# TFT LCD Approval Specification

# MODEL NO.: M240J1- L03

Customer: JVC

Approved by:

Note:

| 記錄 | 工作 | 審核 | 角色 | 投票 |
|---|---|---|---|---|
| 2007-03-05 21:22:50 CST | Approve by Dept. Mgr.(QA RA) | tomy_chen(陳永一 /52720/54140/43150) | Department Manager(QA RA) | Accept |
| 2007-02-26 15:18:15 CST | Approve by Director | teren_lin(林添仁 /56910/36064) | Director | Accept |

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## REVISION HISTORY

| Version | Date | Section | Description |
|---|---|---|---|
| Ver 2.0 | Oct. 9, 06' | - | M240J1 -L03 Approval specifications was first issued. |
| Ver 3.0 | Feb. 26, 07' | 10.1 | Customer's barcode definition is QLD0466-002. |

# 1. GENERAL DESCRIPTION

## 1.1 OVERVIEW

M240J1-L03 is an 24.0" TFT Liquid Crystal Display module with 6 CCFL Backlight unit and 30 pins 2ch-LVDS interface. This module supports 1920 x 1200 WUXGA mode and can display up to 16.7M colors. The inverter module for Backlight is built in.

## 1.2 FEATURES

- Super MVA extra-wide viewing angle.
- High contrast ratio.
- Fast response time.
- High color saturation.
- WUXGA (1920 x 1200 pixels) resolution.
- DE (Data Enable) only mode.
- LVDS (Low Voltage Differential Signaling) interface.
- RoHS compliance.
- TCO'03 compliance.
- Scan function support by the inverter module that built in the Backlight unit.

## 1.3 APPLICATION

- TFT LCD Monitor

## 1.4 GENERAL SPECIFICATI0NS

| Item | Specification | Unit | Note |
|---|---|---|---|
| Active Area | 518.4 (H) x 324 (V) (24.0" diagonal) | mm | (1) |
| Bezel Opening Area | 522.4 (H) x 328.0 (V) | mm | |
| Driver Element | a-si TFT active matrix | - | - |
| Pixel Number | 1920 x R.G.B. x 1200 | pixel | - |
| Pixel Pitch | 0.270 (H) x 0.270 (V) | mm | - |
| Pixel Arrangement | RGB vertical stripe | - | - |
| Display Colors | 16.7M | color | - |
| Transmissive Mode | Normally black | - | - |
| Surface Treatment | AG type: Hard coating (3H), Anti-glare (Haze 25)<br>Glare type: 2H hard coating, reflection<3% | - | - |

## 1.5 MECHANICAL SPECIFICATIONS

| Item | | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Module Size | Horizontal(H) | 545.9 | 546.4 | 546.9 | mm | (1) |
| | Vertical(V) | 351.5 | 352.0 | 352.5 | mm | |
| | Depth(D) | | 41.2 | 41.7 | mm | |
| Weight | | - | - | 3000 | g | - |

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

## 2. ABSOLUTE MAXIMUM RATINGS

### 2.1 ABSOLUTE RATINGS OF ENVIRONMENT

| Item | Symbol | Value | | Unit | Note |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Storage Temperature | $T_{ST}$ | -20 | 60 | ºC | (1) |
| Operating Ambient Temperature | $T_{OP}$ | 0 | 50 | ºC | (1), (2) |
| Shock (Non-Operating) | $S_{NOP}$ | - | 50 | G | (3), (5) |
| Vibration (Non-Operating) | $V_{NOP}$ | - | 1.5 | G | (4), (5) |

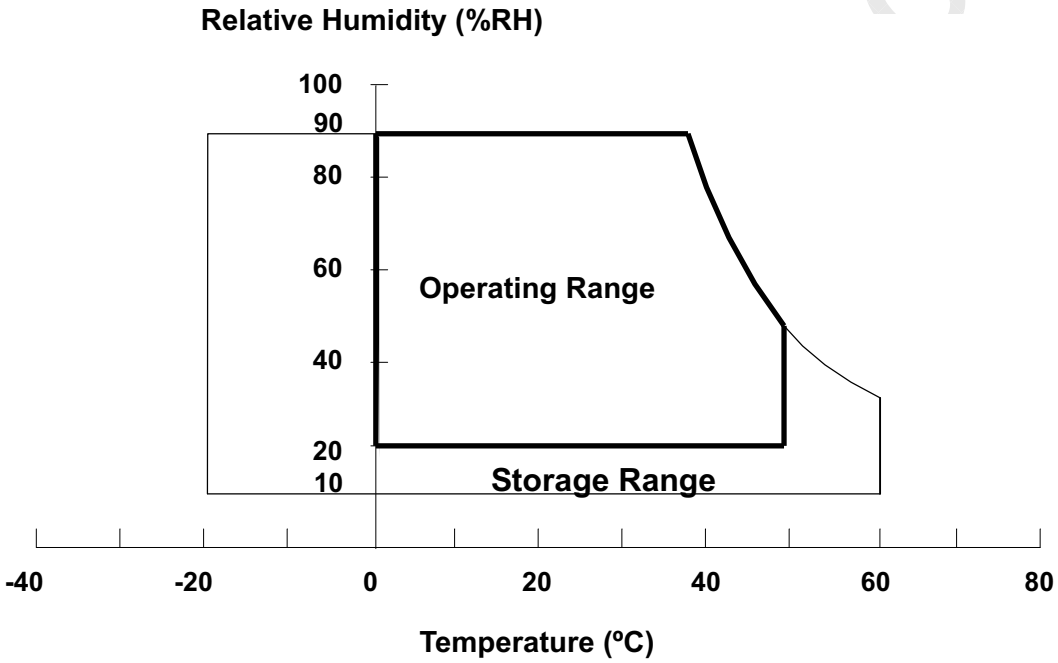
Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. (Ta ≦ 40 ºC).

(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

(c) No condensation.

Note (2) The temperature of panel display surface area should be 0 ºC Min. and 60 ºC Max.

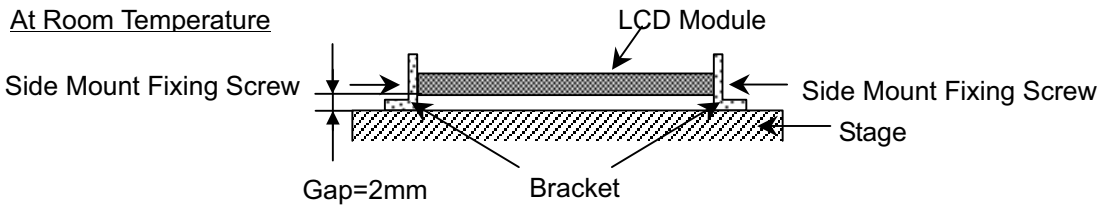



Note (3) 11ms, half sine wave, 1 time for ± X, ± Y, ± Z.

Note (4) 10 ~ 300 Hz, 10min/cycle, 3 cycles each X, Y, Z.

Note (5) 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.

The fixing condition is shown as below:



## 2.2 ELECTRICAL ABSOLUTE RATINGS

### 2.2.1 TFT LCD MODULE

| Item | Symbol | Value | | Unit | Note |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Power Supply Voltage | Vcc | -0.3 | +6.0 | V | (1) |
| Logic Input Voltage | $V_{IN}$ | -0.3 | 4.3 | V | |

### 2.2.2 BACKLIGHT UNIT

| Item | Symbol | Value | | Unit | Note |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Lamp Voltage | $V_L$ | - | 4.5K | $V_{RMS}$ | (1), (2) |
| Lamp Current | $I_L$ | 4.0 | 7.0 | $mA_{RMS}$ | (1), (2) |
| Lamp Frequency | $F_L$ | 40 | 80 | KHz | |

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

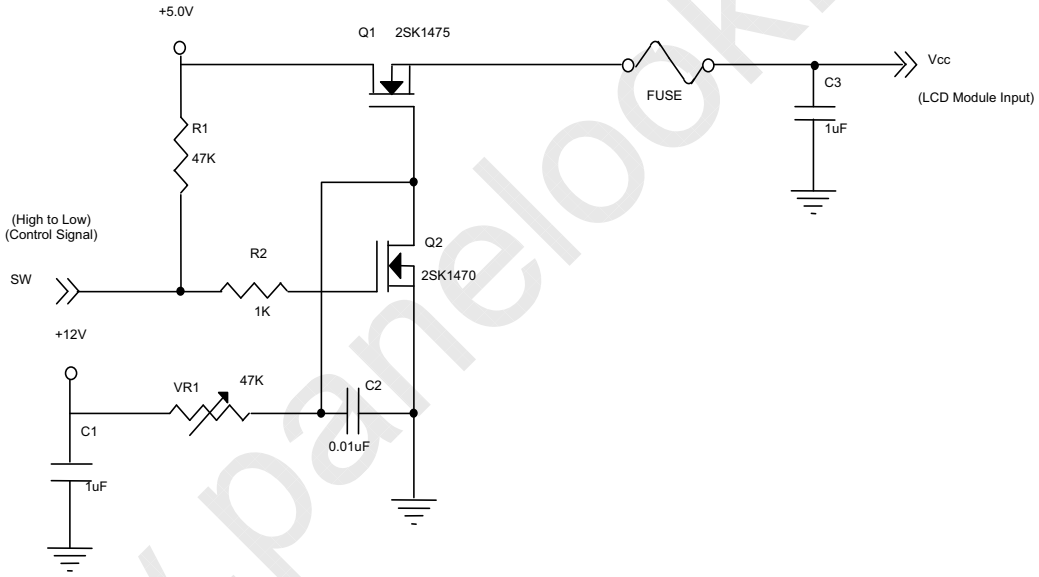
### 3.1 TFT LCD MODULE

Ta = 25 ± 2 ºC

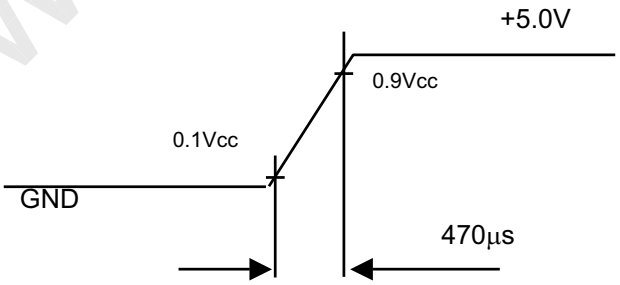
| Parameter | | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| Power Supply Voltage | | Vcc | 4.5 | 5.0 | 5.5 | V | - |
| Ripple Voltage | | $V_{RP}$ | - | - | 100 | mV | - |
| Rush Current | | $I_{RUSH}$ | - | 2 | 4 | A | (2) |
| Power Supply Current | White | - | | 1.8 | 2.2 | A | (3)a |
| | Black | - | | 1.3 | 1.7 | A | (3)b |
| | Vertical Stripe | - | | 1.7 | 2.1 | A | (3)c |
| LVDS differential input voltage | | Vid | 100 | - | 600 | mV | |
| LVDS common input voltage | | Vic | - | 1.2 | - | V | |
| Logic "L" input voltage | | Vil | Vss | - | 0.8 | V | |

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

Note (2) Measurement Conditions:




**Vcc rising time is 470μs**



Note (3) The specified power supply current is under the conditions at Vcc = 5.0 V, Ta = 25 ± 2 ºC, $f_v$ = 60 Hz, whereas a power dissipation check pattern below is displayed.

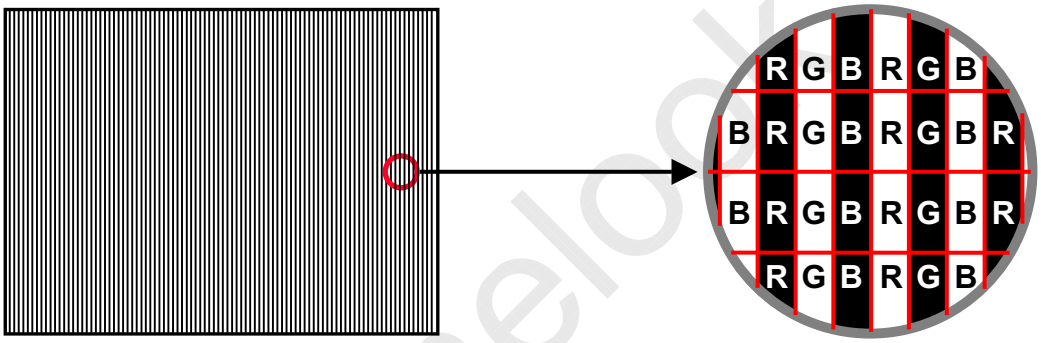
a. White Pattern

Active Area

b. Black Pattern

Active Area

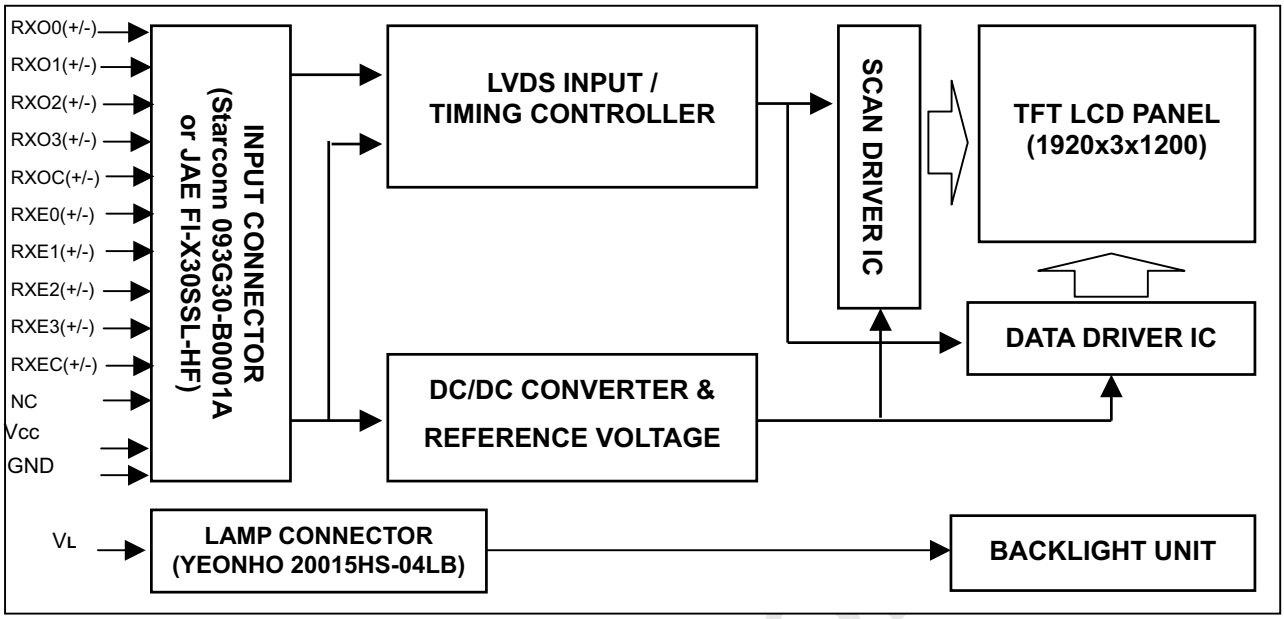
c. Vertical Stripe Pattern



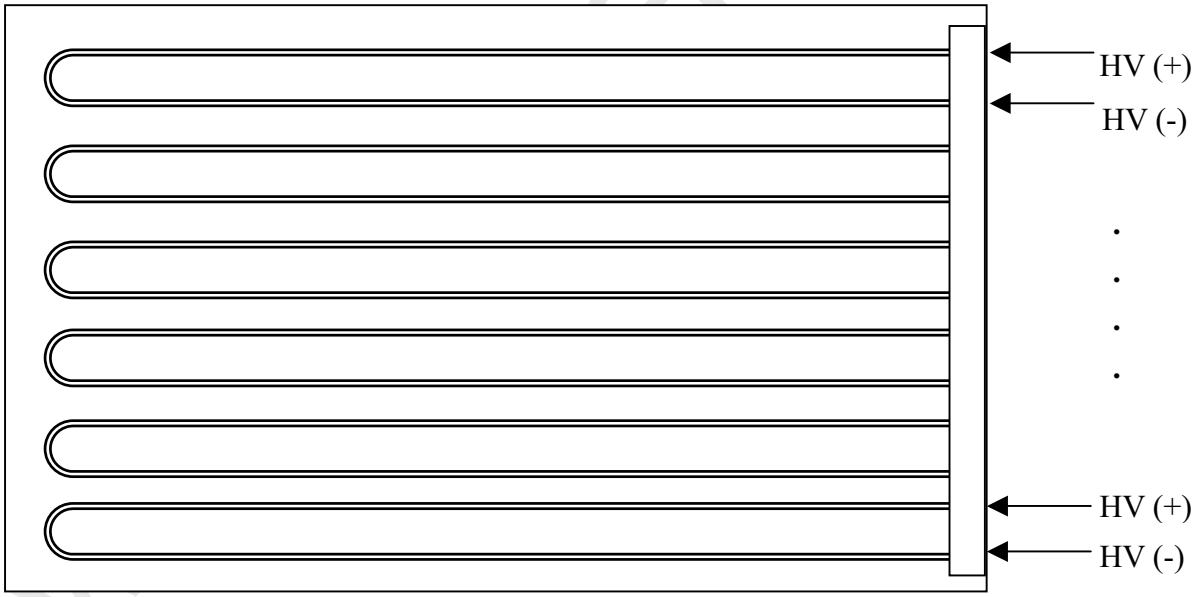

Active Area

# 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 | RXO0- | Negative LVDS differential data input. Channel O0 (odd) |
| 2 | RXO0+ | Positive LVDS differential data input. Channel O0 (odd) |
| 3 | RXO1- | Negative LVDS differential data input. Channel O1 (odd) |
| 4 | RXO1+ | Positive LVDS differential data input. Channel O1 (odd) |
| 5 | RXO2- | Negative LVDS differential data input. Channel O2 (odd) |
| 6 | RXO2+ | Positive LVDS differential data input. Channel O2 (odd) |
| 7 | GND | Ground |
| 8 | RXOC- | Negative LVDS differential clock input. (odd) |
| 9 | RXOC+ | Positive LVDS differential clock input. (odd) |
| 10 | RXO3- | Negative LVDS differential data input. Channel O3(odd) |
| 11 | RXO3+ | Positive LVDS differential data input. Channel O3 (odd) |
| 12 | RXE0- | Negative LVDS differential data input. Channel E0 (even) |
| 13 | RXE0+ | Positive LVDS differential data input. Channel E0 (even) |
| 14 | GND | Ground |
| 15 | RXE1- | Negative LVDS differential data input. Channel E1 (even) |
| 16 | RXE1+ | Positive LVDS differential data input. Channel E1 (even) |
| 17 | GND | Ground |
| 18 | RXE2- | Negative LVDS differential data input. Channel E2 (even) |
| 19 | RXE2+ | Positive LVDS differential data input. Channel E2 (even) |
| 20 | RXEC- | Negative LVDS differential clock input. (even) |
| 21 | RXEC+ | Positive LVDS differential clock input. (even) |
| 22 | RXE3- | Negative LVDS differential data input. Channel E3 (even) |
| 23 | RXE3+ | Positive LVDS differential data input. Channel E3 (even) |
| 24 | GND | Ground |
| 25 | NC | No connection |
| 26 | NC | Not connection. |
| 27 | VCC | +5.0V power supply |
| 28 | VCC | +5.0V power supply |
| 29 | VCC | +5.0V power supply |
| 30 | VCC | +5.0V power supply |

Note (1) Connector Part No.: Starconn 093G30-B0001A or JAE FI-X30SSL-HF.

Note (2) The first pixel is odd.

Note (3) Input signal of even and odd clock should be the same timing.

| SELLVDS = Low or Open | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| LVDS Channel E0 | LVDS output | D7 | D6 | D4 | D3 | D2 | D1 | D0 |
| | Data order | EG0 | ER5 | ER4 | ER3 | ER2 | ER1 | ER0 |
| LVDS Channel E1 | LVDS output | D18 | D15 | D14 | D13 | D12 | D9 | D8 |
| | Data order | EB1 | EB0 | EG5 | EG4 | EG3 | EG2 | EG1 |
| LVDS Channel E2 | LVDS output | D26 | D25 | D24 | D22 | D21 | D20 | D19 |
| | Data order | DE | NA | NA | EB5 | EB4 | EB3 | EB2 |
| LVDS Channel E3 | LVDS output | D23 | D17 | D16 | D11 | D10 | D5 | D27 |
| | Data order | NA | EB7 | EB6 | EG7 | EG6 | ER7 | ER6 |
| LVDS Channel O0 | LVDS output | D7 | D6 | D4 | D3 | D2 | D1 | D0 |
| | Data order | OG0 | OR5 | OR4 | OR3 | OR2 | OR1 | OR0 |
| LVDS Channel O1 | LVDS output | D18 | D15 | D14 | D13 | D12 | D9 | D8 |
| | Data order | OB1 | OB0 | OG5 | OG4 | OG3 | OG2 | OG1 |
| LVDS Channel O2 | LVDS output | D26 | D25 | D24 | D22 | D21 | D20 | D19 |
| | Data order | DE | NA | NA | OB5 | OB4 | OB3 | OB2 |
| LVDS Channel O3 | LVDS output | D23 | D17 | D16 | D11 | D10 | D5 | D27 |
| | Data order | NA | OB7 | OB6 | OG7 | OG6 | OR7 | OR6 |

5.2 BACKLIGHT UNIT:

| Pin | Symbol | Description | Remark |
|---|---|---|---|
| 1-1 | HV | High Voltage | Pink |
| 1-2 | HV | High Voltage | White |
| 2-3 | HV | High Voltage | Pink |
| 2-4 | HV | High Voltage | White |
| 3-5 | HV | High Voltage | Pink |
| 3-6 | HV | High Voltage | White |
| 4-7 | HV | High Voltage | Pink |
| 4-8 | HV | High Voltage | White |
| 5-9 | HV | High Voltage | Pink |
| 5-10 | HV | High Voltage | White |
| 6-11 | HV | High Voltage | Pink |
| 6-12 | HV | High Voltage | White |

Note (1) Connector Part No.: 20015HS-04LB (YEONHO) 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 | 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 | 0 | 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(253) | 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(254) | 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(255) | 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(253) | 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(254) | 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(255) | 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 | 0 | 1 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Blue(253) | 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(254) | 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(255) | 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. INVERTER SPECIFICATIONS

## 6.1 CONNECTOR TYPE

| Items | Input connector type | Output connector type |
|---|---|---|
| CN1 | YEONHO 20022WR-14L | YEONHO 20022HS-14L |
| CN2 | ACES 88260-02001-06 | ACES 87214-0200 |
| CAN-CNE | YEONHO 20015HS-04LB | YEONHO 20015WR-07B |

## 6.2 INPUT CONNECTOR PIN ASSIGNMENT

**CN1 : YEONHO 20022WR-14L**

| No. | Signal | Feature |
|---|---|---|
| 1 | $V_{BL}$ | +24 V |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | GND | GND |
| 7 | | |
| 8 | | |
| 9 | | |
| 10 | | |
| 11 | SOS | Shutdown Protection Signal |
| 12 | BLON | BL ON/OFF |
| 13 | ADIM | Analog Mode Dimming |
| 14 | SCAN ON/OFF | SCAN BL ON/OFF |

**CN2 : ACES 88260-02001-06**

| No. | Signal | Feature |
|---|---|---|
| 1 | STV | STV Signal Input |
| 2 | GND | GND |

## 6.3 OUTPUT CONNECTOR PIN ASSIGNMENT

**CNA-CNE : YEONHO 20015WR-07B**

| No. | Signal | Feature |
|---|---|---|
| 1 | CFL HOT | CFL High Voltage |
| 2 | CFL HOT | CFL High Voltage |

## 6.4 GENERAL ELECTRICAL SPECIFICATIONS

### 6.4.1 ABSOLUTE MAXIMUM RATING

| NO. | ITEM | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE(1) |
|---|---|---|---|---|---|---|---|---|
| 1 | INPUT VOLTAGE | $V_{IN}$ | - | 0 | - | 28 | V | |
| 2 | SHUTDOWN PROTECTION SIGNAL | SOS | - | -0.5 | - | 6.5 | V | |
| 3 | ON/OFF CONTROL VOLTAGE | $V_{BLON}$ | - | | | | | |
| 4 | ANALOG DIMMING VOLTAGE | $V_{ADIM}$ | - | | | | | |
| 5 | SCAN MODE ON/OFF CONTROL VOLTAGE | $V_{SCAN}$ | - | | | | | |
| 6 | STV SIGNAL | $V_{STV}$ | - | | | | | |
| 7 | OPERATING TEMPERATURE | $T_{OP}$ | 5~90% RH | 0 | - | 75 | °C | Protect inverters from moisture condensation and freezing. (Note 1) |
| 8 | STORAGE TEMPERATURE | $T_{ST}$ | 5~95% RH | -30 | - | 80 | °C | |

Note: The absolute maximum rating that a rated value must not be exceeded during operation. When it is used exceeding the maximum rating, for a certain reason, a possibility that an inverter may be damaged also recommends being used fully in operating condition as below.

### 6.4.2 OPERATING CONDITION

| NO. | ITEM | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE(1) |
|---|---|---|---|---|---|---|---|---|
| 1 | POWER CONSUMPTION | $P_{BL}$ | Normal mode | - | - | 72 | W | |
| 2 | INPUT VOLTAGE | $V_{BL}$ | - | 21.6 | 24 | 26.4 | V | |
| 3 | INPUT CURRENT | $I_{IN}$ | - | - | 3 | 3.5 | A | |
| 4 | SHUTDOWN PROTECTION SIGNAL | SOS | Normal | - | 0 | - | V | |
| | | | Abnormal | - | 5 | - | V | |
| 5 | ON/OFF CONTROL VOLTAGE | $V_{BLON}$ | $V_{BLON}$=ON | 2.5 | - | 5 | V | |
| | | | $V_{BLON}$=OFF | 0 | - | 0.8 | V | |
| 6 | ANALOG DIMMING VOLTAGE | $V_{ADIM}$ | Max. | - | 5 | - | V | |
| | | | Min. | - | 0 | - | V | |
| 7 | SCAN MODE ON/OFF CONTROL VOLTAGE | $V_{SCAN}$ | $V_{SCAN}$=H | 2.5 | - | 5 | V | |
| | | | $V_{SCAN}$=L | 0 | - | 0.8 | V | |
| 8 | STV SIGNAL | $T_{STV}$ | $V_{SYN}$=H | 2.5 | - | 5 | V | |
| | | | $V_{SYN}$=L | 0 | - | 0.8 | V | |
| 9 | OPERATING TEMPERATURE | $T_{OP}$ | 20～95% RH | 0 | - | 60 | °C | Protect inverters from moisture condensation and freezing. (Note 1) |
| 10 | STORAGE TEMPERATURE | $T_{ST}$ | 5～95% RH | -20 | - | 75 | °C | |

Note 1 Temperature and relative humidity condition are as below.

(a) 90 %RH Max. (Ta ≦ 40 ℃)

(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

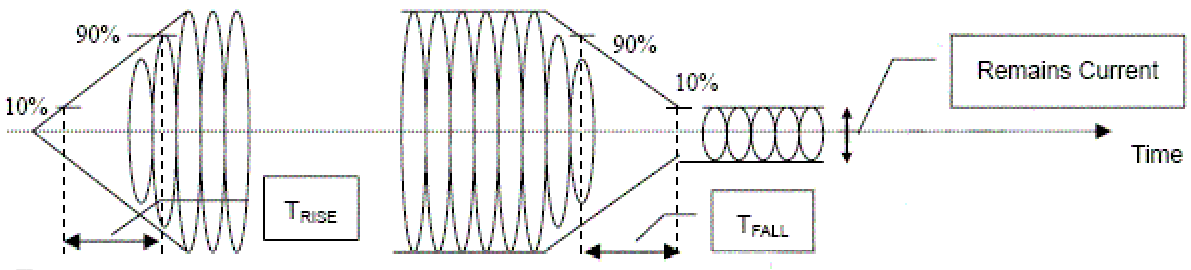
(c) No condensation of water.

6.4.3 INITIAL CHARACTERISTICS (Ta = 25 ± 5 °C)

| NO. | ITEM | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE |
|---|---|---|---|---|---|---|---|---|
| 1 | INPUT VOLTAGE | $V_{BL}$ | - | 21.6 | 24 | 26.4 | V | |
| 2 | INPUT CURRENT | $I_{BL}$ | Normal Mode | - | 3 | 3.5 | A | |
| 3 | INPUT INRUSH CURRENT | - | $V_{BL}$=24 V | - | - | 6 | $A_{peak}$ | |
| 4 | INDIVIDUAL MAXIMUM LAMP CURRENT | $I_{L(max.)}$ | Normal Mode or Scan Mode | 10.4 | - | 11.4 | mA | |
| 5 | SCAN MODE INDIVIDUAL LAMP CURRENT | $I_{L(min.)}$ | Scan Mode or Scan Mode | 2.7 | - | 3.7 | mA | |
| 6 | OSCILLATING FREQUENCY | $F_W$ | - | 50 | 55 | 70 | KHz | |
| 7 | BURST MODE FREQUENCY | $F_B$ | Normal Mode | - | 180 | - | Hz | |
| 8 | OPEN LAMP VOLTAGE | $V_S$ | Ta=0 °C | 3900 | - | - | $V_{rms}$ | |
| | | | Ta=25 °C | 3670 | - | - | $V_{rms}$ | |
| 9 | LAMP VOLTAGE | $V_W$ | Ta=25 °C | - | 1900 | - | $V_{rms}$ | |
| 10 | RISING TIME | $T_{RISE}$ | - | - | - | 500 | μs | See Fig. 1, (Note 3) |
| 11 | FALLING TIME | $T_{FALL}$ | - | - | - | 500 | μs | |
| 12 | START-UP TIME | $T_S$ | ≧0.9*$I_L$ | 1 | - | 2 | Sec. | Power on to $I_L$ stabilize period |
| 13 | TOTAL EFFICIENCY | η | - | 80 | - | - | % | $P_{BL}$ / $P_L$, (Load: CCFL) |

Note 2 Lamp for measurement, use back light: 24”back light unit. The measurement result is a result after 30 minutes of lighting.

Note 3 The definitions of rising time, falling time and remains current are based on high side lamp current and diagramed as Fig.1.



6.4.4 PROTECTION CHARACTERISTICS

| NO. | ITEM | TEST CONDITION | RESPONDENCE OF SUBJECT | NOTE |
|---|---|---|---|---|
| 1 | OPEN LAMP PROTECTION (OLP) | - | Shutdown | 1S<$T_{fault}$<2S (Note 4~7) |
| 2 | OUTPUT SHORT PROTECTION (OSP) | Output Shutter: 2 KΩ | Shutdown or $I_{short}$ (peak value)≦ 2.8*$I_{rms}$ | |
| 3 | INPUT OVER VOLTAGE PROTECTION (IOP) | ≧1.25*Vin (typ) | Shutdown | |
| 4 | INPUT UNDER VOLTAGE PROTECTION (IUP) | ≦0.8*Vin (typ) | Shutdown | |

Note 4 $T_{fault}$ is the duration since inverter ignition till shutdown by protection circuit is triggered.

Note 5 Any output short outside inverter should be protected.

Note 6 Whatever the above items occurred before inverter turn on or under inverter operating duration that inverter should be protected.

Note 7 When OLP & OSP protections have been trigged, inverter shall be restarted by input power source and $V_{BLON}$ signal.

6.4.5 INTERFACE CHARACTERISTICS

| NO. | ITEM | | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE(11-12) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ON/OFF CONTROL VOLTAGE | ON | $V_{BLON}$ | - | 2.5 | - | 5 | V | |
| | | OFF | | - | 0 | - | 0.8 | V | |
| 2 | ANALOG DIMMING VOLTAGE | MAX | $V_{ADIM}$ | - | - | - | 5 | V | Minimum Duty Ratio |
| | | MIN | | - | - | 0 | - | V | Maximum Duty Ratio |
| 3 | SCAN MODE CONTROL VOLTAGE | ON | $V_{SCAN}$ | - | 2.5 | - | 5 | V | |
| | | OFF | | - | 0 | - | 0.8 | V | |
| 4 | STV SINGLE VOLTAGE | HI | $V_{STV}$ | - | 2.5 | - | 5 | V | Ext. Dim. Control |
| | | LO | | - | 0 | - | 0.8 | V | Int. Dim. Control |

Note 8 Even if control signal over range in any conditions that there must no smell, smoke, and fire cause by any failure on inverter PCB or components.

Note 9 All the interface circuits without spike suppress component hence the hot plug in or plug out of all connectors are inhibited.

6.4.6 Inverter Operating Mode

| No | OPERATING STATUS | ON/OFF CONTROL VBLON | | ANALOG DIMMING VADIM. | | SCAN MODE CONTROL VSCAN | | STV SINGLE INPUT VSTV | |
|---|---|---|---|---|---|---|---|---|---|
| | | ON | OFF | MAX. | MIN. | ON | OFF | ENABLE | DISABLE |
| | | 2.5~5V | 0~0.8V | 5V | 0V | 2.5~5V | 0~0.8V | 2.5~5V | 0~0.8V |
| 1 | INVERTER OFF | - | - | DISABLE | | DON'T CARE | DON'T CARE | DON'T CARE | DON'T CARE |
| 2 | NORMAL MODE OPERATION | V | - | ENABLE | | - | V | V | - |
| 3 | SCAN MODE OPERTAION | V | - | ENABLE | | V | - | V | - |
| 4 | PROTECTION MODE OPERATION(NOTE 10) | V | - | DISABLE | | DON'T CARE | DON'T CARE | - | V |

# 7. INTERFACE TIMING

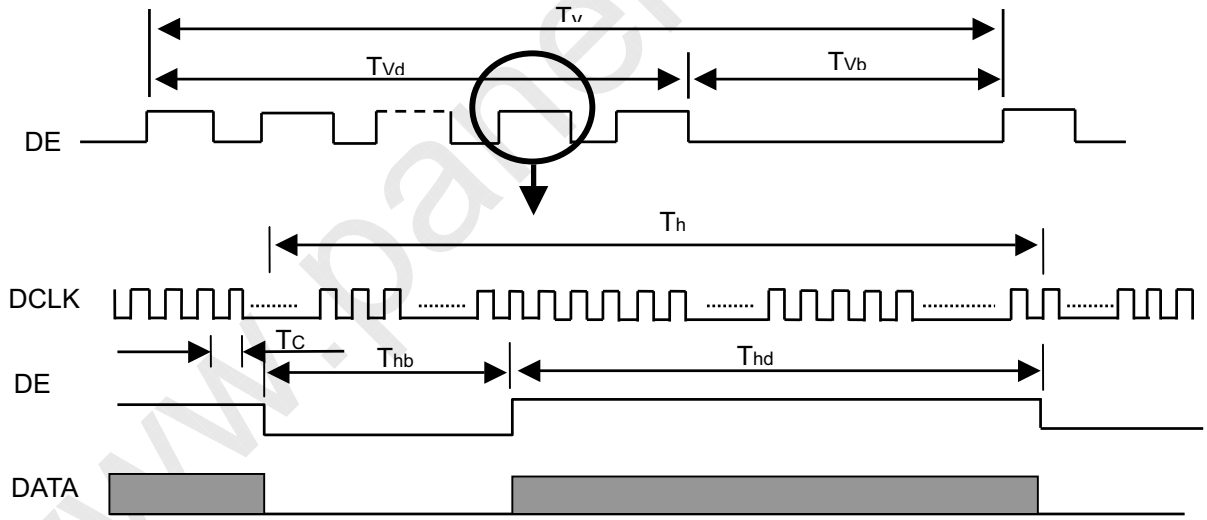
## 7.1 INPUT SIGNAL TIMING SPECIFICATIONS

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

| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| LVDS Clock | Frequency | Fc | 50.0 | 77 | 83.0 | MHz | - |
| | Period | Tc | - | 13.0 | - | ns | |
| | High Time | Tch | - | 4/7 | - | Tc | - |
| | Low Time | Tcl | - | 3/7 | - | Tc | - |
| LVDS Data | Setup Time | Tlvs | 600 | - | - | ps | - |
| | Hold Time | Tlvh | 600 | - | - | ps | - |
| Vertical Active Display Term | Frame Rate | Fr | 40 | 60 | 63 | Hz | Tv=Tvd+Tvb |
| | Total | Tv | 1209 | 1235 | 1245 | Th | - |
| | Display | Tvd | 1200 | 1200 | 1200 | Th | - |
| | Blank | Tvb | (9) | 35 | Tv-Tvd | Th | - |
| Horizontal Active Display Term | Total | Th | 1030 | 1040 | 1075 | Tc | Th=Thd+Thb |
| | Display | Thd | 960 | 960 | 960 | Tc | - |
| | Blank | Thb | 70 | 80 | Th-Thd | Tc | - |

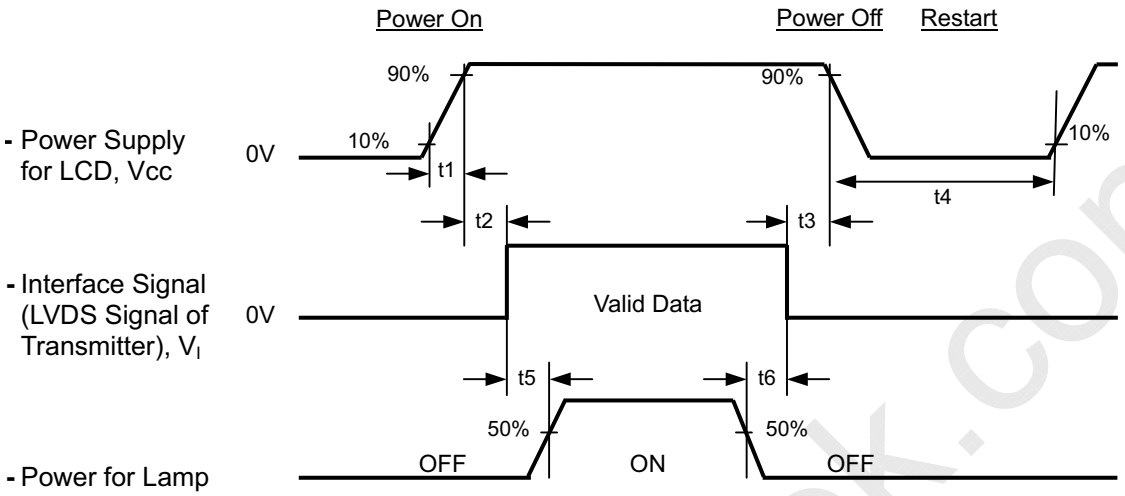
Note: Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

**INPUT SIGNAL TIMING DIAGRAM**



7.2 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 ≦ 10 msec

0 < t2 ≦ 50 msec

0 < t3 ≦ 50 msec

t4 ≧ 500 msec

t5 ≧ 500 msec

t6 ≧ 90 msec

## 8. OPTICAL CHARACTERISTICS

### 8.1 TEST CONDITIONS

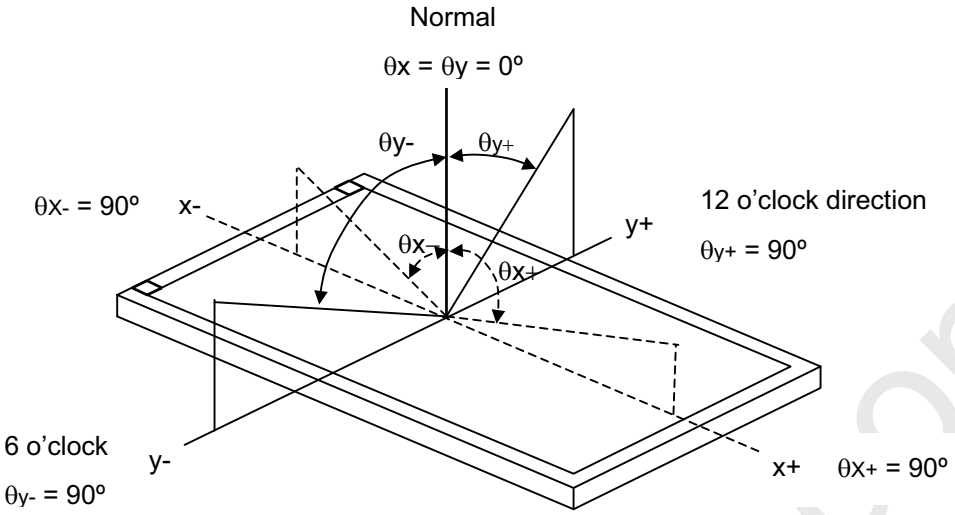
| Item | Symbol | Value | Unit |
|---|---|---|---|
| Ambient Temperature | Ta | 25±2 | °C |
| Ambient Humidity | Ha | 50±10 | %RH |
| Supply Voltage | $V_{CC}$ | 5.0 | V |
| Input Signal | According to typical value in "3. ELECTRICAL CHARACTERISTICS" | | |
| Lamp Current | $I_L$ | (6.0) | mA |
| Inverter Operating Frequency | $F_L$ | 50 | KHz |
| Inverter | BSVD24U01A | | |

### 8.2 OPTICAL SPECIFICATIONS

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

| Item | | Symbol | Condition | | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|---|
| Color Chromaticity (CIE 1931) | Red | Rx | $\theta_x$=0°, $\theta_Y$ =0° CS-1000T | | Typ - 0.03 | 0.640 | Typ + 0.03 | - | (1), (5) |
| | | Ry | | | | 0.348 | | | |
| | Green | Gx | | | | 0.293 | | | |
| | | Gy | | | | 0.585 | | | |
| | Blue | Bx | | | | 0.143 | | | |
| | | By | | | | 0.075 | | | |
| | White | Wx | | | | 0.313 | | | |
| | | Wy | | | | 0.329 | | | |
| Center Luminance of White (Center of Screen) | | $L_C$ | | | 350 | 400 | - | cd/m$^2$ | (4), (5) |
| Contrast Ratio | | CR | | | 700 | 1000 | - | - | (2), (5) |
| Response Time | | $T_R$ | $\theta_x$=0°, $\theta_Y$ =0° | | - | 13 | 18 | ms | (3),(7) |
| | | $T_F$ | | | - | 7 | 12 | | |
| | | $T_{GtoG,AVE}$ | | | - | 8 | 13 | | |
| Motion Picture Response Time (For Scan Function) | | $T_{MPRT}$ | $\theta_x$=0°, $\theta_Y$ =0° | Off | - | 19 | - | ms | (8) |
| | | | | On | - | 14 | - | | |
| White Variation | | δW | $\theta_x$=0°, $\theta_Y$ =0° | | - | 1.25 | 1.40 | - | (5), (6) |
| Viewing Angle | Horizontal | $\theta_x$+ | CR ≧ 10 | | 80 | 88 | - | Deg. | (1), (5) |
| | | $\theta_x$- | | | 80 | 88 | - | | |
| | Vertical | $\theta_Y$+ | | | 80 | 88 | - | | |
| | | $\theta_Y$- | | | 80 | 88 | - | | |

Note (1) Definition of Viewing Angle (θx, θy):




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

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L255 / L0

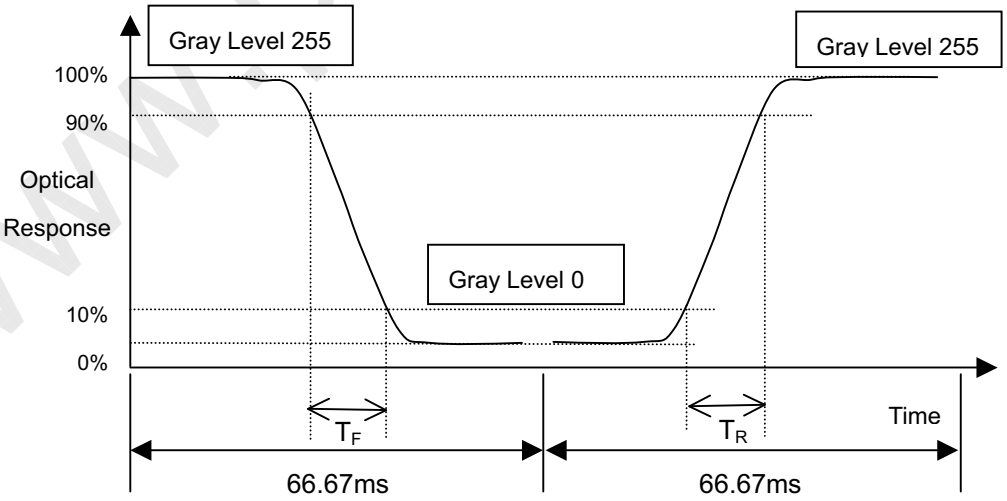
L255: Luminance of gray level 255

L 0: Luminance of gray level 0

**CR = CR (1)**

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

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



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

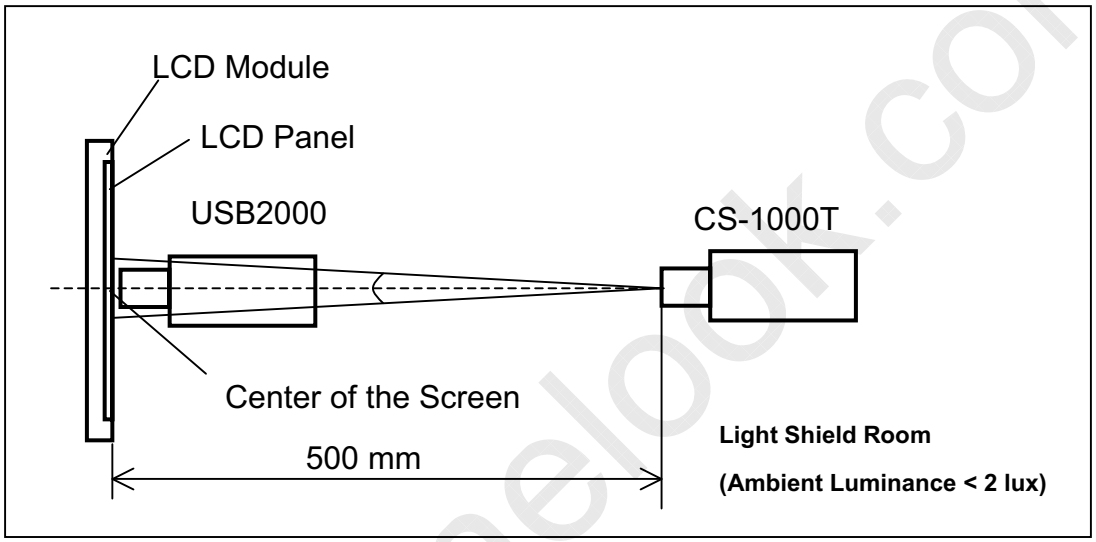
Measure the luminance of gray level 255 at center point

**$L_C$ = L (1)**

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

Note (5) Measurement Setup:

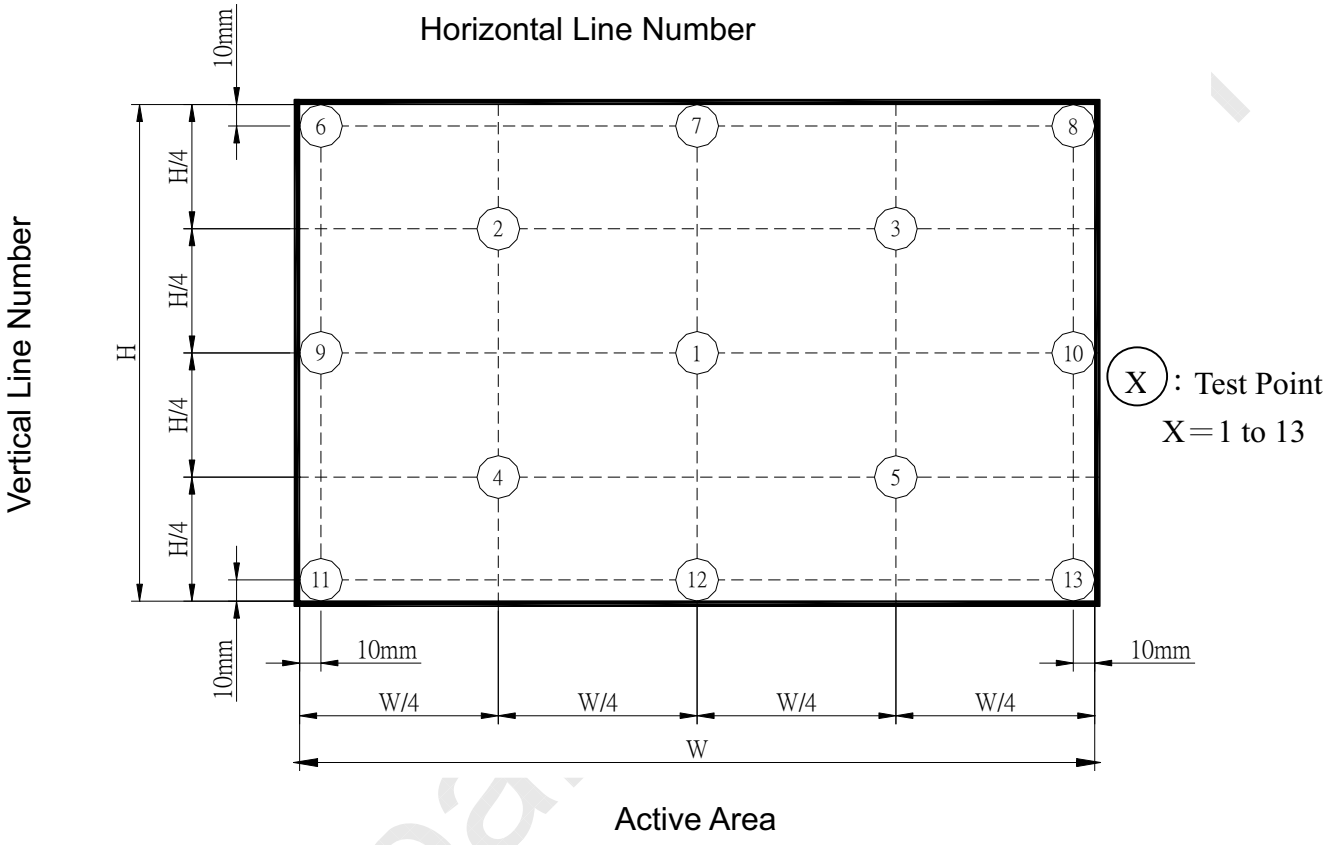
The LCD module should be stabilized at given temperature for 40 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 40 minutes in a windless room.



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

Measure the luminance of gray level 255 at 13 points

$$\delta W = \frac{\text{Maximum [L(1), L(2), L(3), L(4), L(5), L(6), L(7), L(8), L(9), L(10), L(11), L(12), L(13)]}}{\text{Minimum [L(1), L(2), L(3), L(4), L(5), L(6), L(7), L(8), L(9), L(10), L(11), L(12), L(13)]}}$$



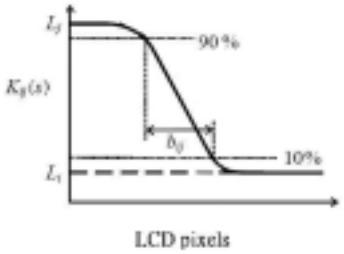

Note (7) Definition of Response Time ($T_{GTG\_AVE}$):

$T_{GTG\_AVE}$ is defined as the total average response time for “Gray To Gray “.

The Gray to Gray response time is defined as the following chart.

| Gray to Gray | | Target Gray | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | G0 | G32 | G64 | G96 | G128 | G160 | G192 | G224 | G255 |
| Initial Gray | G0 | | | | | | | | | |
| | G32 | | | | | | | | | |
| | G64 | | | | | | | | | |
| | G96 | | | | | | | | | |
| | G128 | | | | | | | | | |
| | G160 | | | | | | | | | |
| | G192 | | | | | | | | | |
| | G224 | | | | | | | | | |
| | G255 | | | | | | | | | |

Note (8) Definition of MPRT ($T_{MPRT}$):




The motion picture response time (in mini-second) is the average of blurred edge widths divided by scroll speed *u* (10 pixels per frame):

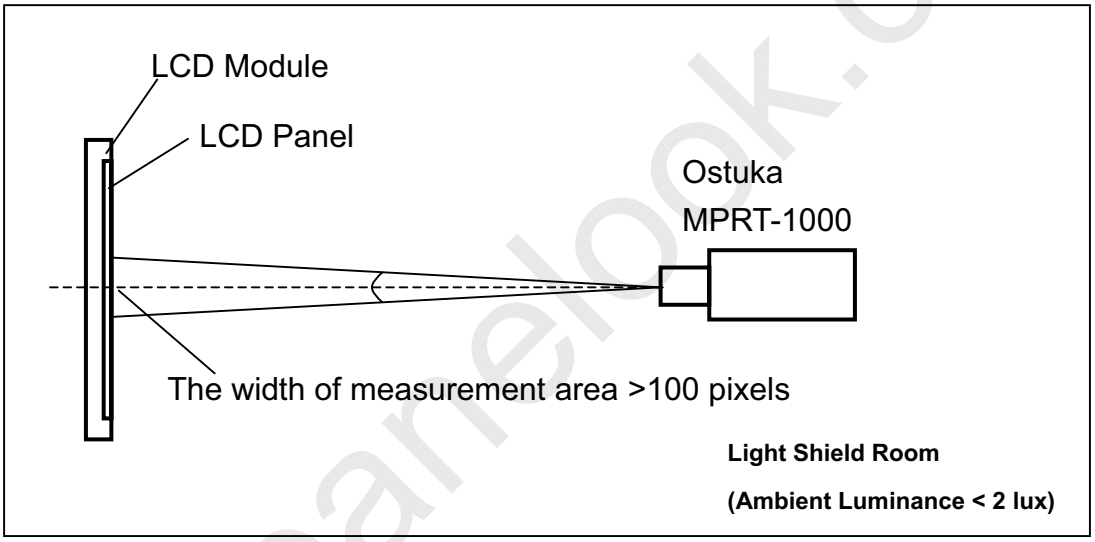
$$T_{MPRT} = \frac{1}{uNf}\sum_{i \neq j} b_{ij}$$

where

$b_{ij}$ is 10% to 90% blurred edge width measured by Otsuka MPRT-1000.

f is frame rate.

N is the number of i≠j transitions. For the case of nine gray levels ( i = 0, 31, 63, 91, 127, 191, 223, 255; j = 0, 31, 63, 91, 127, 191, 223, 255, and i≠j).



## 9. PACKAGING

### 9.1 PACKING SPECIFICATIONS

(1) 5 LCD modules / 1 Box

(2) Box dimensions: 645(L) X 377(W) X 470(H) mm

(3) Weight: approximately 17.5Kg (5 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<br>Random, Frequency Range: 1 – 200 Hz<br>Top & Bottom: 30 minutes (+Z), 10 min (-Z),<br>Right & Left: 10 minutes (X)<br>Back & Forth 10 minutes (Y) | Non Operation |
| Dropping Test | 1 Angle, 3 Edge, 6 Face, 60cm | Non Operation |

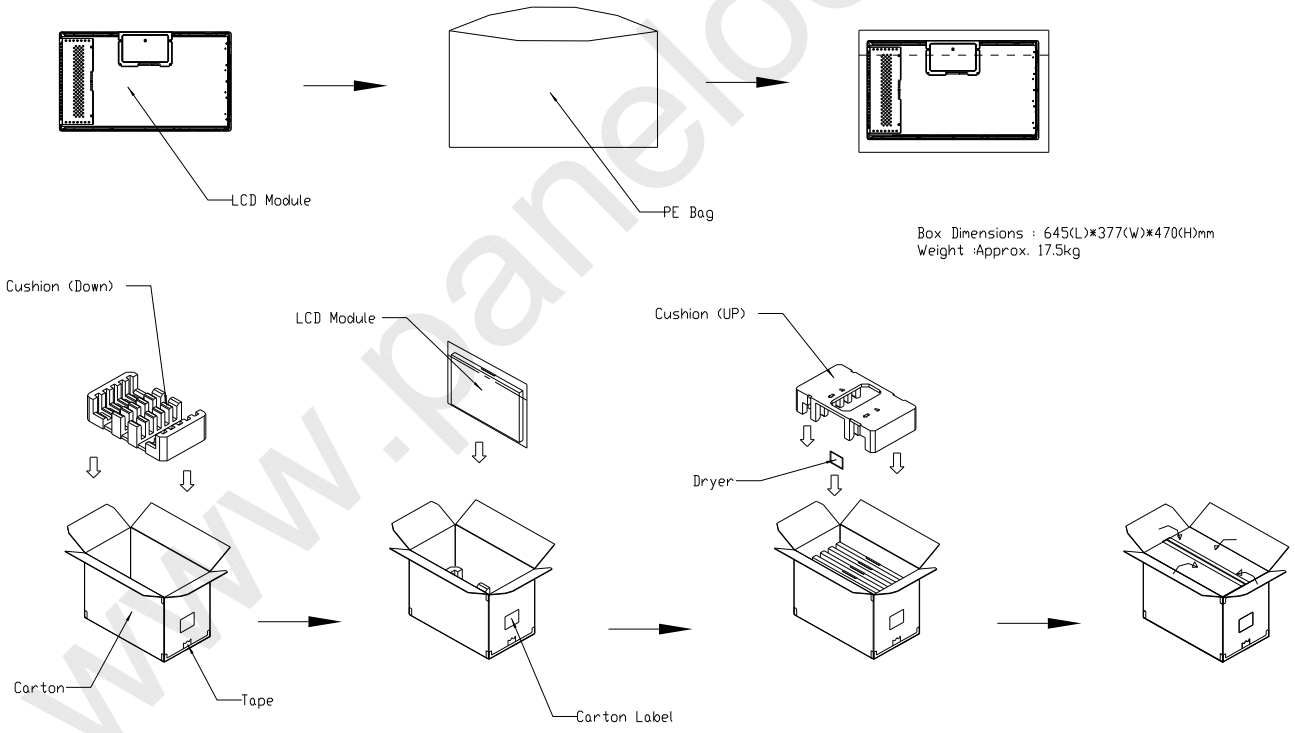



**Figure. 9-1 Packing method**

For ocean shipping

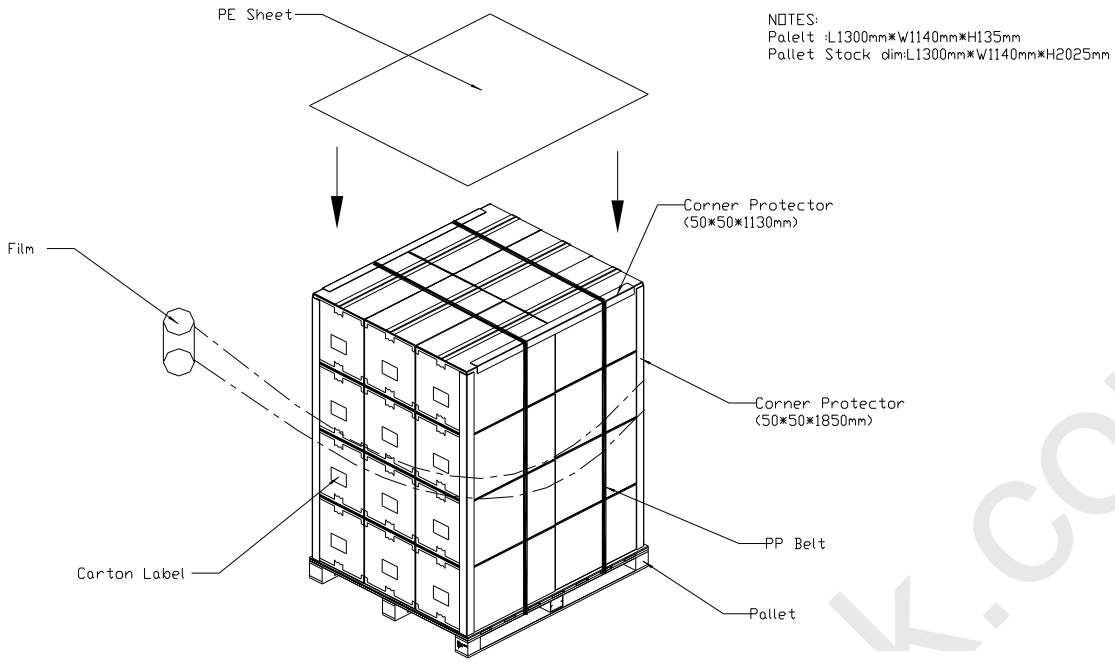



**Figure. 9-2 Packing method**

For air transport

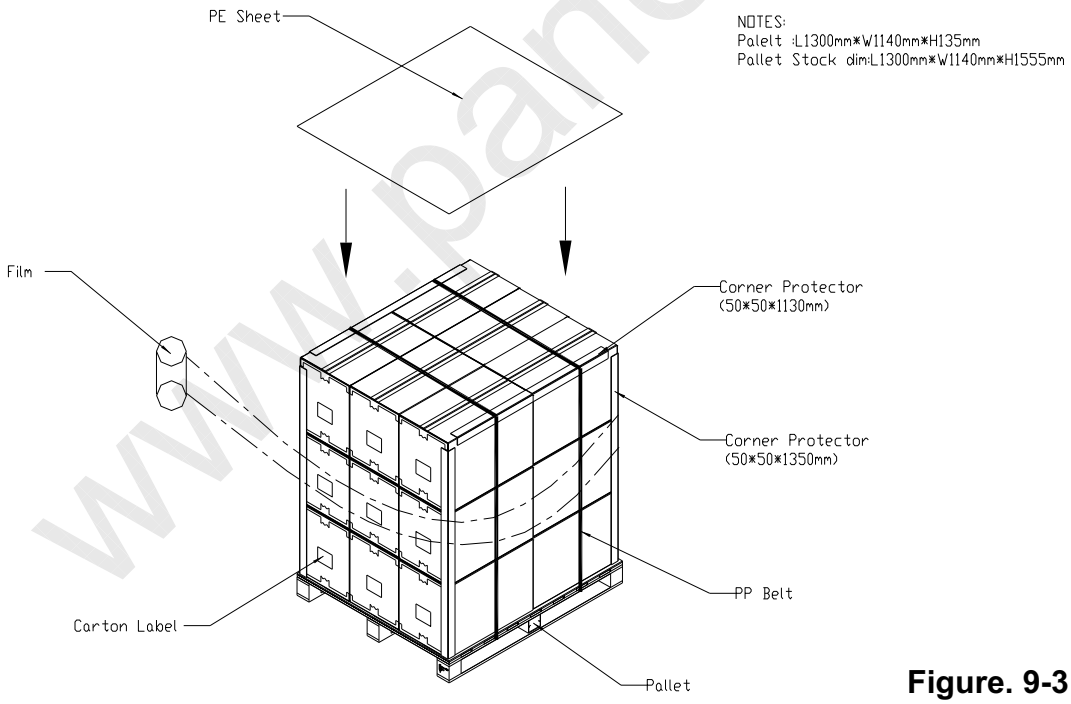



**Figure. 9-3 Packing method**

## 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: M240J1-L03

(b) Revision: Rev. XX, for example: A0, A1… B1, B2… or C1, C2…etc.

(c) CMO barcode definition:

Serial ID: XX-XX-X-XX-YMD-L-NNNN

| Code | Meaning | Description |
|---|---|---|
| XX | CMO internal use | - |
| XX | Revision | Cover all the change |
| X | CMO internal use | - |
| XX | CMO internal use | - |
| YMD | Year, month, day | Year: 2001=1, 2002=2, 2003=3, 2004=4…<br>Month: 1~12=1, 2, 3, ~, 9, A, B, C<br>Day: 1~31=1, 2, 3, ~, 9, A, B, C, ~, W, X, Y, exclude I, O, and U. |
| L | Product line # | Line 1=1, Line 2=2, Line 3=3, … |
| NNNN | Serial number | Manufacturing sequence of product |

(d) Customer's barcode definition:

Serial ID: QLD0466-002

## 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) 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.

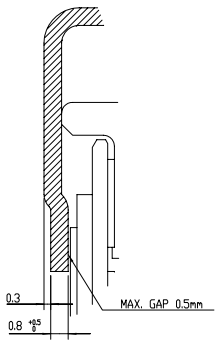
(10) When ambient temperature is lower than 10ºC may reduce the display quality. For example, the response time will become slowly, and the starting voltage of CCFL will be higher than room temperature.

## 11.2 SAFETY PRECAUTIONS

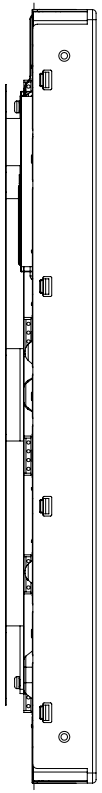
(1) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.

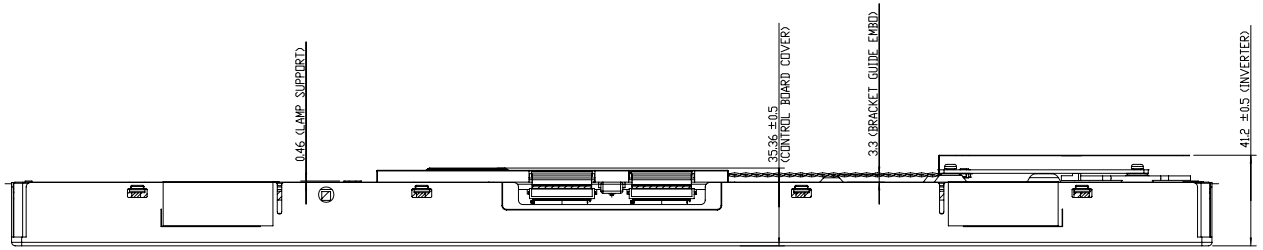
(2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.

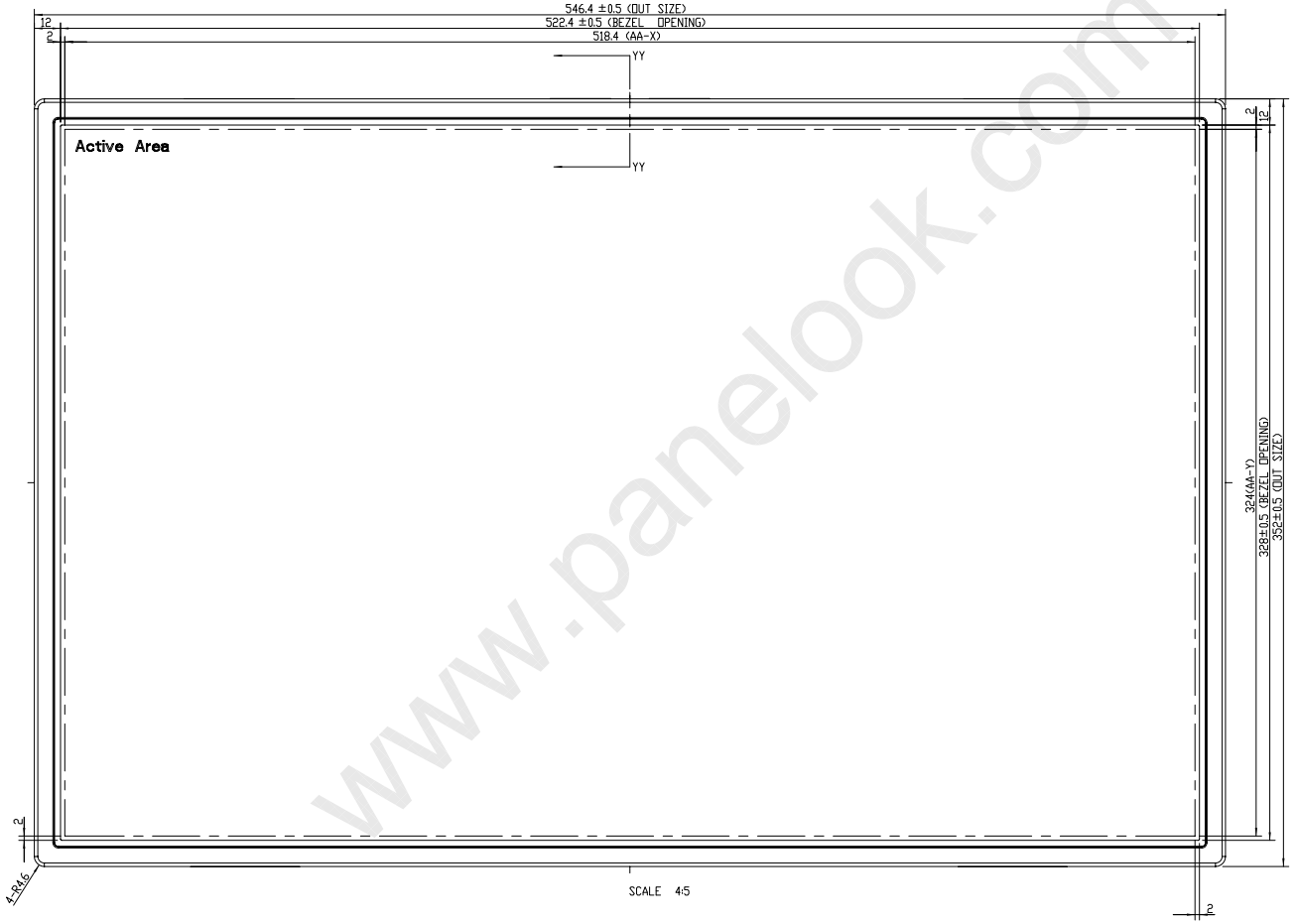
(3) After the module's end of life, it is not harmful in case of normal operation and storage.



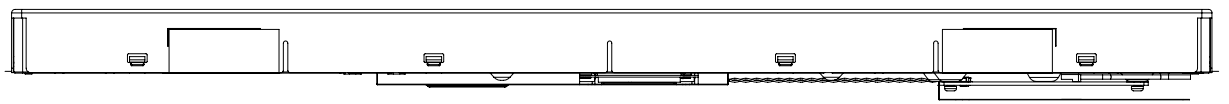

SECTION YY-YY
SCALE 8:1

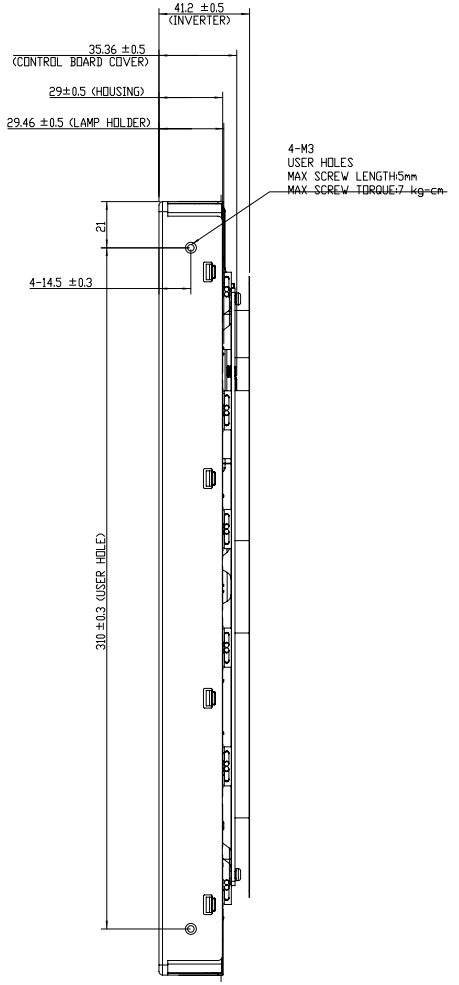





SCALE 4:5






NOTES:
1.OUTLINE TOLERANCE: ±0.5mm.

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

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| TITLE | ASSY_MODULE_M240J1-L03 | | | | | 2D REV. | A0+ |
| | | | | | | 3D REV. | 1.20+ |
| Approved | JEMMY CHANG | Drawing No. | M24014105A | | | | |
| Checked | TAURUS HSIEH | Part No. | M00J103901 | | | | |
| Drawer | TOBIAS WANG | Material | TBD | Sheet | 1 / 2 | A1 | |
| Designer | TOBIAS WANG | Date | 29-Sep-2005 | Scale | 1:1 | Unit:mm | |

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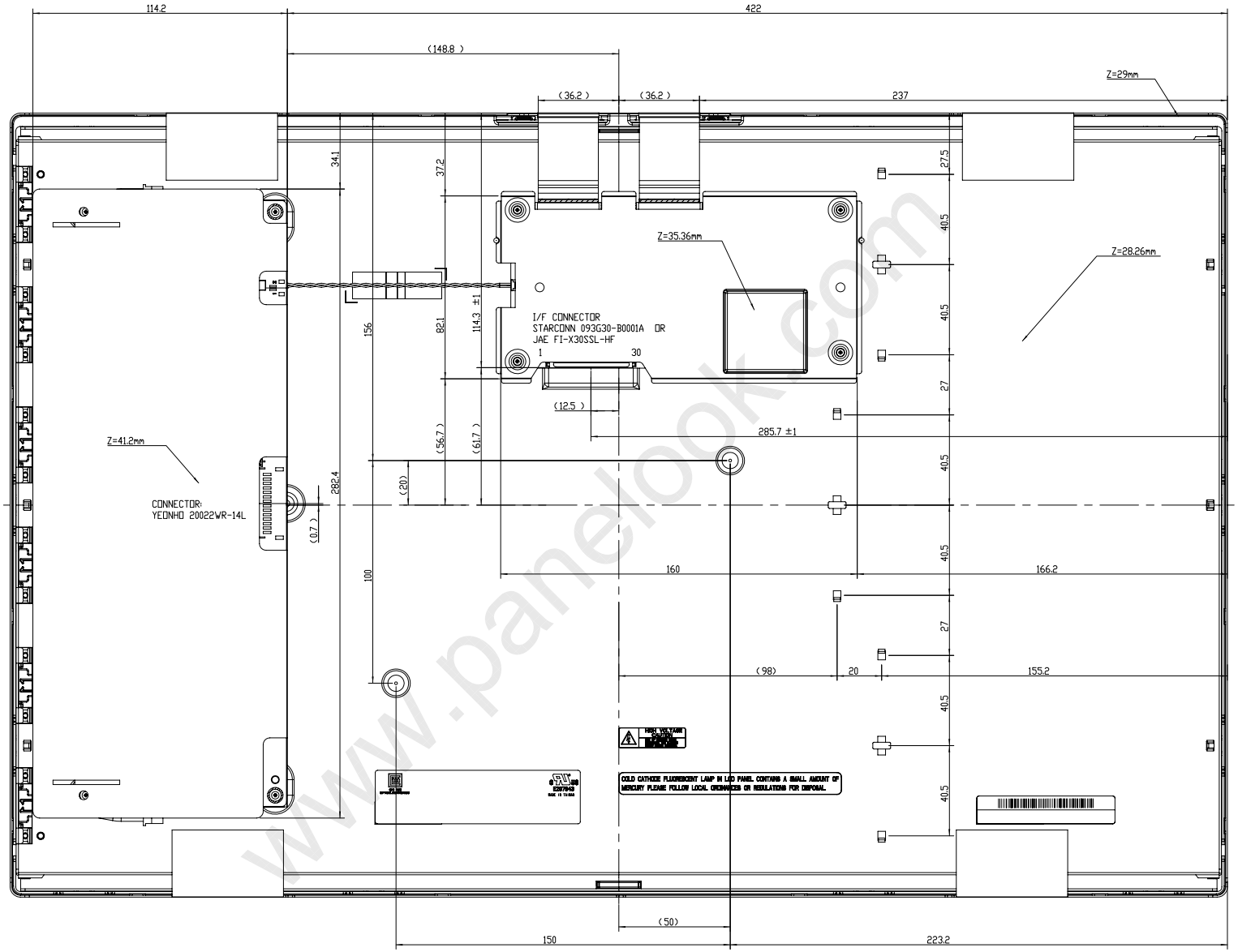


SCALE 1:1

NOTES:
1.OUTLINE TOLERANCE: ±0.5mm.

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

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| TITLE | ASSY_MODULE_M240J1-L03 | | | | | 2D REV. | A0+ | |
| | | | | | | 3D REV. | 1.20+ | |
| Approved | JEMMY CHANG | | Drawing No. | M240141054 | | | | |
| Checked | TAURUS HSIEH | | Part No. | M00J103901 | | | | |
| Drawer | TOBIAS WANG | | Material | TBD | | Sheet | 2 / 2 | A1 |
| Designer | TOBIAS WANG | | Date | 29-Sep-2005 | Scale | 1:1 | Unit:mm | |

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