# TFT LCD Approval Specification

# MODEL NO.: N154Z3 - L03

Customer : Fujitsu

Approved by :

Note :

| 記錄 | 工作 | 審核 | 角色 | 投票 |
|---|---|---|---|---|
| 2008-09-12 15:04:40 CST | PMMD III Director | annie_hsu(徐凡琇/56522 / 54873) | Director | Accept |

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## REVISION HISTORY

| Version | Date | Page (New) | Section | Description |
|---|---|---|---|---|
| Ver 3.0 | Sep. 18,'08 | All | All | Approval Specification was first issued. |

# 1. GENERAL DESCRIPTION

## 1.1 OVERVIEW

N154Z3 - L03 is a 15.4" TFT Liquid Crystal Display module with single CCFL Backlight unit and 30 pins LVDS interface. This module supports 1680 x 1050 Wide-SXGA+ mode and can display 262,144 colors. The optimum viewing angle is at 6 o'clock direction. The inverter module for Backlight is not built in.

## 1.2 FEATURES

- Thin and High Brightness
- WSXGA+ (1680 x 1050 pixels) resolution
- DE only mode
- 3.3V LVDS (Low Voltage Differential Signaling) interface with 2 pixel/clock
- Meet RoHS requirement

## 1.3 APPLICATION

- TFT LCD Notebook

## 1.4 GENERAL SPECIFICATI0NS

| Item | Specification | Unit | Note |
|---|---|---|---|
| Active Area | 331.2 (H) x 207.0 (V) (15.4 inch Diagonal) | mm | (1) |
| Bezel Opening Area | 334.7 (H) x 210.5 (V) | mm | |
| Driver Element | a-si TFT active matrix | - | - |
| Pixel Number | 1680 x 3 (RGB) x 1050 | pixel | - |
| Pixel Pitch | 0.1971 x 0.1971 | mm | - |
| Pixel Arrangement | RGB vertical stripe | - | - |
| Display Colors | 262,144 | color | - |
| Transmissive Mode | Normally white | - | - |
| Surface Treatment | Hard coating (3H), Anti-glare | - | - |

## 1.5 MECHANICAL SPECIFICATIONS

| Item | | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Module Size | Horizontal (H) | 343.5 | 344 | 344.5 | mm | (1) |
| | Vertical (V) | 221.5 | 222 | 222.5 | mm | |
| | Depth (D) | --- | 6.2 | 6.5 | mm | |
| Weight | | --- | 515 | 530 | 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

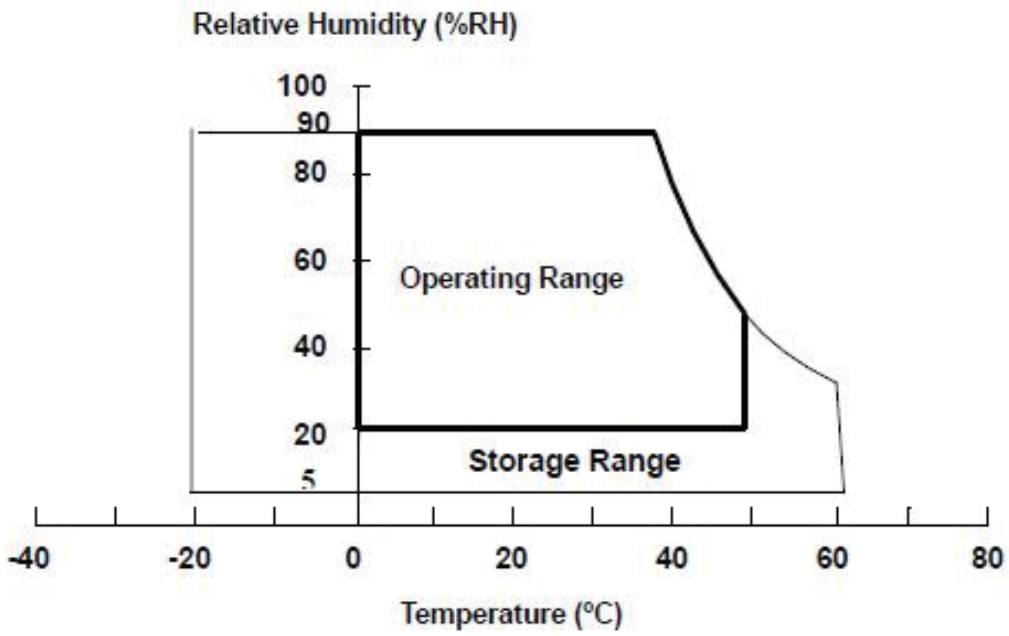
| Item | Symbol | Value | | Unit | Note |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Storage Temperature | $T_{ST}$ | -20 | +60 | ºC | (1) |
| Operating Ambient Temperature | $T_{OP}$ | 0 | +50 | ºC | (1), (2) |
| Shock (Non-Operating) | $S_{NOP}$ | - | 200/2 | G/ms | (3), (5) |
| Vibration (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.



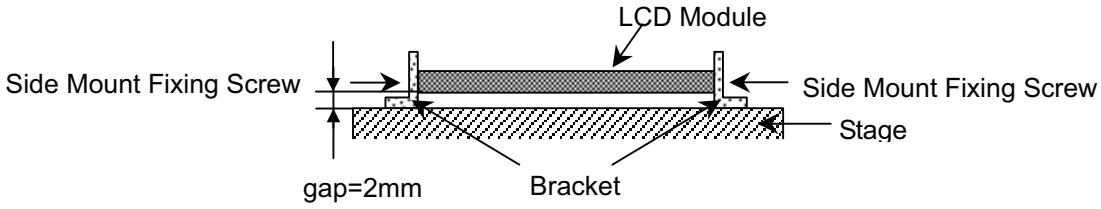

Note (2) The temperature of panel surface should be 0 ºC Min. and 50 ºC Max.

Note (3) 1 time for ± X, ± Y, ± Z. for Condition (200G / 2ms) is half Sine Wave,

Note (4) 10 ~ 200 Hz, 0.5 Hr / Cycle, 1 cycles for 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 | $V_{CC}$ | -0.3 | +4.0 | 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), $I_L$ = 6.0 mA |
| Lamp Current | $I_L$ | 3 | 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

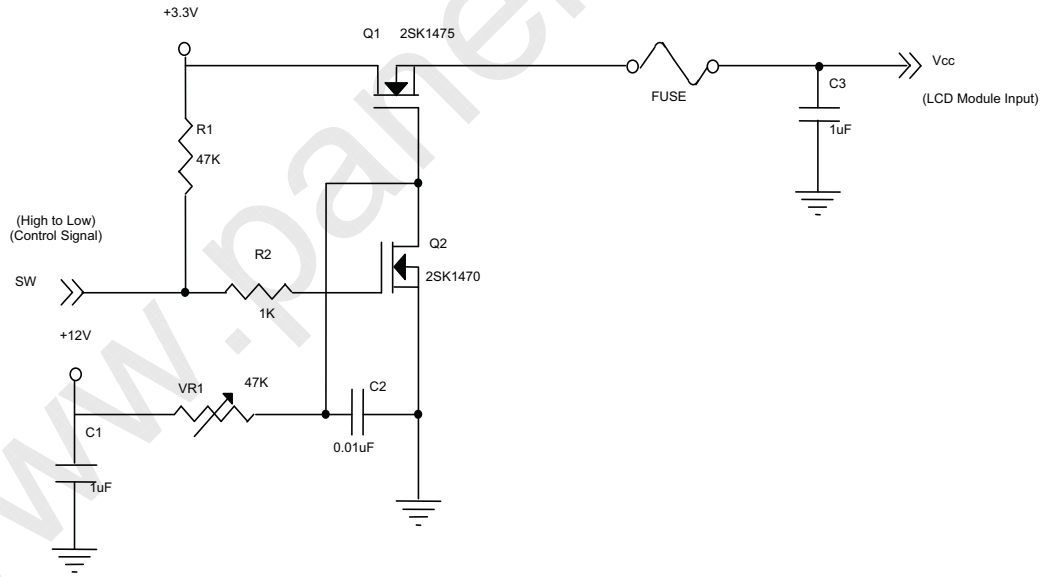
| Parameter | | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| Power Supply Voltage | | Vcc | 3.0 | 3.3 | 3.6 | V | - |
| Ripple Voltage | | $V_{RP}$ | | 50 | | mV | - |
| Rush Current | | $I_{RUSH}$ | | | 1.5 | A | (2) |
| Initial Stage Current | | $I_{IS}$ | | | 1.0 | A | (2) |
| Power Supply Current | White | Lcc | | 350 | 380 | mA | (3)a |
| | Black | | | 490 | 520 | mA | (3)b |
| LVDS Differential Input High Threshold | | $V_{TH(LVDS)}$ | | | +100 | mV | (5), $V_{CM}$=1.2V |
| LVDS Differential Input Low Threshold | | $V_{TL(LVDS)}$ | -100 | | | mV | (5) $V_{CM}$=1.2V |
| LVDS Common Mode Voltage | | $V_{CM}$ | 1.125 | | 1.375 | V | (5) |
| LVDS Differential Input Voltage | | $\|V_{ID}\|$ | 100 | | 600 | mV | (5) |
| Terminating Resistor | | $R_T$ | | 100 | | Ohm | |
| Power per EBL WG | | $P_{EBL}$ | - | 3.63 | - | W | (4) |

Note (1) The ambient temperature is Ta = 25 ± 2 ºC.

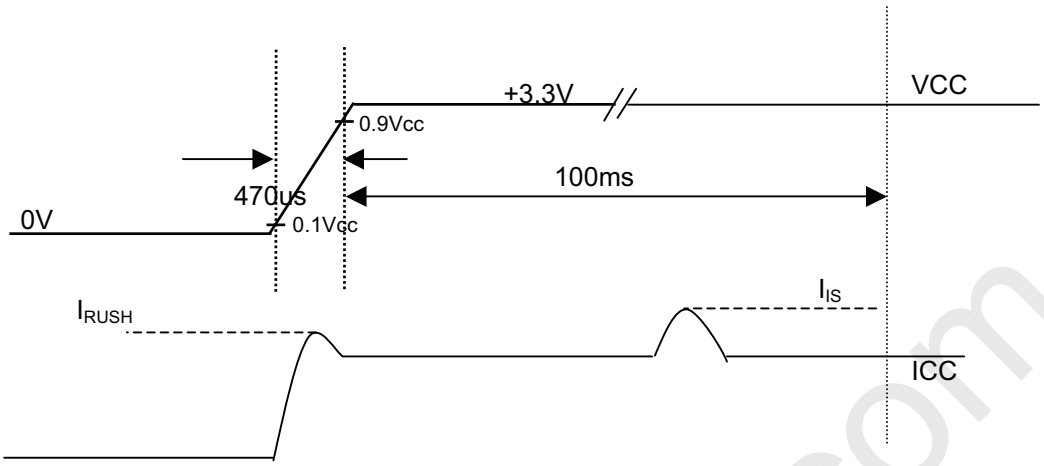
Note (2) $I_{RUSH}$: the maximum current when VCC is rising

$I_{IS}$: the maximum current of the first 100ms after power-on

Measurement Conditions: Shown as the following figure. Test pattern: black.



**Vcc rising time is 470us**




Note (3) The specified power supply current is under the conditions at Vcc = 3.3 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

Note (4) The specified power are the sum of LCD panel electronics input power and the inverter input power. Test conditions are as follows.

(a) Vcc = 3.3 V, Ta = 25 ± 2 ºC, $f_v$ = 60 Hz,

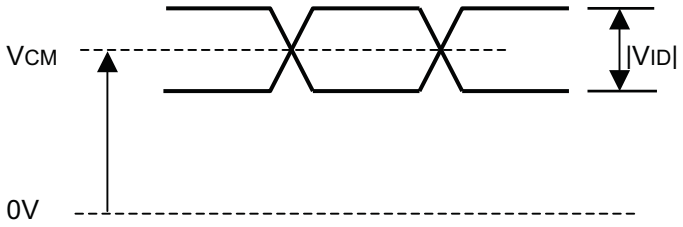
(b) The pattern used is a black and white 32 x 36 checkerboard, slide #100 from the VESA file "Flat Panel Display Monitor Setup Patterns", FPDMSU.ppt.

(c) Luminance: 60 nits..

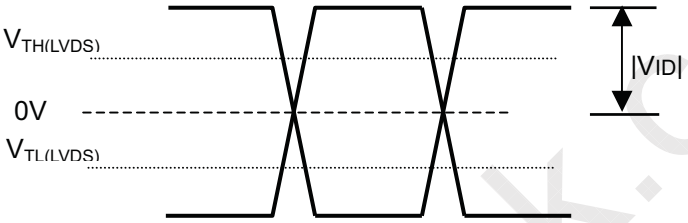
(d) The inverter used is provided from Sumida . Please contact them for detail information. CMO doesn't provide the inverter in this product.

Note (5) The parameters of LVDS signals are defined as the following figures.

**Single Ended**




**Differential**

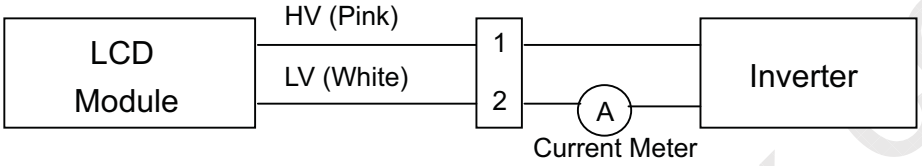


3.2 BACKLIGHT UNIT

Ta = 25 ± 2 ºC

| Parameter | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Lamp Input Voltage | $V_L$ | 675 | 730 | 945 | $V_{RMS}$ | $I_L$ = 6.0 mA |
| Lamp Current | $I_L$ | 2.0 | 6.0 | 6.5 | $mA_{RMS}$ | (1),(2) |
| | | 3.0 | | | | (1),(3) |
| Lamp Turn On Voltage | $V_S$ | | | 1000 (0 °C) | $V_{RMS}$ | (4) |
| Operating Frequency | $F_L$ | 40 | | 80 | KHz | (5) |
| Lamp Life Time | $L_{BL}$ | 15,000 | | | Hrs | (7) |
| Power Consumption | $P_L$ | | 4.38 | | W | (4), $I_L$ = 6.0 mA |

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




Note (2) for burst mode inverter design

Note (3) for continuous mode inverter design

Note (4) The voltage that must be larger than Vs should be applied to the lamp for more than 1 second after startup. Otherwise the lamp may not be turned on.

Note (5) 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 (6) $P_L = I_L \times V_L$

Note (7) The lifetime of lamp can be defined as the time in which it continues to operate under the condition Ta = 25 ±2 °C and $I_L$ = 6.0 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.

(The effective ignition length is a scope that luminance is over 70% of that at the center point.)

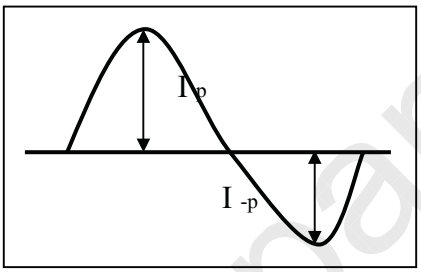
Note (8) The waveform of the voltage output of inverter must be area-symmetric and the design of the inverter must have specifications for the modularized lamp. The performance of the Backlight, such as lifetime or brightness, is greatly influenced by the characteristics of the DC-AC inverter for the lamp. All the parameters of an inverter should be carefully designed to avoid generating 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 $\sqrt{2}$ ± 10%;
c. The ideal sine wave form shall be symmetric in positive and negative polarities.




* Asymmetry rate:

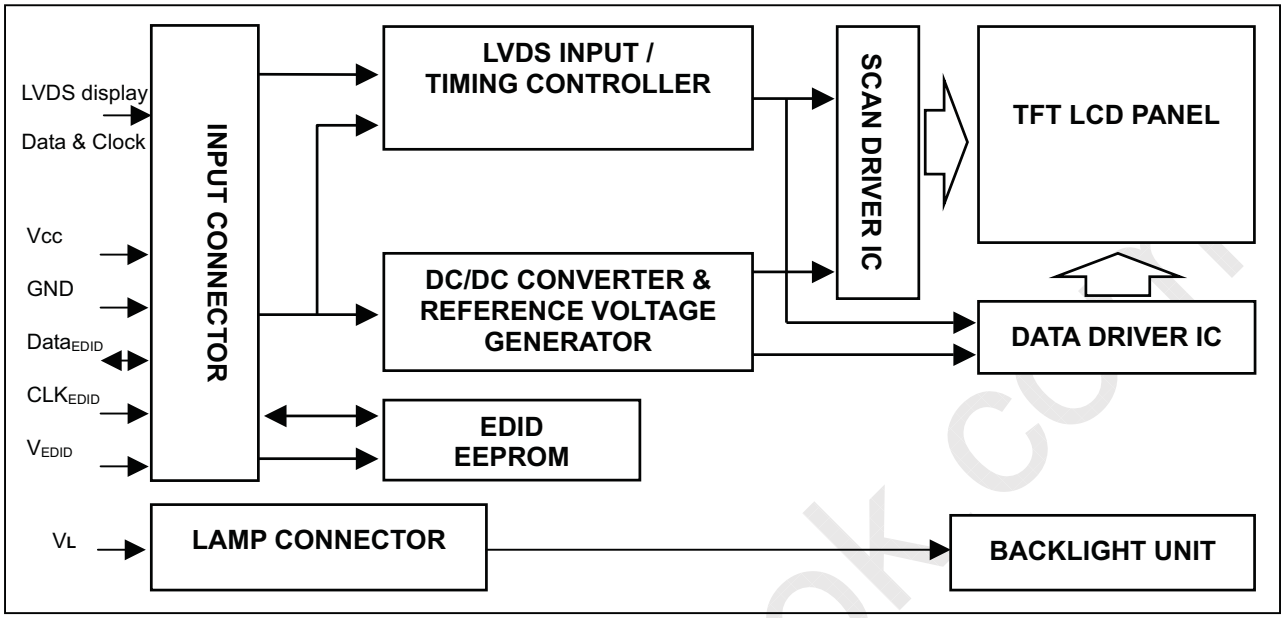
$| I_p - I_{-p} | / I_{rms} * 100\%$

* Distortion rate

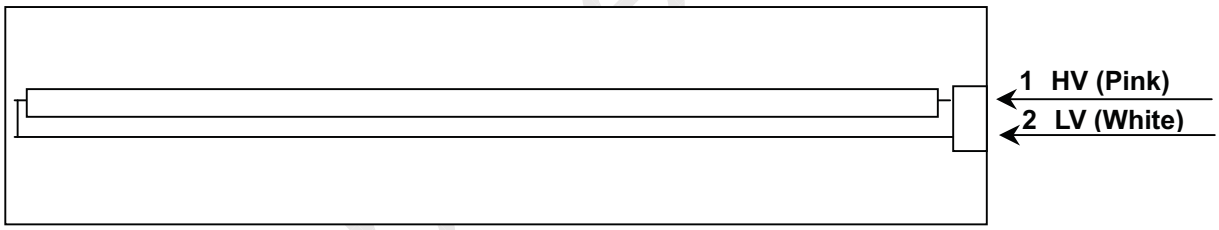
$I_p$ (or $I_{-p}$) / $I_{rms}$

# 4. BLOCK DIAGRAM

## 4.1 TFT LCD MODULE




## 4.2 BACKLIGHT UNIT



## 5. INPUT TERMINAL PIN ASSIGNMENT

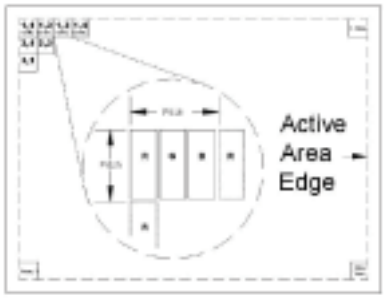
### 5.1 TFT LCD MODULE

| Pin | Symbol | Description | Polarity | Remark |
|---|---|---|---|---|
| 1 | Vss | Ground | | |
| 2 | $V_{CC}$ | Power Supply +3.3 V (typical) | | |
| 3 | $V_{CC}$ | Power Supply +3.3 V (typical) | | |
| 4 | $V_{EDID}$ | DDC 3.3V Power | | |
| 5 | NC | Non-Connection | | |
| 6 | $CLK_{EDID}$ | DDC Clock | | |
| 7 | $DATA_{EDID}$ | DDC Data | | |
| 8 | RXO0- | LVDS Differential Data Input (Odd) | Negative | |
| 9 | RXO0+ | LVDS Differential Data Input (Odd) | Positive | |
| 10 | Vss | Ground | | |
| 11 | RXO1- | LVDS Differential Data Input (Odd) | Negative | |
| 12 | RXO1+ | LVDS Differential Data Input (Odd) | Positive | |
| 13 | Vss | Ground | | |
| 14 | RXO2- | LVDS Differential Data Input (Odd) | Negative | |
| 15 | RXO2+ | LVDS Differential Data Input (Odd) | Positive | |
| 16 | Vss | Ground | | |
| 17 | RXOC- | LVDS Clock Data Input (Odd) | Negative | |
| 18 | RXOC+ | LVDS Clock Data Input (Odd) | Positive | |
| 19 | Vss | Ground | | |
| 20 | RXE0- | LVDS Differential Data Input (Even) | Negative | |
| 21 | RXE0+ | LVDS Differential Data Input (Even) | Positive | |
| 22 | Vss | Ground | | |
| 23 | RXE1- | LVDS Differential Data Input (Even) | Negative | |
| 24 | RXE1+ | LVDS Differential Data Input (Even) | Positive | |
| 25 | Vss | Ground | | |
| 26 | RXE2- | LVDS Differential Data Input (Even) | Negative | |
| 27 | RXE2+ | LVDS Differential Data Input (Even) | Positive | |
| 28 | Vss | Ground | | |
| 29 | RXEC- | LVDS Clock Data Input (Even) | Negative | |
| 30 | RXEC+ | LVDS Clock Data Input (Even) | Positive | |

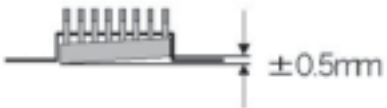
Note (1) Connector Part No.: JAE FI-XB30SL-HF10 or equivalent

Note (2) User's connector Part No: FI-X30M or equivalent

Note (3) The first pixel is odd as shown in the following figure.




Note (4) Mounting inclination of a connector carries out as fol



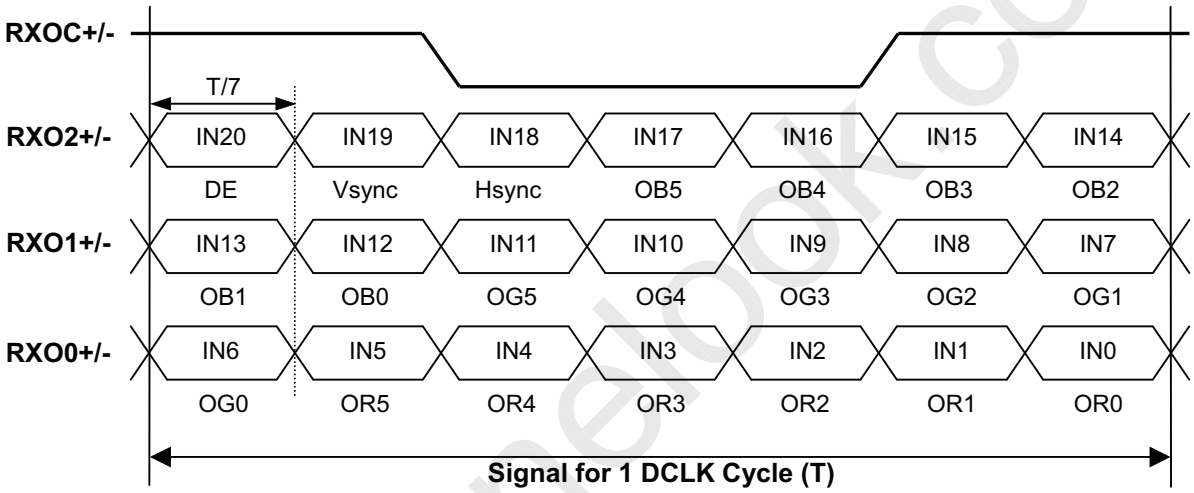
## 5.2 BACKLIGHT UNIT

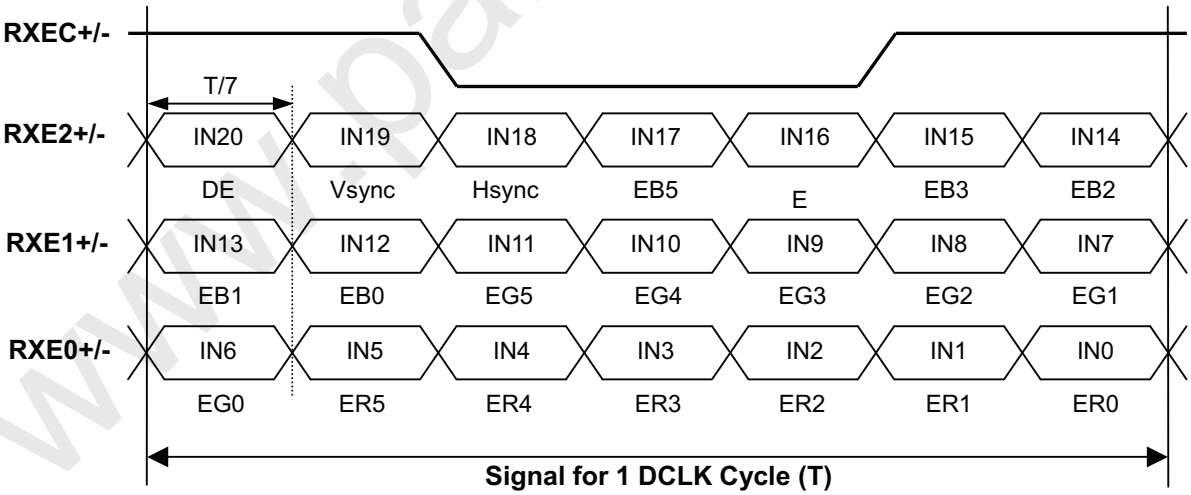
| Pin | Symbol | Description | Color |
|---|---|---|---|
| 1 | HV | High Voltage | Pink |
| 2 | LV | Ground | Black |

Note (1) Connector Part No.: JST-BHSR-02VS-1 or equivalent

Note (2) User's connector Part No.: JST-SM02B-BHSS-1-TB or equivalent

## 5.3 TIMING DIAGRAM OF LVDS INPUT SIGNAL



## 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 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Green(61) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(62) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(63) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale Of Blue | Blue(0)/Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | Blue(2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Blue(61) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 |
| | Blue(62) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| | Blue(63) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |

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

## 5.5 EDID DATA STRUCTURE

The EDID (Extended Display Identification Data) data formats are to support displays as defined in the VESA Plug & Display and FPDI standards.

| Byte # (decimal) | Byte # (hex) | Field Name and Comments | Value (hex) | Value (binary) |
|---|---|---|---|---|
| 0 | 0 | Header | 00 | 00000000 |
| 1 | 1 | Header | FF | 11111111 |
| 2 | 2 | Header | FF | 11111111 |
| 3 | 3 | Header | FF | 11111111 |
| 4 | 4 | Header | FF | 11111111 |
| 5 | 5 | Header | FF | 11111111 |
| 6 | 6 | Header | FF | 11111111 |
| 7 | 7 | Header | 00 | 00000000 |
| 8 | 8 | EISA ID manufacturer name (“CMO”) | 0D | 00001101 |
| 9 | 9 | EISA ID manufacturer name (Compressed ASCII) | AF | 10101111 |
| 10 | 0A | ID product code (N154Z3-L03) | 64 | 01100100 |
| 11 | 0B | ID product code (hex LSB first; N154Z3-L03) | 15 | 00010101 |
| 12 | 0C | ID S/N (fixed “0”) | 00 | 00000000 |
| 13 | 0D | ID S/N (fixed “0”) | 00 | 00000000 |
| 14 | 0E | ID S/N (fixed “0”) | 00 | 00000000 |
| 15 | 0F | ID S/N (fixed “0”) | 00 | 00000000 |
| 16 | 10 | Week of manufacture (fixed week code) | 12 | 00010010 |
| 17 | 11 | Year of manufacture (fixed year code) | 12 | 00010010 |
| 18 | 12 | EDID structure version # (“1”) | 01 | 00000001 |
| 19 | 13 | EDID revision # (“3”) | 03 | 00000011 |
| 20 | 14 | Video I/P definition (“digital”) | 80 | 10000000 |
| 21 | 15 | Max H image size (“33.12 cm”) | 21 | 00100001 |
| 22 | 16 | Max V image size (“20.7 cm”) | 14 | 00010100 |
| 23 | 17 | Display Gamma (Gamma = ”2.2”) | 78 | 01111000 |
| 24 | 18 | Feature support (“Active off, RGB Color”) | 0A | 00001010 |
| 25 | 19 | Rx1, Rx0, Ry1, Ry0, Gx1, Gx0, Gy1, Gy0 | F4 | 01000111 |
| 26 | 1A | Bx1, Bx0, By1, By0, Wx1, Wx0, Wy1, Wy0 | 25 | 11110001 |
| 27 | 1B | Rx=0.577 | 93 | 10100000 |
| 28 | 1C | Ry=0.339 | 56 | 01011011 |
| 29 | 1D | Gx=0.313 | 50 | 01001011 |
| 30 | 1E | Gy=0.555 | 8E | 10010110 |
| 31 | 1F | Bx=0.160 | 29 | 00100100 |
| 32 | 20 | By=0.154 | 27 | 00011000 |
| 33 | 21 | Wx=0.313 | 50 | 01001111 |
| 34 | 22 | Wy=0.329 | 54 | 01010100 |
| 35 | 23 | Established timings 1 | 00 | 00000000 |
| 36 | 24 | Established timings 2 | 00 | 00000000 |
| 37 | 25 | Manufacturer’s reserved timings | 00 | 00000000 |
| 38 | 26 | Standard timing ID # 1 | 01 | 00000001 |
| 39 | 27 | Standard timing ID # 1 | 01 | 00000001 |
| 40 | 28 | Standard timing ID # 2 | 01 | 00000001 |
| 41 | 29 | Standard timing ID # 2 | 01 | 00000001 |

| Byte # (decimal) | Byte # (hex) | Field Name and Comments | Value (hex) | Value (binary) |
|---|---|---|---|---|
| 42 | 2A | Standard timing ID # 3 | 01 | 00000001 |
| 43 | 2B | Standard timing ID # 3 | 01 | 00000001 |
| 44 | 2C | Standard timing ID # 4 | 01 | 00000001 |
| 45 | 2D | Standard timing ID # 4 | 01 | 00000001 |
| 46 | 2E | Standard timing ID # 5 | 01 | 00000001 |
| 47 | 2F | Standard timing ID # 5 | 01 | 00000001 |
| 48 | 30 | Standard timing ID # 6 | 01 | 00000001 |
| 49 | 31 | Standard timing ID # 6 | 01 | 00000001 |
| 50 | 32 | Standard timing ID # 7 | 01 | 00000001 |
| 51 | 33 | Standard timing ID # 7 | 01 | 00000001 |
| 52 | 34 | Standard timing ID # 8 | 01 | 00000001 |
| 53 | 35 | Standard timing ID # 8 | 01 | 00000001 |
| 54 | 36 | Detailed timing description # 1 Pixel clock (“119MHz”, According to VESA CVT Rev1.1) | 7C | 01111100 |
| 55 | 37 | # 1 Pixel clock (hex LSB first) | 2E | 00101110 |
| 56 | 38 | # 1 H active (“1680”) | 90 | 10010000 |
| 57 | 39 | # 1 H blank (“160”) | A0 | 10100000 |
| 58 | 3A | # 1 H active : H blank (“1680 : 160”) | 60 | 01100000 |
| 59 | 3B | # 1 V active (”1050”) | 1A | 00011010 |
| 60 | 3C | # 1 V blank (”30”) | 1E | 00011110 |
| 61 | 3D | # 1 V active : V blank (”1050 : 30”) | 40 | 01000000 |
| 62 | 3E | # 1 H sync offset (”48”) | 30 | 00110000 |
| 63 | 3F | # 1 H sync pulse width ("32”) | 20 | 00100000 |
| 64 | 40 | # 1 V sync offset : V sync pulse width (”3 : 6”) | 36 | 00110110 |
| 65 | 41 | # 1 H sync offset : H sync pulse width : V sync offset : V sync width (”48: 32 : 3 : 6”) | 00 | 00000000 |
| 66 | 42 | # 1 H image size (”331.2 mm”) | 4B | 01001011 |
| 67 | 43 | # 1 V image size (”207.0 mm”) | CF | 11001111 |
| 68 | 44 | # 1 H image size : V image size (”331.2 : 207”) | 10 | 00010000 |
| 69 | 45 | # 1 H boarder (”0”) | 00 | 00000000 |
| 70 | 46 | # 1 V boarder (”0”) | 00 | 00000000 |
| 71 | 47 | # 1 Non-interlaced, Normal, no stereo, Separate sync, H/V pol Negatives | 18 | 00011000 |
| 72 | 48 | Detailed timing description # 2 | 00 | 00000000 |
| 73 | 49 | # 2 Flag | 00 | 00000000 |
| 74 | 4A | # 2 Reserved | 00 | 00000000 |
| 75 | 4B | # 2 FE (hex) defines ASCII string (Model Name “N154Z3-L03”, ASCII) | FE | 11111110 |
| 76 | 4C | # 2 Flag | 00 | 00000000 |
| 77 | 4D | # 2 1st character of name (“N”) | 4E | 01001110 |
| 78 | 4E | # 2 2nd character of name (“1”) | 31 | 00110001 |
| 79 | 4F | # 2 3rd character of name (“5”) | 35 | 00110101 |
| 80 | 50 | # 2 4th character of name (“4”) | 34 | 00110100 |
| 81 | 51 | # 2 5th character of name (“Z”) | 5A | 01011010 |
| 82 | 52 | # 2 6th character of name (“3”) | 33 | 00110011 |
| 83 | 53 | # 2 7th character of name (“-”) | 2D | 00101101 |
| 84 | 54 | # 2 8th character of name (“L”) | 4C | 01001100 |

| Byte # (decimal) | Byte # (hex) | Field Name and Comments | Value (hex) | Value (binary) |
|---|---|---|---|---|
| 85 | 55 | # 2 9th character of name (“0”) | 30 | 00110000 |
| 86 | 56 | # 2 9th character of name (“3”) | 33 | 00110011 |
| 87 | 57 | # 2 New line character indicates end of ASCII string | 0A | 00001010 |
| 88 | 58 | # 2 Padding with “Blank” character | 20 | 00100000 |
| 89 | 59 | # 2 Padding with “Blank” character | 20 | 00100000 |
| 90 | 5A | Detailed timing description # 3 | 00 | 00000000 |
| 91 | 5B | # 3 Flag | 00 | 00000000 |
| 92 | 5C | # 3 Reserved | 00 | 00000000 |
| 93 | 5D | # 3 FE (hex) defines ASCII string (Vendor “CMO”, ASCII) | FE | 11111110 |
| 94 | 5E | # 3 Flag | 00 | 00000000 |
| 95 | 5F | # 3 1st character of string (“C”) | 43 | 01000011 |
| 96 | 60 | # 3 2nd character of string (“M”) | 4D | 01001101 |
| 97 | 61 | # 3 3rd character of string (“O”) | 4F | 01001111 |
| 98 | 62 | # 3 New line character indicates end of ASCII string | 0A | 00001010 |
| 99 | 63 | # 3 Padding with “Blank” character | 20 | 00100000 |
| 100 | 64 | # 3 Padding with “Blank” character | 20 | 00100000 |
| 101 | 65 | # 3 Padding with “Blank” character | 20 | 00100000 |
| 102 | 66 | # 3 Padding with “Blank” character | 20 | 00100000 |
| 103 | 67 | # 3 Padding with “Blank” character | 20 | 00100000 |
| 104 | 68 | # 3 Padding with “Blank” character | 20 | 00100000 |
| 105 | 69 | # 3 Padding with “Blank” character | 20 | 00100000 |
| 106 | 6A | # 3 Padding with “Blank” character | 20 | 00100000 |
| 107 | 6B | # 3 Padding with “Blank” character | 20 | 00100000 |
| 108 | 6C | Detailed timing description # 4 | 00 | 00000000 |
| 109 | 6D | # 4 Flag | 00 | 00000000 |
| 110 | 6E | # 4 Reserved | 00 | 00000000 |
| 111 | 6F | # 4 FE (hex) defines ASCII string (Model Name“N154Z3-L03”, ASCII) | FE | 11111110 |
| 112 | 70 | # 4 Flag | 00 | 00000000 |
| 113 | 71 | # 4 1st character of name (“N”) | 4E | 01001110 |
| 114 | 72 | # 4 2nd character of name (“1”) | 31 | 00110001 |
| 115 | 73 | # 4 3rd character of name (“5”) | 35 | 00110101 |
| 116 | 74 | # 4 4th character of name (“4”) | 34 | 00110100 |
| 117 | 75 | # 4 5th character of name (“Z”) | 5A | 01011010 |
| 118 | 76 | # 4 6th character of name (“3”) | 33 | 00110011 |
| 119 | 77 | # 4 7th character of name (“-”) | 2D | 00101101 |
| 120 | 78 | # 4 8th character of name (“L”) | 4C | 01001100 |
| 121 | 79 | # 4 9th character of name (“0”) | 30 | 00110000 |
| 122 | 7A | # 4 9th character of name (“3”) | 33 | 00110011 |
| 123 | 7B | # 4 New line character indicates end of ASCII string | 0A | 00001010 |
| 124 | 7C | # 4 Padding with “Blank” character | 20 | 00100000 |
| 125 | 7D | # 4 Padding with “Blank” character | 20 | 00100000 |
| 126 | 7E | Extension flag | 00 | 00000000 |
| 127 | 7F | Checksum | DB | 10111100 |

# 6. INTERFACE TIMING

## 6.1 INPUT SIGNAL TIMING SPECIFICATIONS

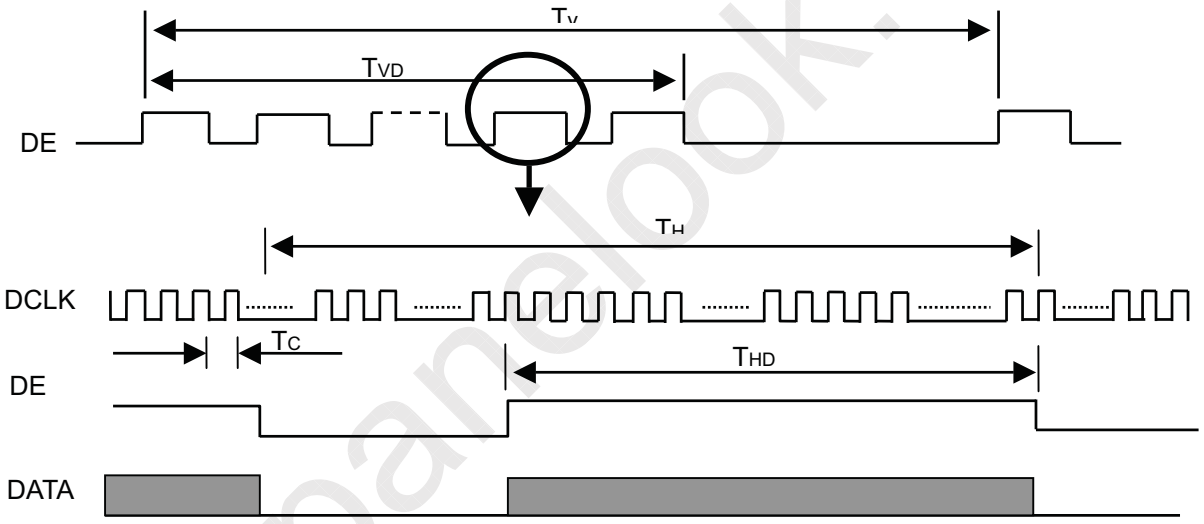
The input signal timing specifications are shown as the following table and timing diagram.

| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| DCLK | Frequency | 1/Tc | 53.6 | 59.6 | 62.6 | MHz | (2) |
| DE | Vertical Total Time | TV | 1057 | 1080 | 1090 | TH | - |
| | Vertical Active Display Period | TVD | 1050 | 1050 | 1050 | TH | - |
| | Vertical Active Blanking Period | TVB | TV-TVD | 30 | TV-TVD | TH | - |
| | Horizontal Total Time | TH | 890 | 920 | 1010 | Tc | (2) |
| | Horizontal Active Display Period | THD | 840 | 840 | 840 | Tc | (2) |
| | Horizontal Active Blanking Period | THB | TH-THD | 80 | TH-THD | Tc | (2) |

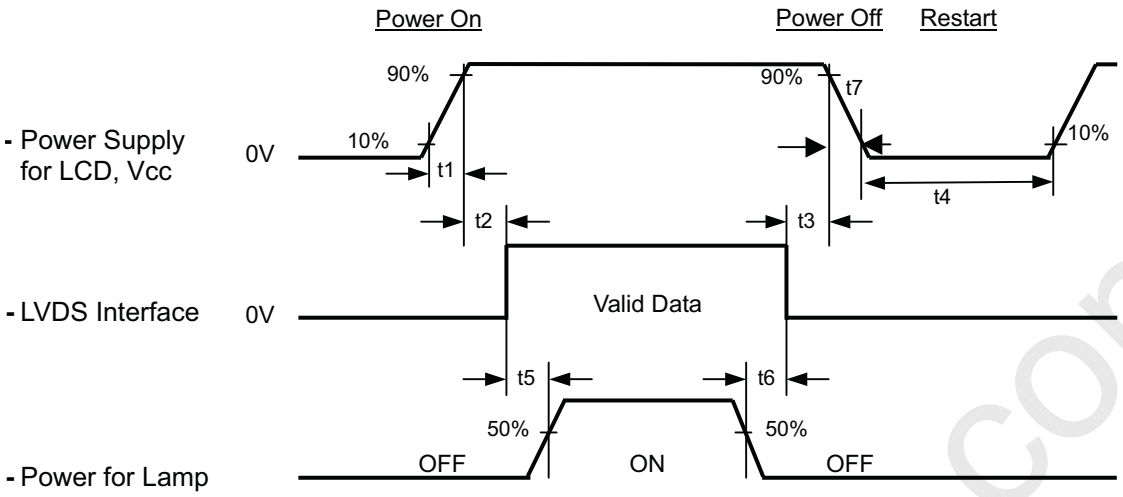
Note (1) Because of this module is operated by DE only mode, Hsync and Vsync are ignored.

(2) 2 channels LVDS input.

**INPUT SIGNAL TIMING DIAGRAM**



6.2 POWER ON/OFF SEQUENCE




Timing Specifications:

0.5 ≦ t1 ≦ 10 ms

0 ≦ t2 ≦ 50 ms

0 ≦ t3 ≦ 50 ms

t4 ≧ 500 ms

t5 ≧ 200 ms

t6 ≧ 200 ms

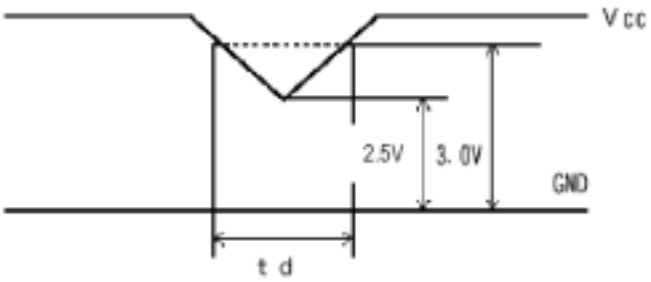
Note (1) Please follow the power on/off sequence described above. Otherwise, the LCD module might be damaged.

Note (2) Please avoid floating state of interface signal at invalid period. 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.

Note (4) Sometimes some slight noise shows when LCD is turned off (even backlight is already off). To avoid this phenomenon, we suggest that the Vcc falling time is better to follow 1ms<t7<10 ms.

6.3 Momentary Voltage Drops




(1) When 2.5V ≦ Vcc ＜3.0V and td≦10ms , the unit must work normally when VCC return to 3.0V.

(2) When Vcc < 2.5V, momentary voltage shall conform to the input voltage sequence.

## 7. OPTICAL CHARACTERISTICS

### 7. 1 TEST CONDITIONS

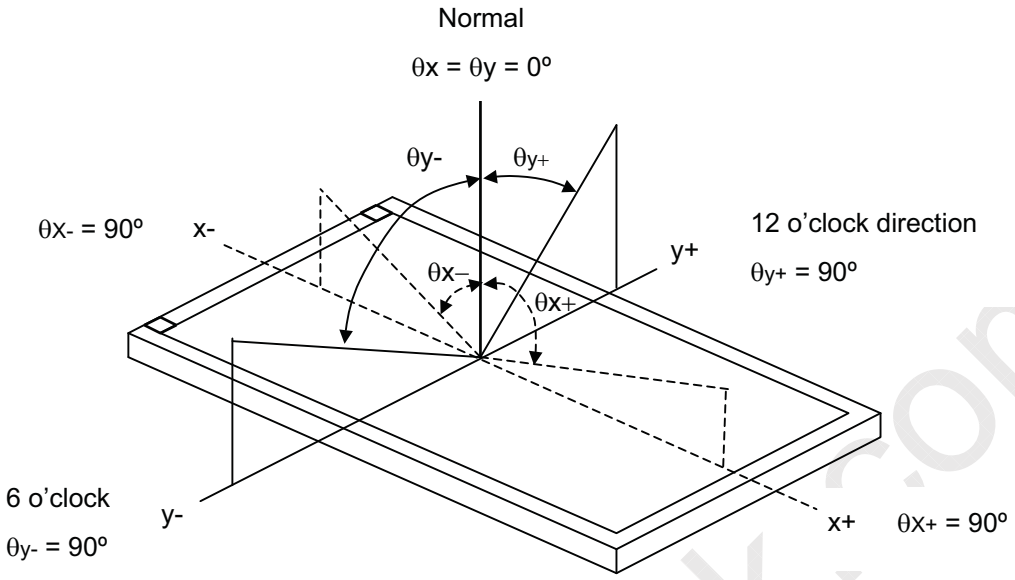
| Item | Symbol | Value | Unit |
|---|---|---|---|
| Ambient Temperature | Ta | 25±2 | °C |
| Ambient Humidity | Ha | 50±10 | %RH |
| Supply Voltage | $V_{CC}$ | 3.3 | V |
| Input Signal | According to typical value in "3. ELECTRICAL CHARACTERISTICS" | | |
| Inverter Current | $I_L$ | 6.0 | mA |
| Inverter Driving Frequency | $F_L$ | 61 | KHz |
| Inverter | Sumida H05-4915 | | |

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).

### 7.2 OPTICAL SPECIFICATIONS

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Contrast Ratio | | CR | $\theta_x$=0°, $\theta_Y$ =0° Viewing Normal Angle | 350 | 500 | -- | - | (2), (5) |
| Response Time | | $T_R$ | | -- | 2 | 5 | ms | (3) |
| | | $T_F$ | | -- | 6 | 11 | ms | |
| Average Luminance of White | | $L_{AVE}$ | | 170 | 200 | -- | cd/m$^2$ | (4), (5) |
| Color Chromaticity | Red | Rx | | TYP -0.03 | 0.577 | TYP +0.03 | -- | (1) |
| | | Ry | | | 0.339 | | -- | |
| | Green | Gx | | | 0.313 | | -- | |
| | | Gy | | | 0.555 | | -- | |
| | Blue | Bx | | | 0.160 | | -- | |
| | | By | | | 0.154 | | -- | |
| | White | Wx | | | 0.313 | | -- | |
| | | Wy | | | 0.329 | | -- | |
| White Variation of 5 Points | | $\delta W_{5p}$ | $\theta_x$=0°, $\theta_Y$ =0° | 80 | -- | -- | % | (5),(6) |
| Viewing Angle | Horizontal | $\theta_x$+ | CR≥10 | 70 | 80 | -- | Deg. | (1), (5) |
| | | $\theta_x$- | | 70 | 80 | -- | | |
| | Vertical | $\theta_Y$+ | | 60 | 70 | -- | | |
| | | $\theta_Y$- | | 60 | 70 | -- | | |

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) = L63 / L0

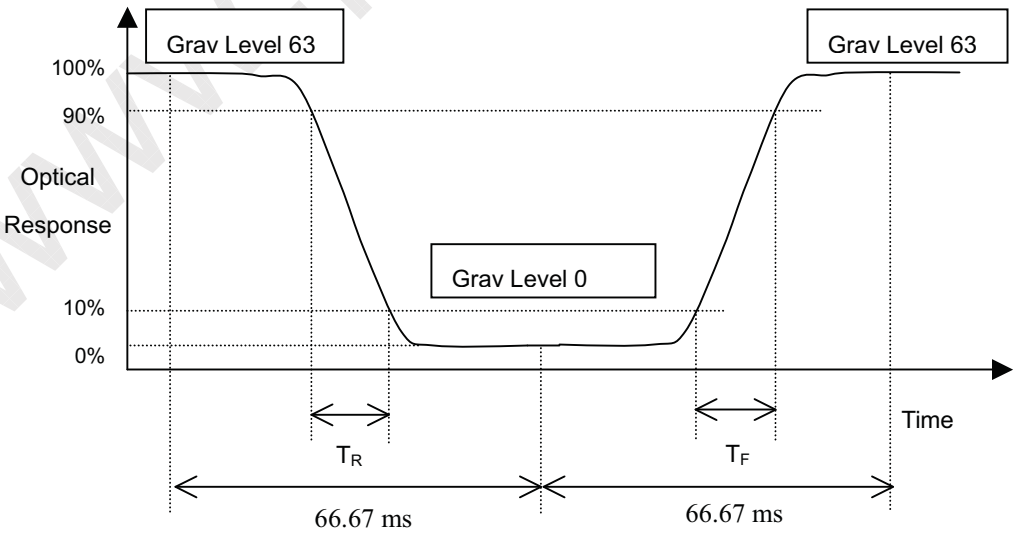
L63: Luminance of gray level 63

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 Average Luminance of White ($L_{AVE}$):

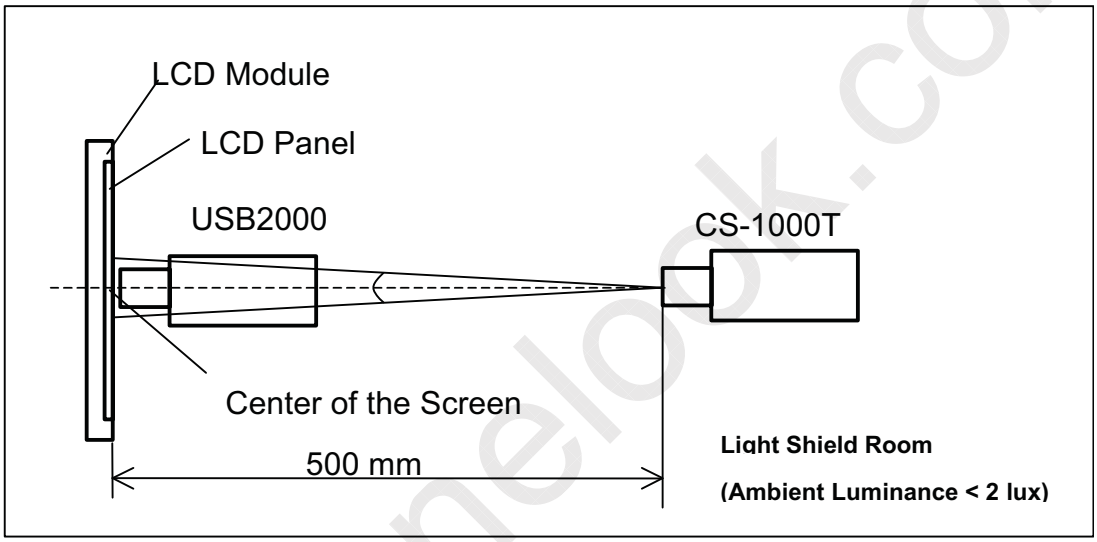
Measure the luminance of gray level 63 at 5 points

$L_{AVE}$ = [L (1)+ L (2)+ L (3)+ L (4)+ L (5)] / 5

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

Note (5) Measurement Setup:

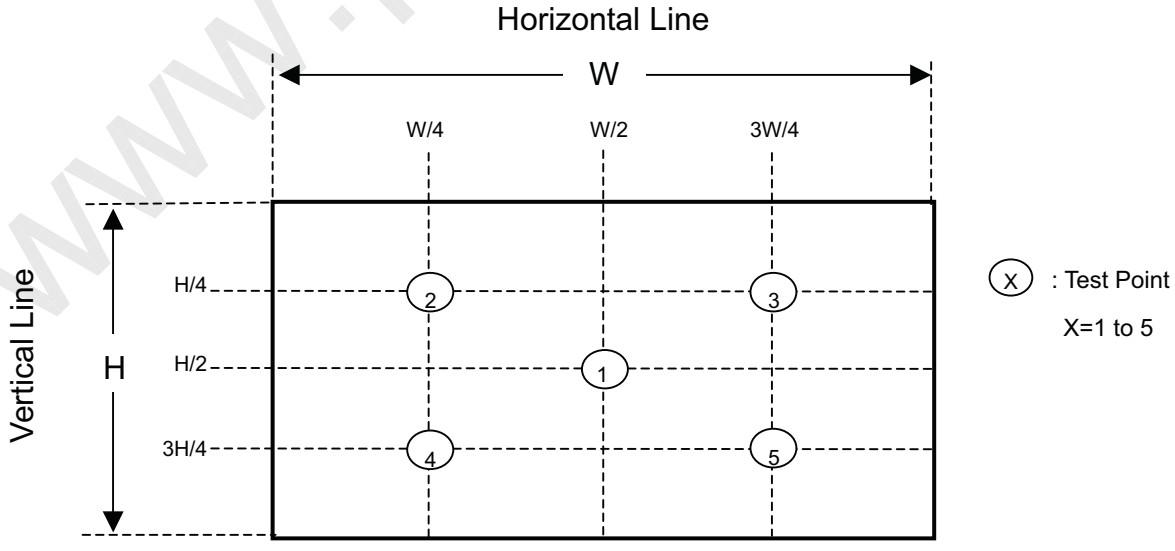
The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.




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

Measure the luminance of gray level 63 at 5 points

$\delta W_{5p}$ = Minimum [L (1)+ L (2)+ L (3)+ L (4)+ L (5)] / Maximum [L (1)+ L (2)+ L (3)+ L (4)+ L (5)]



# 8. PRECAUTIONS

## 8.1 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.

## 8.2 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.

9. PACKING

9.1 CARTON

Box Dimensions : 435(L)*350(W)*325(H)
Weight: Approx. 12.92kg(20 module .per. 1 box)

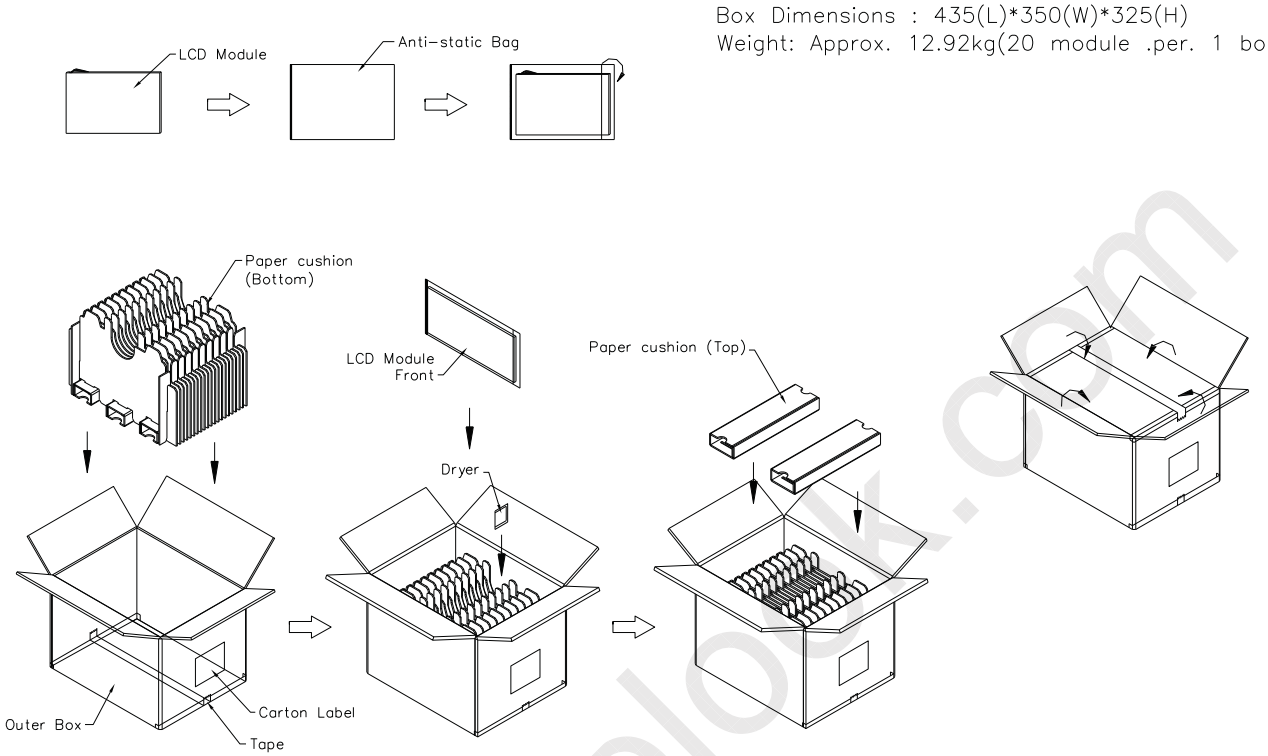



**Figure. 9-1 Packing method**

9.2 PALLET

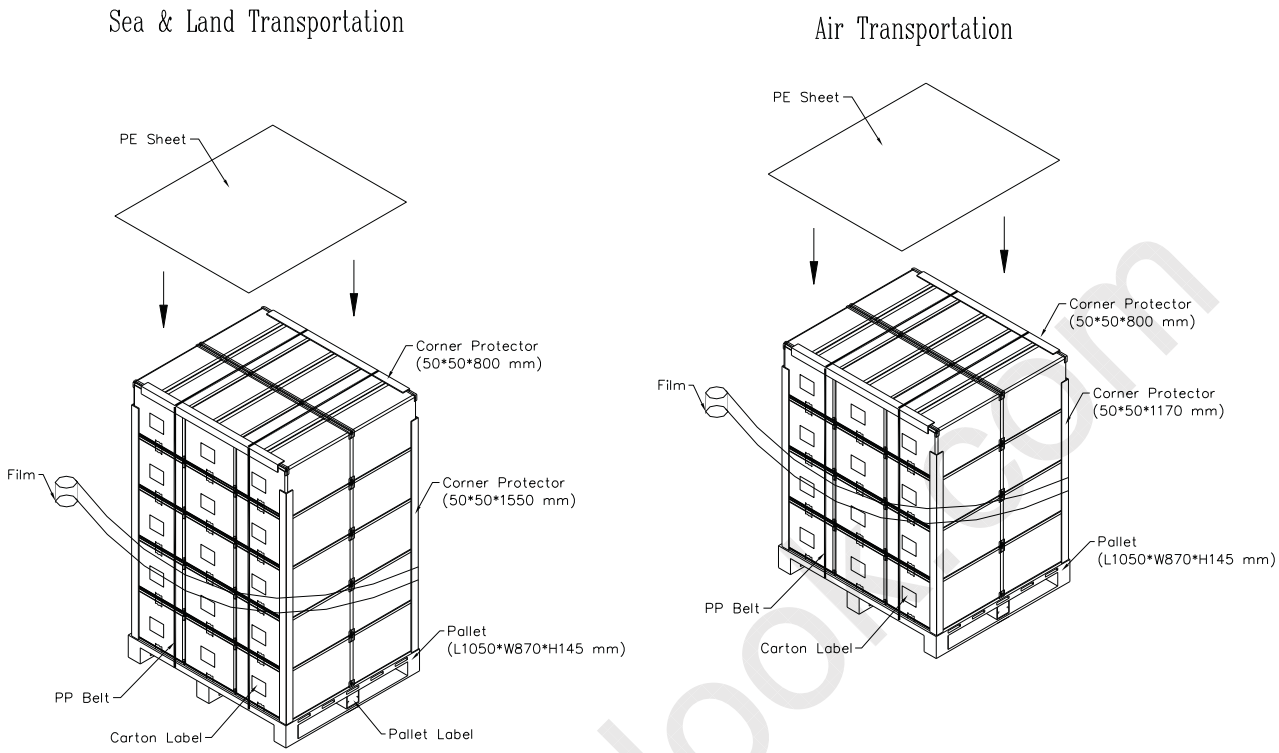
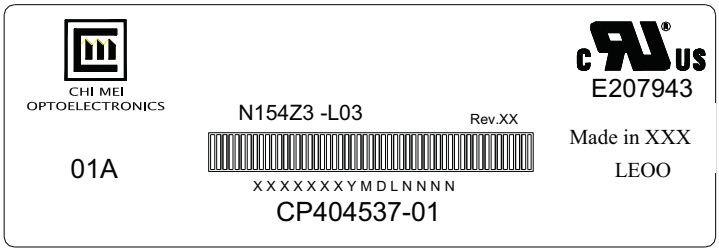



**Figure. 9-2 Packing method**

## 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: N54Z3 - L03

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

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

- Serial No.
- CMO Internal Use
- Year, Month, Date
- CMO Internal Use
- Revision
- CMO Internal Use

Serial ID includes the information as below:

(a) Manufactured Date: Year: 1~9, for 2001~2009

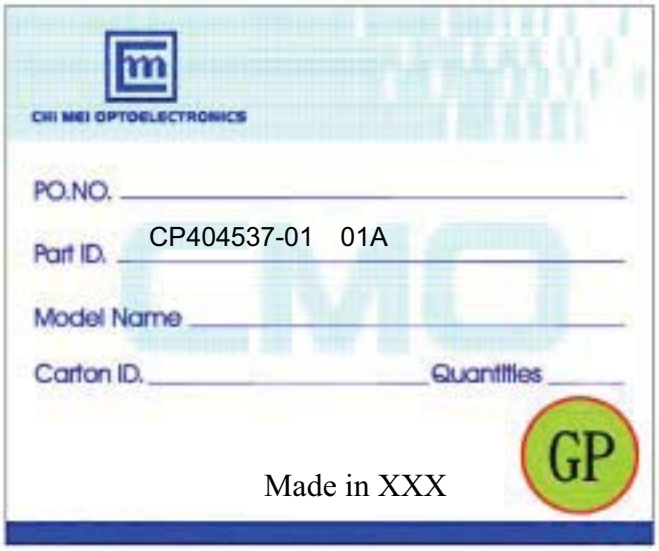
Month: 1~9, A~C, for Jan. ~ Dec.

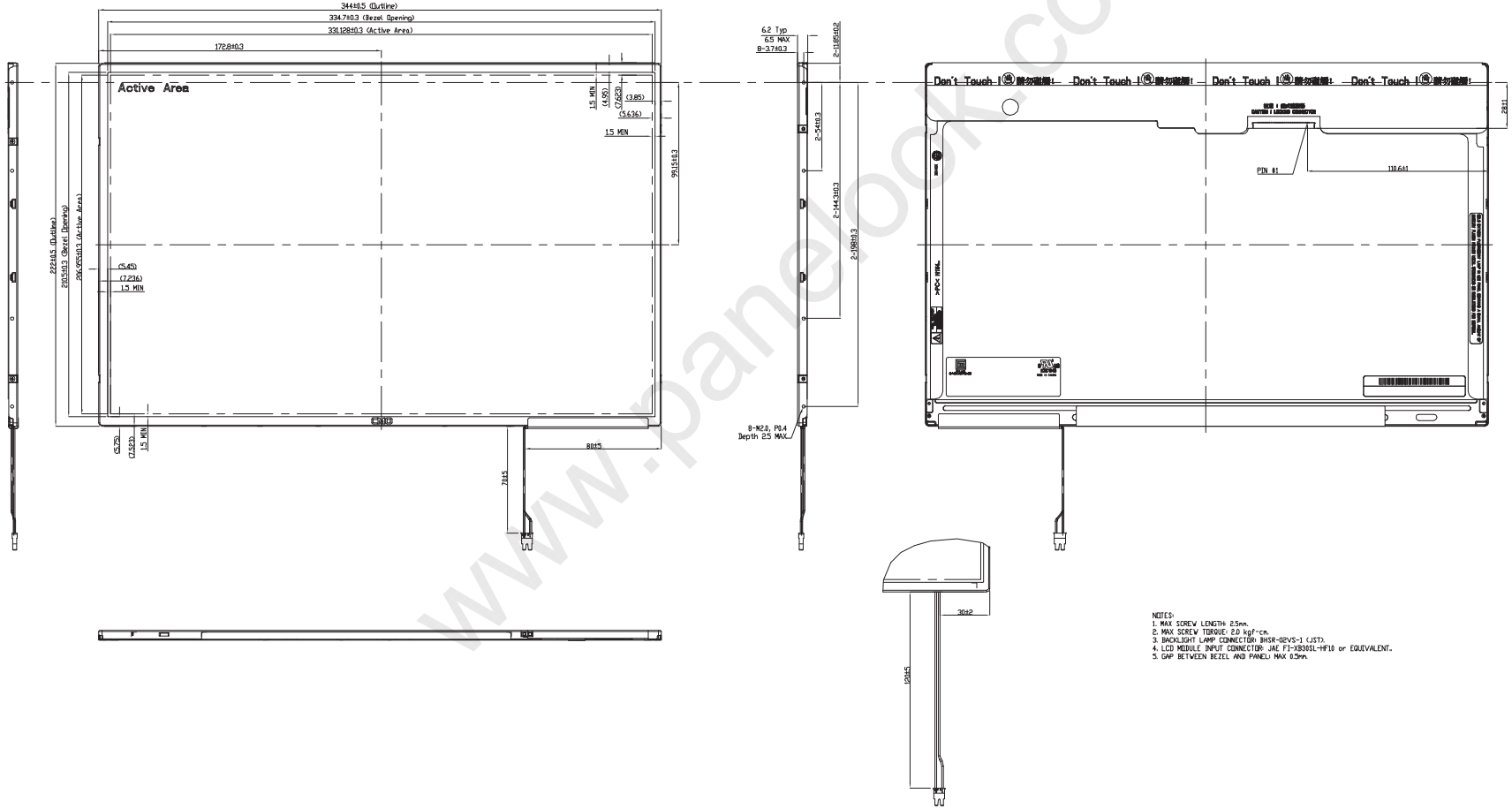
Day: 1~9, A~Y, for 1st to 31st, exclude I , O and U

(b) Revision Code: cover all the change

(c) Serial No.: Manufacturing sequence of product

10.2 CARTON LABEL






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

| | | | |
|---|---|---|---|
| TITLE | M154Z1-L01/L02/L03/L04 Outline Drawing | | ☑ REV.I/A ☑ REV.I |
| Approved | Bill Shiu | Drawing No. | M154Z1001A |
| Checked | Shuenan | Part No. | NA |
| Drawer | Po-Shen Chen | Material | NA |
| Designer | Gary Lu | Date | 13-Jun-2008 |

Sheet 1 / 1 | A0 | Scale 1:1 | Unit:mm

CHI MEI OPTOELECTRONICS CORP.