

TFT LCD Tentative Specification

MODEL NO.: G104X1 - L04

Customer: _____

Approved by: _____

Note:

| Liquid Crystal Display Division | |
|---------------------------------|-------------------|
| QRA Division. | OA Head Division. |
| Approval | Approval |
| | |



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REVISION HISTORY

| Version | Date | Page (New) | Section | Description |
|---------|-----------|------------|---------|---------------------------------|
| 0.0 | 2009/8/17 | All | All | Tentative spec was first issued |

1. GENERAL DESCRIPTION

1.1 OVERVIEW

G104X1- L04 is a 10.4" TFT Liquid Crystal Display module with LED backlight unit and 30-pin-and-1ch LVDS interface. This product supports 1024 x 768 XGA format and can display true 16.2M colors (6-bits colors with FRC). The converter module for LED backlight is built-in.

1.2 FEATURES

- Excellent brightness (500 nits)
- Ultra high contrast ratio (1200:1)
- Fast response time (Ton+Toff average 25 ms)
- High color saturation NTSC 57%
- XGA (1024 x 768 pixels) resolution
- DE (Data Enable) only mode
- LVDS (Low Voltage Differential Signaling) interface
- Ultra wide viewing angle: 176(H)/ 176(V) (CR>10) Super MVA technology
- 180 degree rotation display option
- LED Light Bar Replaceable
- Wide operation temperature

1.3 APPLICATION

- TFT LCD monitor
- Industrial applications

1.4 GENERAL SPECIFICATIONS

| Item | Specification | Unit | Note |
|-------------------------|--|-------|------|
| Active Area | 210.4 (H) x 157.8 (V) (10.4" diagonal) | mm | (1) |
| Bezel Opening Area | 215.4 (H) x 161.8 (V) | mm | |
| Driver Element | a-si TFT active matrix | - | - |
| Pixel Number | 1024 x R.G.B. x 768 | pixel | - |
| Pixel Pitch (Sub Pixel) | 0.0685 (H) x 0.2055 (V) | mm | - |
| Pixel Arrangement | RGB vertical stripe | - | - |
| Display Colors | 16.2 M | color | - |
| Display Operation Mode | Transmissive mode / Normally black | - | - |
| Surface Treatment | Anti Glare | - | - |

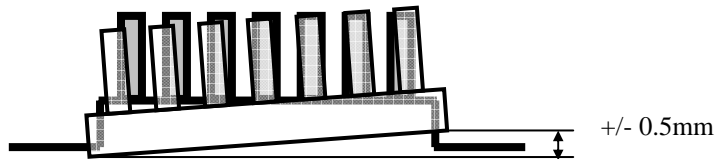
Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

1.5 MECHANICAL SPECIFICATIONS

| Item | Min. | Typ. | Max. | Unit | Note | |
|---------------------------------|--|-------|-------|-------|------|-----|
| Module Size | Horizontal (H) | 225 | 225.5 | 226 | mm | (1) |
| | Vertical (V) | 175.8 | 176.3 | 176.8 | mm | |
| | Depth (D) | 8.2 | 8.7 | 9.2 | mm | - |
| Weight | 380 | 430 | 480 | 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

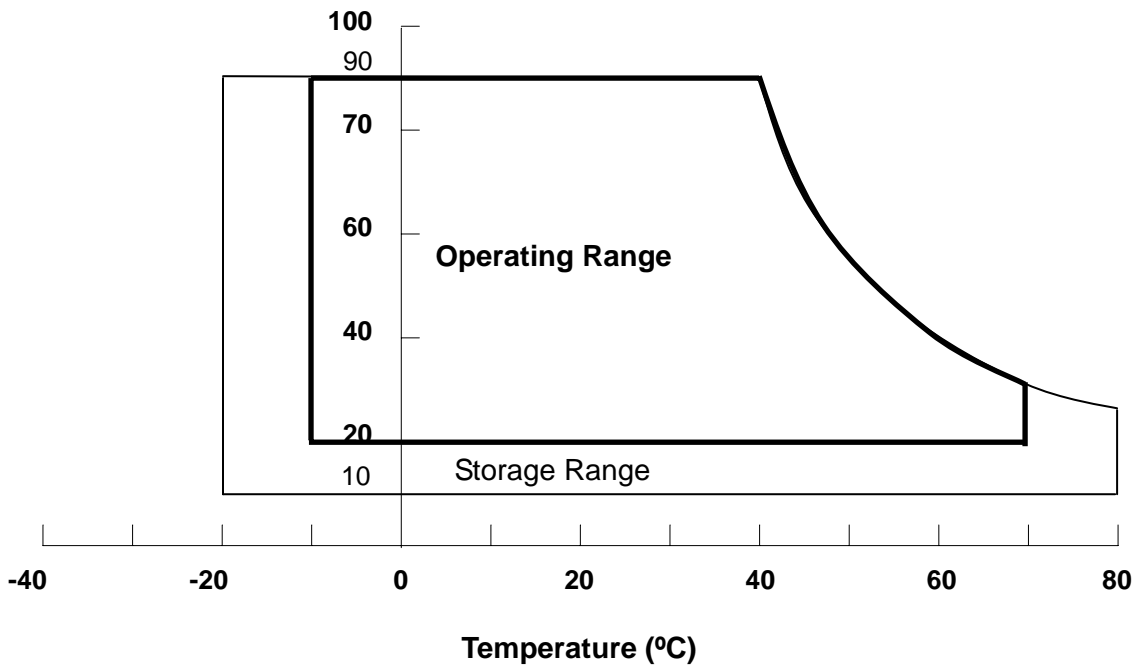
2.1 ABSOLUTE RATINGS OF ENVIRONMENT

| Item | Symbol | Value | | Unit | Note |
|-------------------------------|-----------------|-------|------|------|------|
| | | Min. | Max. | | |
| Operating Ambient Temperature | T _{OP} | -20 | +70 | °C | |
| Storage Temperature | T _{ST} | -20 | +80 | °C | |

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

- (a) 90 %RH Max. (Ta ≤ 40 °C).
- (b) Wet-bulb temperature should be 39 °C Max. (Ta > 40 °C).
- (c) No condensation

Relative Humidity (%RH)



2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

| Item | Symbol | Value | | Unit | Note |
|----------------------|--------|-------|------|------|------|
| | | Min. | Max. | | |
| Power Supply Voltage | VCC | -0.3 | 7 | V | (1) |

2.2.2 LED CONVERTER

| Item | Symbol | Value | | Unit | Note |
|-------------------|--------|-------|------|------|----------|
| | | Min. | Max. | | |
| Converter Voltage | V_i | -0.3 | 18 | V | (1), (2) |
| Enable Voltage | EN | --- | 5.5 | V | |
| Backlight Adjust | ADJ | --- | 3.3 | V | |

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

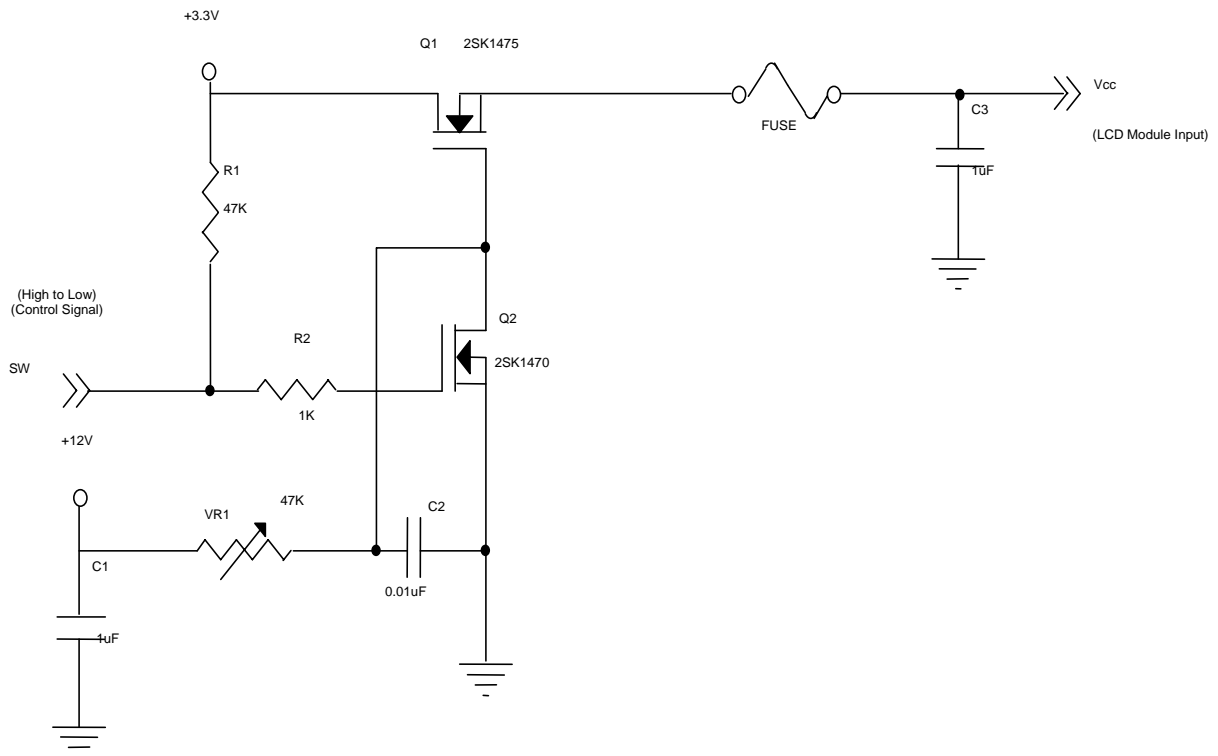
3.1 TFT LCD MODULE

Ta = 25 ± 2 °C

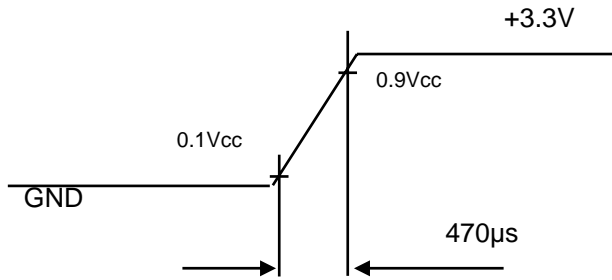
| Parameter | Symbol | Value | | | Unit | Note |
|---------------------------------|-------------------|-------|------|------|------|------|
| | | Min. | Typ. | Max. | | |
| Power Supply Voltage | V _{CC} | 3.0 | 3.3 | 3.6 | V | (1) |
| Rush Current | I _{RUSH} | - | - | 4.3 | A | (2) |
| Power Supply Current | White | - | 600 | - | mA | (3) |
| | Black | - | 430 | - | mA | |
| Power Consumption | P _L | --- | 2.0 | --- | W | |
| LVDS differential input voltage | VID | 100 | - | 600 | mV | - |
| LVDS common input voltage | V _{ICM} | 0.7 | - | 1.6 | V | - |

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

Note (2) Measurement Conditions:



VCC rising time is 470us



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

a. White Pattern



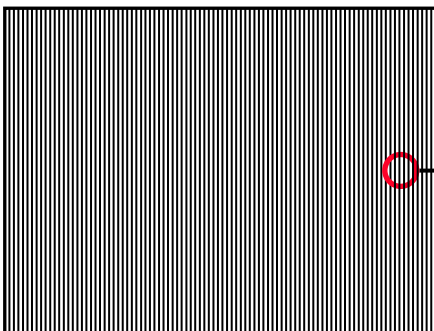
Active Area

b. Black Pattern

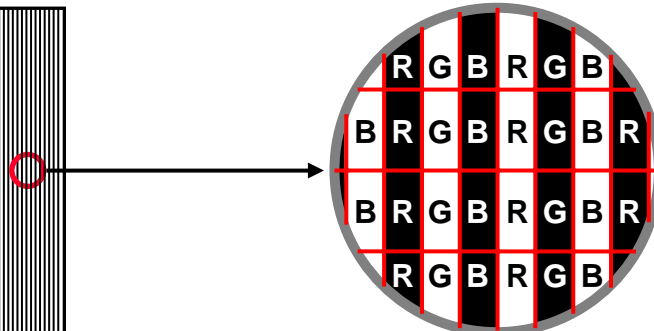


Active Area

c. Vertical Stripe Pattern



Active Area



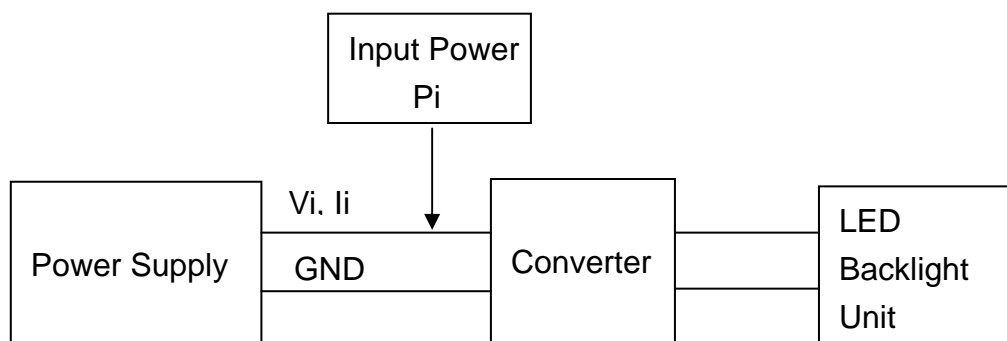
3.2 LED CONVERTER

 $T_a = 25 \pm 2 \text{ }^\circ\text{C}$

| Parameter | Symbol | Value | | | Unit | Note |
|--------------------------------|----------------|--------|------|------|------|-------------------------------------|
| | | Min. | Typ. | Max. | | |
| Converter Power Supply Voltage | V_i | 10.8 | 12.0 | 13.2 | V | (Duty 100%) |
| Converter Power Supply Current | I_i | --- | 0.7 | --- | A | @ $V_i = 12\text{V}$ (Duty 100%) |
| LED Power Consumption | P_{LED} | --- | 8 | --- | | @ $V_i = 12\text{V}$ (Duty 100%) |
| EN Control Level | Backlight on | 2.0 | --- | 3.3 | V | |
| | Backlight off | 0 | --- | 0.8 | V | |
| PWM Control Level | PWM High Level | 2.0 | --- | 3.3 | V | |
| | PWM Low Level | 0 | --- | 0.15 | V | |
| PWM Control Duty Ratio | | 20 | | 100 | % | |
| PWM Control Frequency | f_{PWM} | 190 | 200 | 210 | Hz | |
| LED Life Time | L_L | 50,000 | | | Hrs | (2) |

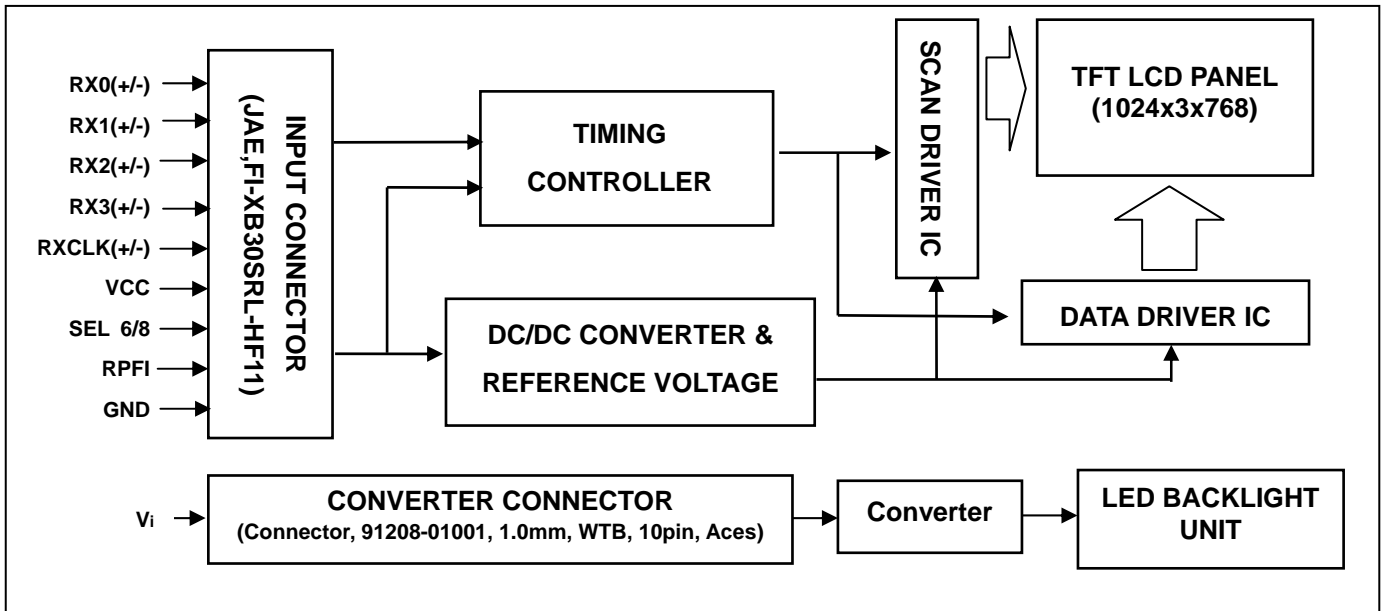
Note (1) LED current is measured by utilizing a high frequency current meter as shown below:

Note (2) The lifetime of LED is defined as the time when it continues to operate under the conditions at $T_a = 25 \pm 2$ and $I_{LED} = 80\text{mA}_{DC}$ (LED forward current) until the brightness becomes 50% of its original value. And minimum LED lifetime is estimated and provided by Nichia in Japan.



4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



5. INTERFACE PIN ASSIGNMENT

5.1 TFT LCD MODULE

CN1 Connector Pin Assignment

| Pin No. | Symbol | Description | Note |
|---------|--------|---|-------|
| 1 | VCC | Power supply: +3.3V | - |
| 2 | VCC | Power supply: +3.3V | - |
| 3 | VCC | Power supply: +3.3V | - |
| 4 | GND | Ground | - |
| 5 | GND | Ground | - |
| 6 | GND | Ground | - |
| 7 | RPMI | Reverse Panel Function (Display Rotation) | (2) |
| 9 | NC | No Connection | - |
| 10 | NC | No Connection | - |
| 11 | SEL6/8 | LVDS 6/8 bit select function control, Low or NC → 8 bit Input Mode High → 6bit Input Mode | (2) |
| 12 | GND | Ground | - |
| 13 | NC | No Connection | - |
| 14 | GND | Ground | - |
| 15 | RX0- | Negative transmission data of pixel 0 | - |
| 16 | RX0+ | Positive transmission data of pixel 0 | - |
| 17 | GND | Ground | - |
| 18 | RX1- | Negative transmission data of pixel 1 | - |
| 19 | RX1+ | Positive transmission data of pixel 1 | - |
| 20 | GND | Ground | - |
| 21 | RX2- | Negative transmission data of pixel 2 | - |
| 22 | RX2+ | Positive transmission data of pixel 2 | - |
| 23 | GND | Ground | - |
| 24 | RXCLK- | Negative of clock | - |
| 25 | RXCLK+ | Positive of clock | - |
| 26 | GND | Ground | - |
| 27 | RX3- | Negative transmission data of pixel 3 | - |
| 28 | RX3+ | Positive transmission data of pixel 3 | - |
| 29 | GND | Ground | - |
| 30 | NC | No Connection | (2) |

Note (1) Connector Part No.: JAE, FI-XB30SRL-HF11 or compatible

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

Note (2) User's connector Part No.: 91209-01011(ACES) or equivalent

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 | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B7 | B6 | 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 | |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 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 | |
| | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 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 | |
| | Magenta | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 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 | |
| | White | 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 | | |
| | Red(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 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 | | |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | | |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | | |
| | Red(253) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | Red(254) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | Red(255) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 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 | | |
| | Green(1) | 0 | 0 | 0 | 0 | 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 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | | |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | | |
| | Green(253) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | Green(254) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | Green(255) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 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 | 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 | 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 | | |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | | |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | | |
| | Blue(253) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| | Blue(254) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| | Blue(255) | 0 | 0 | 0 | 0 | 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

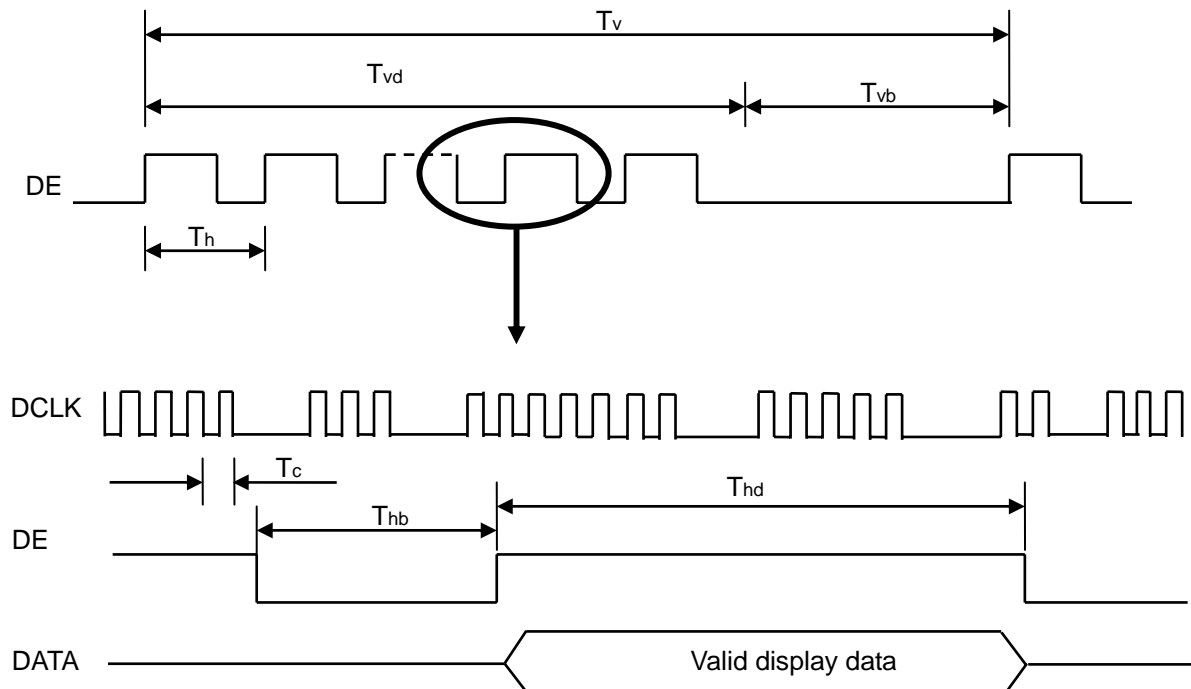
The input signal timing specifications are shown as the following table and timing diagram.

| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|--------------------------------|-----------|--------|------|------|------|------|------------|
| DCLK | Frequency | Fc | 55 | 65 | 75 | MHZ | |
| Vertical Active Display Term | Total | Tv | 770 | 806 | 950 | Th | Tv=Tvd+Tvb |
| | Display | Tvd | 768 | 768 | 768 | Th | - |
| | Blank | Tvb | 2 | 38 | 182 | Th | - |
| Horizontal Active Display Term | Total | Th | 1100 | 1344 | 1800 | Tc | Th=Thd+Thb |
| | Display | Thd | 1024 | 1024 | 1024 | Tc | - |
| | Blank | Thb | 76 | 320 | 776 | Tc | - |

Note (1) Since this assembly is operated in DE only mode, Hsync and Vsync input signals should be set to low logic level. Otherwise, this assembly would operate abnormally.

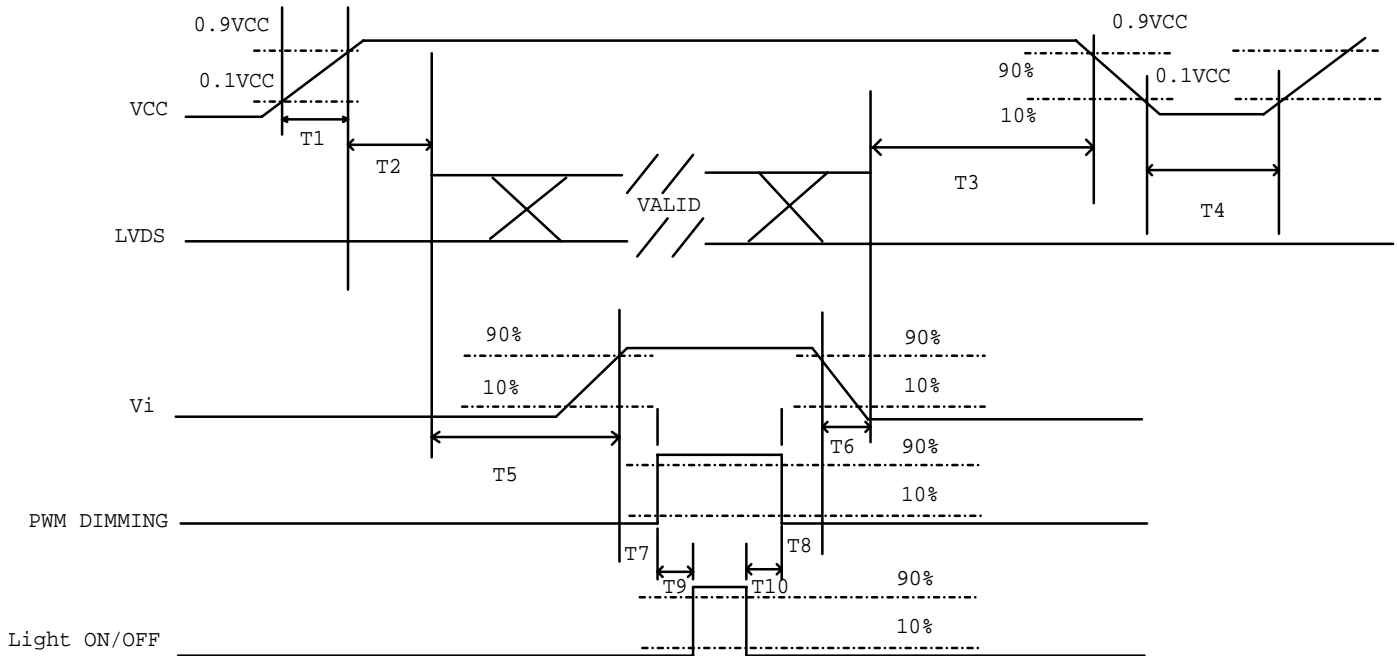
(2) Frame rate is 60Hz

INPUT SIGNAL TIMING DIAGRAM



6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD assembly, the power on/off sequence should be as the diagram below.



Power ON/OFF sequence

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

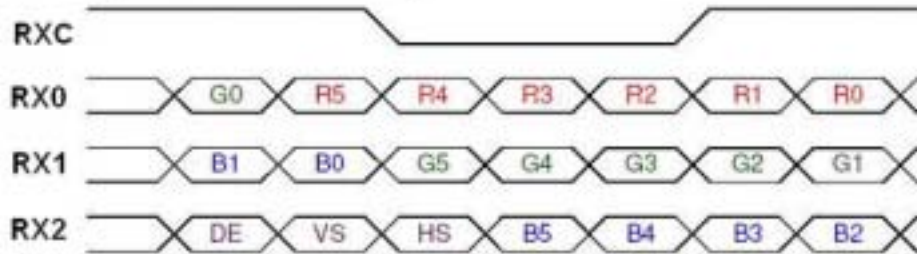
Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD VCC to 0 V.

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

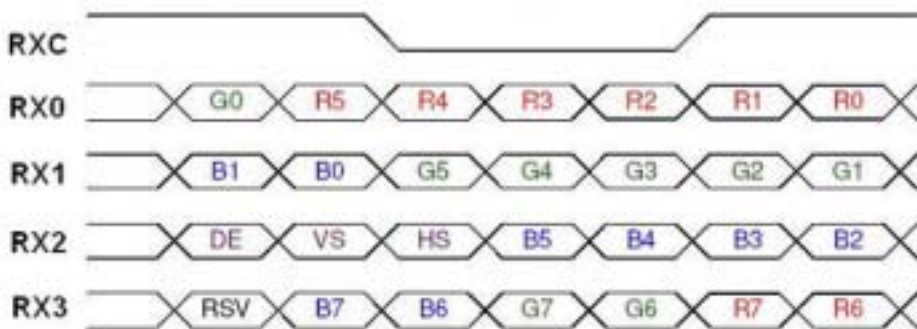
| Parameter | Value | | | Units |
|-----------|-------|-----|-----|-------|
| | Min | Typ | Max | |
| T1 | 0.5 | | 10 | ms |
| T2 | 0 | | 50 | ms |
| T3 | 0 | | 50 | ms |
| T4 | 500 | | | ms |
| T5 | 200 | | | ms |
| T6 | 200 | | | ms |
| T7 | 10 | | | ms |
| T8 | 10 | | | ms |
| T9 | 10 | | | ms |
| T10 | 0 | | | ms |

6.3 The Input Data Format

SEL 6/8 = "High" for 6 bits LVDS Input



SEL 6/8 = "Low" or "NC" 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 |
| R6 | Red Data 6 | Each red pixel's brightness data consists of these 8bits pixel data. |
| 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 |
| G6 | Green Data 6 | Each red pixel's brightness data consists of these 8bits pixel data. |
| G5 | Green Data 5 | |
| G4 | Green Data 4 | |
| G3 | Green Data 3 | |
| G2 | Green Data 2 | |
| G1 | Green Data 1 | |
| G0 | Green Data 0 (LSB) | |
| B7 | Blue Data 7 (MSB) | Blue-pixel Data |
| B6 | Blue Data 6 | Each red pixel's brightness data consists of these 8bits pixel data. |
| 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 Sync | |
| 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.



RPFI = Low/floating; normal display (default)



RPFI = high: display with 180degree rotation

7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

| Item | Symbol | Value | Unit |
|---------------------|---|-------|------|
| Ambient Temperature | T _a | 25±2 | °C |
| Ambient Humidity | H _a | 50±10 | %RH |
| Supply Voltage | V _{CC} | 5 | V |
| Input Signal | According to typical value in "3. ELECTRICAL CHARACTERISTICS" | | |
| Inverter Current | I _L | 80mA | mA |

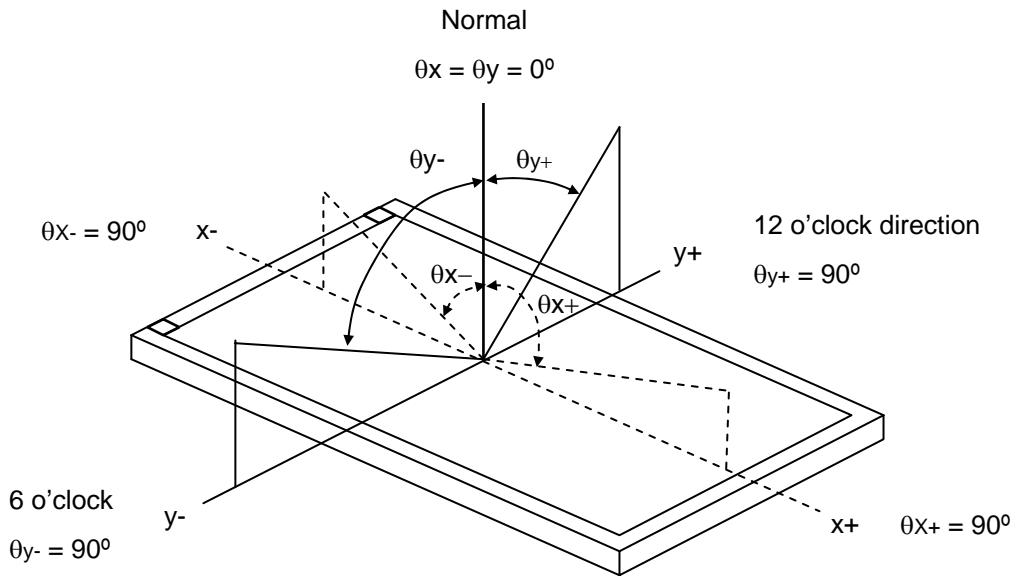
7.2 OPTICAL SPECIFICATIONS

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 | |
|---------------------------|------------|-----------------|---|-----------------------------------|---------------|------|-------------------|------|-----|
| Contrast Ratio | | CR | θ _x =0°, θ _y =0° Viewing angle at normal direction | 900 | 1200 | - | - | (2) | |
| Response Time | | T _R | | - | 14 | 19 | ms | (3) | |
| | | T _F | | - | 11 | 16 | ms | | |
| Center Luminance of White | | L _C | | 450 | 500 | - | cd/m ² | (4) | |
| White Variation | | δW | | - | - | 1.4 | - | (7) | |
| Color Chromaticity | Red | R _x | | Viewing angle at normal direction | Typ. -0.03 | TBD | Typ. +0.03 | - | (6) |
| | | R _y | | | | TBD | | - | |
| | Green | G _x | | | | TBD | | - | |
| | | G _y | | | | TBD | | - | |
| | Blue | B _x | | | | TBD | | - | |
| | | B _y | TBD | | | - | | | |
| | White | W _x | 0.313 | | | - | | | |
| | | W _y | 0.329 | | | - | | | |
| Viewing Angle | Horizontal | θ _{x+} | CR≥10 | 80 | 88 | - | Deg. | (1) | |
| | | θ _{x-} | | 80 | 88 | - | | | |
| | Vertical | θ _{y+} | | 80 | 88 | - | | | |
| | | θ _{y-} | | 80 | 88 | - | | | |

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

Viewing angles are measured by BM5A



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

The contrast ratio can be calculated by the following expression.

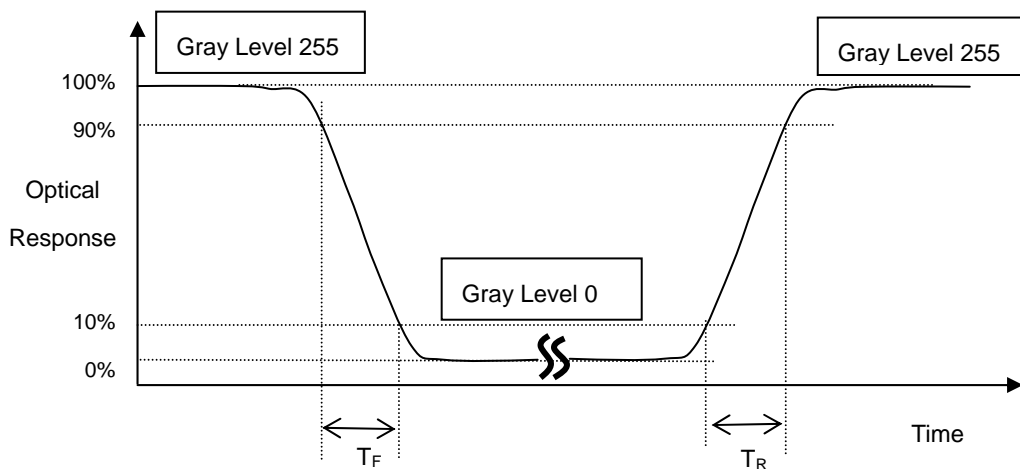
$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

L255: Luminance of gray level 255

L 0: Luminance of gray level 0

CR = CR (5), where CR (X) is corresponding to the Contrast Ratio of the point X at the figure in Note (7).

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



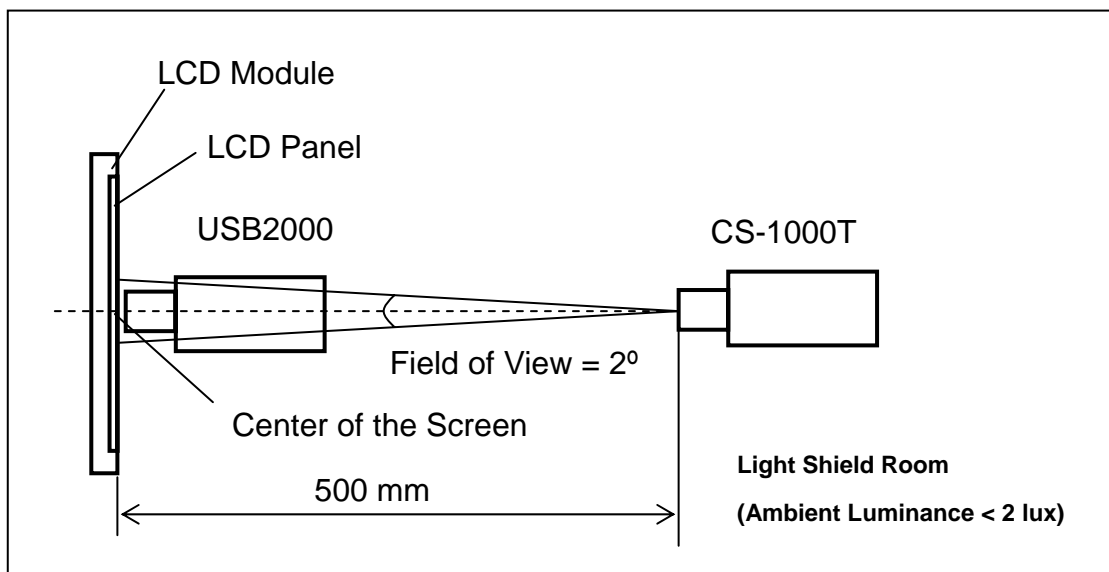
Note (4) Definition of Luminance of White (L_c):

Measure the luminance of gray level 255 at center point and 5 points

$L_c = L(5)$, where $L(X)$ is corresponding to the luminance of the point X at the figure in Note (7).

Note (5) Measurement Setup:

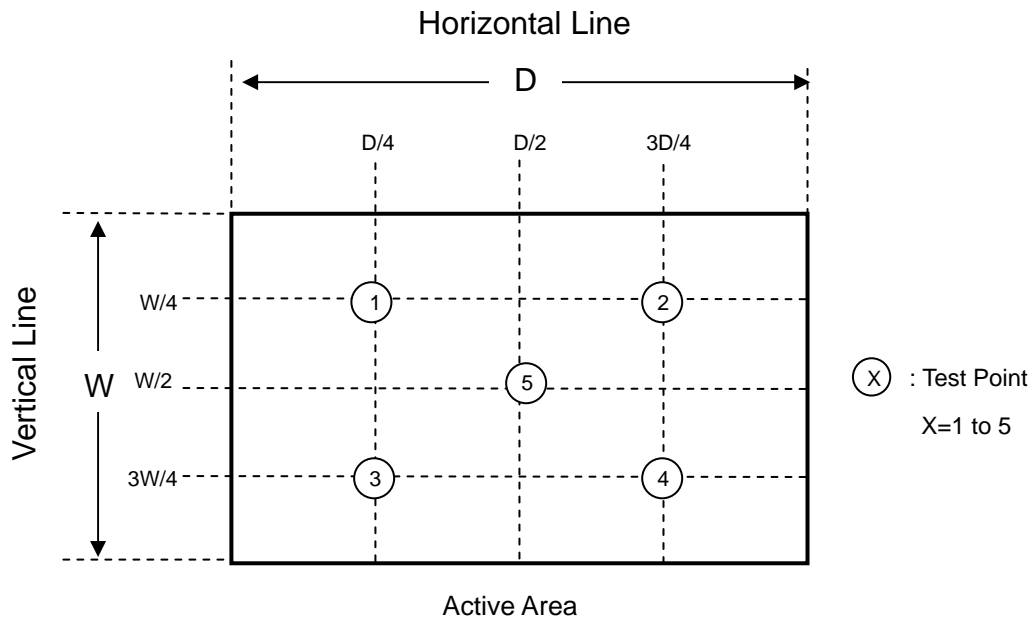
The LCD assembly should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a windless room.



Note (6) Definition of White Variation (δW):

Measure the luminance of gray level 63 (255) at 5 points

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



8. Reliability Test Criteria

| Test Item | Test Condition | Note |
|---|---|---------|
| High Temperature Storage Test | 80°C, 240 hours | (1) (2) |
| Low Temperature Storage Test | -20°C, 240 hours | |
| Thermal Shock Storage Test | -20°C, 0.5hour 70 , 0.5hour; 100cycles, 1hour/cycle | |
| High Temperature Operation Test | 70°C, 240 hours | |
| Low Temperature Operation Test | -20°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 $\pm X$, $\pm Y$, $\pm Z$. | (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 80 °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.

9. PACKAGING

9.1 PACKING SPECIFICATIONS

- (1) 16pcs LCD modules / 1 Box
- (2) Box dimensions: 465 (L) X 362 (W) X 314 (H) mm
- (3) Weight: approximately 15Kg (18 modules per box)

9.2 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: 2 – 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, 61 cm | Non Operation |

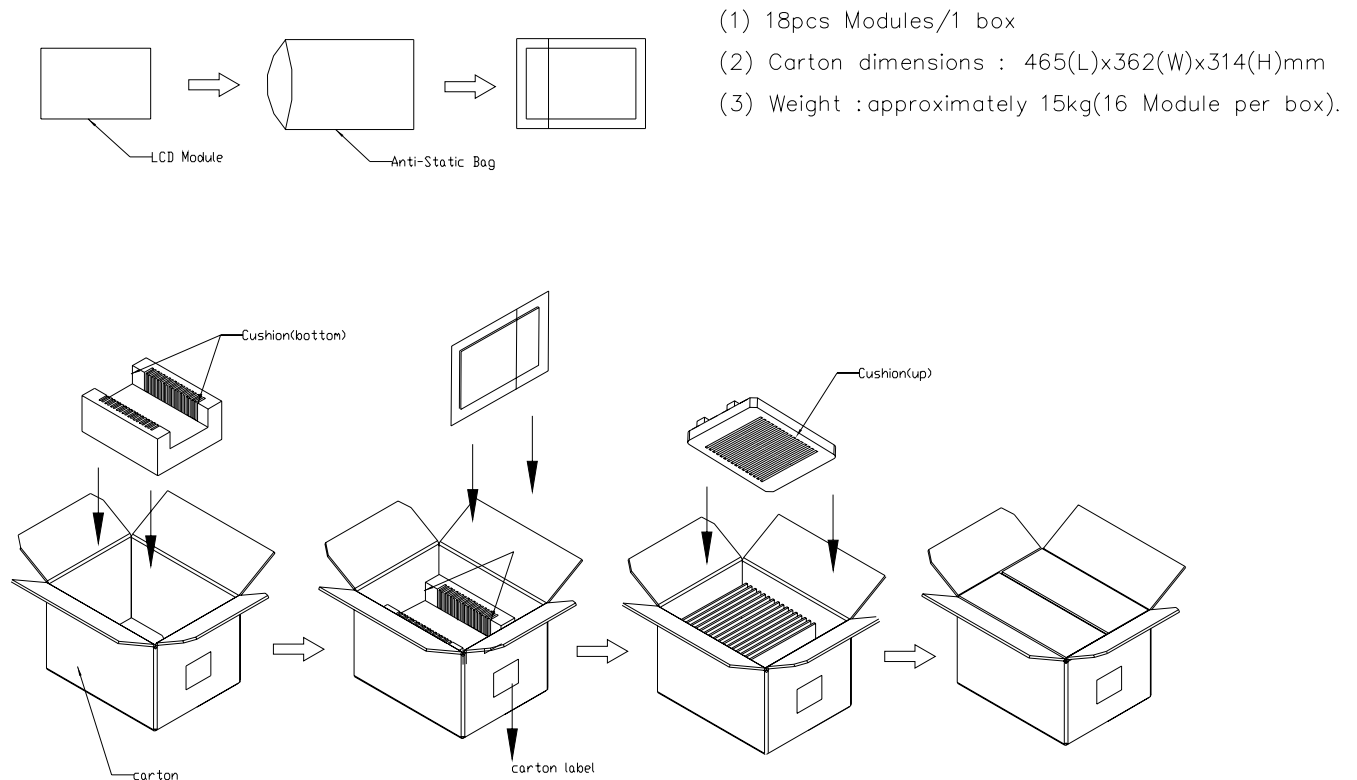


Figure.9-1 packing method

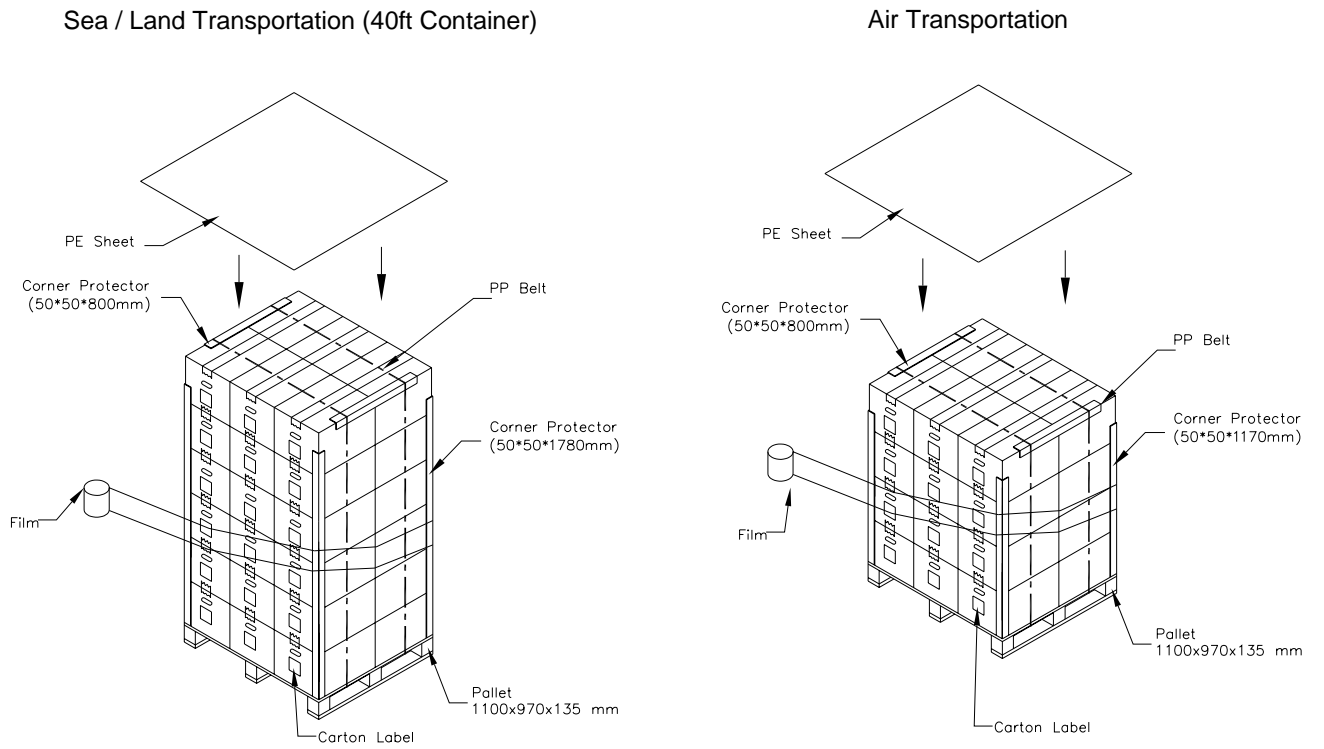
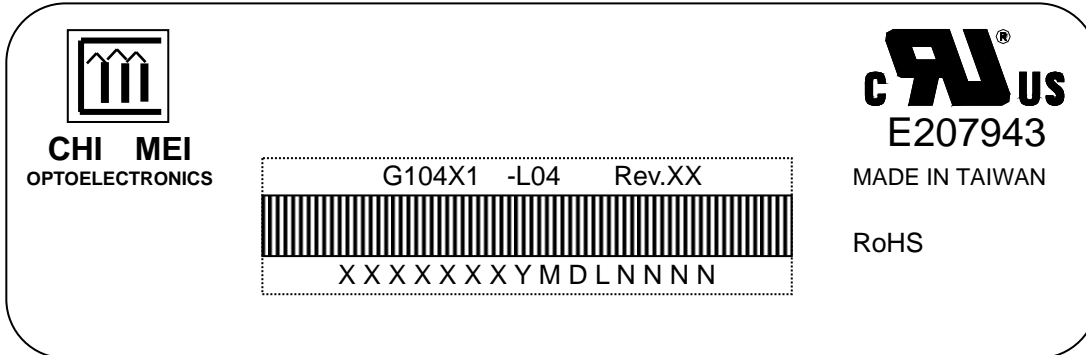


Figure. 9-2 Packing method

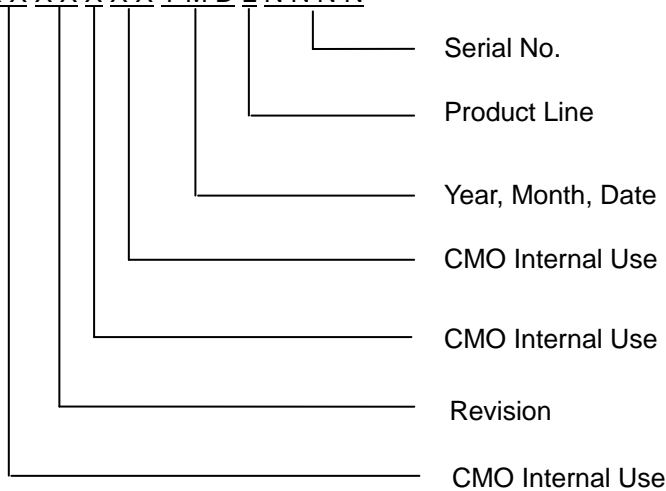
10. DEFINITION OF LABELS

10.1 CMO MODULE LABEL

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



- (a) Model Name: G104X1-L04
- (b) Revision: Rev. XX, for example: A0, A1... B1, B2... or C1, C2...etc.
- (c) Serial ID: XXXXXXYMDLNNNN



Serial ID includes the information as below:

- (a) Manufactured Date: Year: 0~9, 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.

11. PRECAUTIONS

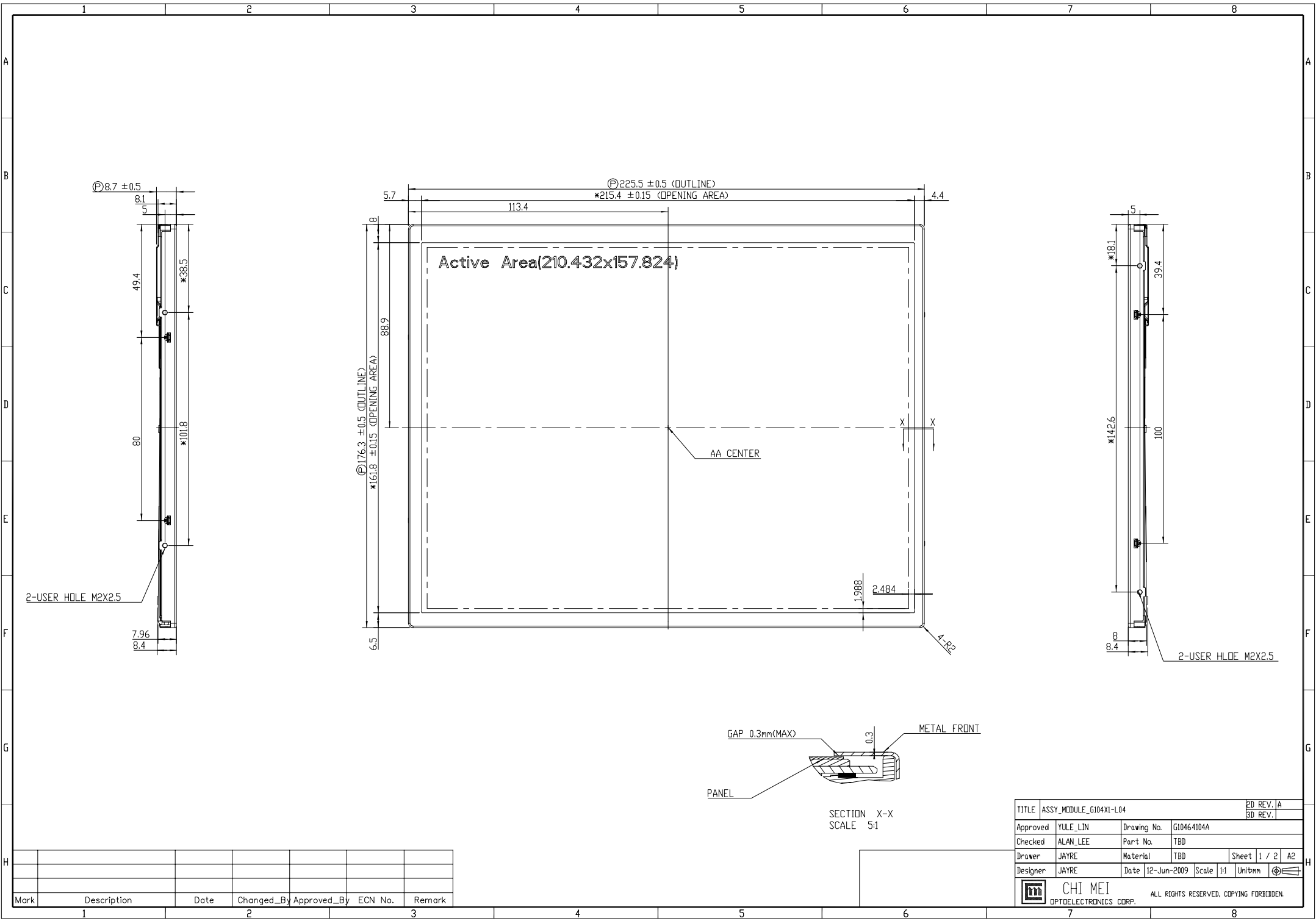
11.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) It is recommended to assemble or to install a module into the user's system in clean working areas.
The dust and oil may cause electrical short or worsen the polarizer.
- (3) Do not apply pressure or impulse to the module to prevent the damage of LCD panel and Backlight.
- (4) Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.
- (5) Do not plug in or pull out the I/F connector while the module is in operation.
- (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) Moisture can easily penetrate into LCD module and may cause the damage during operation.
- (9) High temperature or humidity may deteriorate the performance of LCD module. Please store LCD modules in the specified storage conditions.
- (10) When ambient temperature is lower than 10°C, the display quality might be reduced. For example, the response time will become slow, and the starting voltage of backlight will be higher than that of room temperature.
- (11) Do not keep same pattern in a long period of time. It may cause image sticking on LCD.

11.2 SAFETY PRECAUTIONS

- (1) The startup voltage of a Backlight is approximately 1000 Volts. It may cause an electrical shock while assembling with the 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.

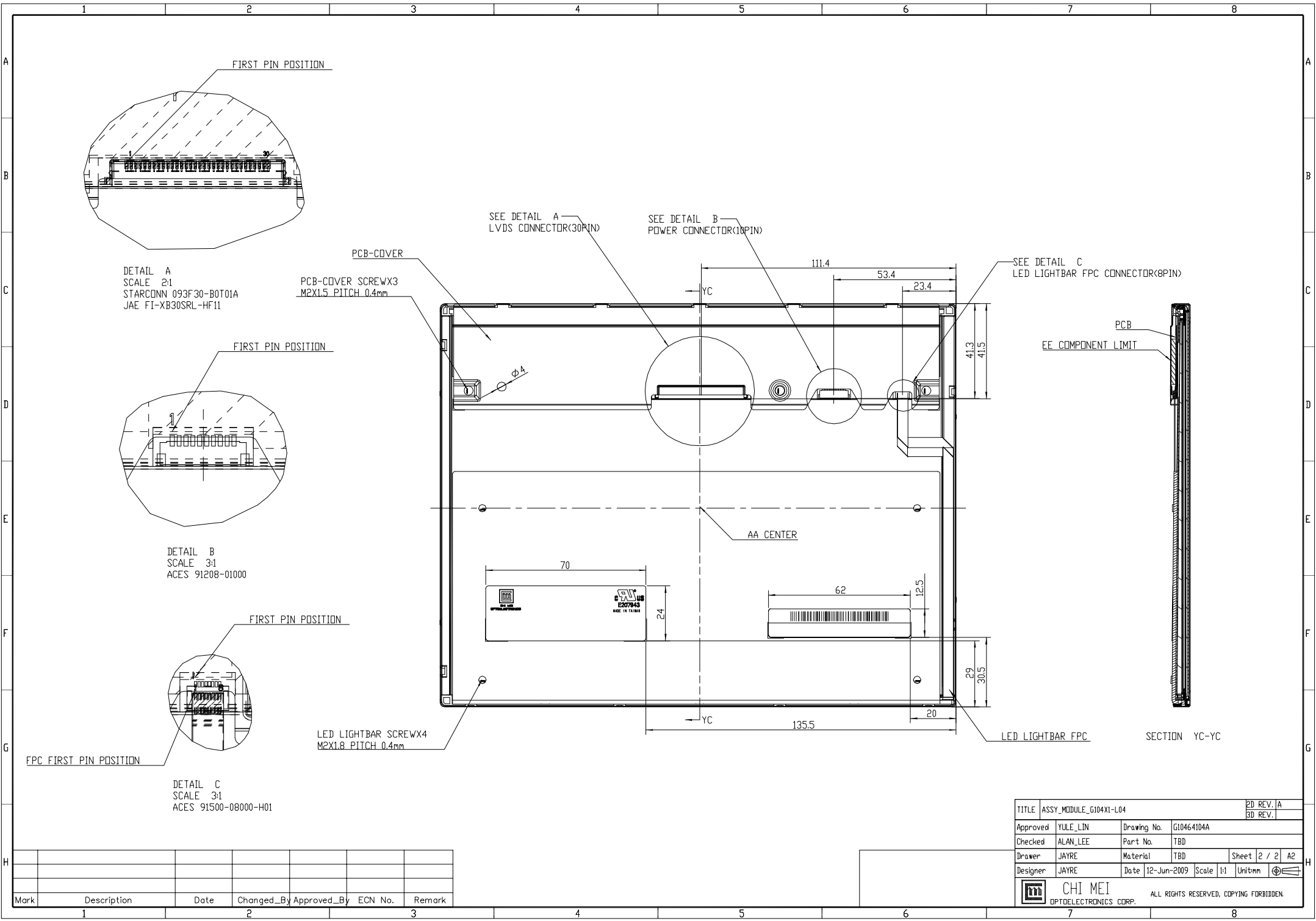
12. MECHANICAL CHARACTERISTICS



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

SECTION X-X
SCALE 5:1

| | | | |
|------------------------------|------------------------|---|---------|
| TITLE ASSY_MODULE_G104X1-L04 | | 2D REV. A | |
| Approved YULE LIN | | BD REV. | |
| Checked ALAN LEE | Drawing No. G1046-104A | | |
| Drawer JAYRE | Part No. TBD | | |
| Designer JAYRE | Date 12-Jun-2009 | Scale 1:1 | Unit mm |
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| OPTOELECTRONICS CORP. | | | |



| Mark | Description | Date | Changed_By | Approved_By | ECN No. | Remark |
|------|-------------|------|------------|-------------|---------|--------|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| 8 | | | | | | |

| | | | |
|---|------------------------|---|--------|
| TITLE ASSY_MODULE_G104X1-L04 | | 2D REV. A | |
| | | 3D REV. | |
| Approved YULE LIN | Drawing No. G10464104A | | |
| Checked ALAN LEE | Part No. TBD | | |
| Drawer JAYRE | Material TBD | Sheet 2 / 2 | A2 |
| Designer JAYRE | Date 12-Jun-2009 | Scale 1:1 | Unitmm |
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