </thead> </table> | Size(mm)                  |                | Acceptable Qty |  |  | L(Length) | W(Width) | Zone |   |                 | Ignore |  | $W \leq 0.03$ | Ignore                  |   | $5.0 < L \leq 10.0$ | $0.03 < W \leq 0.05$ | 2                       |   |  | $L \leq 5.0$ | $0.05 < W \leq 0.08$ | 1 |  |  |       |  | $0.08 < W$ | 0                     |  | Minor |
| Size(mm)                |  | Acceptable Qty  |                           |                |                |  |  |           |          |      |   |                 |        |  |               |                         |   |                     |                      |                         |   |  |              |                      |   |  |  |       |  |            |                       |  |       |
| L(Length)               | W(Width)   | Zone  |                           |                |                |  |  |           |          |      |   |                 |        |  |               |                         |   |                     |                      |                         |   |  |              |                      |   |  |  |       |  |            |                       |  |       |
| Ignore                  |  | $W \leq 0.03$   | Ignore                    |                |                |  |  |           |          |      |   |                 |        |  |               |                         |   |                     |                      |                         |   |  |              |                      |   |  |  |       |  |            |                       |  |       |
| $5.0 < L \leq 10.0$     | $0.03 < W \leq 0.05$   | 2   |                           |                |                |  |  |           |          |      |   |                 |        |  |               |                         |   |                     |                      |                         |   |  |              |                      |   |  |  |       |  |            |                       |  |       |
| $L \leq 5.0$            | $0.05 < W \leq 0.08$   | 1   |                           |                |                |  |  |           |          |      |   |                 |        |  |               |                         |   |                     |                      |                         |   |  |              |                      |   |  |  |       |  |            |                       |  |       |
|                         |  | $0.08 < W$  | 0                         |                |                |  |  |           |          |      |   |                 |        |  |               |                         |   |                     |                      |                         |   |  |              |                      |   |  |  |       |  |            |                       |  |       |
| 4.2.4                   | Polarize Air bubble  | <p>Air bubbles between glass &amp; polarizer</p> <table border="1"> <thead> <tr> <th data-bbox="421 1570 643 1686">2. Zone<br/>Size(mm)</th> <th colspan="3" data-bbox="643 1570 1137 1624">Acceptable Qty</th> </tr> <tr> <td colspan="2" data-bbox="421 1624 643 1686"></td> <th data-bbox="643 1624 799 1686">A</th> <th data-bbox="799 1624 971 1686">B</th> <th data-bbox="971 1624 1137 1686">C</th> </tr> </thead> <tbody> <tr> <td data-bbox="421 1686 643 1762"><math>\Phi \leq 0.2</math></td> <td colspan="3" data-bbox="643 1686 1137 1762">Ignore</td> </tr> <tr> <td data-bbox="421 1762 643 1839"><math>0.20 &lt; \Phi \leq 0.30</math></td> <td colspan="3" data-bbox="643 1762 1137 1839">2</td> </tr> <tr> <td data-bbox="421 1839 643 1915"><math>0.30 &lt; \Phi \leq 0.50</math></td> <td colspan="3" data-bbox="643 1839 1137 1915">1</td> </tr> <tr> <td data-bbox="421 1915 643 1980"><math>0.50 &lt; \Phi</math></td> <td colspan="3" data-bbox="643 1915 1137 1980">0</td> </tr> </tbody> </table>   | 2. Zone<br>Size(mm)       | Acceptable Qty |                |  |  |           | A        | B    | C | $\Phi \leq 0.2$ | Ignore |  |               | $0.20 < \Phi \leq 0.30$ | 2 |                     |                      | $0.30 < \Phi \leq 0.50$ | 1 |  |              | $0.50 < \Phi$        | 0 |  |  | Minor |  |            |                       |  |       |
| 2. Zone<br>Size(mm)     | Acceptable Qty   |   |                           |                |                |  |  |           |          |      |   |                 |        |  |               |                         |   |                     |                      |                         |   |  |              |                      |   |  |  |       |  |            |                       |  |       |
|                         |  | A   | B                         | C              |                |  |  |           |          |      |   |                 |        |  |               |                         |   |                     |                      |                         |   |  |              |                      |   |  |  |       |  |            |                       |  |       |
| $\Phi \leq 0.2$         | Ignore   |   |                           |                |                |  |  |           |          |      |   |                 |        |  |               |                         |   |                     |                      |                         |   |  |              |                      |   |  |  |       |  |            |                       |  |       |
| $0.20 < \Phi \leq 0.30$ | 2  |   |                           |                |                |  |  |           |          |      |   |                 |        |  |               |                         |   |                     |                      |                         |   |  |              |                      |   |  |  |       |  |            |                       |  |       |
| $0.30 < \Phi \leq 0.50$ | 1  |   |                           |                |                |  |  |           |          |      |   |                 |        |  |               |                         |   |                     |                      |                         |   |  |              |                      |   |  |  |       |  |            |                       |  |       |
| $0.50 < \Phi$           | 0  |   |                           |                |                |  |  |           |          |      |   |                 |        |  |               |                         |   |                     |                      |                         |   |  |              |                      |   |  |  |       |  |            |                       |  |       |

### 4.3. Cosmetic Defect

| Item No  | Items to be inspected           | Inspection Standard  | Classification of defects |           |                                 |           |       |           |       |
|--|---------------------------------|--|---------------------------|-----------|---------------------------------|-----------|-------|-----------|-------|
| 4.3.5  | Glass defect                    | <p>(i) Chips on corner</p>  <table border="1" data-bbox="478 604 1117 705"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤ 2.0</td> <td>≤ S</td> <td>Disregard</td> </tr> </tbody> </table> <p>Notes: S=contact pad length<br/>Chips on the corner of terminal shall not be allowed to extend into the ITO pad or expose perimeter seal.</p> | X                         | Y         | Z                               | ≤ 2.0     | ≤ S   | Disregard | Minor |
|  |                                 | X  | Y                         | Z         |                                 |           |       |           |       |
|  |                                 | ≤ 2.0  | ≤ S                       | Disregard |                                 |           |       |           |       |
| <p>(ii) Usual surface cracks</p>  <table border="1" data-bbox="454 1153 1141 1254"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤ 3.0</td> <td>&lt; Inner border line of the seal</td> <td>Disregard</td> </tr> </tbody> </table> | X                               | Y  | Z                         | ≤ 3.0     | < Inner border line of the seal | Disregard | Minor |           |       |
| X  | Y                               | Z  |                           |           |                                 |           |       |           |       |
| ≤ 3.0  | < Inner border line of the seal | Disregard  |                           |           |                                 |           |       |           |       |
| <p>(iii) Crack</p> <p>Cracks tend to break are not allowed.</p>   | Major                           |  |                           |           |                                 |           |       |           |       |
| 4.3.6  | Parts alignment                 | <p>1) Not allow IC and FPC/heat-seal lead width is more than 50% beyond lead pattern.<br/>2) Not allow chip or solder component is off center more than 50% of the pad outline.</p>  | Minor                     |           |                                 |           |       |           |       |
| 4.3.7  | SMT                             | According to the <Acceptability of electronic assemblies> IPC-A-610C class 2 standard. Component missing or function defect are Major defect, the others are Minor defect.   |                           |           |                                 |           |       |           |       |

## ◆ PRECAUTIONS FOR USING LCD MODULES

### Handling Precautions

(1) The display panel is made of glass and polarizer. As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring. Do not subject it to a mechanical shock by dropping it or impact.

(2) If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.

(3) Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary. Do not touch the display with bare hands. This will stain the display area and degraded insulation between terminals (some cosmetics are determined to the polarizer).

(4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.). Do not put or attach anything on the display area to avoid leaving marks on. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperature they must be warmed up in a container before coming in contact with room temperature air.

(5) If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents

- Isopropyl alcohol
- Ethyl alcohol

Do not scrub hard to avoid damaging the display surface.

(6) Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.

- Water
- Ketone
- Aromatic solvents

Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading. Avoid contacting oil and fats.

(7) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.

(8) Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.

(9) Do not attempt to disassemble or process the LCD module.

(10) NC terminal should be open. Do not connect anything.

(11) If the logic circuit power is off, do not apply the input signals.

(12) Electro-Static Discharge Control , Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

- Before remove LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential. Be sure to ground the body when handling the LCD modules.

- Tools required for assembling, such as soldering irons, must be properly grounded. make certain the AC power source for the soldering iron does not leak. When using an electric screwdriver to attach LCM, the screwdriver should be of ground potential to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.

- To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions. To reduce the generation of static electricity be careful that the air in the work is not too dried. A relative humidity of 50%-60% is recommended. As far as possible make the electric potential of your work clothes and that of the work bench the ground potential

- The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated

( 13 ) Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

- Do not alter, modify or change the shape of the tab on the metal frame.
  - Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
  - Do not damage or modify the pattern writing on the printed circuit board.
  - Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.
  - Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
- Do not drop, bend or twist LCM.

### **Storage Precautions**

When storing the LCD modules, the following precaution is necessary.

- (1) Store them in a sealed polyethylene bag. If properly sealed, there is no need for the dessicant.
- (2) Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0°C and 35°C.
- (3) The polarizer surface should not come in contact with any other objects. (We advise you to store them in the container in which they were shipped).

### **Others**

Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.

If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc., exercise care to avoid holding the following sections when handling the modules.

- Exposed area of the printed circuit board.
- Terminal electrode sections.

### **Precautions for Operation**

(1) Viewing angle varies with the change of liquid crystal driving voltage (VLCD). Adjust VLCD to show the best contrast.

(2) It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage than the limit cause the shorter LCD life. An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.

(3) 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.

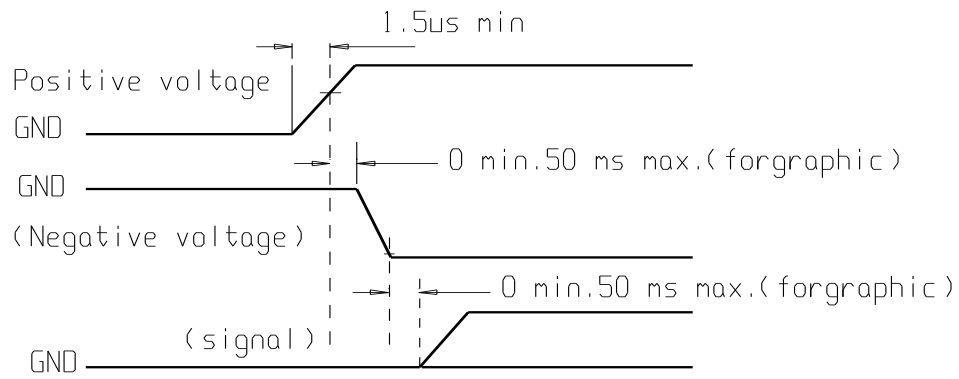
(4) If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.

(5) A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Usage under the maximum operating temperature, 50%RH or less is required.

(6) Input each signal after the positive/negative voltage becomes stable.

(7) Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.





### Safety

(1) It is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.

(2) If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

### Limited Warranty

Unless agreed between Shelly Associates Inc. and customer, Shelly Associates Inc. will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with Shelly Associates Inc. acceptance standards (copies available upon request) for a period of one year from date of shipments. Cosmetic/visual defects must be returned to Shelly Associates Inc. within 90 days of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of Shelly Associates Inc. is limited to repair and/or replacement on the terms set forth above. Shelly Associates Inc. will not be responsible for any subsequent or consequential events.