



DATA DISPLAY GROUP

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# Datasheet

## G150X1-L03-V508

based on CMO G150X1-L03  
with LED backlight unit and optimized sunlight readability

CH-03-015

Rev 1.1  
2010-04-12

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## - CONTENTS -

|                                        |       |    |
|----------------------------------------|-------|----|
| REVISION HISTORY                       | ----- | 3  |
| 1. GENERAL DESCRIPTION                 | ----- | 5  |
| 1.1 OVERVIEW                           |       |    |
| 1.2 FEATURES                           |       |    |
| 1.3 APPLICATION                        |       |    |
| 1.4 GENERAL SPECIFICATIONS             |       |    |
| 1.5 MECHANICAL SPECIFICATIONS          |       |    |
| 2. ABSOLUTE MAXIMUM RATINGS            | ----- | 6  |
| 2.1 ABSOLUTE RATINGS OF ENVIRONMENT    |       |    |
| 2.2 ELECTRICAL ABSOLUTE RATINGS        |       |    |
| 2.2.1 TFT LCD MODULE                   |       |    |
| 2.2.2 BACKLIGHT UNIT                   |       |    |
| 3. ELECTRICAL CHARACTERISTICS          | ----- | 7  |
| 3.1 TFT LCD MODULE                     |       |    |
| 3.2 BACKLIGHT UNIT                     |       |    |
| 4. BLOCK DIAGRAM                       | ----- | 10 |
| 4.1 TFT LCD MODULE                     |       |    |
| 4.2 BACKLIGHT UNIT                     |       |    |
| 5. INPUT TERMINAL PIN ASSIGNMENT       | ----- | 11 |
| 5.1 TFT LCD MODULE                     |       |    |
| 5.2 BACKLIGHT UNIT                     |       |    |
| 5.3 COLOR DATA INPUT ASSIGNMENT        |       |    |
| 6. INTERFACE TIMING                    | ----- | 13 |
| 6.1 INPUT SIGNAL TIMING SPECIFICATIONS |       |    |
| 6.2 POWER ON/OFF SEQUENCE              |       |    |
| 7. OPTICAL CHARACTERISTICS             | ----- | 16 |
| 7.1 TEST CONDITIONS                    |       |    |
| 7.2 OPTICAL SPECIFICATIONS             |       |    |
| 8. PACKAGING                           | ----- | 20 |
| 8.1 PACKING SPECIFICATIONS             |       |    |
| 8.2 PACKING METHOD                     |       |    |
| 9. DEFINITION OF LABELS                | ----- | 22 |
| 10. PRECAUTIONS                        | ----- | 23 |
| 10.1 ASSEMBLY AND HANDLING PRECAUTIONS |       |    |
| 10.2 SAFETY PRECAUTIONS                |       |    |
| 10.3 OPERATION PRECAUTIONS             |       |    |
| 11. MODULE DRAWING                     | ----- | 24 |

**REVISION HISTORY**

| Version        | Date                      | Section        | Description                                                                   |
|----------------|---------------------------|----------------|-------------------------------------------------------------------------------|
| Ver 1.0<br>1.1 | Oct.8 2008<br>Apr.12 2010 | All<br>page 16 | G150X1-L03 Approval SPEC was first issued<br>optical characteristics improved |

## 1. GENERAL DESCRIPTION

### 1.1 OVERVIEW

G150X1-L03-V508 is a 15.0" TFT Liquid Crystal Display module with an LED Backlight unit and 20 pins LVDS interface. This module supports 1024 x 768 XGA mode and can display 16.2M colors.

The PSWG is to establish a set of displays with standard mechanical dimensions and select electrical interface requirements for an industry standard 15.0" XGA LCD panel and the inverter module for Backlight is not built in.

### 1.2 FEATURES

- XGA (1024 x 768 pixels) resolution
- DE(Data Enable) only mode
- LVDS Interface with 1pixel/clock
- PSWG (Panel Standardization Working Group)
- Wide operating temperature.
  
- optimized Sunlight Readability

### 1.3 APPLICATION

- TFT LCD Monitor
- TFT LCD TV
- Industrial Application
- Amusement
- Vehicle

### 1.4 GENERAL SPECIFICATIONS

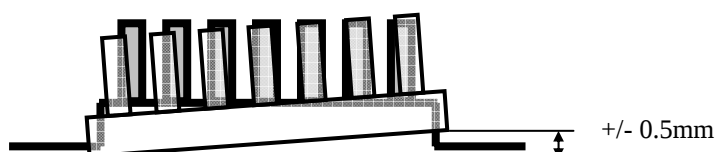
| Item               | Specification                             | Unit  | Note |
|--------------------|-------------------------------------------|-------|------|
| Active Area        | 304.128 (H) x 228.096(V) (15.0" diagonal) | mm    | (1)  |
| Bezel Opening Area | 307.4(H) x 231.3(V)                       | mm    |      |
| Driver Element     | a-Si TFT active matrix                    | -     | -    |
| Pixel Number       | 1024 x R.G.B x 768                        | pixel | -    |
| Pixel Pitch        | 0.297(H) x 0.297(W)                       | mm    | -    |
| Pixel Arrangement  | RGB vertical Stripe                       | -     | -    |
| Display Colors     | 16.2M                                     | color | -    |
| Display Mode       | Normally White                            | -     | -    |
| Surface Treatment  | Hard coating (3H), Glare                  | -     | -    |

## 1.5 MECHANICAL SPECIFICATIONS

| Item        |               | Min.  | Typ.  | Max.  | Unit | Note   |
|-------------|---------------|-------|-------|-------|------|--------|
| Module Size | Horizontal(H) | 326   | 326.5 | 327   | mm   | (1)    |
|             | Vertical(V)   | 253   | 253.5 | 254   | mm   |        |
|             | Depth(D)      | 13.35 | 13.85 | 14.35 | mm   | (1)(2) |
| Weight      |               |       | 970   | 1000  | g    | -      |

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

Note (2) The depth is without connector.



## 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 $\longleftrightarrow$ 80°C, 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)                           | 50G, 11ms, half sine wave, 1 time for $\pm X$ , $\pm Y$ , $\pm Z$ .        | (3)     |
| 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 the 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>DD</sub> | -0.3  | 4.0  | V    |      |

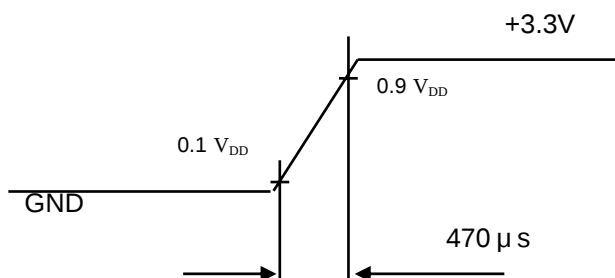
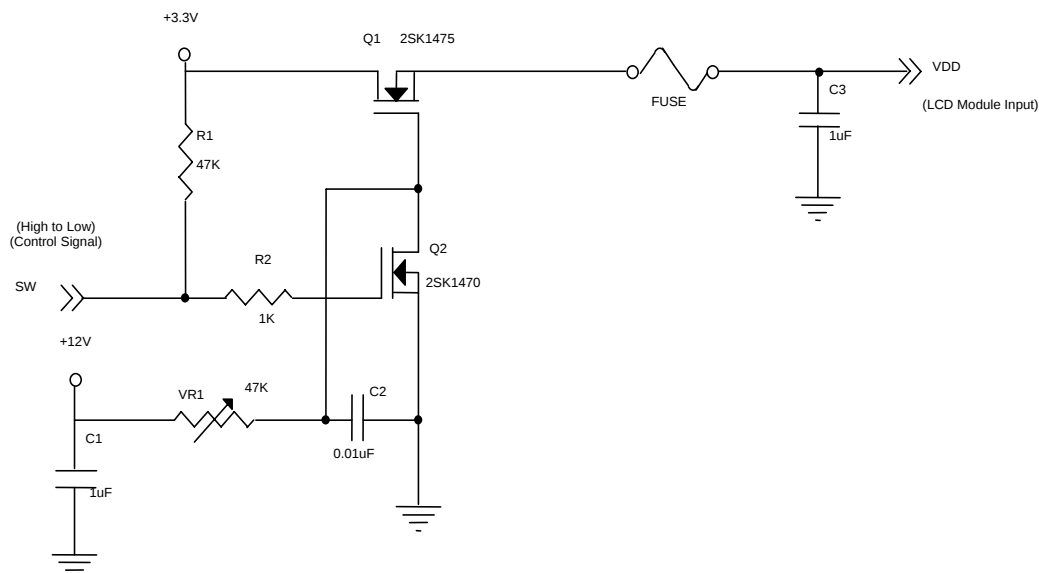
### 3. ELECTRICAL CHARACTERISTICS

#### 3.1 TFT LCD MODULE<sup>(1)</sup>

| Parameter                                              | Symbol     | Value |      |      | Unit  | Note |
|--------------------------------------------------------|------------|-------|------|------|-------|------|
|                                                        |            | Min.  | Typ. | Max. |       |      |
| Power Supply Voltage                                   | $V_{DD}$   | 3.0   | 3.3  | 3.6  | V     | -    |
| Ripple Voltage                                         | $V_{RP}$   | -     | -    | 100  | mVp-p |      |
| Rush Current                                           | $I_{RUSH}$ | -     | -    | 2.0  | A     | (2)  |
| Power Supply Current                                   | White      | -     | 500  |      | mA    | (3)a |
|                                                        | Black      | -     | 750  |      | mA    | (3)b |
| Differential Input Voltage for LVDS Receiver Threshold | "H" Level  | -     | -    | 100  | mV    | -    |
|                                                        | "L" Level  | -100  | -    | -    | mV    | -    |
| Terminating Resistor                                   | $R_T$      |       | 100  | -    | Ohm   | -    |

Note (1) The module should be always operated within above ranges.

Note (2) Measurement Conditions:



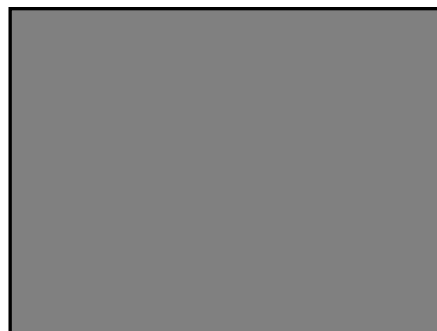
Note (3) The specified power supply current is under the conditions at  $V_{DD} = 3.3V$ ,  $T_a = 25 \pm 2 \text{ }^{\circ}C$ , DC Current and  $f_v = 60 \text{ Hz}$ , whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

b. Black Pattern



Active Area

### 3.2. Backlight Specifications

 $T_a = 25^{\circ}\text{C}$ 

| ITEM                | SYMBOL | MIN | TYP.   | MAX. | UNIT | Remarks              |
|---------------------|--------|-----|--------|------|------|----------------------|
| LED Forward Voltage | VL     | --  | 8.69   | 9.59 | V    | *1), IL = 820mA      |
| LED Forward Current | IL     | --  | --     | 820  | mA   | *2)                  |
| Power Consumption   | WL     | --  | 7.12   | --   | W    | IL = 820mA           |
| Backlight Lifetime  | BL     | --  | 50,000 | --   | h    | *3), *4), IL = 820mA |

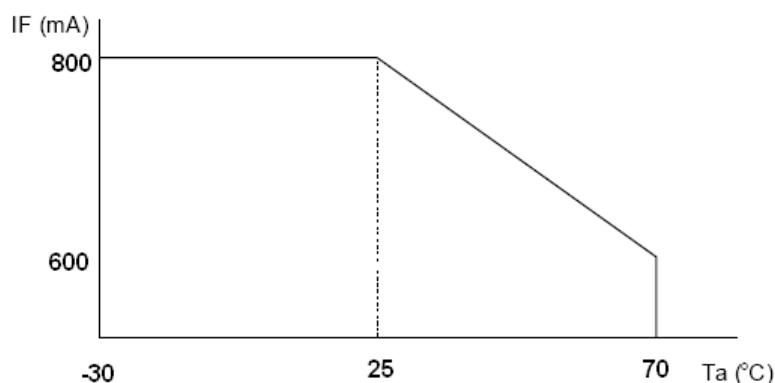
\*1) VL is specified as the sum of the white LED forward voltages.

\*2) LEDs are best driven using a constant current source. To avoid chromaticity shifts while dimming pulse-width modulation (PWM) techniques may be employed (0-100% duty cycle). IL is the current into one backlight connector (rail).

\*3) Backlight lifetime is defined as the time when the brightness becomes 50% of the initial value.

\*4) The lifetime of the backlight depends on the ambient temperature. The lifetime will decrease under high temperature unless LED forward current is reduced accordingly.

\*5) LED forward current derating curve:

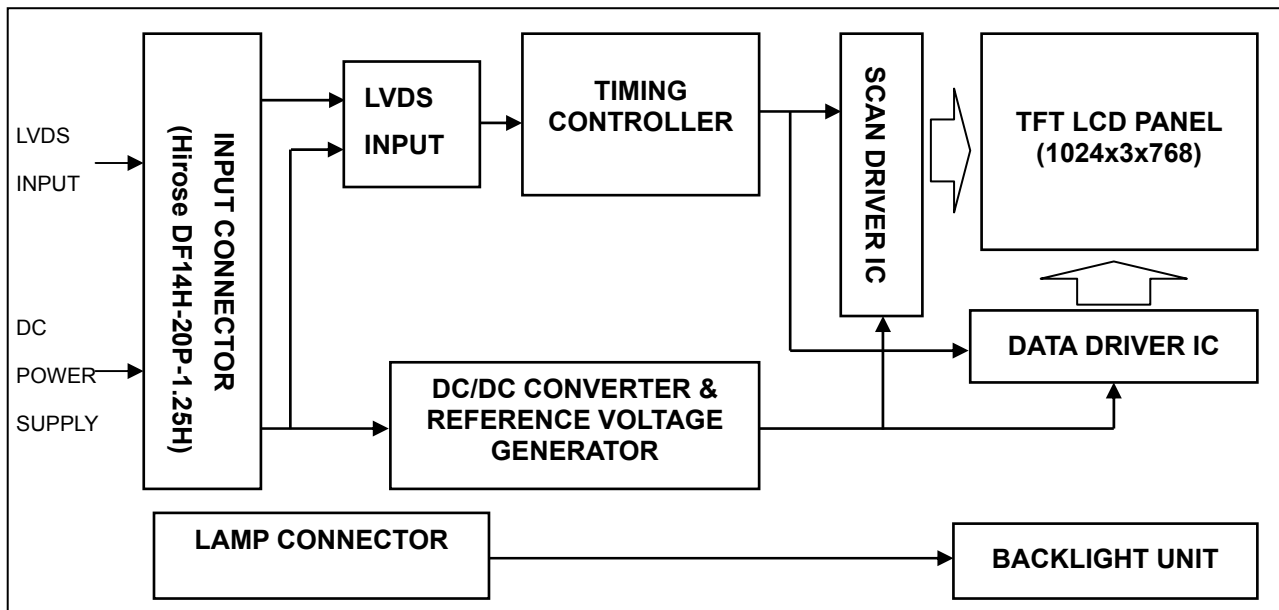


\*5) Recommended backlight power supply:

| PART NUMBER | MANUFACTURER                      |
|-------------|-----------------------------------|
| CCBR-2-800  | Apollo Display Technologies, LLC. |

## 4. BLOCK DIAGRAM

### 4.1 TFT LCD MODULE



## 5. INPUT TERMINAL PIN ASSIGNMENT

### 5.1 TFT LCD MODULE

| Pin No. | Symbol | Function                     | Polarity | Note |
|---------|--------|------------------------------|----------|------|
| 1       | VDD    | Power Supply +3.3V(typical)  |          |      |
| 2       | VDD    | Power Supply +3.3V(typical)  |          |      |
| 3       | GND    | Ground                       |          |      |
| 4       | GND    | Ground                       |          |      |
| 5       | RX0-   | LVDS Differential Data Input | Negative |      |
| 6       | RX0+   | LVDS Differential Data Input | Positive |      |
| 7       | GND    | Ground                       |          |      |
| 8       | RX1-   | LVDS Differential Data Input | Negative |      |
| 9       | RX1+   | LVDS Differential Data Input | Positive |      |
| 10      | GND    | Ground                       |          |      |
| 11      | RX2-   | LVDS Differential Data Input | Negative |      |
| 12      | RX2+   | LVDS Differential Data Input | Positive |      |
| 13      | GND    | Ground                       |          |      |
| 14      | RXCLK- | LVDS Differential Data Input | Negative |      |
| 15      | RXCLK+ | LVDS Differential Data Input | Positive |      |
| 16      | GND    | Ground                       |          |      |
| 17      | RX3-   | LVDS Differential Data Input | Negative |      |
| 18      | RX3+   | LVDS Differential Data Input | Positive |      |
| 19      | GND    | Ground                       |          |      |
| 20      | NC     | tied to ground               |          |      |

(1)Connector Part No.: [Hirose] DF14H-20P-1.25H

(2)Matching socket Part No.: [Hirose] DF14-20S-1.25C

### 5.2 BACKLIGHT UNIT

| Pin | Symbol | Description | Color |
|-----|--------|-------------|-------|
| 1   | HV     | Voltage     | Red   |
| 2   | LV     | Ground      | Black |

Note (1) Connector Part No.: 22-01-3027 (Molex)

Note (2) Matching Connector Part No.: 22-05-3021 (Molex)

Note (3) : VL = HV - LV

### 5.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-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 |    |    |    |    |    |    |    |
|                     |                | R7          | R6 | R5 | R4 | R3 | R2 | R1 | R0 | R7    | R6 | G5 | G4 | G3 | G2 | G1 | G0 | R7   | R6 | 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  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red            | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green          | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Blue           | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Cyan           | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Magenta        | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Yellow         | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 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  | 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  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red(1)         | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red(2)         | 0           | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | .              | .           | .  | .  | .  | .  | .  | .  | .  | .     | .  | .  | .  | .  | .  | .  | .  | .    | .  | .  | .  | .  | .  | .  | .  |
|                     | .              | .           | .  | .  | .  | .  | .  | .  | .  | .     | .  | .  | .  | .  | .  | .  | .  | .    | .  | .  | .  | .  | .  | .  | .  |
|                     | Red(252)       | 1           | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red(252)       | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red(252)       | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 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  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green(1)       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green(2)       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | .              | .           | .  | .  | .  | .  | .  | .  | .  | .     | .  | .  | .  | .  | .  | .  | .  | .    | .  | .  | .  | .  | .  | .  | .  |
|                     | .              | .           | .  | .  | .  | .  | .  | .  | .  | .     | .  | .  | .  | .  | .  | .  | .  | .    | .  | .  | .  | .  | .  | .  | .  |
|                     | Green(252)     | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green(252)     | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green(252)     | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 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  | 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    | 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  | 0    | 0  | 0  | 0  | 0  | 1  | 0  | 0  |
|                     | .              | .           | .  | .  | .  | .  | .  | .  | .  | .     | .  | .  | .  | .  | .  | .  | .  | .    | .  | .  | .  | .  | .  | .  | .  |
|                     | .              | .           | .  | .  | .  | .  | .  | .  | .  | .     | .  | .  | .  | .  | .  | .  | .  | .    | .  | .  | .  | .  | .  | .  | .  |
|                     | Blue(252)      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 0  | 1  |
|                     | Blue(252)      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 0  |
|                     | Blue(252)      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |

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

## 6. INTERFACE TIMING

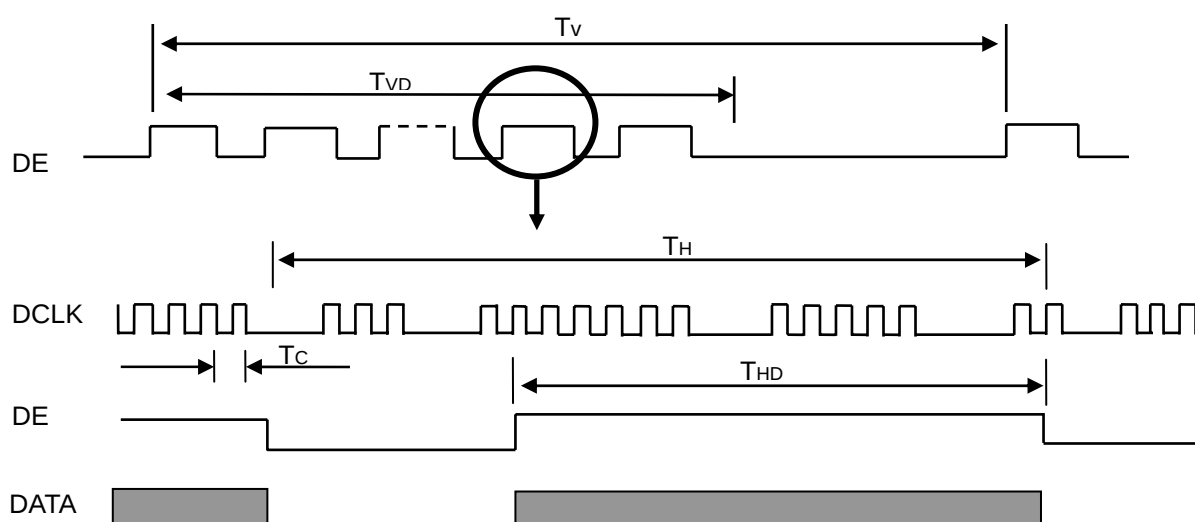
### 6.1 INPUT SIGNAL TIMING SPECIFICATIONS

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

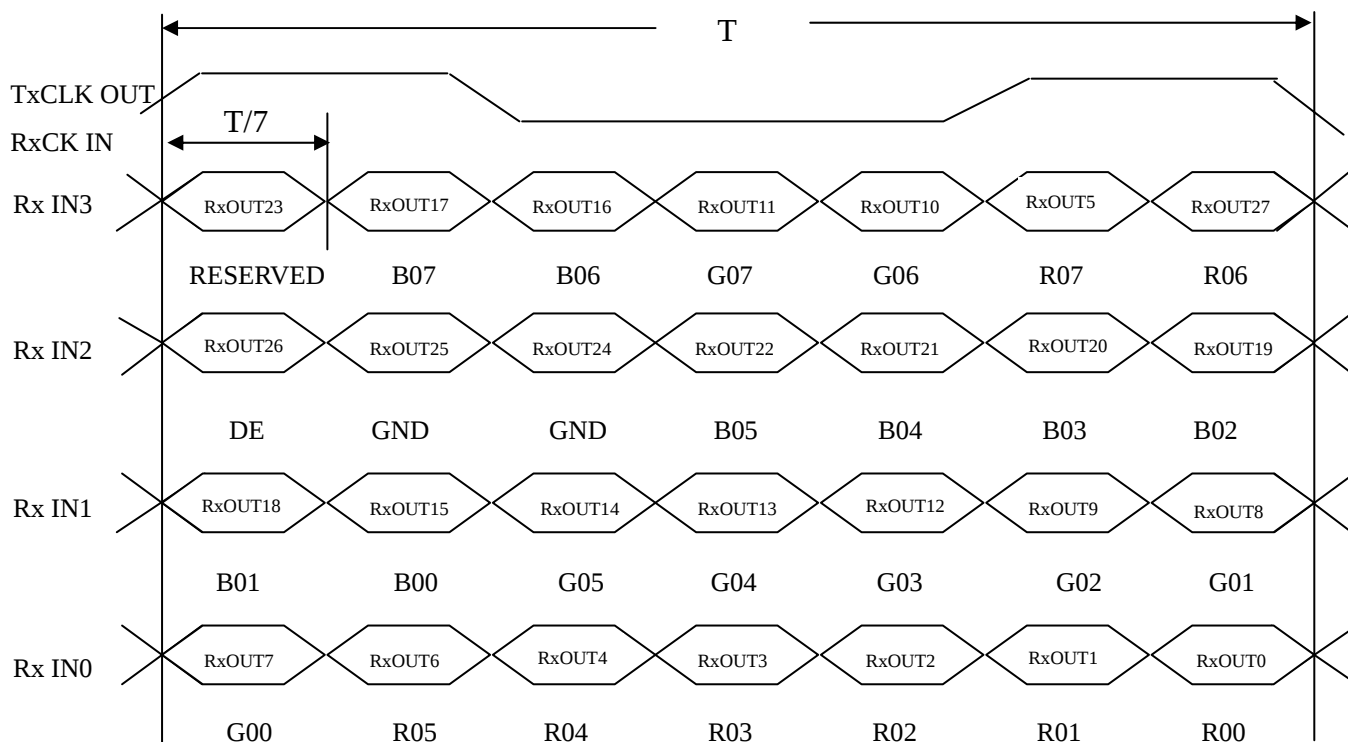
| Signal | Item                    | Symbol   | Min. | Typ. | Max. | Unit  | Note |
|--------|-------------------------|----------|------|------|------|-------|------|
| DCLK   | Pixel Clock             | $1/T_C$  | -    | 65   | 80   | MHz   | -    |
| DE     | Vertical Total Time     | $T_V$    | 780  | 806  | 1200 | $T_H$ | -    |
|        | Vertical Address Time   | $T_{VD}$ | 768  | 768  | 768  | $T_H$ | -    |
|        | Horizontal Total Time   | $T_H$    | 1140 | 1344 | 1600 | $T_C$ | -    |
|        | Horizontal Address Time | $T_{HD}$ | 1024 | 1024 | 1024 | $T_C$ | -    |

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.

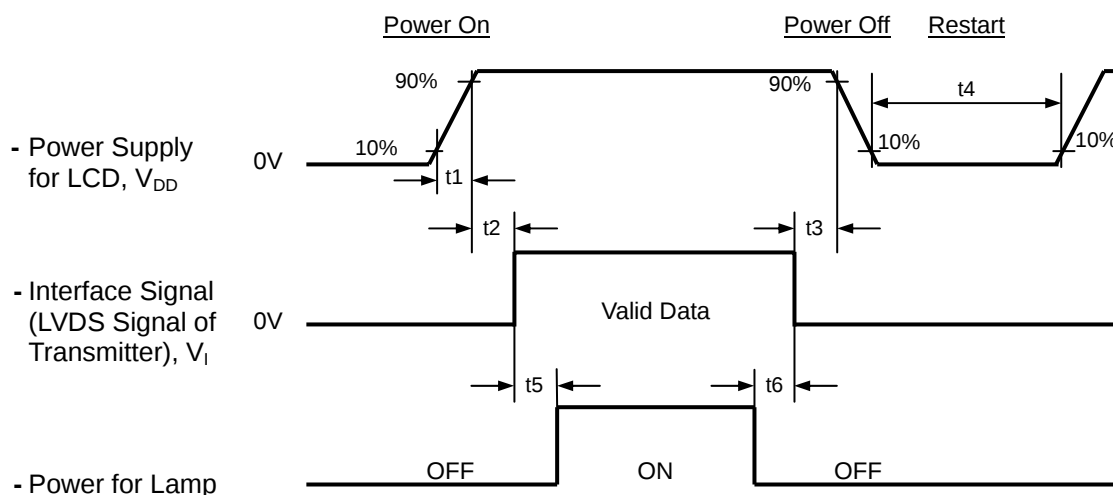
#### INPUT SIGNAL TIMING DIAGRAM



### TIMING DIAGRAM of LVDS



## 6.2 POWER ON/OFF SEQUENCE



### Timing Specifications:

|            |          |
|------------|----------|
| $0.5 < t1$ | 10 msec  |
| $0 < t2$   | 50 msec  |
| $0 < t3$   | 50 msec  |
| $t4$       | 500 msec |
| $t5$       | 200 msec |
| $t6$       | 200 msec |

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  $V_{DD}$  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.

## 7. OPTICAL CHARACTERISTICS

### 7.1 TEST CONDITIONS

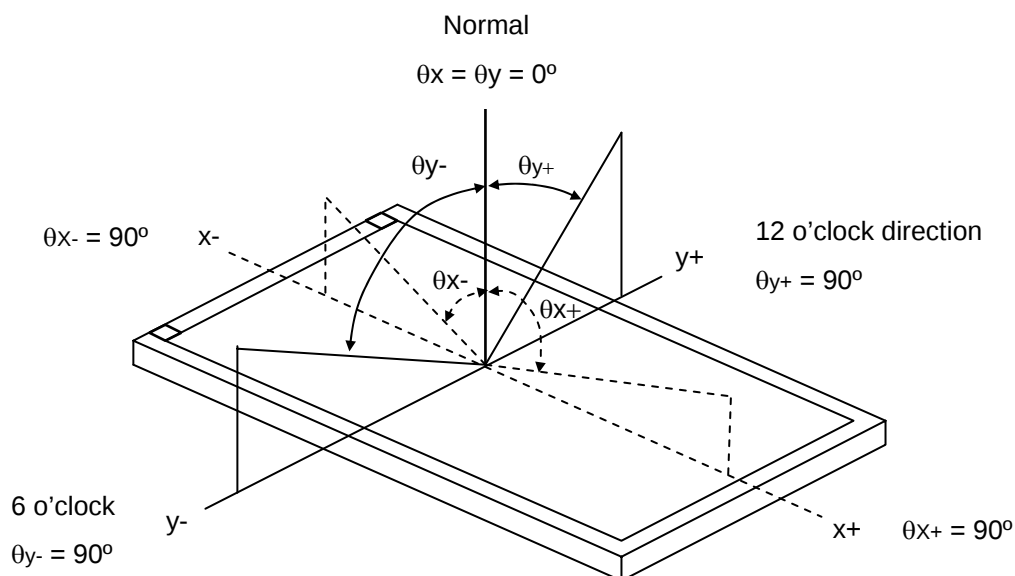
| Item                | Symbol                                                        | Value | Unit |
|---------------------|---------------------------------------------------------------|-------|------|
| Ambient Temperature | T <sub>a</sub>                                                | 25±2  | °C   |
| Ambient Humidity    | H <sub>a</sub>                                                | 50±10 | %RH  |
| Supply Voltage      | V <sub>DD</sub>                                               | 3.3   | V    |
| Input Signal        | According to typical value in "3. ELECTRICAL CHARACTERISTICS" |       |      |
| LED Rail Current    | I <sub>L</sub>                                                | 820   | mA   |
| LED Driver          | CCBR - 2 - 800                                                |       |      |

The measurement methods of optical characteristics are shown in Section 7.2. The following items should be measured under the test conditions described in Section 7.1 and stable environment shown in Note (4).

### 7.2 OPTICAL SPECIFICATIONS

| Item                              |            | Symbol           | Condition                                                    | Min.      | Typ.  | Max.      | Unit | Note     |
|-----------------------------------|------------|------------------|--------------------------------------------------------------|-----------|-------|-----------|------|----------|
| Contrast Ratio                    |            | CR               | $\theta_x=0^\circ, \theta_Y=0^\circ$<br>Viewing Normal Angle | 480       | 700   |           | -    | (2), (4) |
| Response Time                     |            | T <sub>R</sub>   |                                                              | -         | 8     | 13        | ms   | (3)      |
|                                   |            | T <sub>F</sub>   |                                                              | -         | 17    | 22        | ms   |          |
| Luminance of White (Center point) |            | L                |                                                              | 800       | 1000  | -         | cd/m | (4),(5)  |
| White Variation                   |            | δW               |                                                              | -         | 1.25  | 1.4       | -    | (4),(5)  |
| Color Chromaticity                | Red        | R <sub>x</sub>   |                                                              | Typ+ 0.03 | 0.617 | Typ+ 0.03 | -    | (1), (4) |
|                                   |            | R <sub>y</sub>   |                                                              |           | 0.345 |           | -    |          |
|                                   | Green      | G <sub>x</sub>   |                                                              |           | 0.315 |           | -    |          |
|                                   |            | G <sub>y</sub>   |                                                              |           | 0.575 |           | -    |          |
|                                   | Blue       | B <sub>x</sub>   |                                                              |           | 0.145 |           | -    |          |
|                                   |            | B <sub>y</sub>   |                                                              |           | 0.110 |           | -    |          |
|                                   | White      | W <sub>x</sub>   |                                                              |           | 0.313 |           | -    |          |
|                                   |            | W <sub>y</sub>   |                                                              |           | 0.329 |           | -    |          |
| Viewing Angle                     | Horizontal | θ <sub>x</sub> + | CR≥10                                                        | 70        | 80    | -         | Deg. |          |
|                                   |            | θ <sub>x</sub> - |                                                              | 70        | 80    | -         |      |          |
|                                   | Vertical   | θ <sub>y</sub> + |                                                              | 70        | 80    | -         |      |          |
|                                   |            | θ <sub>y</sub> - |                                                              | 70        | 80    | -         |      |          |
| Contrast Ratio in daylight        |            | CR               | Sun lamp                                                     | 50        | 70    |           |      | (6)      |

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.

$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

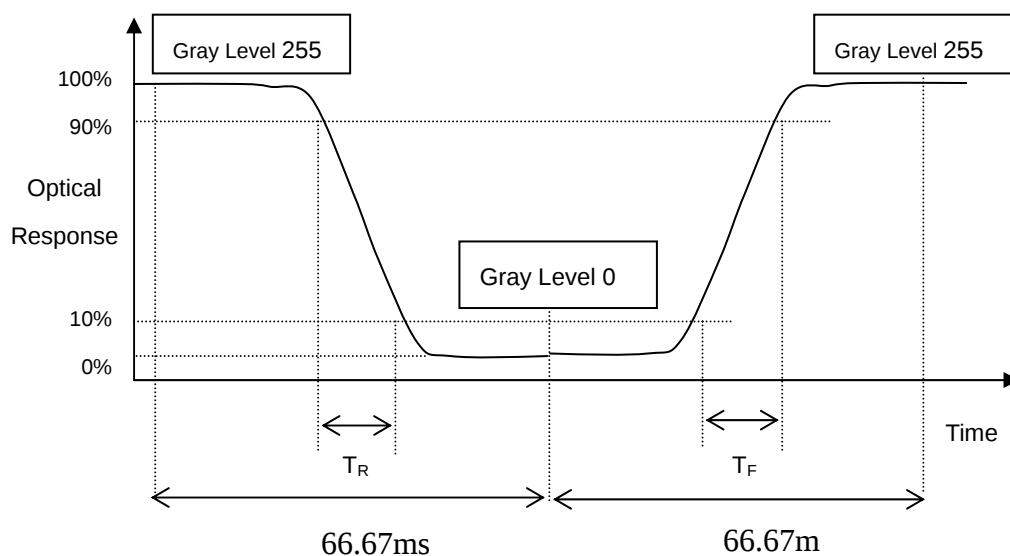
L255: Luminance of gray level 255

L 0: Luminance of gray level 0

$$\text{CR} = \text{CR (1)}$$

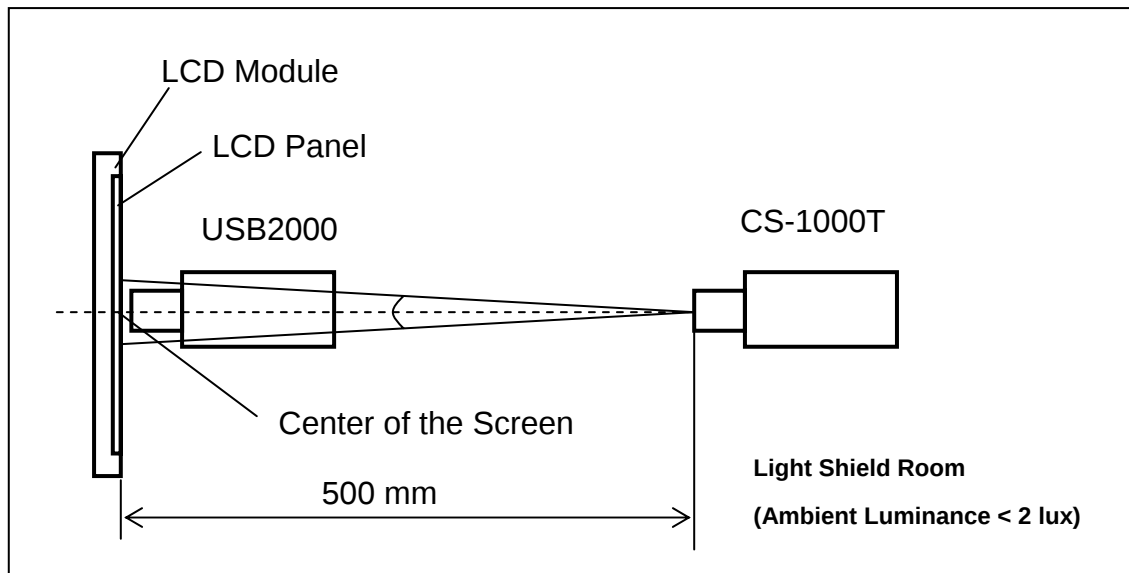
CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (5).

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



Note (4) Measurement Setup:

The LCD module should be stabilized at given temperature for 15 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



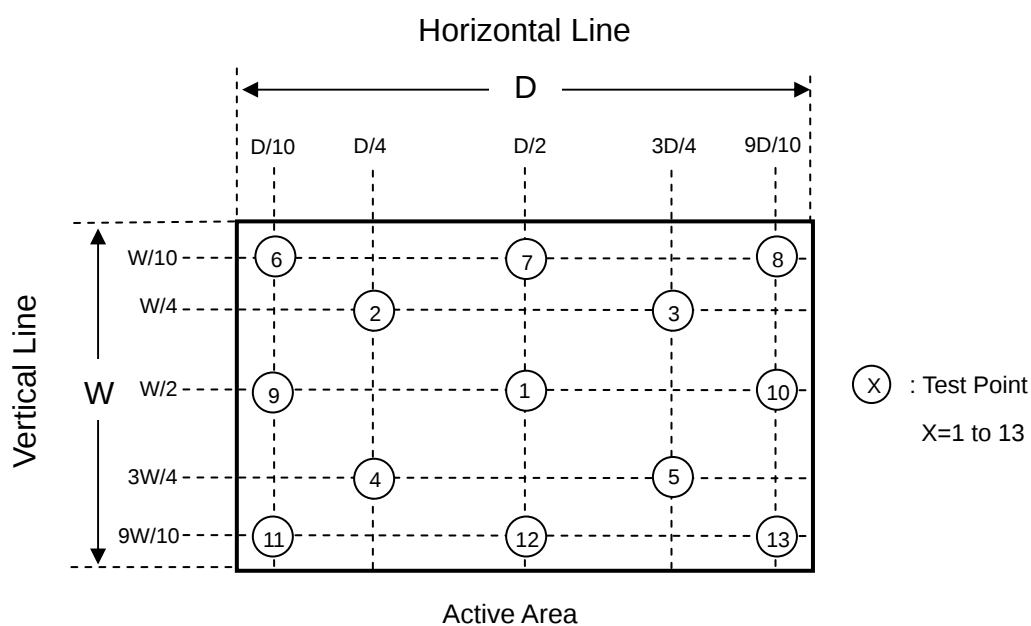
Note (5) Definition of luminance measured points:

Measure the luminance of gray level 255 at point L(1)

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

Measure the luminance of gray level 255 at 9 points

$$\delta W = \frac{\text{Maximum [L (1), L (6), L (7), L (8), L (9), L (10), L (11), L (12), L (13)]}}{\text{Minimum [L (1), L (6), L (7), L (8), L (9), L (10), L (11), L (12), L (13)]}}$$

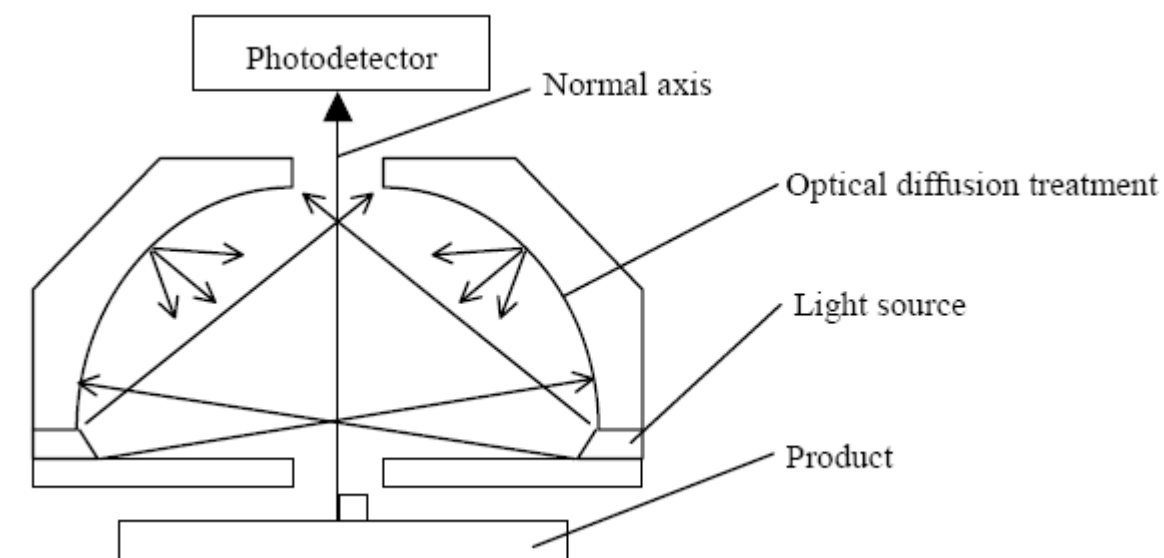


Note (6) Contrast Ratio in daylight:

Measuring method:

Sun lamp:10000 Lux

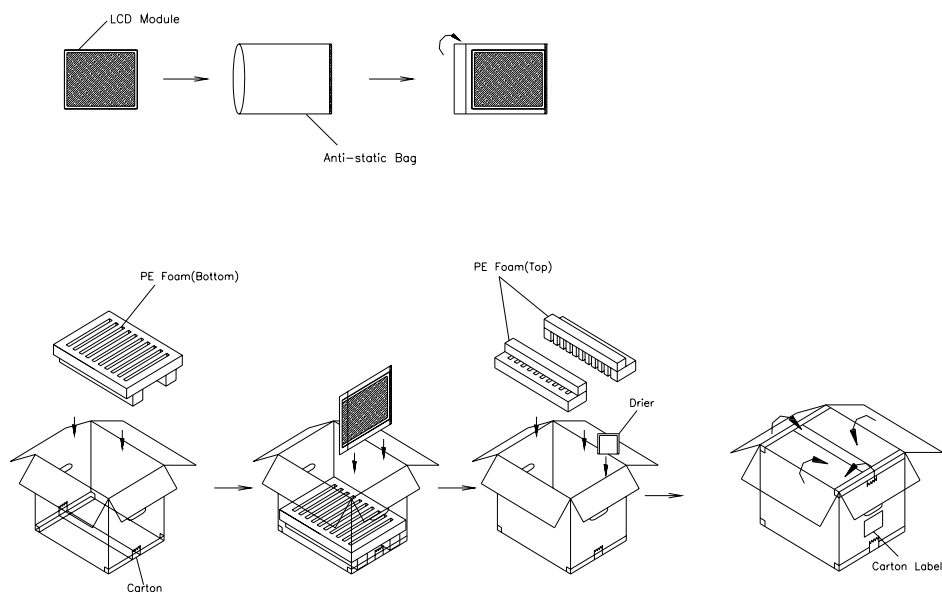
Contrast Ratio in daylight=Luminance of white screen/ Luminance of black screen



## 8. PACKAGING

### 8.1 PACKING SPECIFICATIONS

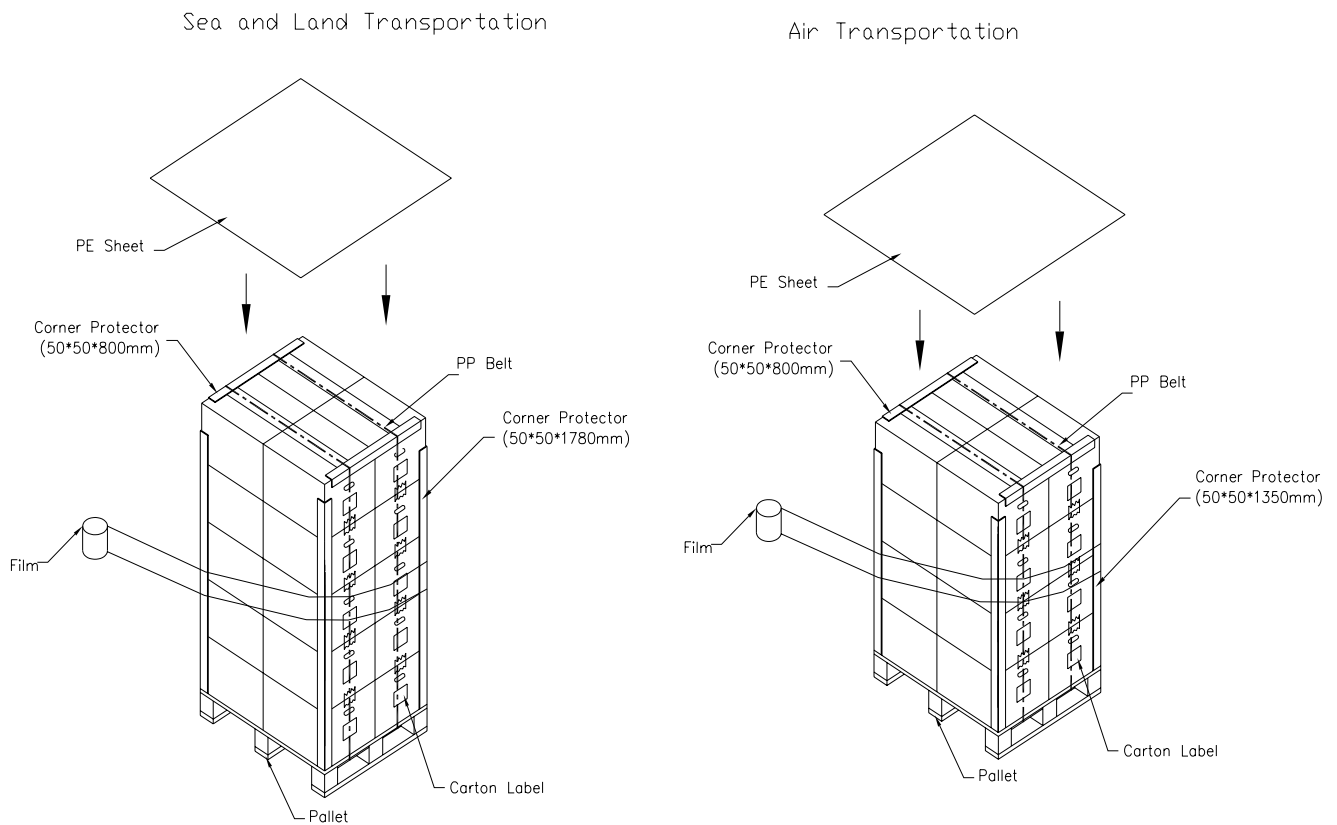
- (1) 10 LCD modules / 1 Box
- (2) Box dimensions : 511(L) X 420(W) X 360(H) mm
- (3) Weight : approximately 13Kg ( 10 modules per box)



- (1) 10 modules/1 box
- (2) Carton dimensions : 511(L)x420(W)x360(H)mm
- (3) Weight : approximately 12.7kg(10 modules per box).

Figures 8-1

## 8.2 PACKING Method

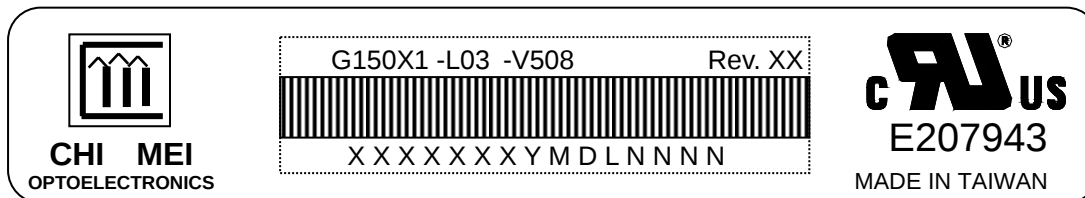


Figures 8-2

## 9. DEFINITION OF LABELS

### 9.1 CMO MODULE LABEL

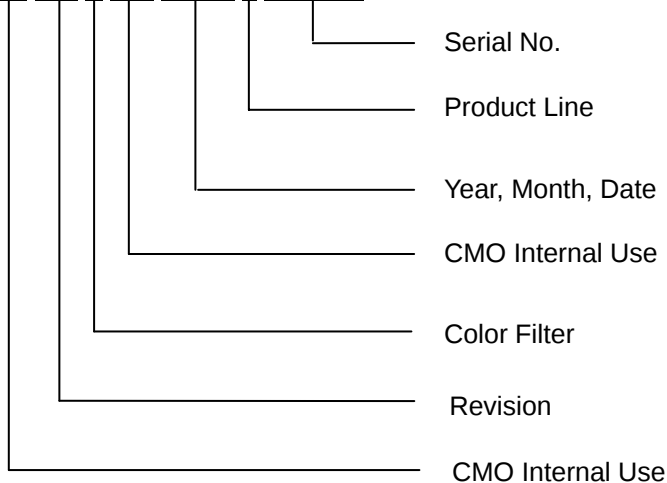
The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



(a) Model Name: G150X1 –L01

(b) Revision: Rev. XX, for example: C1, C2 ...etc.

(c) Serial ID: X X X X X X Y M D L N N N N



Serial ID includes the information as below:

(a) Manufactured Date: Year: 1~9, for 2000~2009

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 and O

(b) Revision Code: cover all the change

(c) Color Filter: 0 ->CMO, 2 -> Toppan

(d) Serial No.: Manufacturing sequence of product

(e) Product Line: 1 -> Line1, 2 -> Line 2, ...etc.

## 10. PRECAUTIONS

### 10.1 HANDLING PRECAUTIONS

- (1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.
- (2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.
- (3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.
- (5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.
- (6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.
- (7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.
- (8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.
- (9) Do not disassemble the module.
- (10) Do not pull the lamp wire.
- (11) Pins of I/F connector should not be touched directly with bare hands.
- (12) Do not keep same pattern in a long period of time. It may cause image sticking on LCD.

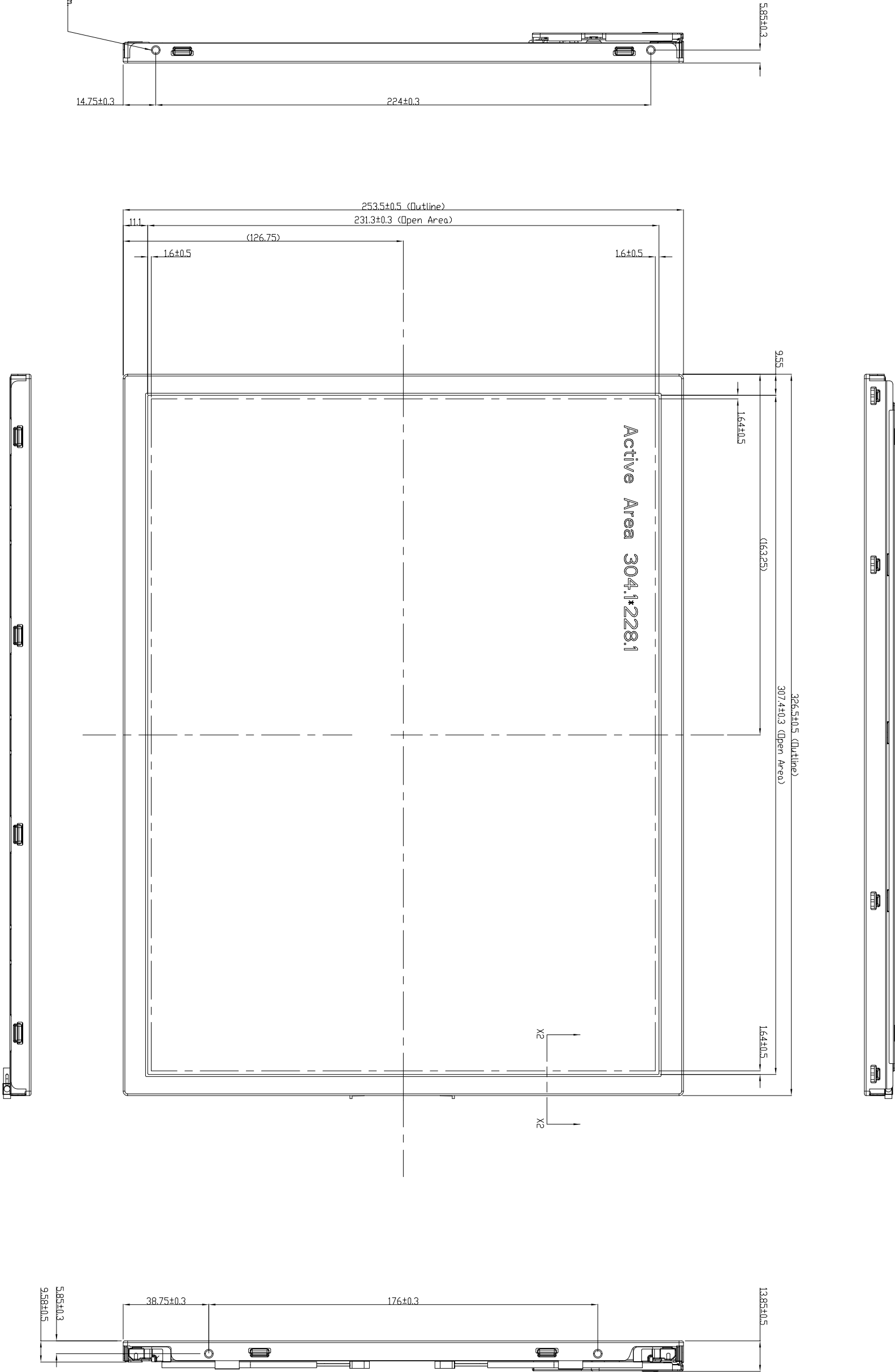
### 10.2 STORAGE PRECAUTIONS

- (1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.
- (3) It may reduce the display quality if the ambient temperature is lower than 10 °C. For example, the response time will become slowly, and the starting voltage of lamp will be higher than the room temperature.

### 10.3 OPERATION PRECAUTIONS

- (1) Do not pull the I/F connector in or out while the module is operating.
- (2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.

Do not disassemble the module or insert anything into the Backlight unit.



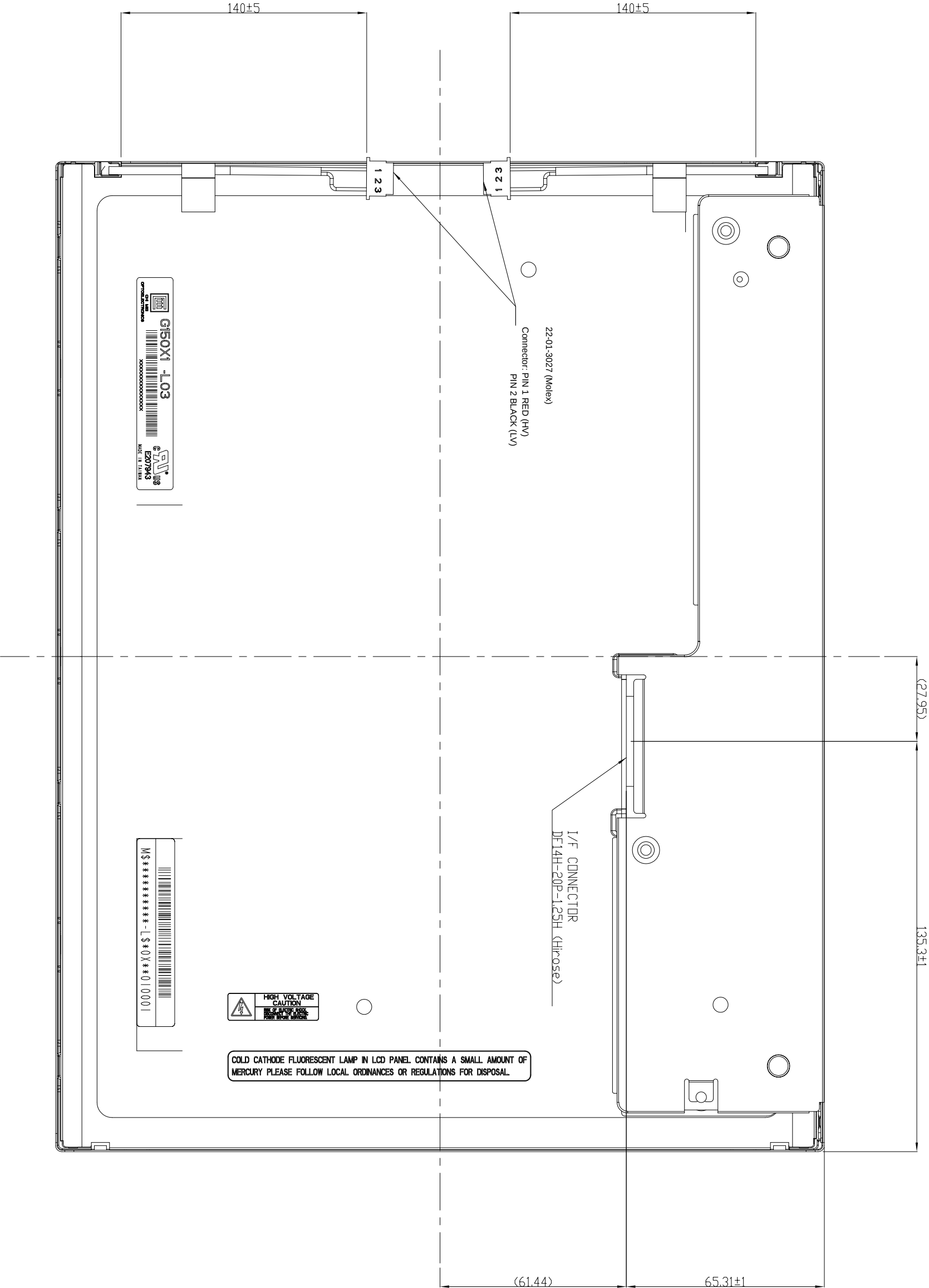
NOTE:  
1. OUTLINE TOLERANCE±0.5mm,  
2. I/F CONNECTOR: DJ14H-20P-1.25H (Hirose)  
3. LAMP CONNECTOR: BHR-03VS-1 (LST)

| Work | Description | Date | Changed_By | Approved_By | ECN No. | Remark |
|------|-------------|------|------------|-------------|---------|--------|
| 1    |             |      |            |             |         |        |
| 2    |             |      |            |             |         |        |
| 3    |             |      |            |             |         |        |
| 4    |             |      |            |             |         |        |

SECTION X2-X2  
SCALE S1

|                              |             |             |             |            |          |
|------------------------------|-------------|-------------|-------------|------------|----------|
| TITLE ASSY MODULE_GIS0X1-L03 |             |             |             | 2D REV/A   |          |
| Approved                     | TIGER CHANG | Drawing No. | GIS04102A   | 3D REV/HS+ |          |
| Checked                      | JANNA PAN   | Part No.    | 1B0         |            |          |
| Drawer                       | TIBBAS WANG | Material    | 1B0         | Sheet      | 1 / 2 AI |
| Designer                     | TIBBAS WANG | Date        | 10-Dec-2007 | Scale      | 1:1      |
|                              |             |             |             | Unit/mm    |          |

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|                                |             |              |             |
|--------------------------------|-------------|--------------|-------------|
| TITLE ASSY_MODULE E_GI50X1-L03 |             | 2D REV.1 B   |             |
| Approved TIGER CHANG           |             | 3D REV.1.15+ |             |
| Checked                        | AMDNA PAN   | Part No.     | GI5014102B  |
| Drawer                         | TDOBAS WANG | Material     | TBD         |
| Designer                       | TDOBAS WANG | Date         | 10-Dec-2007 |
|                                |             | Scale        | 1:1         |
|                                |             | Sheet        | 2 / 2       |
|                                |             | Unit/mm      | A2          |

NOTE:  
1.DUTLINE TOLERANCE:±0.5mm,  
2.I/F CONNECTOR: DF14H-20P-1.25H (Hirose)  
3.LAMP CONNECTOR: BHR-03VS-1 (JST)

|      |             |      |            |             |         |        |
|------|-------------|------|------------|-------------|---------|--------|
| Mark | Description | Date | Changed_By | Approved_By | ECN No. | Remark |
| 1    |             |      |            |             |         |        |
|      |             |      |            |             |         |        |
|      |             |      |            |             |         |        |
|      |             |      |            |             |         |        |



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