

TFT LCD Approval Specification

MODEL NO.: G104V1-T01

Customer: _____

Approved by: _____

Note:

| 記錄 | 工作 | 審核 | 角色 | 投票 |
|----------------------------|---------------------------------|--------------------------------------|----------|--------|
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REVISION HISTORY

| Version | Date | Section | Description |
|----------------|-------------|----------------|---|
| Ver 2.0 | Nov.07. 05 | All | G104V1-T01 Specifications was first issued. |
| Ver 2.1 | Aug.09 . 06 | 2.1 | ABSOLUTE RATINGS OF ENVIRONMENT 1.Change the Operation Temp. |

1. GENERAL DESCRIPTION

1.1 OVERVIEW

G104V1-T01 is an 10.4 inch TFT Liquid Crystal Display module with a 2-CCFL Backlight unit and a-31-pin-and-1ch-TTL interface. This module supports 640 x 480 VGA mode and can display 262,144 colors. The inverter module for Backlight is not built in.

1.2 FEATURES

- Wide viewing angle.
- High contrast ratio
- Fast response time
- High color saturation
- VGA (640 x 480 pixels) resolution
- Wide operating temperature
- DE (Data Enable) mode
- CMOS/TTL (Transistor –Transistor Logic) Interface
- Reversible - scan function

1.3 APPLICATION

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

1.4 GENERAL SPECIFICATIONS

| Item | Specification | Unit | Note |
|--------------------|----------------------------------|-------|------|
| Diagonal Size | 264.0 (10.4 inch) | mm | |
| Active Area | 211.2x158.4 | mm | (1) |
| Bezel Opening Area | 215.4x161.8 | mm | |
| Driver Element | a-si TFT active matrix | - | - |
| Pixel Number | 640xR.G.B.x480 | pixel | - |
| Pixel Pitch | 0.33x0.33 | mm | - |
| Pixel Arrangement | RGB vertical stripe | - | - |
| Display Colors | 262,144 | color | - |
| Display Mode | Normally Black | - | - |
| Surface Treatment | Hard Coating (3H), AG (Haze 25%) | - | - |
| Weight | 470 | g | |

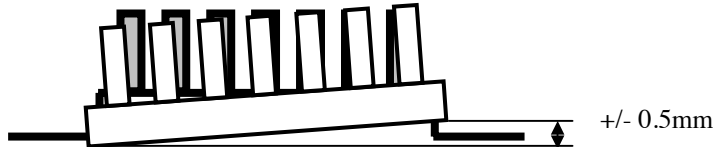
Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

1.5 MECHANICAL SPECIFICATIONS

| Item | | Min. | Typ. | Max. | Unit | Note |
|---------------------------------|---------------|--|-------|-------|------|------|
| Module Size | Horizontal(H) | 225.0 | 225.5 | 226.0 | mm | (1) |
| | Vertical(V) | 175.8 | 176.3 | 176.8 | mm | |
| | Depth(D) | - | 9.5 | 10.0 | mm | |
| 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.

Note (2) Connector mounting position



2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

| No. | Test Item | Test Condition | Note |
|-----|---|--|---------|
| 1 | High Temperature Storage Test | 80°C, 240 hours | (1) (2) |
| 2 | Low Temperature Storage Test | -20°C, 240 hours | |
| 3 | Thermal Shock Storage Test | -20°C, 0.5hour \longleftrightarrow 80°C, 0.5hour; 100cycles, 1hour/cycle | |
| 4 | High Temperature Operation Test | 70°C, 240 hours | |
| 5 | Low Temperature Operation Test | -20°C, 240 hours | |
| 6 | High Temperature & High Humidity Operation Test | 60°C, RH 90%, 240hours | |
| 7 | Heat Cycle Operation Test | -20°C, 1hour \longleftrightarrow 70°C, 1hour; 50cycles, 4hour/cycle | |
| 8 | ESD Test (Operation) | 150pF, 330 Ω , 1sec/cycle Condition 1 : panel contact, ± 8 KV Condition 2 : panel non-contact ± 15 KV | (2) |
| 9 | Shock (Non-Operating) | 220G, 2ms, half sine wave, 1 time for $\pm X$, $\pm Y$, $\pm Z$. | (2)(3) |
| 10 | Vibration (Non-Operating) | 1.5G, 10 ~ 300 Hz, 10min/cycle, 3 cycles each X, Y, Z | (2)(3) |

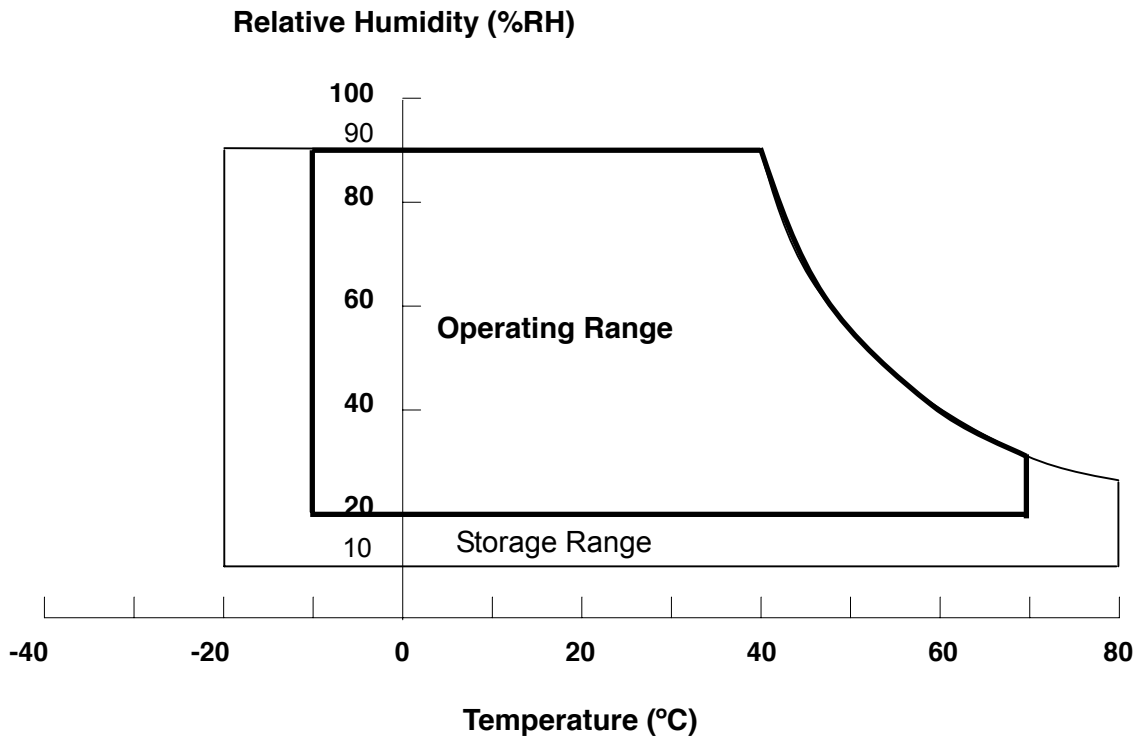
Note (1) Temperature and relative humidity range is shown in the figure below.

- (a) 90 %RH Max. ($T_a \leq 40$ °C).
- (b) Wet-bulb temperature should be 39 °C Max. ($T_a > 40$ °C).
- (c) No condensation.

Note (2) No display malfunctions.

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) The temperature of panel display surface area should be 80 °C Max.



2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

| Item | Symbol | Value | | Unit | Note |
|----------------------|-----------------|-------|-----------------------|------|------|
| | | Min. | Max. | | |
| Power Supply Voltage | V _{CC} | -0.3 | 6.0 | V | (1) |
| Logic Input Voltage | V _{IN} | -0.3 | V _{CC} + 0.3 | V | |

2.2.2 BACKLIGHT UNIT

| Item | Symbol | Value | | Unit | Note |
|----------------|----------------|-------|------|-------------------|------------------------------------|
| | | Min. | Max. | | |
| Lamp Voltage | V _L | - | 2.5K | V _{RMS} | (1), (2), I _L = (5.5)mA |
| Lamp Current | I _L | 2.0 | 6.0 | mA _{RMS} | |
| Lamp Frequency | F _L | 45 | 80 | KHZ | (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 I_L information).

3. ELECTRICAL CHARACTERISTICS

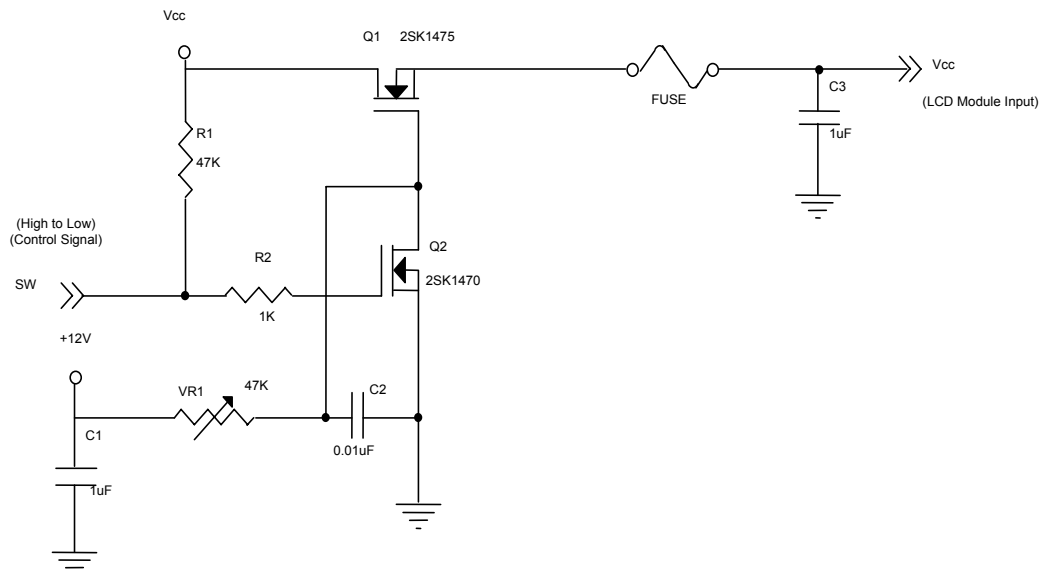
3.1 TFT LCD MODULE

Ta = 25 ± 2 °C

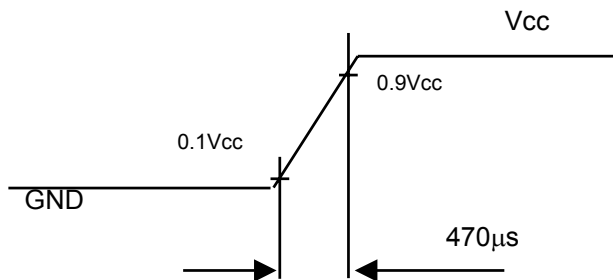
| Parameter | Symbol | Value | | | Unit | Note |
|----------------------|-------------------|--------------------|---------|--------------------|------|------|
| | | Min. | Typ. | Max. | | |
| Power Supply Voltage | V _{CC} | 3.0 | 3.3 / 5 | 5.25 | V | - |
| Ripple Voltage | V _{RP} | - | - | 100 | mV | - |
| Rush Current | I _{RUSH} | - | - | 1 | A | (2) |
| Power Supply Current | White | - | 420 | - | mA | (3)a |
| | Black | - | 380 | - | mA | (3)b |
| | Vertical Stripe | - | 470 | - | mA | (3)c |
| Logic input voltage | V _{IH} | 0.7V _{CC} | - | V _{CC} | V | |
| | V _{IL} | 0 | - | 0.3V _{CC} | V | |

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

Note (2) Measurement Conditions: V_{CC} = 3.3 V, Ta = 25 ± 2 °C.



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



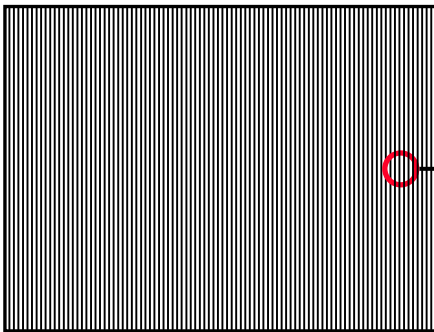
Active Area

b. Black Pattern

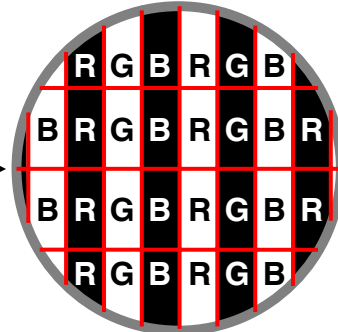


Active Area

c. Vertical Stripe Pattern



Active Area



3.2 BACKLIGHT UNIT

Ta = 25 ± 2 °C

| Parameter | Symbol | Value | | | Unit | Note |
|----------------------|-----------------|--------|------|------------|-------------------|--------------------------------|
| | | Min. | Typ. | Max. | | |
| Lamp Input Voltage | V _L | 440 | 490 | 540 | V _{RMS} | (1), I _L = (5.5) mA |
| Lamp Current | I _L | 2.0 | 5.5 | 6.0 | mA _{RMS} | (1) |
| Lamp Turn On Voltage | V _s | - | - | 770 (25°C) | V _{RMS} | (2) |
| | | - | - | 960 (0°C) | V _{RMS} | (2) |
| Operating Frequency | F _L | 45 | - | 80 | KHz | (3) |
| Lamp Life Time | L _{BL} | 50,000 | - | - | Hrs | (5) |
| Power Consumption | P _L | - | 5.39 | - | W | (4), I _L = 5.5 mA |

Note (1) I_L means the lamp current of one lamp.

Note (2) The voltage shown above should be applied to the lamp for more than 1 second after startup. Otherwise the lamp may not be turned on.

Note (3) The lamp frequency may produce interference with horizontal synchronous frequency from the display, and this may cause line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

Note (4) P_L = I_L × V_L

Note (5) The lifetime of lamp can be defined as the time in which it continues to operate under the condition Ta = 25 ± 2 °C and I_L = (5.5) mArms until one of the following events occurs:

(a) When the brightness becomes or lower than 50% of its original value.

(b) When the effective ignition length becomes or lower than 80% of its original value. (Effective ignition length is defined as an area that has less than 70% brightness compared to the brightness in the center point.)

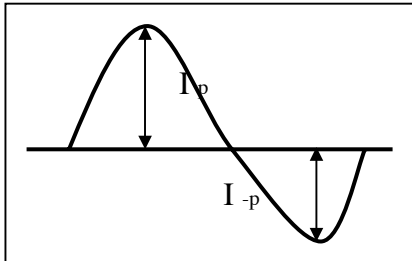
Note (6) The waveform of the voltage output of inverter must be area-symmetric and the design of the inverter must have specifications for the modularized lamp. The performance of the Backlight, such as lifetime or brightness, is greatly influenced by the characteristics of the DC-AC inverter for the lamp. All the parameters of an inverter should be carefully designed to avoid producing too much current leakage from high voltage output of the inverter. When designing or ordering the inverter please make sure that a poor lighting caused by the mismatch of the Backlight and the inverter (miss-lighting, flicker, etc.) never occurs. If the above situation is confirmed, the module should be operated in the same manners when it is installed in your instrument.

The output of the inverter must have symmetrical (negative and positive) voltage waveform and symmetrical current waveform.(Unsymmetrical ratio is less than 10%) Please do not use the inverter which has unsymmetrical voltage and unsymmetrical current and spike wave. Lamp frequency may produce interface with horizontal synchronous frequency and as a result this may cause beat on the display. Therefore lamp frequency shall be as away possible from the horizontal synchronous frequency and from its harmonics in order to prevent interference.

Requirements for a system inverter design, which is intended to have a better display performance, a

better power efficiency and a more reliable lamp. It shall help increase the lamp lifetime and reduce its leakage current.

- a. The asymmetry rate of the inverter waveform should be 10% below;
- b. The distortion rate of the waveform should be within $\sqrt{2} \pm 10\%$;
- c. The ideal sine wave form shall be symmetric in positive and negative polarities.



* Asymmetry rate:

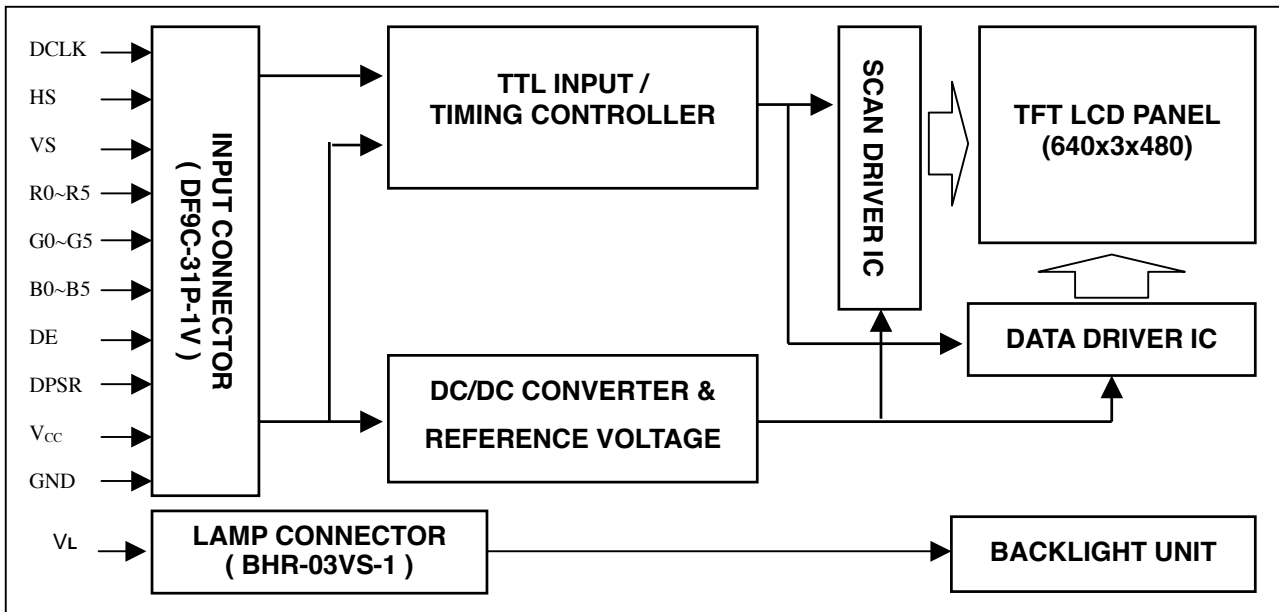
$$| I_p - I_{-p} | / I_{rms} * 100\%$$

* Distortion rate

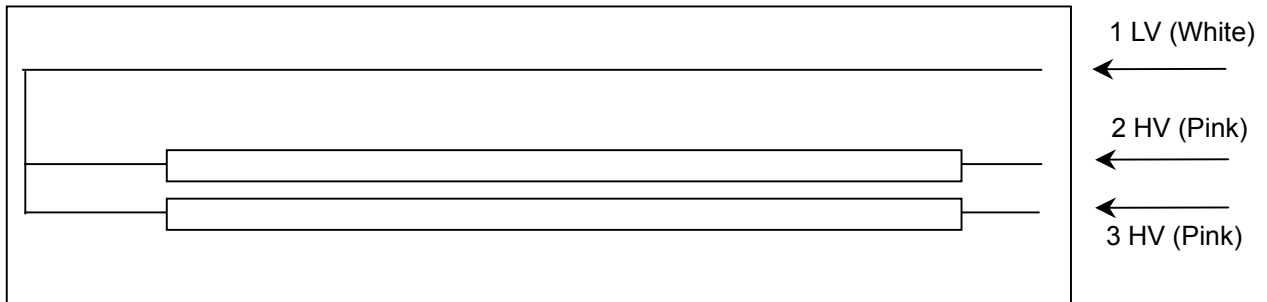
$$I_p \text{ (or } I_{-p}) / I_{rms}$$

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 |
|-----|------|------------------------------------|
| 1 | GND | Ground |
| 2 | DCLK | Dot clock |
| 3 | HS | Horizontal synchronous |
| 4 | VS | Vertical synchronous |
| 5 | GND | Ground |
| 6 | R0 | Red data (LSB) |
| 7 | R1 | Red data |
| 8 | R2 | Red data |
| 9 | R3 | Red data |
| 10 | R4 | Red data |
| 11 | R5 | Red data (MSB) |
| 12 | GND | Ground |
| 13 | G0 | Green data (LSB) |
| 14 | G1 | Green data |
| 15 | G2 | Green data |
| 16 | G3 | Green data |
| 17 | G4 | Green data |
| 18 | G5 | Green data (MSB) |
| 19 | GND | Ground |
| 20 | B0 | Blue data (LSB) |
| 21 | B1 | Blue data |
| 22 | B2 | Blue data |
| 23 | B3 | Blue data |
| 24 | B4 | Blue data |
| 25 | B5 | Blue data (MSB) |
| 26 | GND | Ground |
| 27 | DE | Data enable signal |
| 28 | Vcc | Power supply |
| 29 | Vcc | Power supply |
| 30 | N.C. | Reserved, please keep it floating. |
| 31 | DPSR | Selection of scan direction |

Note (1) Connector Part No.: DF 9C-31P-1V or equivalent.

5.2 SCANNING DIRECTION

The following figures are seen from a front view and the arrow shows the direction of scan.

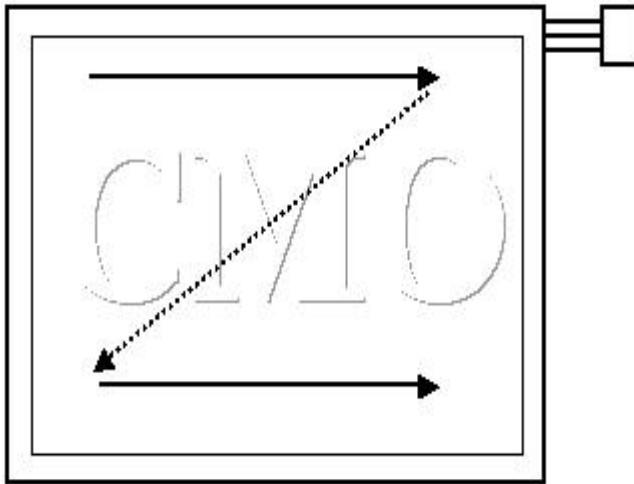


Figure1.Normal scan (DPSR : Low or Open)

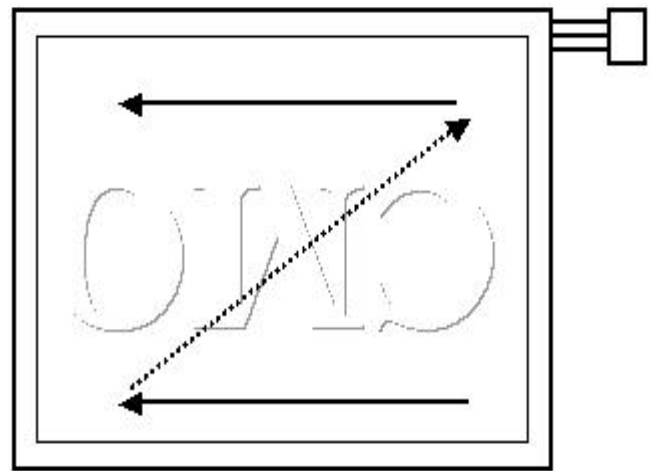


Figure 2. Reverse scan (DPSR : High)

5.3 BACKLIGHT UNIT

| Pin | Symbol | Description | Remark |
|-----|--------|--------------|--------|
| 1 | LV | Ground | White |
| 2 | HV1 | High Voltage | Pink |
| 3 | HV2 | High Voltage | Pink |

Note (1) Connector Part No.: BHR-03VS-1 (J.S.T Mfg,Co,Ltd)

5.4 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 | 1 | 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 | 1 | 0 | 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

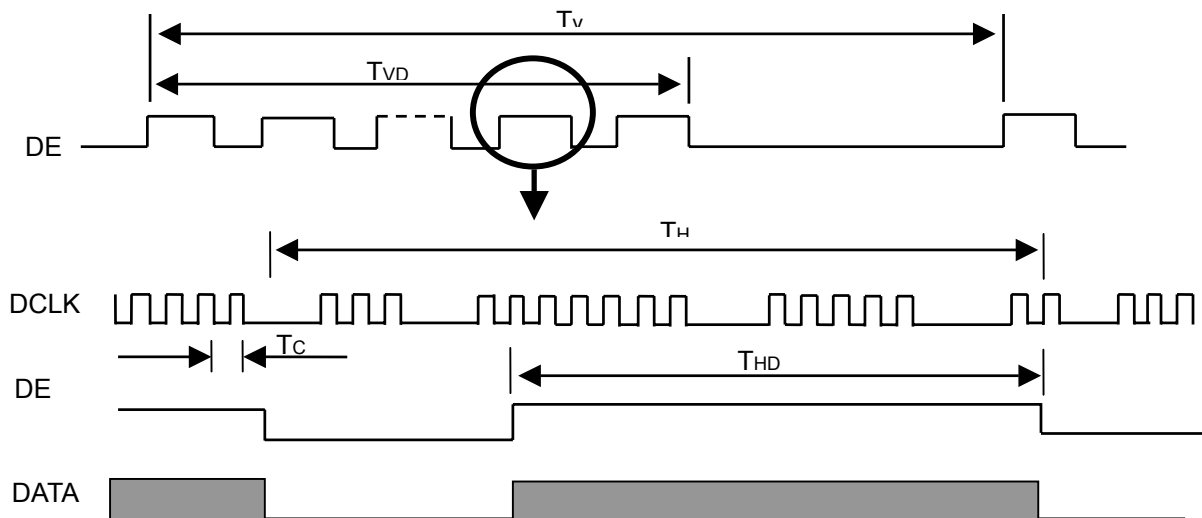
6. INTERFACE TIMING

6.1 INPUT SIGNAL TIMING SPECIFICATIONS

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

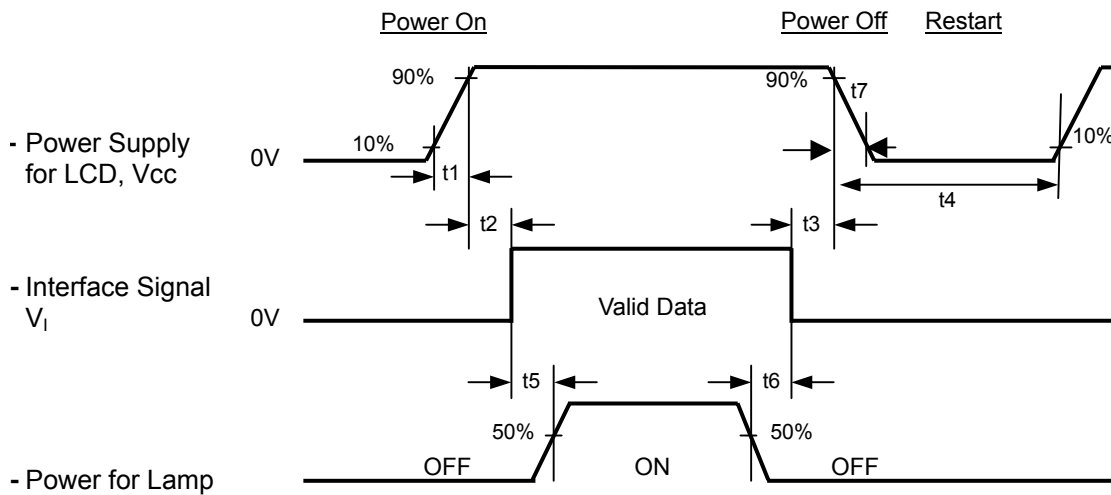
| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|--------------------------------|------------|--------|------|--------|--------|------|------------|
| Dot Clock | Frequency | Fc | 21 | 25.175 | 29 | MHz | - |
| | Duty | | 0.4 | 0.5 | 0.6 | | |
| Dot Data | Setup Time | Tlvs | 8 | - | - | ns | - |
| | Hold Time | Tlvh | 12 | - | - | ns | - |
| Vertical Active Display Term | Frame Rate | Fr | - | 60 | - | Hz | Tv=Tvd+Tvb |
| | Total | Tv | - | 800 | - | Th | - |
| | Display | Tvd | 640 | 640 | 640 | Th | - |
| | Blank | Tvb | - | 160 | Tv-Tvd | Th | - |
| Horizontal Active Display Term | Total | Th | - | 525 | - | Tc | Th=Thd+Thb |
| | Display | Thd | 480 | 480 | 480 | Tc | - |
| | Blank | Thb | - | 45 | Th-Thd | Tc | - |

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 be as the diagram below.



Timing Specifications:

- $0.5 < t1 \leq 10 \text{ ms}$
- $0 < t2 \leq 50 \text{ ms}$
- $0 < t3 \leq 50 \text{ ms}$
- $t4 \geq 500 \text{ ms}$
- $t5 \geq 200 \text{ ms}$
- $t6 \geq 200 \text{ ms}$

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.

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 _{CC} | 3.3 | V |
| Input Signal | According to typical value in "3. ELECTRICAL CHARACTERISTICS" | | |
| Lamp Current | I _L | 5.5 | mA _{RMS} |
| Inverter Operating Frequency | F _L | 61 | KHz |
| Inverter | (Sumida IV40090T/B2) | | |

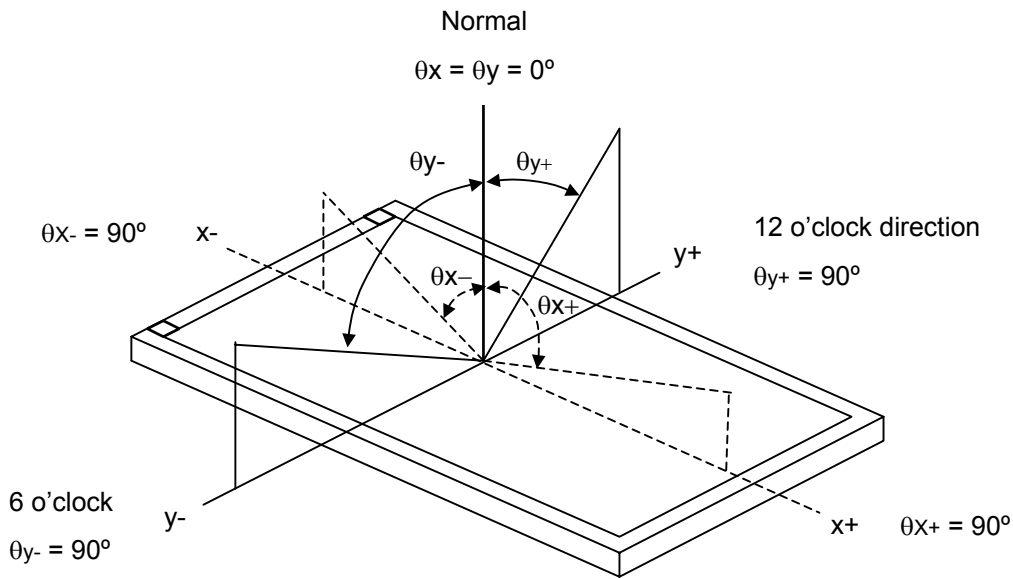
Note (1) I_L means the lamp current of one lamp.

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 (6).

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit | Note | |
|---------------------------|----------------|--------------------------------------|------------|-----------------|------------|-------------------|----------|-------|
| Color Chromaticity | Red | $\theta_x=0^\circ, \theta_y=0^\circ$ | Typ - 0.03 | 0.626 | Typ + 0.03 | - | (1), (6) | |
| | | | | Ry | | | | 0.348 |
| | Green | | | Gx | | | | 0.303 |
| | | | | Gy | | | | 0.563 |
| | Blue | | | Bx | | | | 0.145 |
| | | | | By | | | | 0.105 |
| | White | | | Wx | | | | 0.319 |
| | | | | Wy | | | | 0.338 |
| Center Luminance of White | L _C | | 400 | 450 | - | cd/m ² | (4), (6) | |
| Contrast Ratio | CR | | 1000 | 1500 | - | - | (2), (6) | |
| Response Time | T _R | | - | 14 | 19 | Ms | (3) | |
| | T _F | | - | 9 | 14 | Ms | | |
| White Variation | δW | | - | 1.25 | 1.40 | - | (5) | |
| Viewing Angle | Horizontal | CR ≧ 10 | 80 | 88 | - | Deg. | (1), | |
| | | | | θ _{x-} | | | | 88 |
| | Vertical | | | θ _{y+} | | | | 88 |
| | | | | θ _{y-} | | | | 88 |

Note (1) Definition of Viewing Angle (θ_x , θ_y):



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

The contrast ratio can be calculated by the following expression.

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

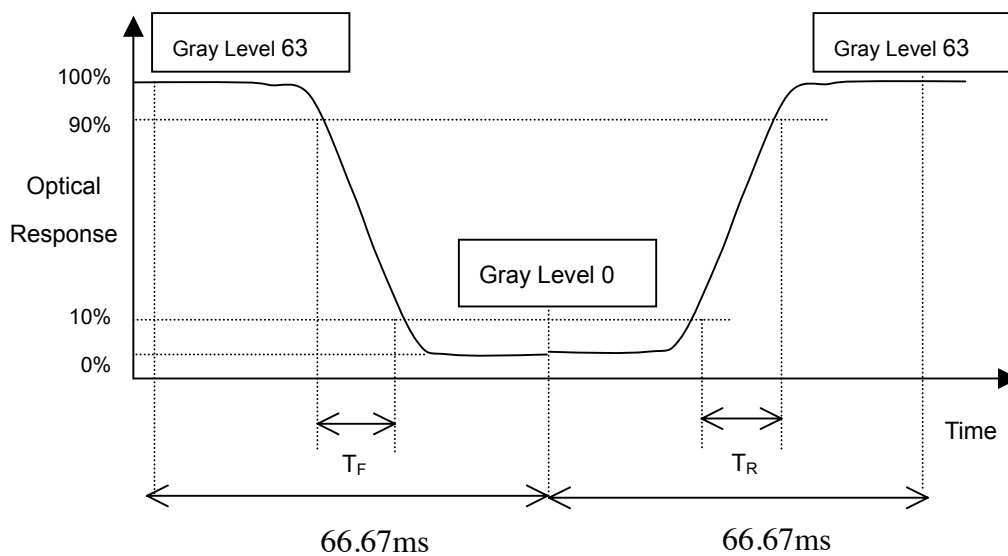
L63: Luminance of gray level 63

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 (5).

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

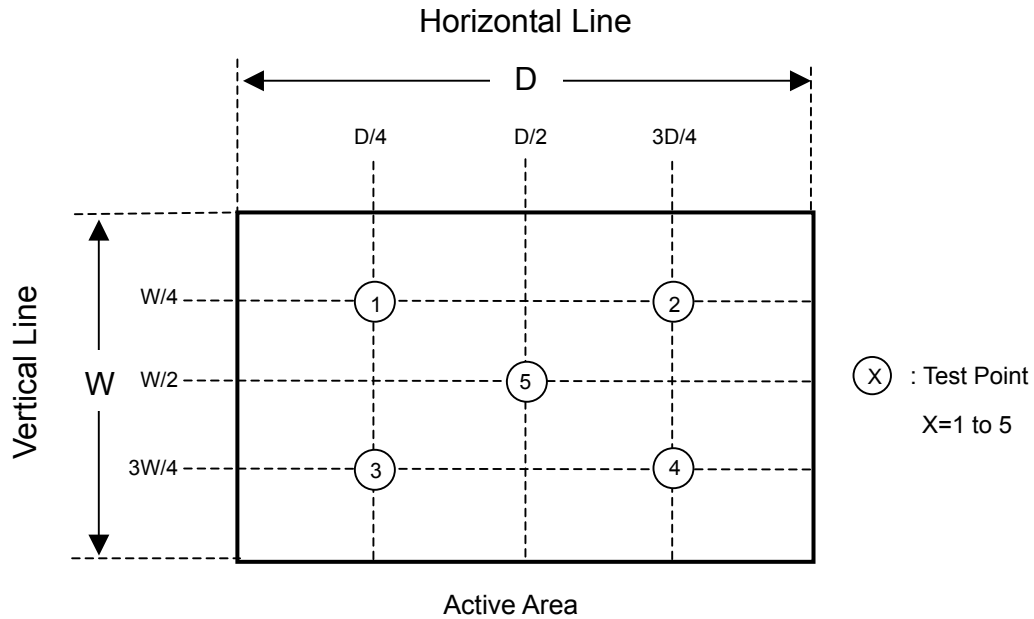
$$L_C = L(5)$$

$L(x)$ is corresponding to the luminance of the point X at Figure in Note (5).

Note (5) Definition of White Variation (δW):

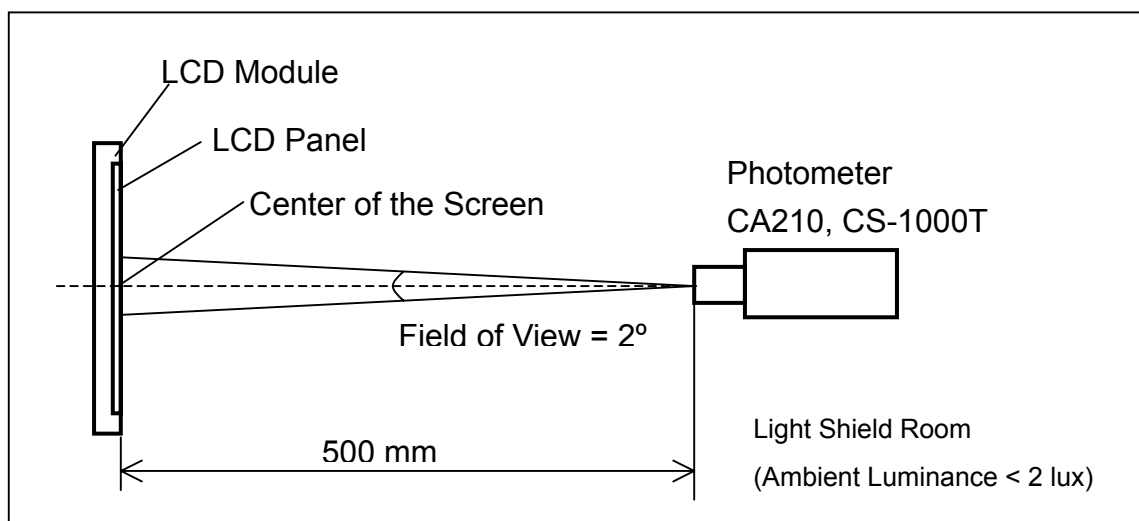
Measure the luminance of gray level 63 at 5 points

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



Note (6) 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.



8. PACKAGING

8.1 PACKING SPECIFICATIONS

- (1) 30 LCD modules / 1 Box
- (2) Box dimensions: 500(L) X 400(W) X 330(H) mm
- (3) Weight: approximately 15.5Kg (30 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 Random, Frequency Range: 1 - 200 Hz Top & Bottom: 30 minutes (+Z), 10 min (-Z), Right & Left: 10 minutes (X) Back & Forth 10 minutes (Y) | Non Operation |
| Dropping Test | 1 Angle, 3 Edge, 6 Face, 60cm | Non Operation |

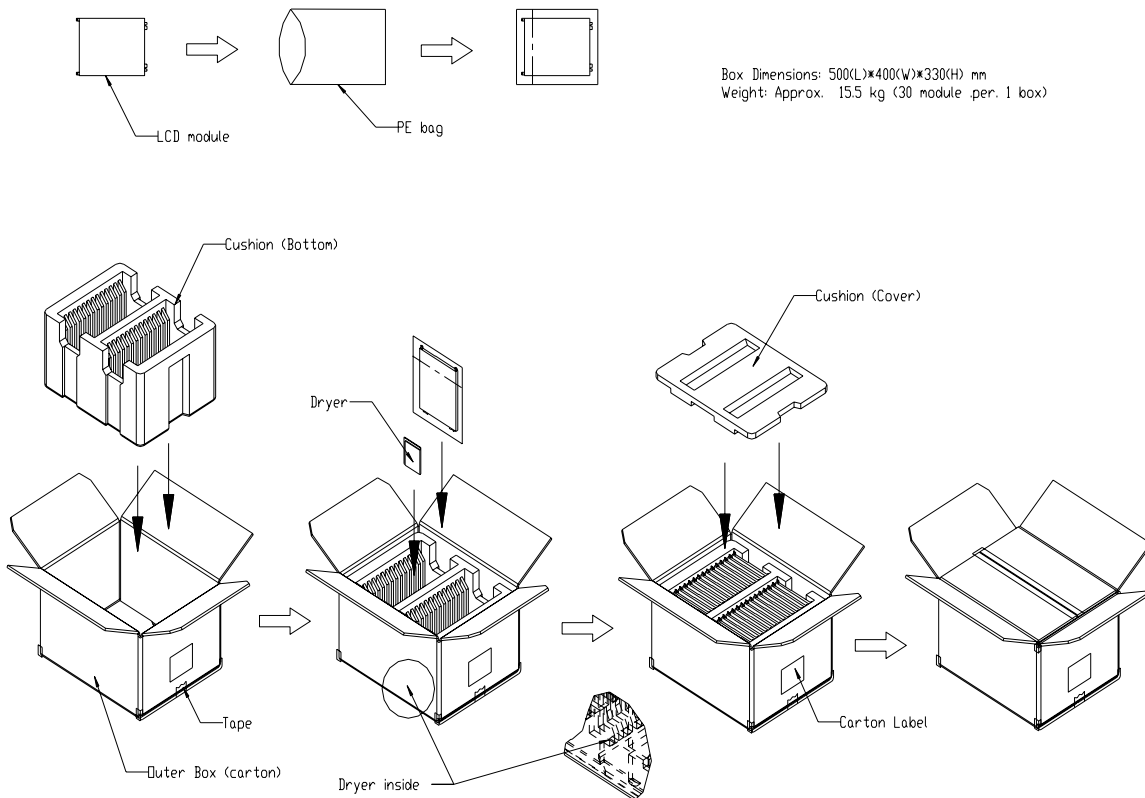
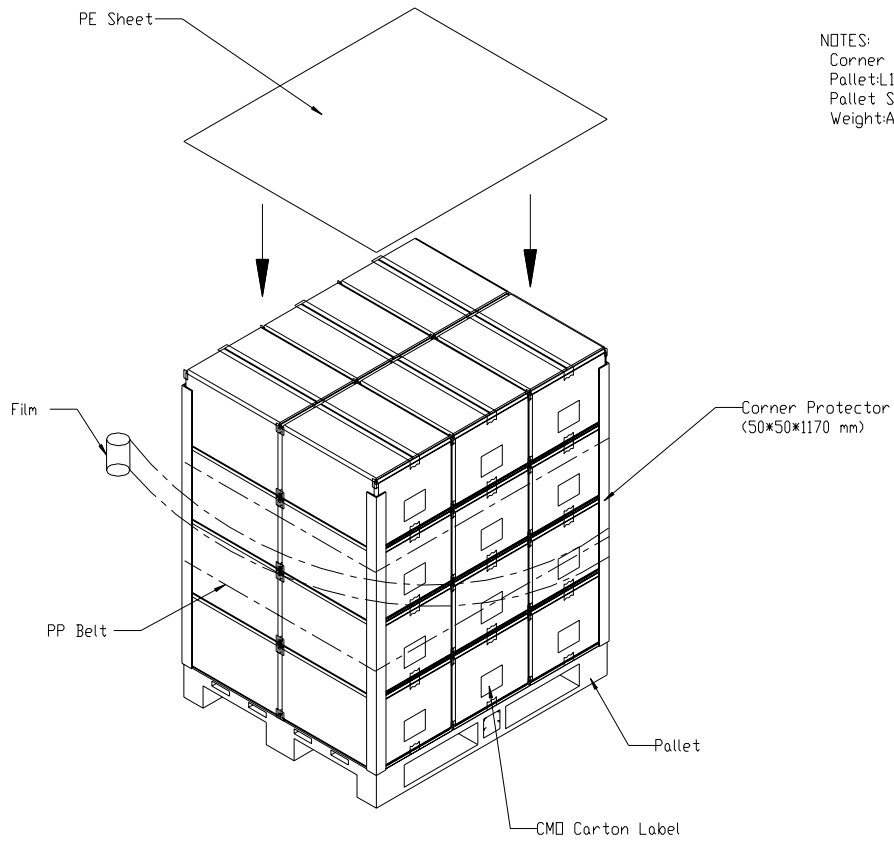


Figure. 8-1 Packing method



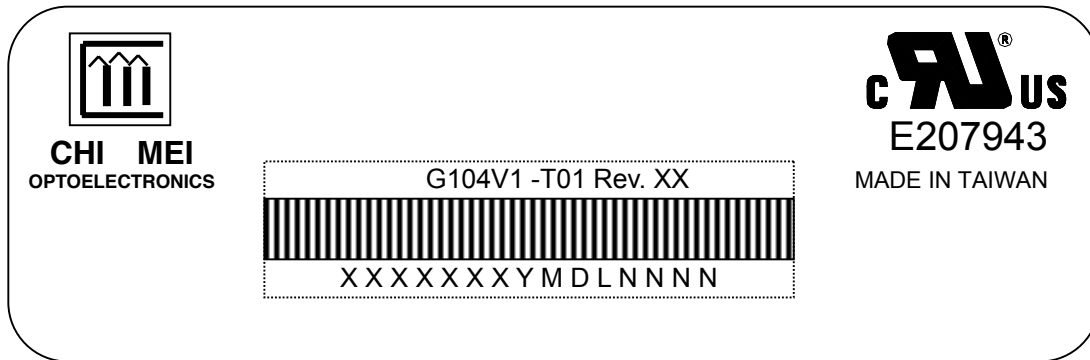
NOTES:
Corner Protector:L1170mm*50mm*50mm
Pallet:L1200*W1000*H135mm
Pallet Stock Dim:L1200*W1000*H1465mm
Weight:Approx. 392 kg

Figure. 8-2 Packing method

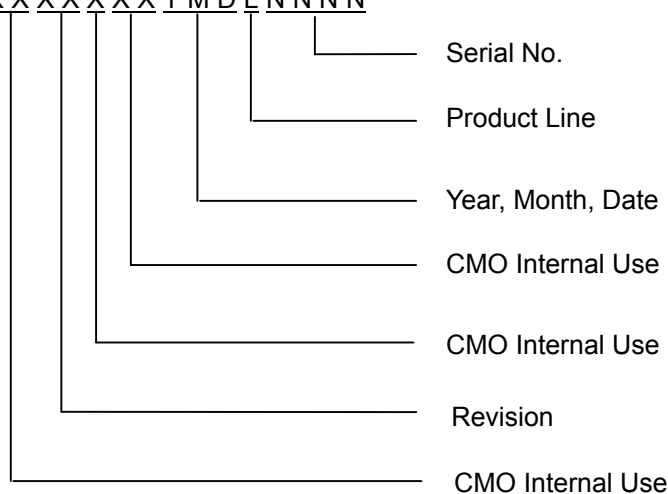
9. DEFINITION OF LABELS

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: G104v1 -T01
- (b) Revision: Rev. XX, for example: A0, A1... B1, B2... or C1, C2...etc.
- (c) Serial ID: XXXXXXXXYMDLNNNN



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 1st to 31st, exclude I ,O, and U.
- (b) Revision Code: Cover all the change
- (c) Serial No.: Manufacturing sequence of product
- (d) Product Line: 1 -> Line1, 2 -> Line 2, ...etc.

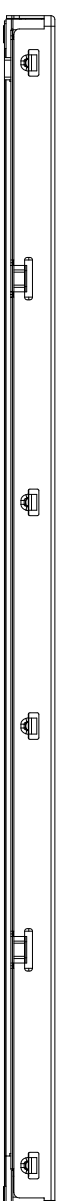
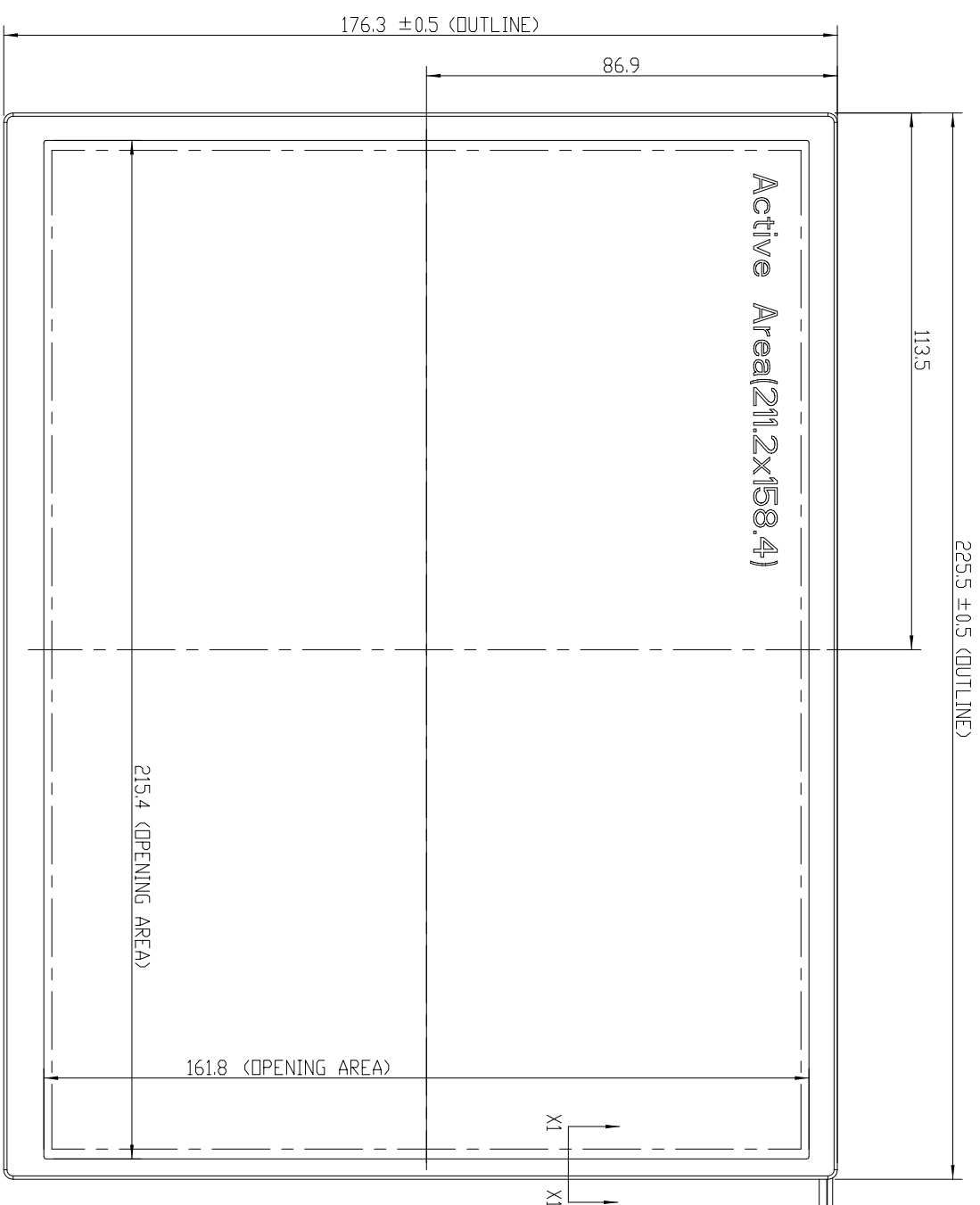
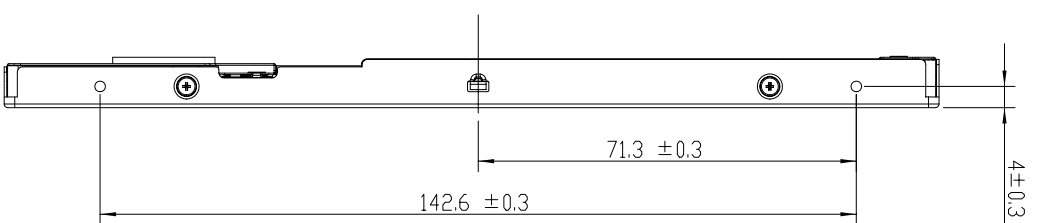
10. PRECAUTIONS

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.

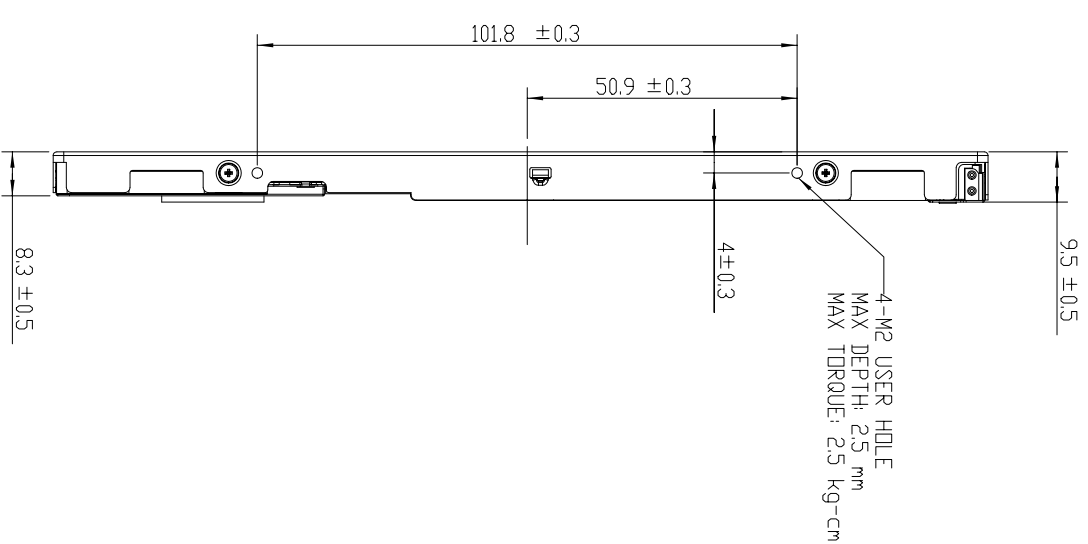
10.2 SAFETY PRECAUTIONS

- (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.



GAP:0.3(MAX)

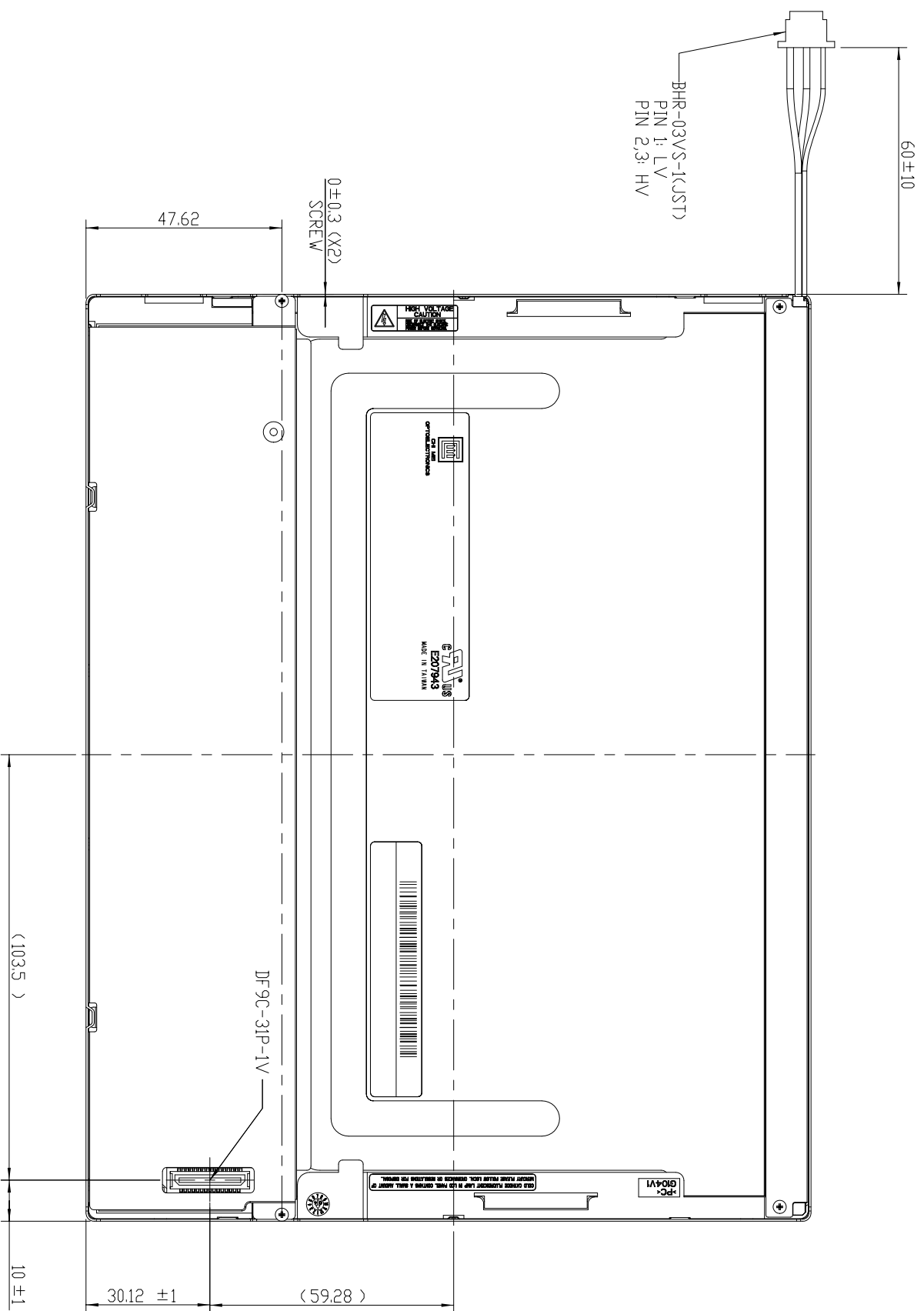
SECTION X1-X1
SCALE 4:1



- NOTES:
1. OUTLINE TOLERANCE: $\pm 0.5\text{mm}$.
 2. * MARKS THE DESIGN CRITICAL DIMENSION.
 3. $\text{\textcircled{P}}$ MARKS THE PROCESS CRITICAL DIMENSION.

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


| | | | | |
|---|-------------|------------------------|-------------|----------------|
| TITLE | | ASSY_MODULE_G104VI-101 | | 2D REV. 1.1 |
| Approved | JENNY_CHANG | Drawing No. | G10424101 | 3D REV. 1.1.2+ |
| Checked | SHUBINHON | Part No. | GAAV101901 | |
| Drawer | TIGER_CHANG | Material | TBD | Sheet 1 / 2 |
| Designer | TIGER_CHANG | Date | 11-Apr-2005 | Scale 1:1 |
| CHI MEI OPTOELECTRONICS CORP. | | Scale | 1:1 | Unit:mm |
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NOTES:
 1. OUTLINE TOLERANCE: ±0.5mm.
 2. * MARKS THE DESIGN CRITICAL DIMENSION.
 3. ⊕ MARKS THE PROCESS CRITICAL DIMENSION.

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

| | | | | | |
|----------|-------------|------------------------|-------------|-------------|-------|
| TITLE | | ASSY_MODULE_G104V1-101 | | 2D REV/2 | |
| Approved | JEMMY_CHANG | Drawing No. | G104241011 | 3D REV/112+ | |
| Checked | SHUBINHON | Part No. | GA4V101901 | | |
| Drawer | TIGER_CHANG | Material | TBD | Sheet | 2 / 2 |
| Designer | TIGER_CHANG | Date | 11-Apr-2005 | Scale | 1:1 |
| | | Unit | mm | | |

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