

## TFT LCD Tentative Specification

# MODEL NO.: G121X1-L03

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

Approved by: \_\_\_\_\_

Note:

**FOR MORE INFORMATION:**  
AZ DISPLAYS, INC.  
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| Liquid Crystal Display Division |                   |
|---------------------------------|-------------------|
| QRA Division.                   | OA Head Division. |
| Approval                        | Approval          |
|                                 |                   |

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**REVISION HISTORY**

| Version | Date        | Section | Description                                 |
|---------|-------------|---------|---|
| 0.0     | Feb. 9.2008 | All     | G121X1-L03 Tentative Spec. was first issued |

## 1. GENERAL DESCRIPTION

### 1.1 OVERVIEW

The G121X1-L03 model is a 12.1" TFT-LCD module with a white LED Backlight Unit and a 20-pin 1ch-LVDS interface. This module supports 1024 x 768 XGA mode and displays 262k/16.2M colors. The converter for the Backlight Unit is built in.

### 1.2 FEATURES

- Wide viewing angle
- High contrast ratio
- Fast response time
- XGA (1024 x 768 pixels) resolution
- Wide operating temperature
- DE (Data Enable) mode
- LVDS (Low Voltage Differential Signaling) interface
- RoHS Compliance
- Lamp Replaceable
- Sunlight Readable

### 1.3 APPLICATION

- TFT LCD Monitor
- Industrial Application
- Amusement
- Vehicle

### 1.4 GENERAL SPECIFICATIONS

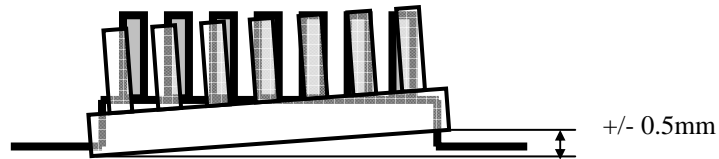
| Item               | Specification            | Unit  | Note |
|--------------------|--------------------------|-------|------|
| Diagonal Size      | 12.1                     | inch  | (1)  |
| Active Area        | 245.76(H) x 184.32(V)    | mm    |      |
| Bezel Opening Area | 249.0 x 187.5            | mm    |      |
| Driver Element     | a-si TFT active matrix   | -     | -    |
| Pixel Number       | 1024 x R.G.B. x 768      | pixel | -    |
| Pixel Pitch        | 0.240(H) x 0.240(V)      | mm    | -    |
| Pixel Arrangement  | RGB vertical stripe      | -     | -    |
| Display Colors     | 262k/16.2M               | color | -    |
| Transmissive Mode  | Normally white           | -     | -    |
| Surface Treatment  | Hard coating (3H), Glare | -     | -    |

### 1.5 MECHANICAL SPECIFICATIONS

| Item                            | Min.   | Typ.  | Max.  | Unit  | Note |     |
|---------------------------------|--|-------|-------|-------|------|-----|
| Module Size                     | Horizontal (H)   | 260.2 | 260.5 | 260.8 | mm   | (1) |
|                                 | Vertical (V)   | 239.7 | 204   | 204.3 | mm   |     |
|                                 | Depth (D)  | 8.0   | 8.5   | 9.0   | mm   |     |
| Weight                          |  | 430   | 460   | g     | -    |     |
| I/F connector mounting position | The mounting inclination of the connector makes the screen center within $\pm 0.5\text{mm}$ as the horizontal. |       |       | -     | (2)  |     |

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

(2) Connector mounting position



## 2. ABSOLUTE MAXIMUM RATINGS

### 2.1 ABSOLUTE RATINGS OF ENVIRONMENT

| Item                          | Symbol          | Value |      | Unit | Note |
|-------------------------------|-----------------|-------|------|------|------|
|                               |                 | Min.  | Max. |      |      |
| Operating Ambient Temperature | T <sub>OP</sub> | -30   | +80  | °C   |      |
| Storage Temperature           | T <sub>ST</sub> | -40   | +85  | °C   |      |

| Test Item                                       | Test Condition  | Note   |
|---|---|--------|
| High Temperature Storage Test                   | 85°C, 240 hours                                       | (1)(2) |
| Low Temperature Storage Test                    | -40°C, 240 hours                                      |        |
| Thermal Shock Storage Test                      | -30°C, 0.5hour 80 , 0.5hour; 1hour/cycle,100cycles    |        |
| High Temperature Operation Test                 | 80°C, 240 hours                                       |        |
| Low Temperature Operation Test                  | -30°C, 240 hours                                      |        |
| High Temperature & High Humidity Operation Test | 60°C, 90%RH, 240hours                                 |        |
| Shock (Non-Operating)                           | 200G, 2ms, half sine wave, 1 time for ± X, ± Y, ± Z.  |        |
| Vibration (Non-Operating)                       | 1.5G, 10 ~ 300 Hz, 10min/cycle, 3 cycles each X, Y, Z | (3)    |

Note (1) There should be no condensation on the surface of panel during test.

Note (2) Temperature of panel display surface area should be 90 °C Max.

Note (3) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

Note (4) In the standard conditions, there is no function failure issue occurred. All the cosmetic specification is judged before reliability test.

### 2.2 ELECTRICAL ABSOLUTE RATINGS

#### 2.2.1 TFT LCD MODULE

| Item                 | Symbol          | Value |                       | Unit | Note |
|----------------------|-----------------|-------|-----------------------|------|------|
|                      |                 | Min.  | Max.                  |      |      |
| Power Supply Voltage | V <sub>CC</sub> | -0.3  | 5.25                  | V    | (1)  |
| Logic Input Voltage  | V <sub>IN</sub> | -0.3  | V <sub>CC</sub> +0.25 | V    | (1)  |

#### 2.2.2 BACKLIGHT UNIT

| Item              | Symbol         | Value |      | Unit | Note      |
|-------------------|----------------|-------|------|------|-----------|
|                   |                | Min.  | Max. |      |           |
| Converter Voltage | V <sub>i</sub> | 10.8  | 13.2 | V    | (1) , (2) |
| Converter Current | I <sub>i</sub> | -     | 1.0  | A    | (1) , (2) |

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for lamp (Refer to 3.2 for further information).

### 3. ELECTRICAL CHARACTERISTICS

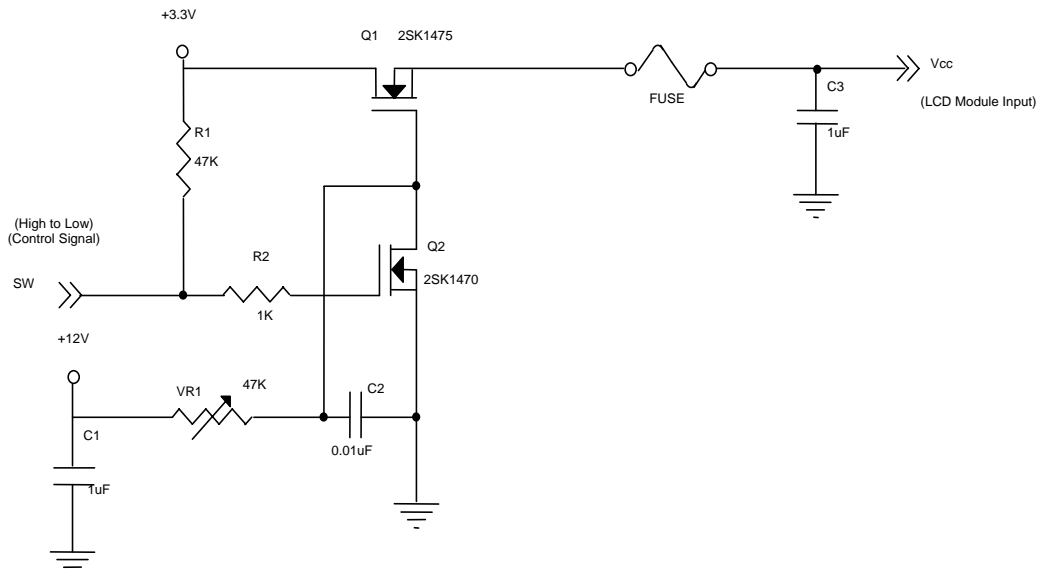
#### 3.1 TFT LCD MODULE

Ta = 25 ± 2 °C

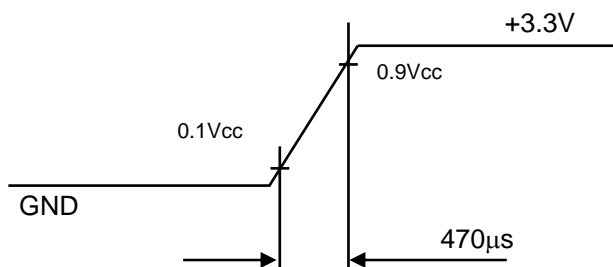
| Parameter                       | Symbol            | Value |      |      | Unit | Note        |                   |
|---------------------------------|-------------------|-------|------|------|------|-------------|-------------------|
|                                 |                   | Min.  | Typ. | Max. |      |             |                   |
| Power Supply Voltage            | Vcc               | 3.0   | 3.3  | 3.6  | V    | at Vcc=3.3V |                   |
|                                 |                   | 4.75  | 5.0  | 5.25 | V    | at Vcc=5.0V |                   |
| Ripple Voltage                  | V <sub>RP</sub>   | -     | -    | 100  | mV   | -           |                   |
| Rush Current                    | I <sub>RUSH</sub> | -     | -    | 1.5  | A    | (2)         |                   |
| Power Supply Current            | White             | -     | -    | 800  | 910  | mA          | (3)a, at Vcc=3.3V |
|                                 |                   |       | -    | 500  | 590  | mA          | (3)a, at Vcc=5.0V |
|                                 | Black             |       | -    | 1.1  | 1.2  | A           | (3)b, at Vcc=3.3V |
|                                 |                   |       | -    | 710  | 782  | mA          | (3)b, at Vcc=5.0V |
| LVDS differential input voltage | V <sub>id</sub>   | -100  | -    | +100 | mV   | -           |                   |
| LVDS common input voltage       | V <sub>ic</sub>   | -     | 1.2  | -    | V    | -           |                   |

Note (1) The module is recommended to operate within specification ranges listed above for normal function.

Note (2) Measurement Conditions:



**Vcc rising time is 470μs**



Note (3) The specified power supply current is under the conditions at  $V_{cc} = 3.3\text{ V}$ ,  $T_a = 25 \pm 2\text{ }^\circ\text{C}$ ,  $f_v = 60\text{ Hz}$ , whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

b. Black Pattern



Active Area



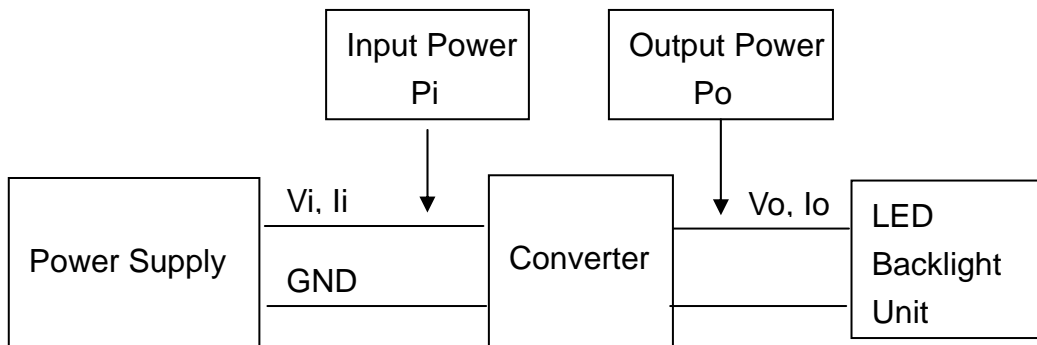
3.2 BACKLIGHT UNIT

Ta = 25 ± 2 °C

| Parameter   | Symbol         | Value |      |      | Unit             | Note        |
|-------------|----------------|-------|------|------|------------------|-------------|
|             |                | Min.  | Typ. | Max. |                  |             |
| LED Voltage | V <sub>O</sub> | ---   | 24.5 | 28   | V <sub>DC</sub>  | (Duty 100%) |
| LED Current | I <sub>O</sub> | ---   | ---  | 320  | mA <sub>DC</sub> | (Duty 100%) |

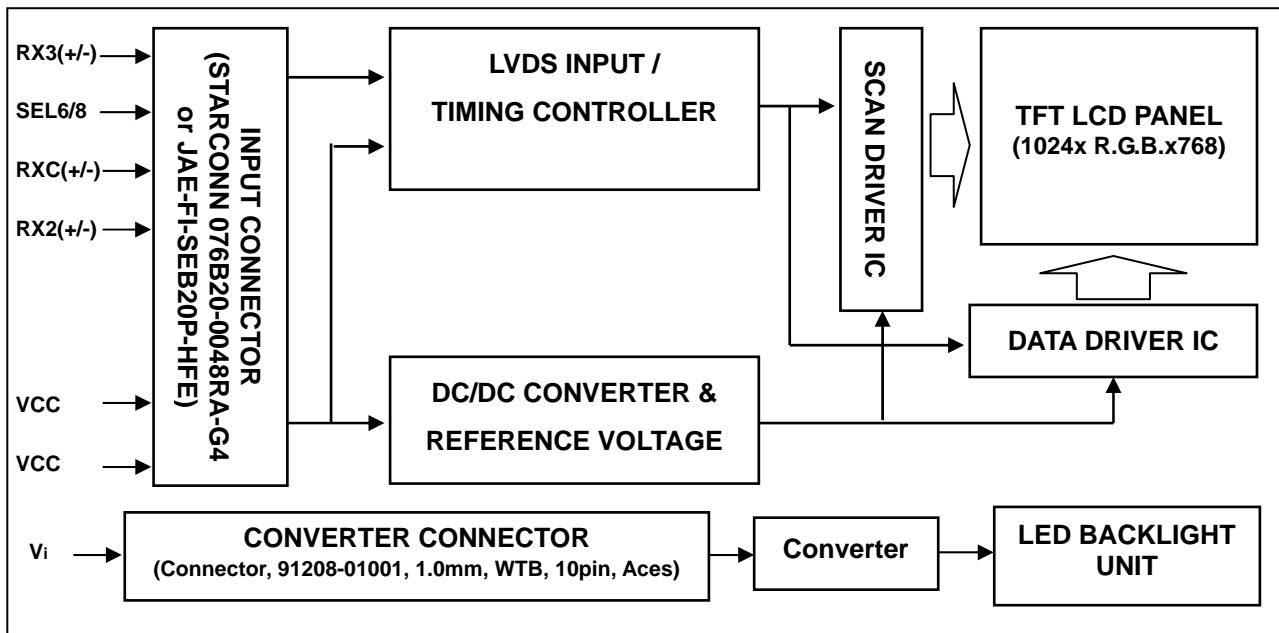
Note (1) LED current is measured by utilizing a high frequency current meter as shown below:

Note (2) P<sub>O</sub> = I<sub>O</sub> × V<sub>O</sub>

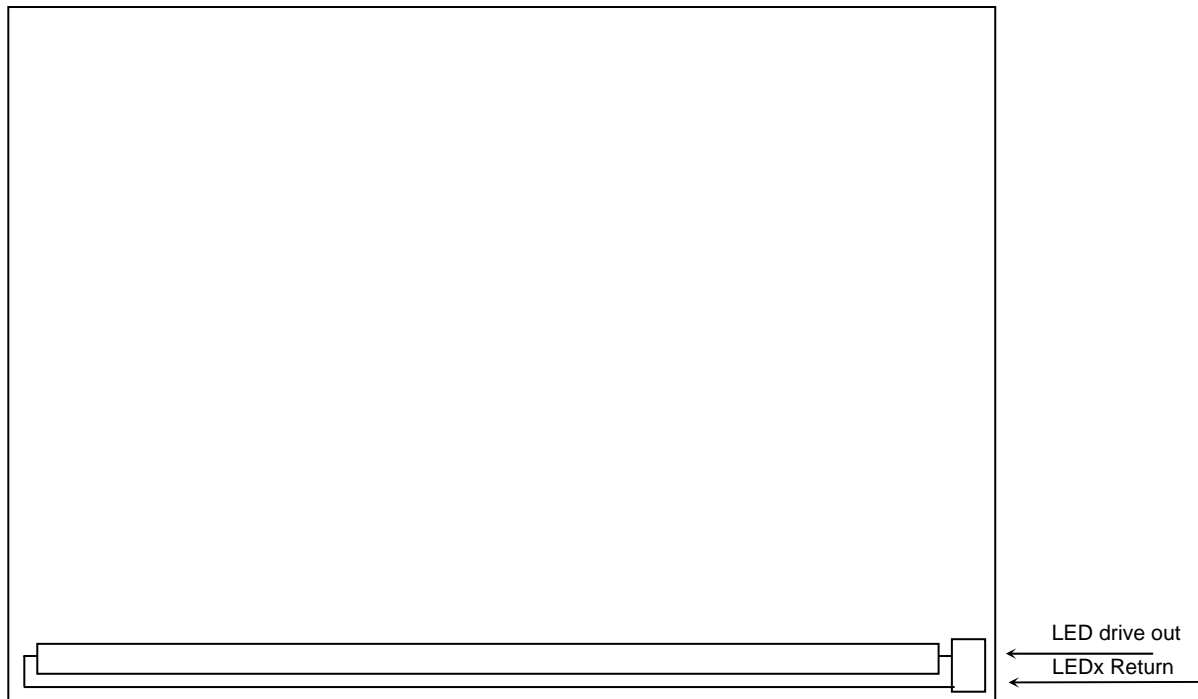


#### 4. BLOCK DIAGRAM

##### 4.1 TFT LCD MODULE



##### 4.2 BACKLIGHT UNIT



## 5. INPUT TERMINAL PIN ASSIGNMENT

### 5.1 TFT LCD MODULE

| Pin | Name  | Description   | Remark           |
|-----|-------|---|------------------|
| 1   | RX3+  | Differential Data Input, CH3 ( Positive )   |                  |
| 2   | RX3-  | Differential Data Input, CH3 (Negative )  |                  |
| 3   | NC    | NC  |                  |
| 4   | SEL68 | LVDS 6/8 bit select function control,<br>Low or NC → 6 bit Input Mode<br>High → 8bit Input Mode | Note ( 4 )       |
| 5   | GND   | Ground  |                  |
| 6   | RXC+  | Differential Clock Input ( Positive )   | LVDS Level Clock |
| 7   | RXC-  | Differential Clock Input ( Negative )   |                  |
| 8   | GND   | Ground  |                  |
| 9   | RX2+  | Differential Data Input , CH2 ( Positive )  |                  |
| 10  | RX2-  | Differential Data Input , CH2 ( Negative )  |                  |
| 11  | GND   | Ground  |                  |
| 12  | RX1+  | Differential Data Input , CH1 ( Positive )  |                  |
| 13  | RX1-  | Differential Data Input, CH1 ( Negative )   |                  |
| 14  | GND   | Ground  |                  |
| 15  | RX0+  | Differential Data Input, CH0 ( Positive )   |                  |
| 16  | RX0-  | Differential Data Input, CH0 (Negative )  |                  |
| 17  | reLR  | Horizontal Reverse Scan Control,<br>Low or NC → Normal Mode.<br>High → Horizontal Reverse Scan  | Note ( 4 )       |
| 18  | reUD  | Vertical Reverse Scan Control,<br>Low or NC → Normal Mode,<br>High → Vertical Reverse Scan      | Note ( 4 )       |
| 19  | VCC   | Power supply  |                  |
| 20  | VCC   | Power supply  |                  |

Note (1) Connector Part No.: STARCONN 076B20-0048RA-G4 or JAE FI-SEB20P-HFE or equivalent.

Note (2) "Low" stands for 0V. "High" stands for 3.3V. "NC" stands for "No Connected".

### 5.2 BACKLIGHT UNIT(Converter connector pin)

| Pin | Symbol    | Description             | Remark      |
|-----|-----------|-------------------------|-------------|
| 1   | $V_i$     | Converter input voltage | 12V         |
| 2   | $V_i$     | Converter input voltage | 12V         |
| 3   | $V_i$     | Converter input voltage | 12V         |
| 4   | $V_i$     | Converter input voltage | 12V         |
| 5   | $V_{GND}$ | Converter ground        | Ground      |
| 6   | $V_{GND}$ | Converter ground        | Ground      |
| 7   | $V_{GND}$ | Converter ground        | Ground      |
| 8   | $V_{GND}$ | Converter ground        | Ground      |
| 9   | EN        | Enable pin              | 3.3V        |
| 10  | ADJ       | Backlight Adjust        | PWM Dimming |

Note (1) Connector Part No.: 91208-01001(ACES) or equivalent

### 5.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

| Color               |               | Data Signal |    |    |    |    |    |       |    |    |    |    |    |      |    |    |    |    |    |
|---------------------|---------------|-------------|----|----|----|----|----|-------|----|----|----|----|----|------|----|----|----|----|----|
|                     |               | Red         |    |    |    |    |    | Green |    |    |    |    |    | Blue |    |    |    |    |    |
|                     |               | R5          | R4 | R3 | R2 | R1 | R0 | G5    | G4 | G3 | G2 | G1 | G0 | B5   | B4 | B3 | B2 | B1 | B0 |
| Basic Colors        | Black         | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Red           | 1           | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Green         | 0           | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Blue          | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  |
|                     | Cyan          | 0           | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  |
|                     | Magenta       | 1           | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 1  | 1  | 1  | 1  | 1  |
|                     | Yellow        | 1           | 1  | 1  | 1  | 1  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | White         | 1           | 1  | 1  | 1  | 1  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  |
| Gray Scale Of Red   | Red(0)/Dark   | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Red(1)        | 0           | 0  | 0  | 0  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Red(2)        | 0           | 0  | 0  | 0  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | Red(61)       | 1           | 1  | 1  | 1  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Red(62)       | 1           | 1  | 1  | 1  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
| Red(63)             | 1             | 1           | 1  | 1  | 1  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  |    |
| Gray Scale Of Green | Green(0)/Dark | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Green(1)      | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 1  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Green(2)      | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | Green(61)     | 0           | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 0  | 1  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Green(62)     | 0           | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
| Green(63)           | 0             | 0           | 0  | 0  | 0  | 0  | 1  | 1     | 1  | 1  | 1  | 1  | 0  | 0    | 0  | 0  | 0  | 0  |    |
| Gray Scale Of Blue  | Blue(0)/Dark  | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Blue(1)       | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 1  |
|                     | Blue(2)       | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 1  | 0  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | Blue(61)      | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 0  | 1  |
|                     | Blue(62)      | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 0  |
| Blue(63)            | 0             | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 1  | 1    | 1  | 1  | 1  | 1  |    |

Note (1) 0: Low Level Voltage, 1: High Level Voltage

## 6. INTERFACE TIMING

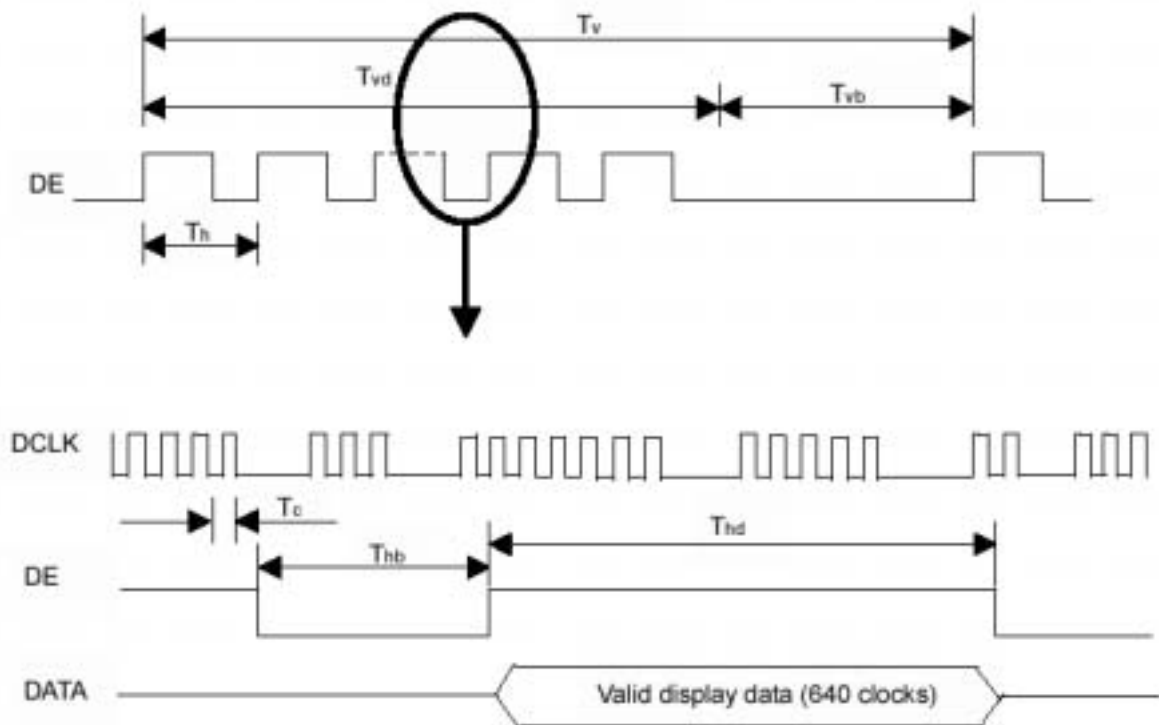
### 6.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

| Signal                         | Item       | Symbol   | Min.           | Typ. | Max.           | Unit  | Note                    |
|--------------------------------|------------|----------|----------------|------|----------------|-------|-------------------------|
| DCLK                           | Frequency  | $F_c$    | 57.5           | 64.9 | 74.4           | MHz   |                         |
|                                | Period     | $T_c$    | 13.4           | 15.4 | 17.3           | ns    |                         |
| Vertical Active Display Term   | Frame Rate | $F_r$    | 56             | 60   | 75             | Hz    |                         |
|                                | Total      | $T_v$    | 774            | 806  | 848            | $T_h$ | $T_v = T_{vd} + T_{vb}$ |
|                                | Display    | $T_{vd}$ | 768            | 768  | 768            | $T_h$ |                         |
|                                | Blank      | $T_{vb}$ | $T_v - T_{vd}$ | 38   | $T_v - T_{vd}$ | $T_h$ |                         |
| Horizontal Active Display Term | Total      | $T_h$    | 1240           | 1344 | 1464           | $T_c$ | $T_h = T_{hd} + T_{hb}$ |
|                                | Display    | $T_{hd}$ | 1024           | 1024 | 1024           | $T_c$ |                         |
|                                | Blank      | $T_{hb}$ | $T_h - T_{hd}$ | 320  | $T_h - T_{hd}$ | $T_c$ |                         |

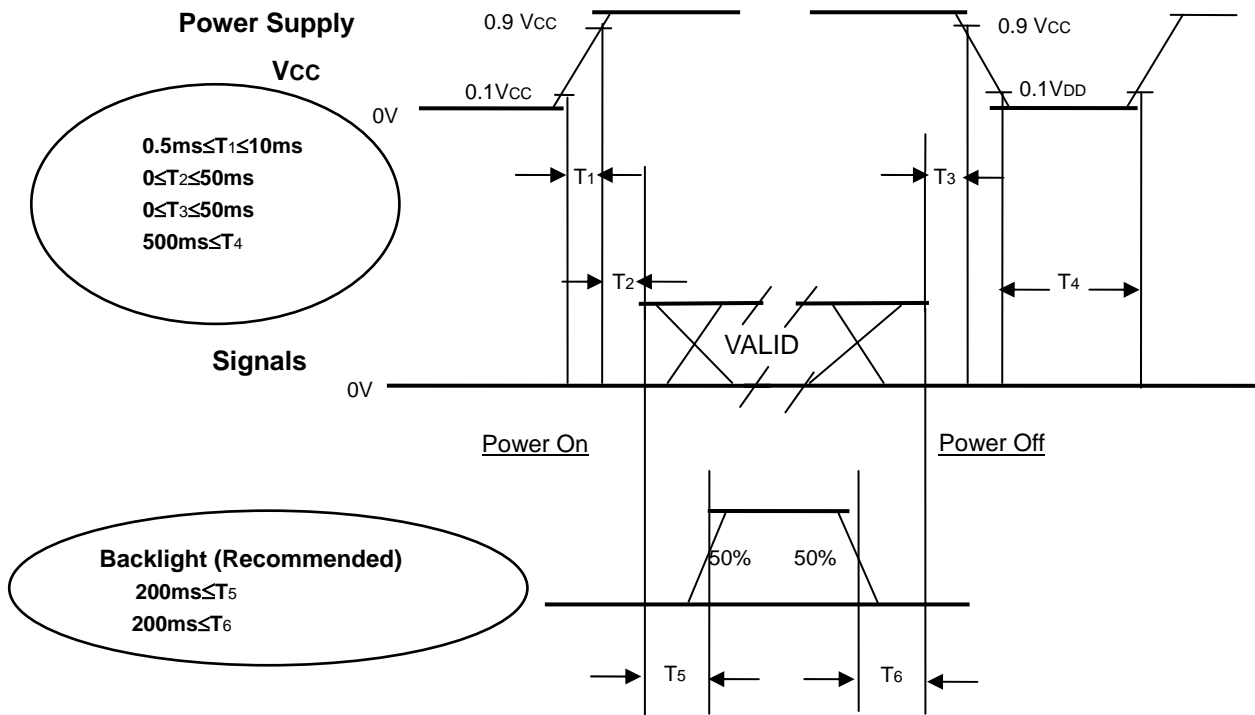
Note : (1) Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

### INPUT SIGNAL TIMING DIAGRAM



## 6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should follow the conditions shown in the following diagram.



**Power ON/OFF Sequence**

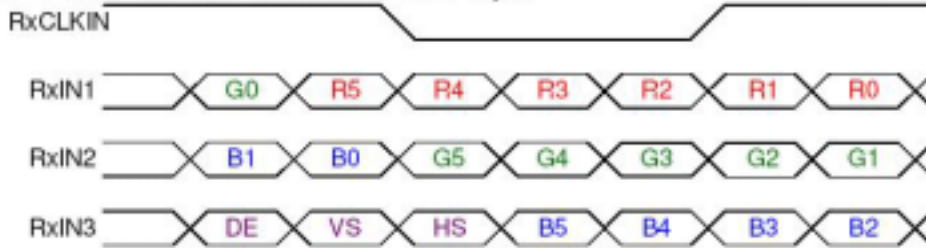
Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD Vcc to 0 V.

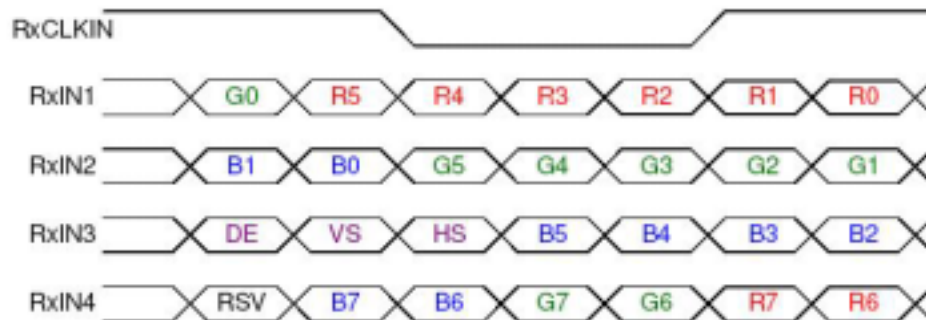
Note (3) The Backlight inverter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight inverter power must be turned off before the power supply for the logic and the interface signal is invalid.

### 6.3 The Input Data Format

#### SEL68 = "Low" or "NC" for 6 bits LVDS Input



#### SEL68 = "High" for 8 bits LVDS Input



Note (1) R/G/B data 7: MSB, R/G/B data 0: LSB

Note (2) Please follow PSWG

| Signal Name | Description        | Remark  |
|-------------|--------------------|---|
| R7          | Red Data 7 (MSB)   | Red-pixel Data<br>Each red pixel's brightness data consists of these 8 bits pixel data.     |
| R6          | Red Data 6         |   |
| R5          | Red Data 5         |   |
| R4          | Red Data 4         |   |
| R3          | Red Data 3         |   |
| R2          | Red Data 2         |   |
| R1          | Red Data 1         |   |
| R0          | Red Data 0 (LSB)   |   |
| G7          | Green Data 7 (MSB) | Green-pixel Data<br>Each green pixel's brightness data consists of these 8 bits pixel data. |
| G6          | GreenData 6        |   |
| G5          | GreenData 5        |   |
| G4          | GreenData 4        |   |
| G3          | GreenData 3        |   |
| G2          | GreenData 2        |   |
| G1          | GreenData 1        |   |
| G0          | GreenData 0 (LSB)  |   |
| B7          | Blue Data 7 (MSB)  | Blue-pixel Data<br>Each blue pixel's brightness data consists of these 8 bits pixel data.   |
| B6          | Blue Data 6        |   |
| B5          | Blue Data 5        |   |
| B4          | Blue Data 4        |   |
| B3          | Blue Data 3        |   |
| B2          | Blue Data 2        |   |
| B1          | Blue Data 1        |   |
| B0          | Blue Data 0 (LSB)  |   |
| RXCLKIN+    | LVDS Clock Input   |   |
| RXCLKIN-    |                    |   |
| DE          | Display Enable     |   |
| VS          | Vertical Sync      |   |
| HS          | Horizontal Sync    |   |

Note (3) Output signals from any system shall be low or Hi-Z state when VCC is off

#### 6.4 Scanning Direction

The following figures show the image see from the front view. The arrow indicates the direction of scan.

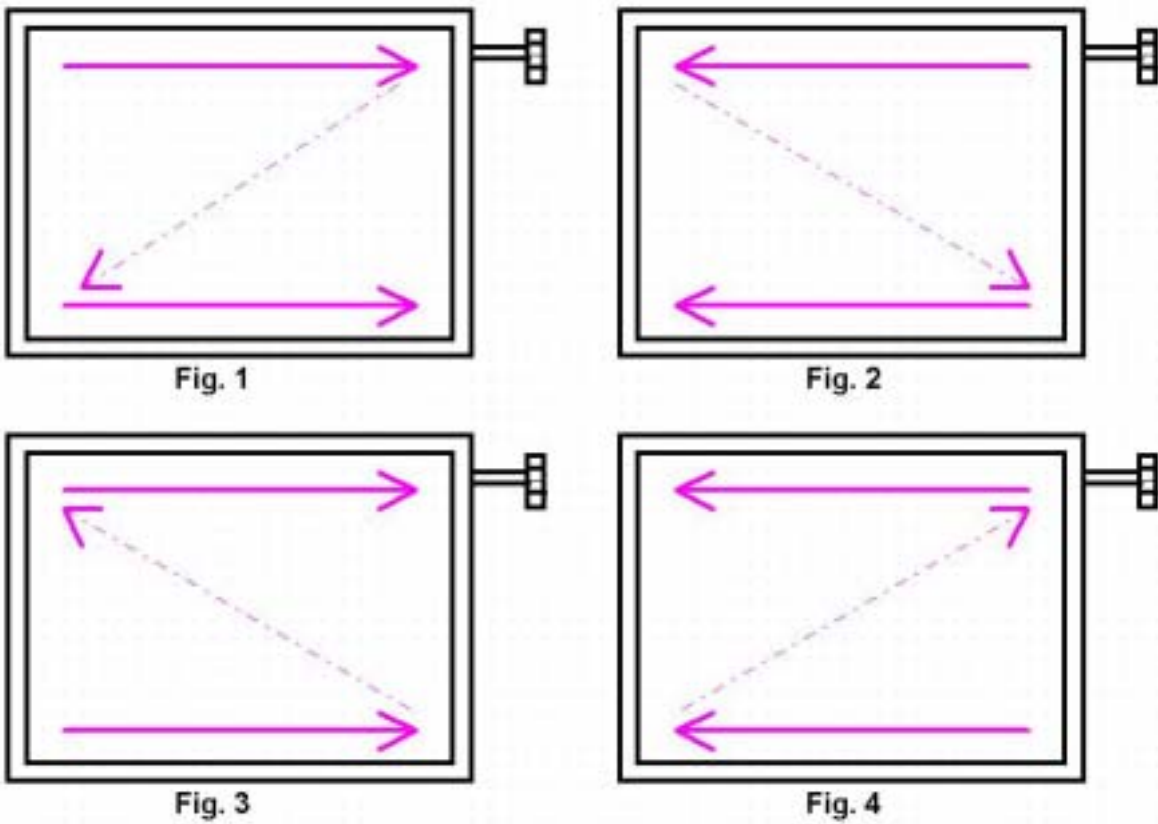


Fig. 1 Normal scan ( pin 17, reLR = Low or NC, pin 18, reUD = Low or NC )

Fig. 2 Reverse scan ( pin 17, reLR = High, pin 18, reUD = Low or NC )

Fig. 3 Reverse scan ( pin 17, reLR = Low or NC, pin 18, reUD = High )

Fig. 4 Reverse scan ( pin 17, reLR = High, pin 18, reUD = High )



## 7. OPTICAL CHARACTERISTICS

### 7.1 TEST CONDITIONS

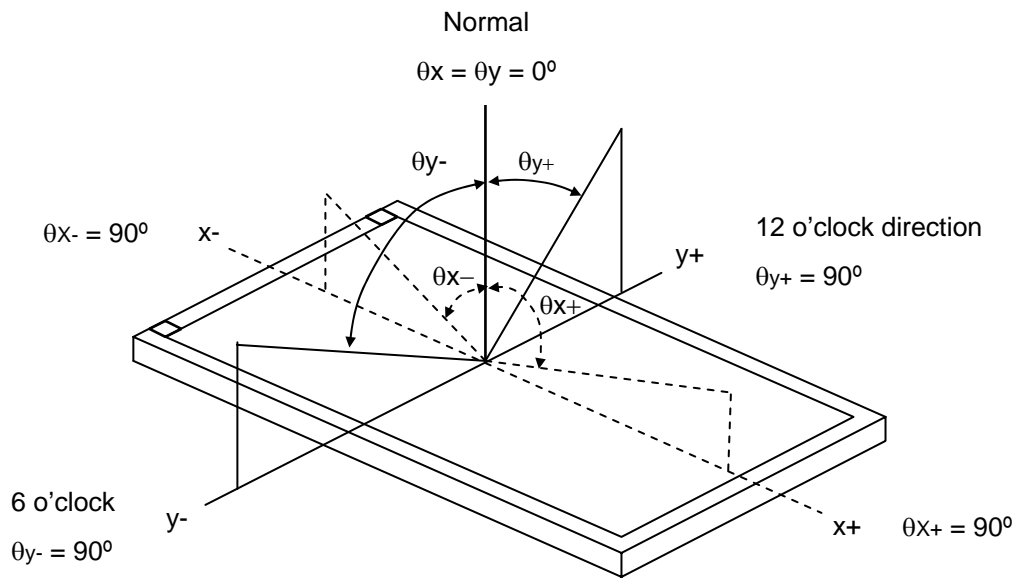
| Item                       | Symbol  | Value   | Unit |
|----------------------------|---|---------|------|
| Ambient Temperature        | Ta  | 25±2    | °C   |
| Ambient Humidity           | Ha  | 50±10   | %RH  |
| Supply Voltage             | V <sub>CC</sub>   | 3.3     | V    |
| Input Signal               | According to typical value in "3. ELECTRICAL CHARACTERISTICS" |         |      |
| Inverter Current           | I <sub>L</sub>  | 8.0±0.5 | mA   |
| Inverter Driving Frequency | F <sub>L</sub>  | 61±5    | KHz  |
| Inverter                   | Sumida H05-5052   |         |      |

### 7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (5).

| Item                       | Symbol         | Condition                                       | Min.          | Typ.  | Max.          | Unit | Note     |
|----------------------------|----------------|---|---------------|-------|---------------|------|----------|
| Color Chromaticity         | Red            | $\theta_x=0^\circ, \theta_y=0^\circ$<br>CS-1000 | Typ -<br>0.03 | 0.595 | Typ +<br>0.03 | -    | (1), (5) |
|                            |                |   |               | 0.339 |               | -    |          |
|                            | Green          |   |               | 0.317 |               | -    |          |
|                            |                |   |               | 0.531 |               | -    |          |
|                            | Blue           |   |               | 0.152 |               | -    |          |
|                            |                |   |               | 0.123 |               | -    |          |
|                            | White          |   |               | 0.308 |               | -    |          |
|                            |                |   |               | 0.318 |               | -    |          |
| Center Luminance of White  | L <sub>C</sub> |   | 380           | 500   | -             | -    | (4), (5) |
| Contrast Ratio             | CR             |   | 500           | 700   | -             | -    | (2), (5) |
| Response Time              | T <sub>R</sub> | $\theta_x=0^\circ, \theta_y=0^\circ$            | -             | 6     | 11            | ms   | (3)      |
|                            | T <sub>F</sub> |   |               | 17    | 22            | ms   |          |
| White Variation            | $\delta W$     | $\theta_x=0^\circ, \theta_y=0^\circ$            | -             | 1.25  | 1.4           | -    | (5), (6) |
| Viewing Angle              | Horizontal     | CR≥10   | 70            | 80    | -             | Deg. | (1), (5) |
|                            |                |   |               | 80    | -             |      |          |
|                            | Vertical       |   |               | 80    | -             |      |          |
|                            |                |   |               | 80    | -             |      |          |
| Contrast Ratio in daylight |                | Sun lamp  | 40            | 60    | -             | -    | (7)      |

Note (1) Definition of Viewing Angle ( $\theta_x, \theta_y$ ):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

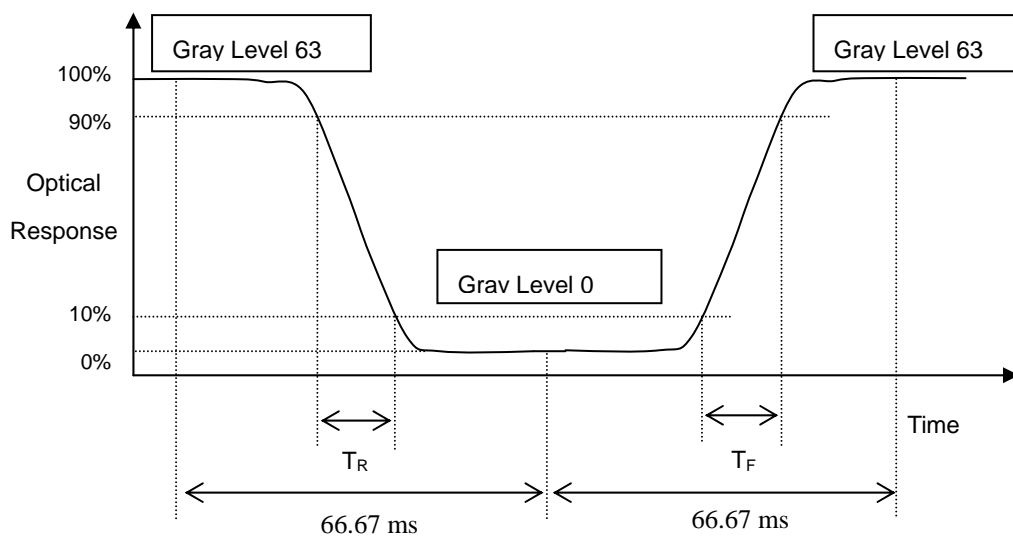
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

$$\text{CR} = \text{CR} (5)$$

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time ( $T_R, T_F$ ) and measurement method:



Note (4) Definition of Luminance of White ( $L_C$ ):

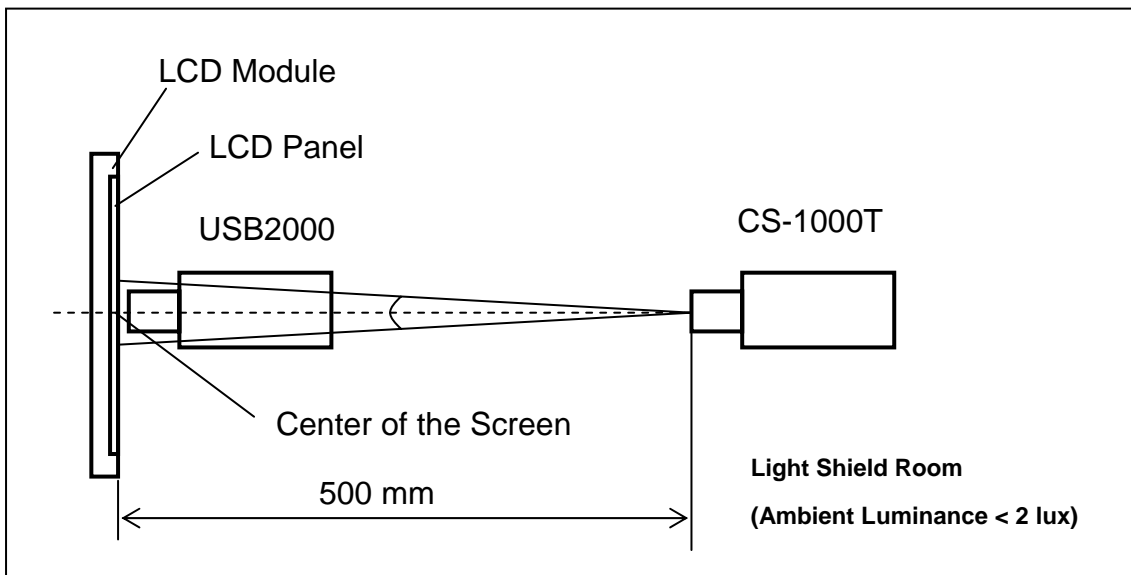
Measure the luminance of gray level 63 at center point

$$L_C = L(5)$$

$L(x)$  is corresponding to the luminance of the point X at Figure in Note (6).

Note (5) Measurement Setup:

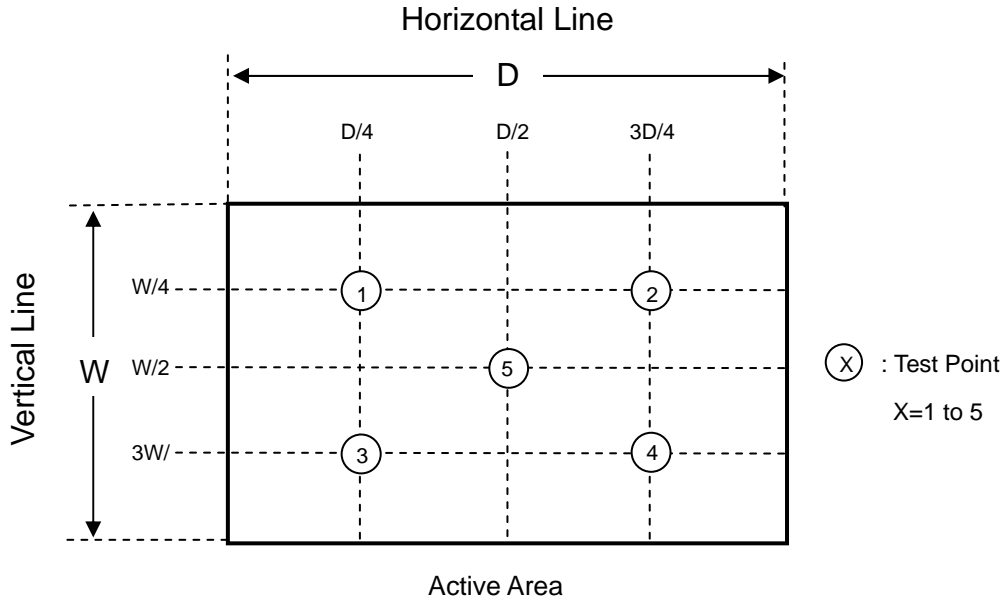
The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



Note (6) Definition of White Variation ( $\delta W$ ):

Measure the luminance of gray level 63 at 5 points

$$\delta W = \frac{\text{Maximum [L (1), L (2), L (3), L (4), L (5)]}}{\text{Minimum [L (1), L (2), L (3), L (4), L (5)]}}$$

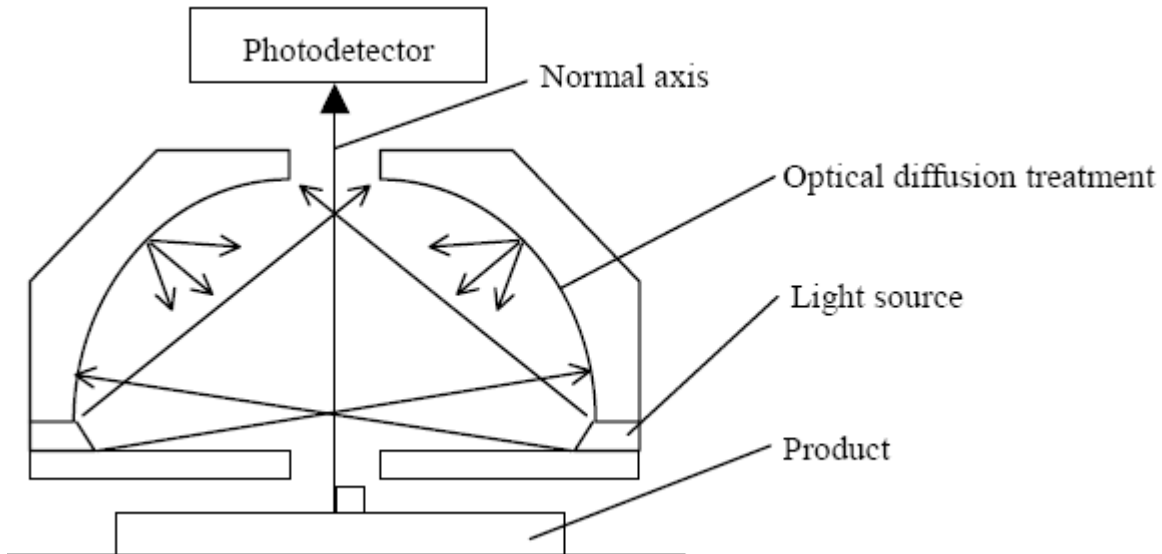


Note (7) Contrast Ratio in daylight:

Measuring method:

Sun lamp: 10000 Lux

Contrast Ratio in daylight = Luminance of white screen / Luminance of black screen



## 8. PACKAGING

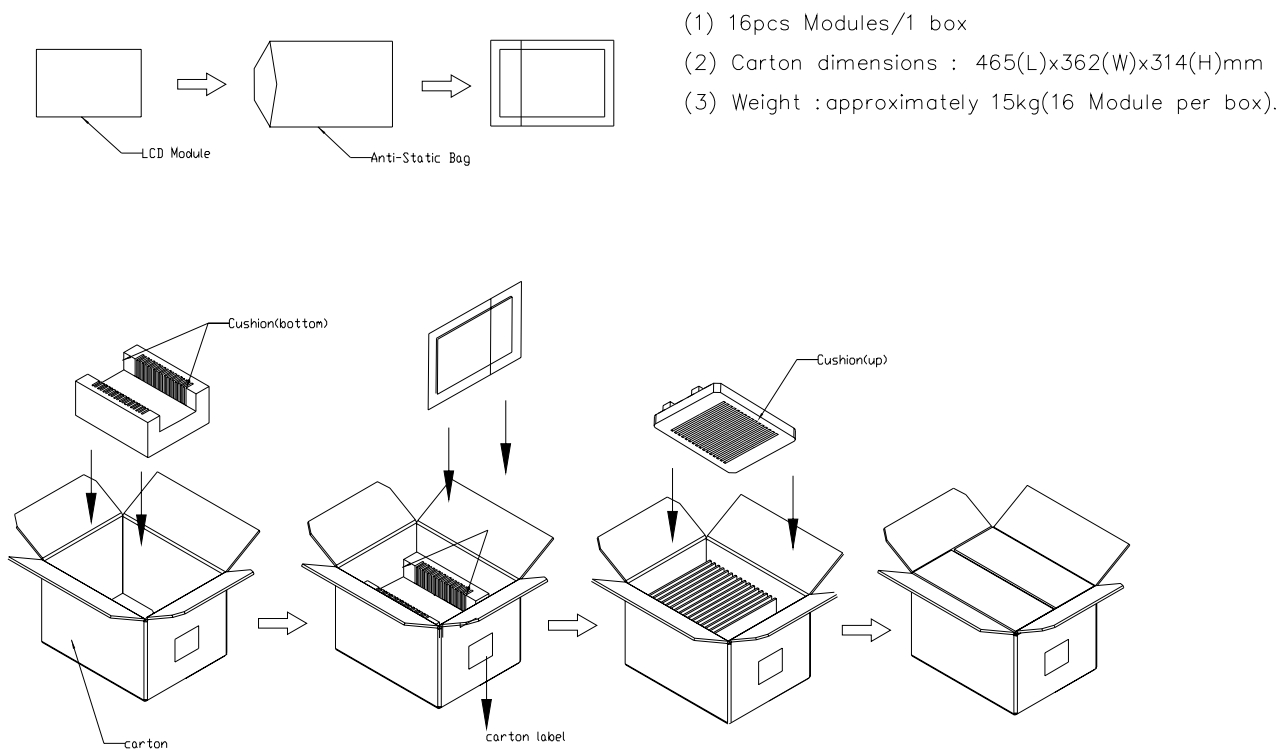
### 8.1 PACKING SPECIFICATIONS

- (1) 16pcs LCD modules / 1 Box
- (2) Box dimensions: 465 (L) X 362 (W) X 314 (H) mm
- (3) Weight: approximately 15Kg (16 modules per box)

### 8.2 PACKING METHOD

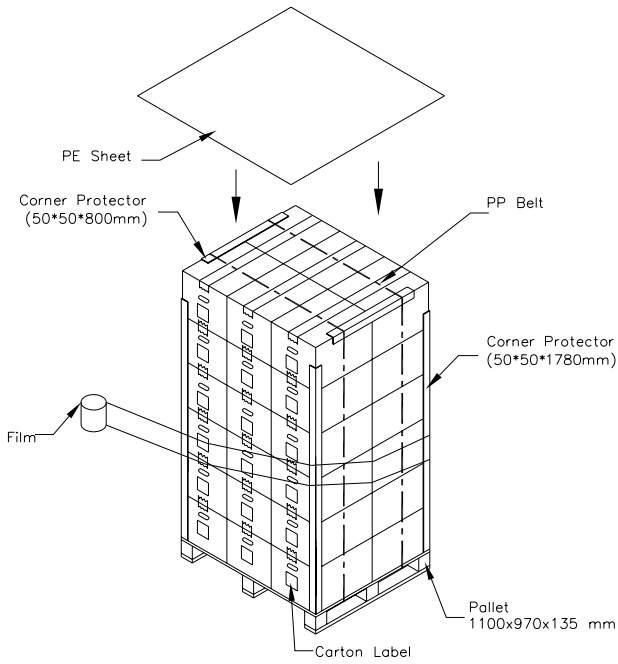
- (1) Carton Packing should have no failure in the following reliability test items.

| Test Item     | Test Conditions  | Note          |
|---------------|--|---------------|
| Vibration     | ISTA STANDARD<br>Random, Frequency Range: 2 – 200 Hz<br>Top & Bottom: 30 minutes (+Z), 10 min (-Z),<br>Right & Left: 10 minutes (X)<br>Back & Forth 10 minutes (Y) | Non Operation |
| Dropping Test | 1 Angle, 3 Edge, 6 Face, 61 cm   | Non Operation |

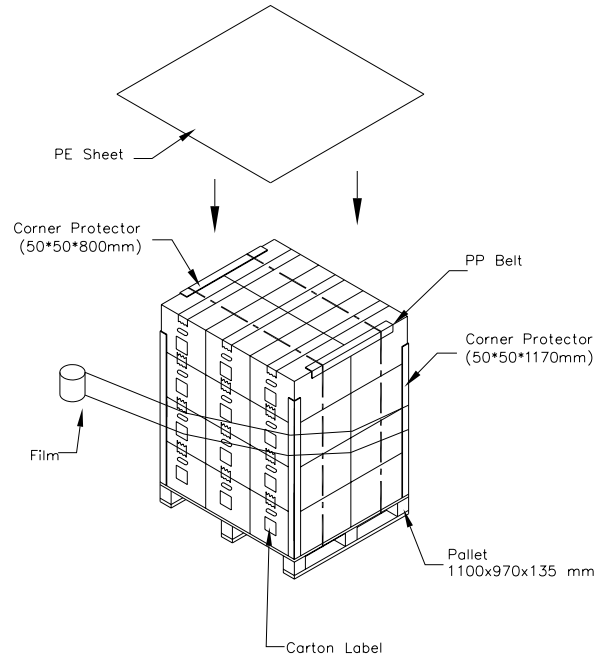


**Figure. 8-1 Packing method**

Sea / Land Transportation (40ft Container)



Air Transportation

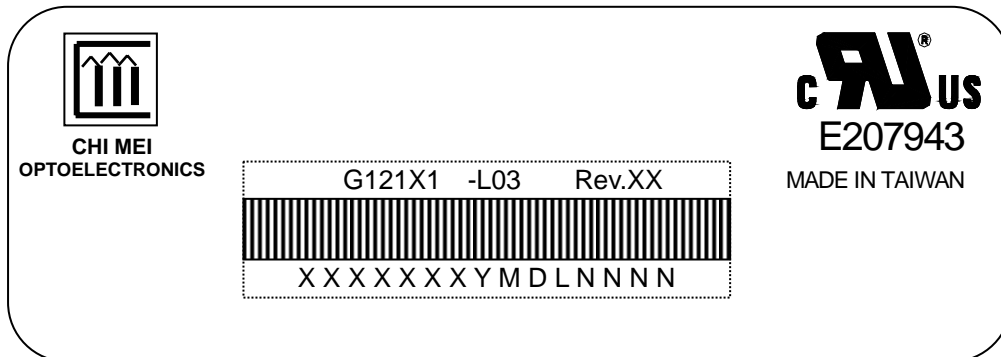


**Figure. 8-2 Packing method**

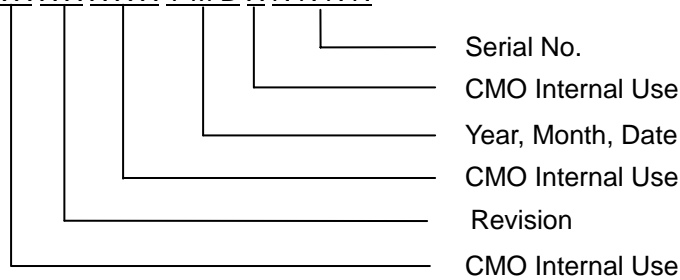
## 9. DEFINITION OF LABELS

### 9.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



- (a) Model Name: G121X1 -L03
- (b) Revision: Rev. XX, for example: A1, ...C1, C2 ...etc.
- (c) Serial ID: X X X X X X Y M D X N N N N



Serial ID includes the information as below:

- (a) Manufactured Date: Year: 1~9, for 2001~2009  
 Month: 1~9, A~C, for Jan. ~ Dec.  
 Day: 1~9, A~Y, for 1<sup>st</sup> to 31<sup>st</sup>, exclude I, O and U
- (b) Revision Code: cover all the change
- (c) Serial No.: Manufacturing sequence of product

## 10. PRECAUTIONS

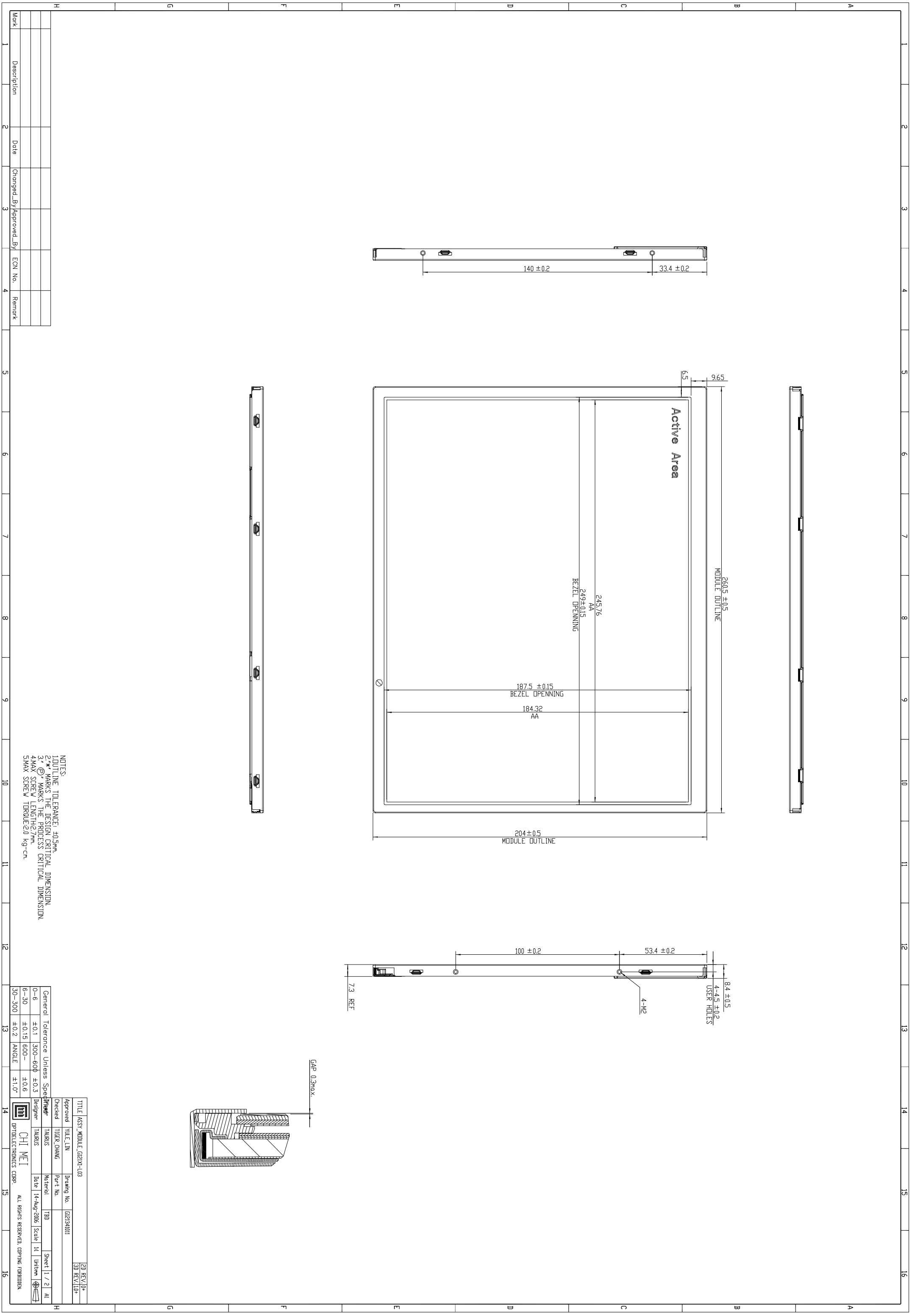
### 10.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) To assemble or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- (3) It's not permitted to have pressure or impulse on the module because the LCD panel and Backlight will be damaged.
- (4) Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.
- (5) Do not pull the I/F connector in or out while the module is operating.
- (6) Do not disassemble the module.
- (7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (8) It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.
- (9) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (10) When ambient temperature is lower than 10°C may reduce the display quality. For example, the response time will become slowly, and the starting voltage of CCFL will be higher than room temperature.
- (11) Do not keep same pattern in a long period of time. It may cause image sticking on LCD.

### 10.2 SAFETY PRECAUTIONS

- (1) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.
- (2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- (3) After the module's end of life, it is not harmful in case of normal operation and storage.





| Mark | Description | Date | Changed By/Approved By | ECN No. | Remark |
|------|-------------|------|------------------------|---------|--------|
| 1    |             |      |                        |         |        |
| 2    |             |      |                        |         |        |
| 3    |             |      |                        |         |        |
| 4    |             |      |                        |         |        |

NOTES:  
 1. OUTLINE TOLERANCE: ±0.5mm.  
 2. \* MARKS THE DESIGN CRITICAL DIMENSION.  
 3. @ MARKS THE PROCESS CRITICAL DIMENSION.  
 4. MAX SCREW LENGTH: 2.7mm.  
 5. MAX SCREW TORQUE: 2.0 kg-cm.

|                             |                            |  |             |             |             |
|-----------------------------|----------------------------|--|-------------|-------------|-------------|
| TITLE: ASSY MODULE (22X)-03 |                            | Drawing No. G21241001                    |             | 2D REV/0+   |             |
| Approved                    | TILE LIN                   | Checked                                  | TIGER CHANG | 3D REV/10+  |             |
| General                     | Tolerance Unless Specified | Part No.                                 |             |             |             |
| 0-6                         | ±0.1                       | 300-600                                  | ±0.3        | Designer    | TRAVIS      |
| 6-30                        | ±0.15                      | 600-                                     | ±0.6        | Date        | 14-Aug-2006 |
| 30-300                      | ±0.2                       | ANGLE                                    | ±1.0°       | Scale       | 1:1         |
| CHI MEI                     |                            | CHI MEI                                  |             | Sheet 1 / 2 |             |
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