□ Tentative Specification
□ Preliminary Specification
■ Approval Specification

# MODEL NO.: V236H1
# SUFFIX: L03

**Customer:**

**APPROVED BY** **SIGNATURE**

Name / Title _____ _____

**Note**

Please return 1 copy for your confirmation with your signature and comments.

| Approved By | Checked By | Prepared By |
|---|---|---|
| Chao-Chun Chung | Roger Huang | Bowei Huang |

## CONTENTS

## REVISION HISTORY

| Version | Date | Page(New) | Section | Description |
|---|---|---|---|---|
| Ver. 2.0 | Jun. 03, 2011 | All | All | The Approved specification was first issued. |

# 1. GENERAL DESCRIPTION

## 1.1 OVERVIEW

V236H1-L03 is a 23.6" TFT Liquid Crystal Display module with 2 U-type CCFL Backlight unit and 30 pins 2ch-LVDS interface. This module supports 1920 x 1080 Full HDTV format and can display 16.7M (6 bit+Hi-FRC) colors. The inverter module for backlight isn't built-in.

## 1.2 FEATURES

- Extra-wide viewing angle.
- High contrast ratio.
- Fast response time.
- High color saturation.
- Full HD (1920 x 1080 pixels) resolution.
- DE (Data Enable) only mode.
- LVDS (Low Voltage Differential Signaling) interface.
- RoHS compliance.

## 1.3 APPLICATION

- Standard Living Room TVs
- MFM Application

## 1.4 GENERAL SPECIFICATIONS

| Item | Specification | Unit | Note |
|---|---|---|---|
| Active Area | 521.28H) x 293.22(V) (23.547" diagonal) | mm | (1) |
| Bezel Opening Area | 525.22 (H) x 297.22 (V) | mm | |
| Driver Element | a-si TFT active matrix | - | - |
| Pixel Number | 1920 x R.G.B. x 1080 | pixel | - |
| Pixel Pitch | 0.2715(H) x 0.2715(V) | mm | - |
| Pixel Arrangement | RGB vertical stripe | - | - |
| Power consumption | 32.1W (LVDS input Power 5.1W + CCFL Backlight Power 27 W) | Watt | (2) |
| Display Colors | 16.7M (6 bit+Hi-FRC) | color | - |
| Display Operation Mode | Transmissive mode / Normally white | - | - |
| Surface Treatment | Anti-Glare coating (Haze 25%) | - | (3) |

Note (1) Please refer to the attached drawings in chapter 9 for more information about the front and back outlines.

Note (2) Please refer sec 3.1 and 3.2 for more information of Power consumption

Note (3) The spec. of the surface treatment is temporarily for this phase. CMI reserves the rights to change this feature.

### 1.5 MECHANICAL SPECIFICATIONS

| Item | | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Module Size | Horizontal (H) | 543.8 | 544.8 | 545.8 | mm | (1) |
| | Vertical (V) | 319.5 | 320.5 | 321.5 | mm | (1) |
| | Depth (D) | 45.7 | 46.7 | 47.7 | mm | To Rear |
| | Depth (D) | 50.7 | 51.7 | 52.7 | mm | To Boss |
| Weight | | - | 2400 | - | 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 | TST | -20 | +60 | ºC | (1) |
| Operating Ambient Temperature | TOP | 0 | 50 | ºC | (1), (2) |
| Shock (Non-Operating) | SNOP | - | 50 | G | (3), (5) |
| Vibration (Non-Operating) | VNOP | - | 1.0 | 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).

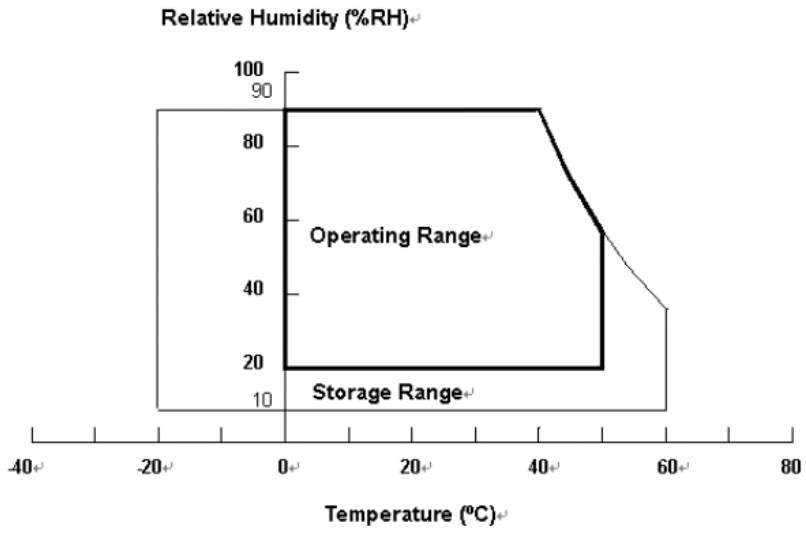
(c) No condensation.

Note (2) The maximum operating temperature is based on the test condition that the surface temperature of display area is less than or equal to 65 ºC with LCD module alone in a temperature controlled chamber. Thermal management should be considered in final product design to prevent the surface temperature of display area from being over 65 ºC. The range of operating temperature may degrade in case of improper thermal management in final product design.

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

Note (4) 10 ~ 200 Hz, 10 min, 1 time 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.



## 2.2 PACKAGE STORAGE

When storing modules as spares for a long time, the following precaution is necessary.

(a) Do not leave the module in high temperature, and high humidity for a long time, It is highly recommended to store the module with temperature from 0 to 35 ℃ at normal humidity without condensation.

(b) The module shall be stored in dark place. Do not store the TFT-LCD module in direct sunlight or fluorescent light.

## 2.3 ELECTRICAL ABSOLUTE RATINGS

### 2.3.1 TFT LCD MODULE

| Item | Symbol | Value | | Unit | Note |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Power Supply Voltage | $V_{CC}$ | -0.3 | +6 | V | (1) |
| Logic Input Voltage | $V_{IN}$ | -0.3 | 3.6 | V | |

### 2.3.2 BACKLIGHT UNIT

| Item | Symbol | Value | | Unit | Note |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Lamp Voltage | $V_L$ | 981 | 1188 | $V_{RMS}$ | |
| Power Supply Voltage | $V_{BL}$ | 0 | 30 | V | (1) |
| Control Signal Level | — | -0.3 | 7 | V | (1), (3) |

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) No moisture condensation or freezing.

Note (3) The control signals include On/Off Control & E-PWM.

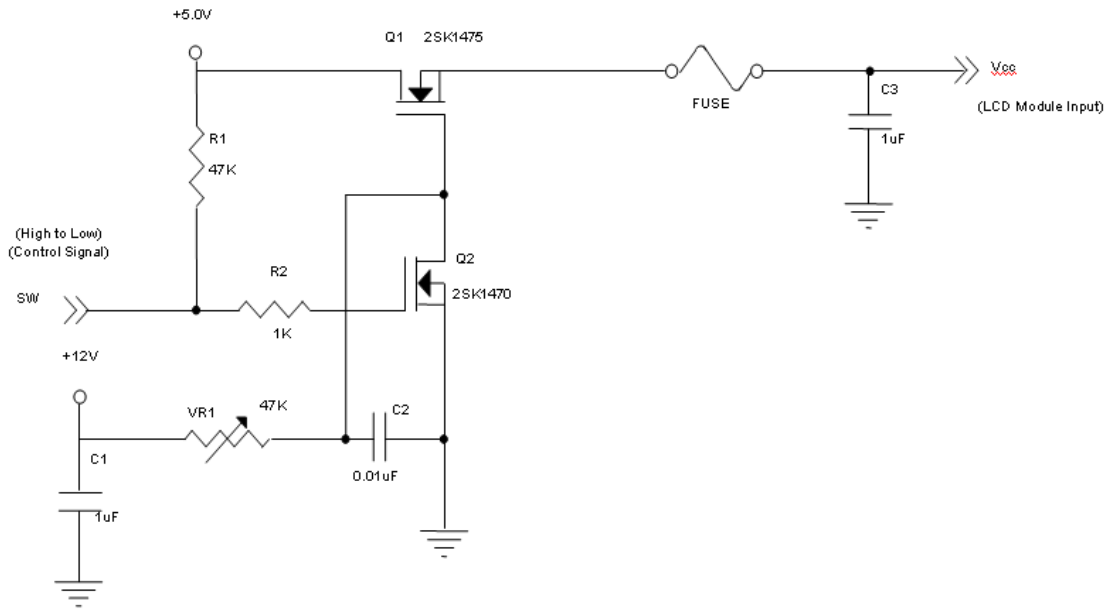
## 3. ELECTRICAL CHARACTERISTICS

### 3.1 TFT LCD MODULE

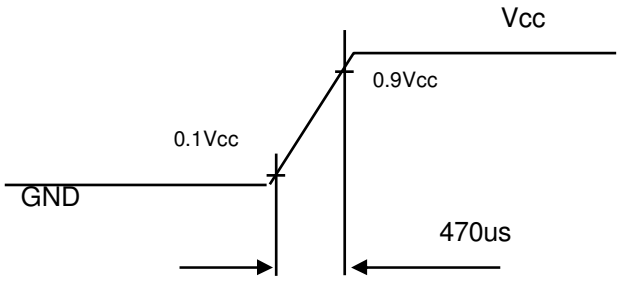
(Ta = 25 ± 2 ºC)

| Parameter | | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| Power Supply Voltage | | $V_{CC}$ | 4.5 | 5.0 | 5.5 | V | (1) |
| Rush Current | | $I_{RUSH}$ | — | — | 3 | A | (2) |
| Power Consumption | | $P_T$ | — | 5.1 | 6.45 | W | (3) |
| Power Supply Current | White Pattern | — | — | 0.4 | 0.55 | A | (4) |
| | Vertical Stripe | — | — | 0.96 | 1.29 | A | |
| | Black Pattern | — | — | 1.02 | 1.29 | A | |
| LVDS interface | Differential Input High Threshold Voltage | $V_{LVTH}$ | +100 | — | — | mV | (5) |
| | Differential Input Low Threshold Voltage | $V_{LVTL}$ | — | — | -100 | mV | |
| | Common Input Voltage | $V_{CM}$ | 1.0 | 1.2 | 1.4 | V | |
| | Differential input voltage (single-end) | $\|V_{ID}\|$ | 200 | — | 600 | mV | |

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



**Vcc rising time is 470us**




Note (3) The Specified Power consumption is under Vertical Stripe pattern.

Note (4) The specified power supply current is under the conditions at Vcc = 12 V, Ta = 25 ± 2 ºC, $f_v$ = 60 Hz, whereas a power dissipation check pattern below is displayed.

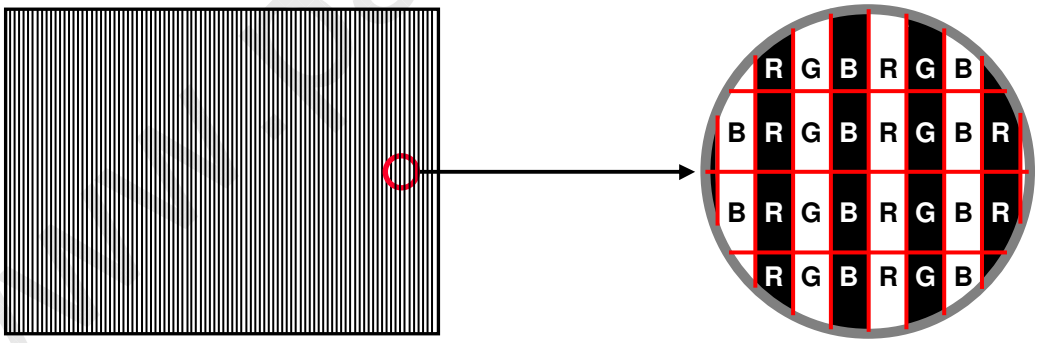
a. White Pattern

Active Area

b. Black Pattern

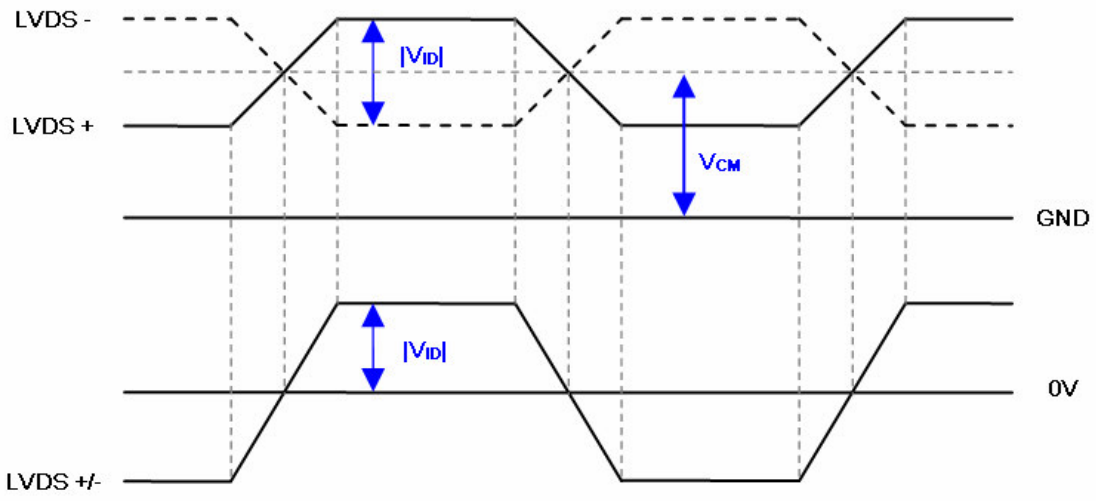
Active Area

c. Vertical Stripe Pattern




Active Area

Note (5) The LVDS input characteristics are as follows :



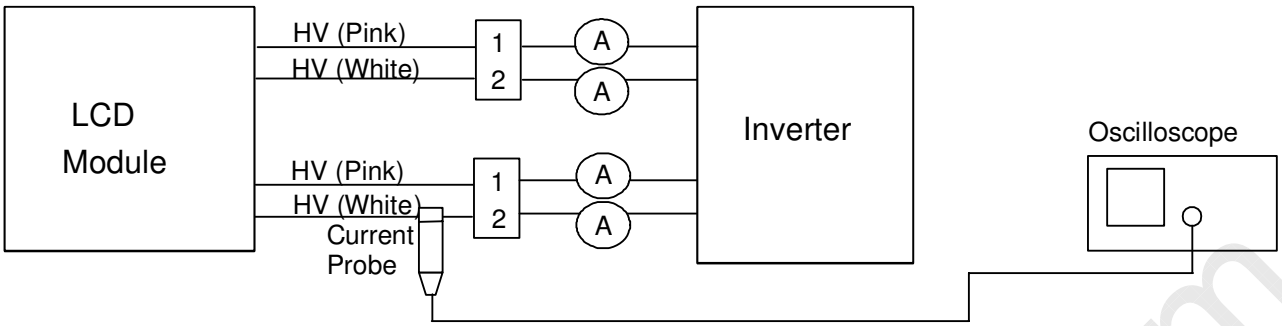

### 3.2 BACKLIGHT CONNECTOR PIN CONFIGURATION

#### 3.2.1 LAMP SPECIFICATION

(Ta = 25 ± 2 ºC)

| Parameter | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Lamp Input Voltage | $V_L$ | 981 | 1080 | 1188 | $V_{RMS}$ | $I_L$=12.5mA |
| Lamp Current | $I_L$ | 12.0 | 12.5 | 13.0 | $mA_{RMS}$ | |
| Lamp Turn On Voltage | $V_S$ | - | - | 1910 | $V_{RMS}$ | (1) , Ta = 0 ºC |
| | | - | - | 1730 | $V_{RMS}$ | (1) , Ta = 25 ºC |
| Operating Frequency | $F_O$ | 30 | - | 80 | KHz | (2) |
| Lamp Life Time | $L_{BL}$ | 50,000 | - | - | Hrs | (3) |
| Power Consumption | $P_{BL}$ | - | 27 | - | W | |

Note (1) Lamp current is measured by AC current probe & oscilloscope as shown below:




Measure equipment:

AC Current probe: Tektronix P6022

Oscilloscope: TDS3054B

Ta = 25 ± 2 ºC

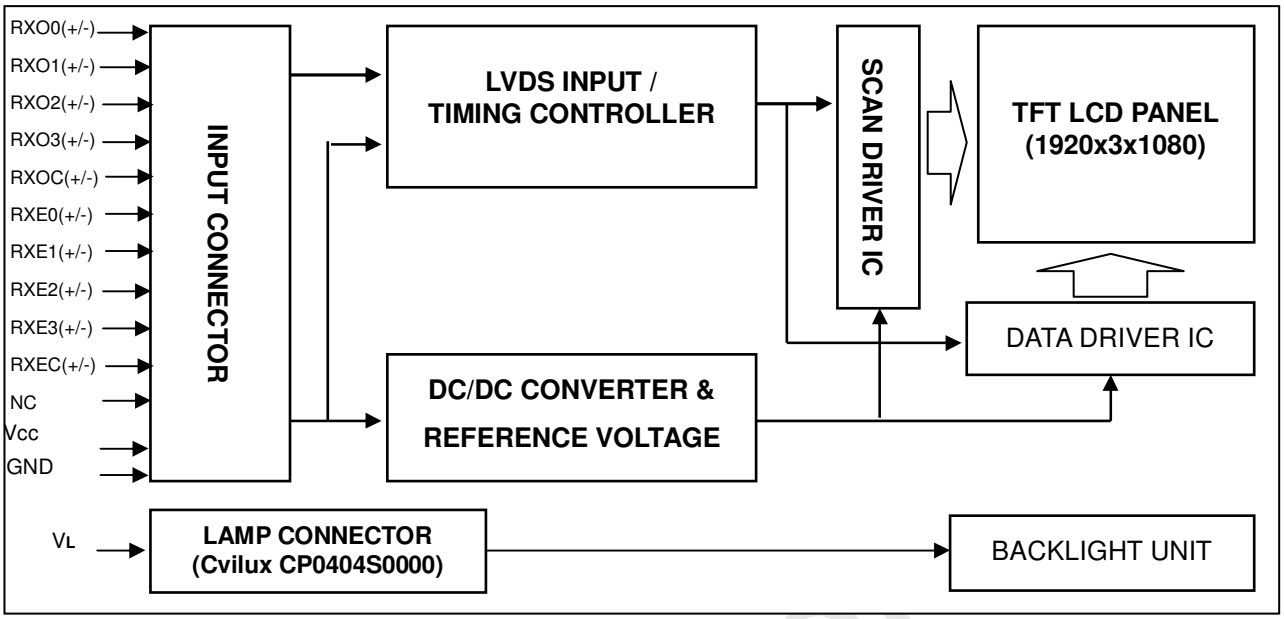
Note (2) The lamp starting voltage $V_S$ should be applied to the lamp for more than 1 second after startup. Otherwise the lamp may not be turned on.

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

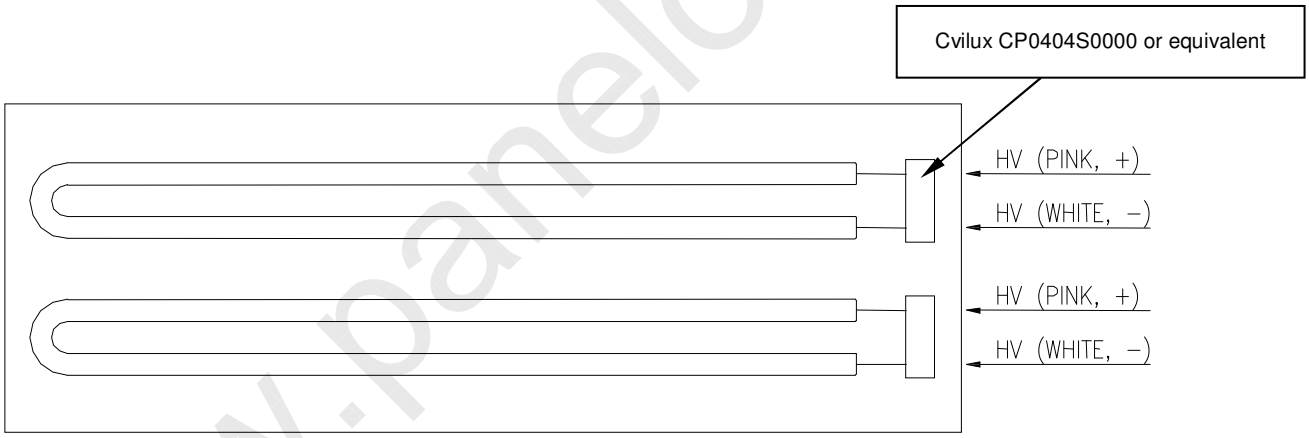
Note (4) The life time of a lamp is defined as when the brightness is larger than 50% of its original value and the effective discharge length is longer than 80% of its original length (Effective discharge length is defined as an area that has equal to or more than 70% brightness compared to the brightness at the center point of lamp.) as the time in which it continues to operate under the condition at Ta = 25 ±2℃ and $I_L$ = 12.0~ 13.0mArms.

## 4. BLOCK DIAGRAM OF INTERFACE

### 4.1 TFT LCD MODULE




### 4.2 BACKLIGHT UNIT




Note: On the same side, the same polarity lamp voltage design for lamps is recommended.

## 5. INPUT TERMINAL PIN ASSIGNMENT

### 5.1 TFT LCD Module Input

| 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 | For LCD internal use only, Do not connect |
| 26 | NC | For LCD internal use only, Do not connect |
| 27 | NC | For LCD internal use only, Do not connect |
| 28 | VCC | +5.0V power supply |
| 29 | VCC | +5.0V power supply |
| 30 | VCC | +5.0V power supply |

Note (1) Connector Part No.: GS23301-1321S-7H (FOXCONN) or 187053-30091 (P-TWO) or equivalent

Note (2) User's connector Part No:

Mating Wire Cable Connector Part No.: FI-X30H(JAE) or FI-X30HL(JAE)

Note (3) The first pixel is odd.

Note (4) Input signal of even and odd clock should be the same timing.

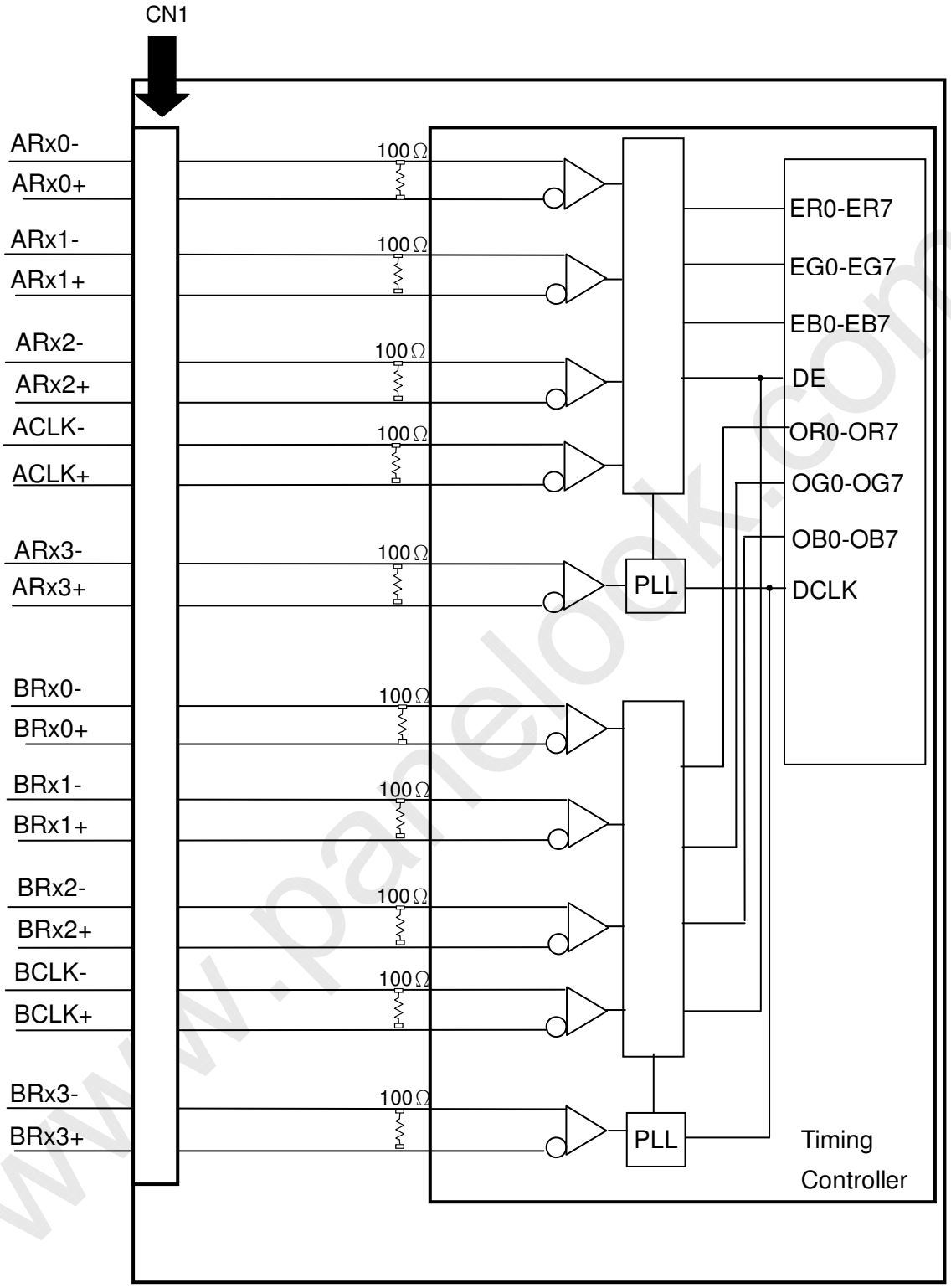
### 5.2 BACKLIGHT UNIT

The pin configuration for the housing and the leader wire is shown in the table below.

| 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 |

Note (1) Connector Part No.: Cvilux CP0404S0000 or equivalent

### 5.3 BLOCK DIAGRAM OF INTERFACE



| | | | |
|---|---|---|---|
| ER0~ER7 | Even pixel R data | OR0~OR7 | Odd pixel R data |
| EG0~EG7 | Even pixel G data | OG0~OG7 | Odd pixel G data |
| EB0~EB7 | Even pixel B data | OB0~OB7 | Odd pixel B data |
| | | DE | Data enable signal |
| | | DCLK | Data clock signal |

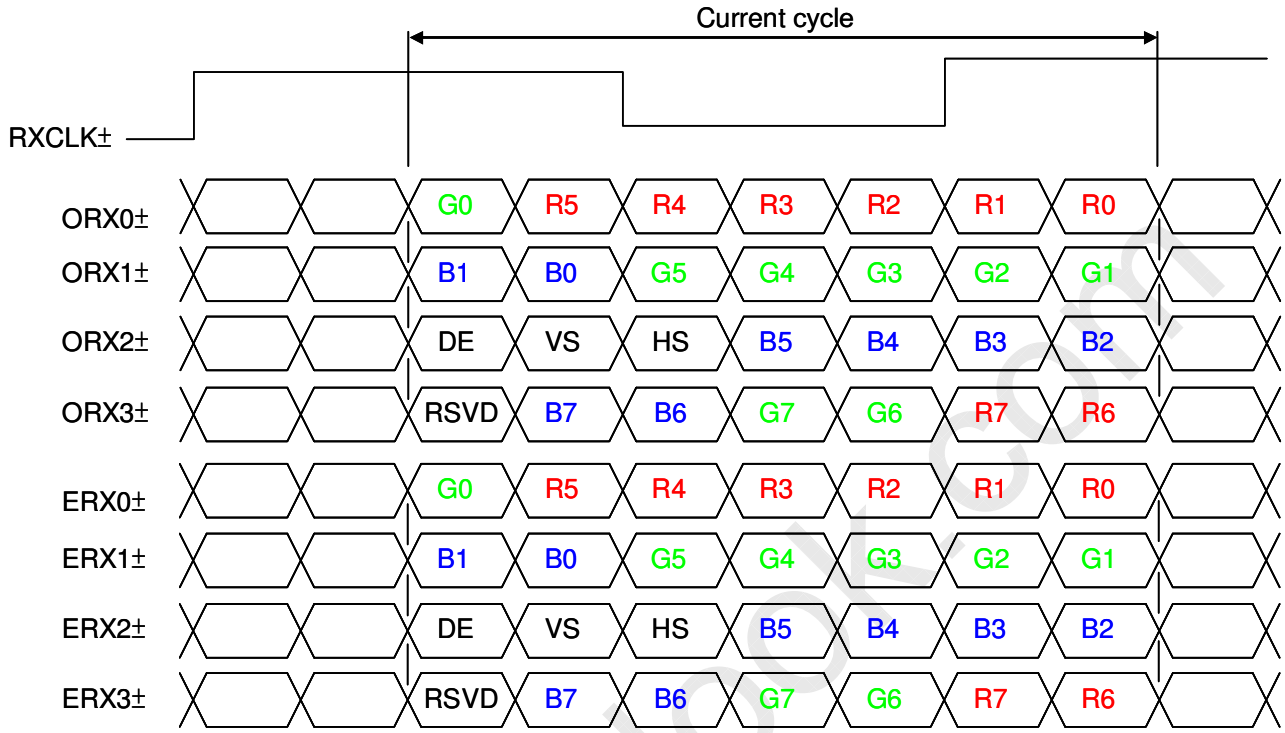
Note (1) The system must have the transmitter to drive the module.

Note (2) LVDS cable impedance shall be 50 ohms per signal line or about 100 ohms per twist-pair line when it is used differentially.

Note (3) Two pixel data send into the module for every clock cycle. The first pixel of the frame is odd pixel and the second pixel is even pixel.

### 5.4 LVDS INTERFACE

VESA Format




R0~R7: Pixel R Data (7; MSB, 0; LSB)

G0~G7: Pixel G Data (7; MSB, 0; LSB)

B0~B7: Pixel B Data (7; MSB, 0; LSB)

DE : Data enable signal

DCLK : Data clock signal

Notes (1) RSVD (reserved) pins on the transmitter shall be “H” or “L”.

### 5.5 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 the 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. INTERFACE TIMING

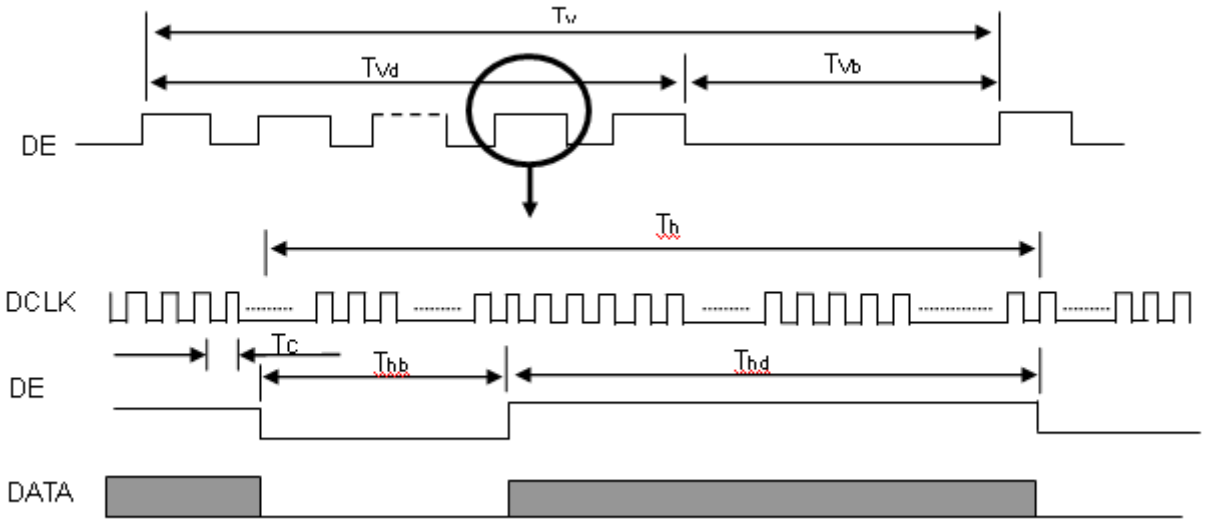
### 6.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram. (Ta = 25 ± 2 ºC)

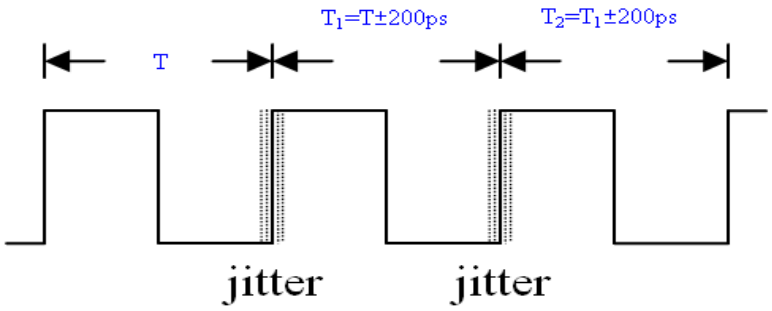
| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| LVDS Receiver Clock | Frequency | $F_{clkin}$ (=1/TC) | 58.54 | 74.25 | 98 | MHz | |
| | Period | Tc | | 13.47 | - | ns | |
| | Input cycle to Cycle jitter | $T_{rcl}$ | -0.02*Tc | - | 0.02*Tc | ps | (2) |
| | Spread spectrum modulation range | $F_{clkin\_mod}$ | 0.97* $F_{clkin}$ | — | 1.03*$F_{clkin}$ | MHz | (3) |
| | Spread spectrum modulation frequency | $F_{SSM}$ | | | 200 | KHz | |
| LVDS Receiver Data | Setup Time | Tlvsu | 600 | - | - | ps | |
| | Hold Time | Tlvhd | 600 | - | - | ps | |
| Vertical Active Display Term | Frame Rate | $F_r$ | 50 | 60 | 76 | Hz | |
| | Total | Tv | 1115 | 1125 | 1136 | Th | Tv=Tvd+Tvb |
| | Display | Tvd | 1080 | 1080 | 1080 | Th | |
| | Blank | Tvb | 35 | 45 | 56 | Th | |
| Horizontal Active Display Term | Total | Th | 1050 | 1100 | 1150 | Tc | Th=Thd+Thb |
| | Display | Thd | 960 | 960 | 960 | Tc | |
| | Blank | Thb | 90 | 140 | 190 | Tc | |

Note: Because this module is operated by DE only mode, Hsync and Vsync input signals are ignored.

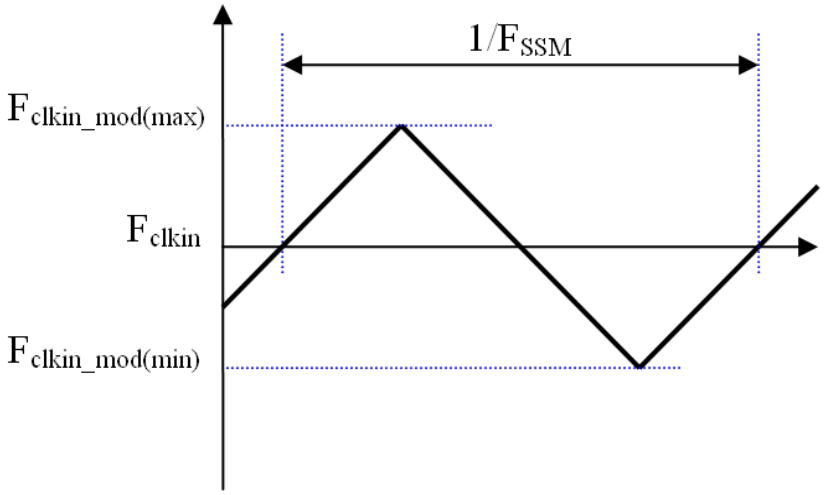
**INPUT SIGNAL TIMING DIAGRAM**




Note (2) The input clock cycle-to-cycle jitter is defined as below figures. Trcl = I $T_1$ – TI



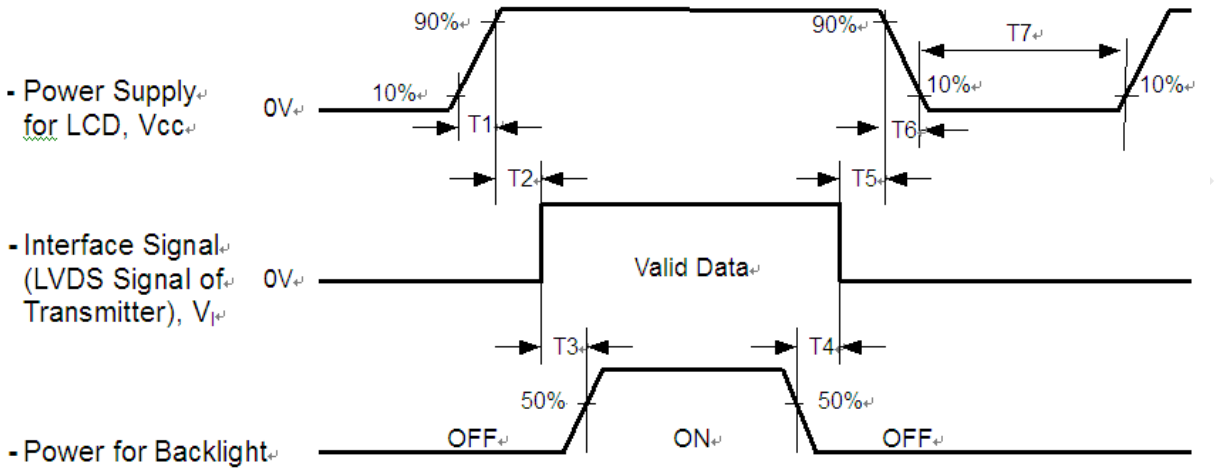

Note (3) The SSCG (Spread spectrum clock generator) is defined as below figures.



### 6.2 POWER ON/OFF SEQUENCE

(Ta = 25 ± 2 ºC)

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




Timing Specifications:

| Parameters | Values | | | Units |
|---|---|---|---|---|
| | Min | Typ. | Max | |
| T1 | 0.5 | -- | 10 | ms |
| T2 | 0 | -- | 50 | ms |
| T3 | 450 | -- | -- | ms |
| T4 | 90 | -- | -- | ms |
| T5 | 0 | -- | 50 | ms |
| T6 | 0.5 | -- | 100 | ms |
| T7 | 500 | -- | -- | ms |

Note (1) The supply voltage of the external system for the module input should be the same as the definition of Vcc.

Note (2) When the backlight turns on before the LCD operation of the LCD turns off, the display may momentarily become abnormal screen.

Note (3) In case of VCC = off level, please keep the level of input signals on the low or keep a high impedance.

Note (4) T7 should be measured after the module has been fully discharged between power off and on period.

Note (5) Interface signal shall not be kept at high impedance when the power is on.

Note (6) CMI won't take any responsibility for the products which are damaged by the customers not following the Power Sequence.

Note (7) There might be slight electronic noise when LCD is turned off (even backlight unit is also off). To avoid this symptom, we suggest "Vcc falling timing" to follow "T6 spec".

## 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 | $V_{CC}$ | 5 | V |
| Input Signal | According to typical value in "3. ELECTRICAL CHARACTERISTICS" | | |
| Lamp Current | $I_L$ | 12.5±0.5 | mA |
| Oscillating Frequency (Inverter) | $F_L$ | 58±3 | KHz |
| Inverter | Logah F236H1-2UA-L001 | | |

The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring in a windless room.

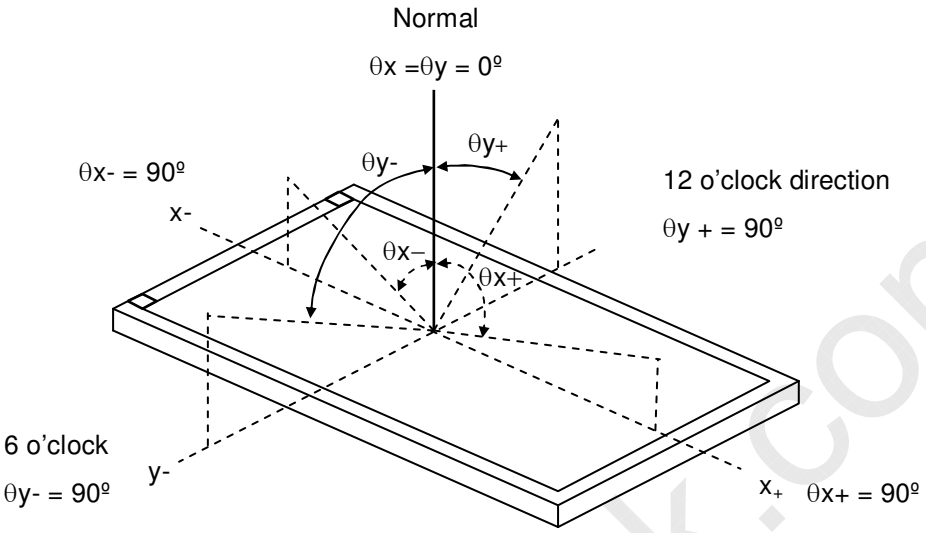
### 7.2 OPTICAL SPECIFICATIONS

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 7.1.

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Contrast Ratio | | CR | θx=0°, θy =0° Viewing angle at normal direction | 600 | 800 | - | - | (2) |
| Response Time | | $T_R$ | | - | 1.5 | 2.5 | ms | (3) |
| | | $T_F$ | | - | 3.5 | 7 | ms | |
| Center Luminance of White | | $L_C$ | | 240 | 300 | - | $cd/m^2$ | (4) |
| White Variation | | δW | | - | - | 1.33 | - | (6) |
| Cross Talk | | CT | | - | - | 4 | % | (5) |
| Color Chromaticity | Red | Rx | | Typ. -0.03 | 0.642 | Typ. +0.03 | - | - |
| | | Ry | | | 0.331 | | - | |
| | Green | Gx | | | 0.265 | | - | |
| | | Gy | | | 0.602 | | - | |
| | Blue | Bx | | | 0.150 | | - | |
| | | By | | | 0.063 | | - | |
| | White | Wx | | | 0.280 | | - | |
| | | Wy | | | 0.290 | | - | |
| | Color Gamut | C.G | | - | 72 | - | % | NTSC |
| Viewing Angle | Horizontal | $\theta_x$+ + $\theta_x$- | CR ≧ 10 USB2000 | 150 | 170 | | Deg. | (1) |
| | Vertical | $\theta_Y$++ $\theta_Y$- | | 140 | 160 | - | | |
| | Horizontal | $\theta_x$+ + $\theta_x$- | CR ≧ 5 USB2000 | 160 | 178 | - | | |
| | Vertical | $\theta_Y$++ $\theta_Y$- | | 150 | 170 | - | | |

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

Viewing angles are measured by Autronic Conoscope Cono-80




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

The contrast ratio can be calculated by the following expression.

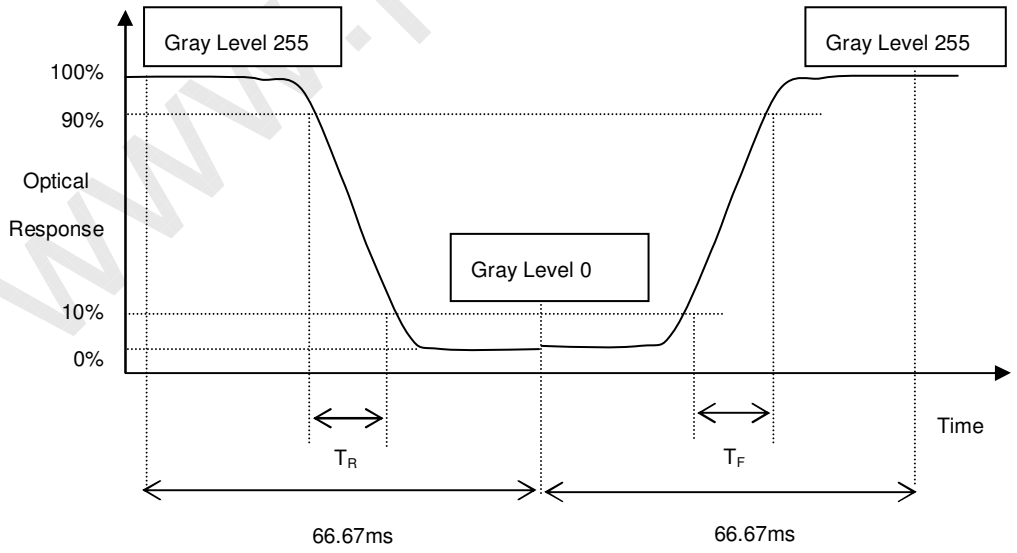
$$\text{Contrast Ratio (CR)} = \frac{\text{Surface Luminance of L255}}{\text{Surface Luminance of L0}}$$

L255: Luminance of gray level 255

L 0: Luminance of gray level 0

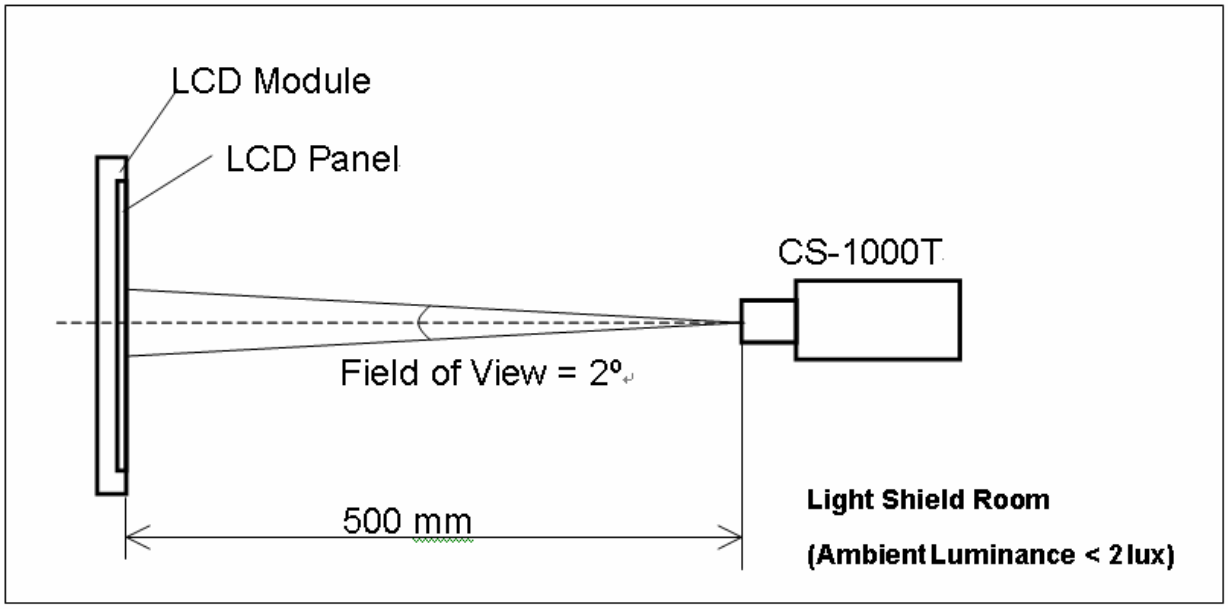
CR =CR (5), where CR (X) is corresponding to the Contrast Ratio of the point X at the figure in Note (6).

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



Note (4) Measurement Setup:

The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 1 hour in a windless room.




Note (5) Definition of Luminance of White ($L_C$, $L_{AVE}$):

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 (6).

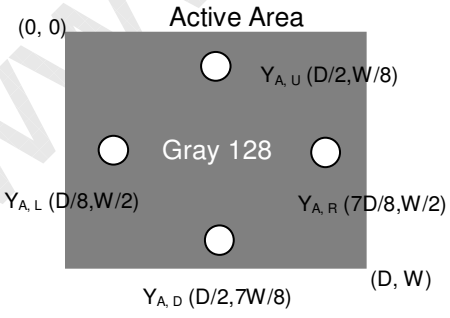
Note (6) Definition of Cross Talk (CT):

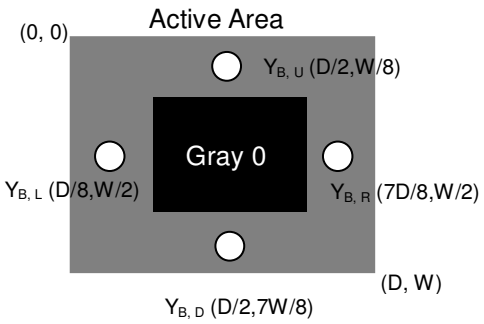
CT = | YB – YA | / YA × 100 (%)

Where:

YA = Luminance of measured location without gray level 0 pattern (cd/m2)

YB = Luminance of measured location with gray level 0 pattern (cd/m2)

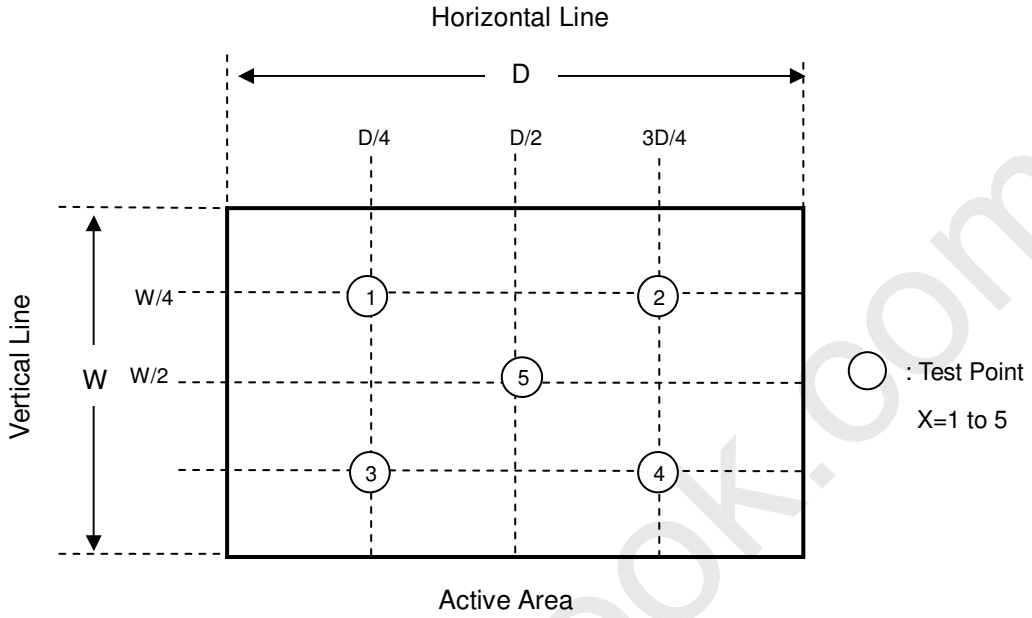


Note (7) Definition of White Variation (δW):

Measure the luminance of gray level 255 at 5 points

δW = Maximum [L (1), L (2), L (3), L (4), L (5)] / Minimum [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 ] 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 CMIS LSI chips.

[ 5 ] Bezel of Set can not press or touch the panel surface. It will make light leakage or scrape.

[ 6 ] Do not plug in or pull out the I/F connector while the module is in operation.

[ 7 ] Do not disassemble the module.

[ 8 ] Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.

[ 9 ] Moisture can easily penetrate into LCD module and may cause the damage during operation.

[ 10 ] When storing modules as spares for a long time, the following precaution is necessary.

[ 10.1 ] Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35℃at normal humidity without condensation.

[ 10.2 ] The module shall be stored in dark place. Do not store the TFT-LCD module in direct sunlight or fluorescent light.

[ 11 ] When ambient temperature is lower than 10ºC, the display quality might be reduced. For example, the response time will become slow, and the starting voltage of CCFL will be higher than that of room temperature.

### 8.2 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.

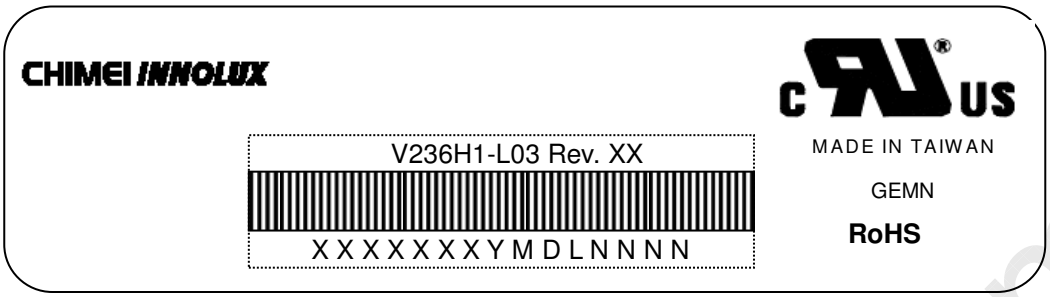
### 8.3 SAFETY STANDARDS

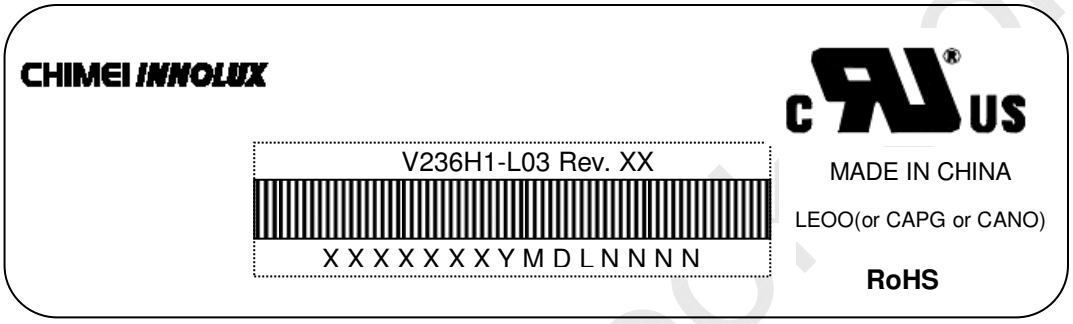
| Requirement | Standard | remark |
|---|---|---|
| UL | UL60950-1:2006 or Ed.2:2007 | |
| | UL60065 Ed.7:2007 | |
| cUL/CSA | CAN/CSA C22.2 No.60950-1-03 or 60950-1-07 | |
| | CAN/CSA C22.2 No.60065-03:2006 + A1:2006 | |
| CB | IEC60950-1:2005 / EN60950-1:2006+ A11:2009 | |
| | IEC60065:2001+ A1:2005 / EN60065:2002 + A1:2006 + A11:2008 | |

## 9. DEFINITION OF LABELS

### 9.1 CMI MODULE LABEL

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

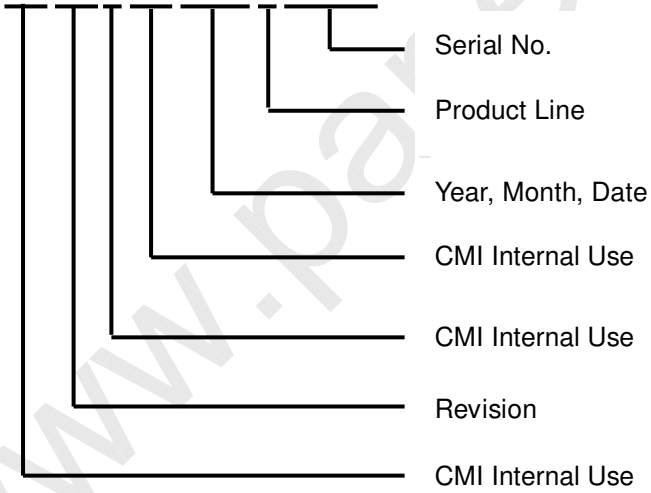



Model Name: V236H1-L03

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

Serial ID: X X X X X X Y M D L N N N N




Serial ID includes the information as below:

Manufactured Date:

Year : 2001=1, 2002=2, 2003=3, 2004=4…2010=0, 2011=1, 2012=2…

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

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

Revision Code : Cover all the change

Serial No. : Manufacturing sequence of product

Product Line : 1 → Line1, 2 → Line 2, …etc.

## 10. PACKAGING

### 10.1 PACKAGING SPECIFICATIONS

(1) 4 LCD TV modules / 1 Box

(2) Box dimensions : 620(L) X 342 (W) X 390 (H) mm

(3) Weight : Approx. 12.1 Kg (4 modules per box)

### 10.2 PACKAGING 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 Corner, 3 Edge, 6 Face, 61cm | Non Operation |

Figures 10-1 and 10-2 are the packing method

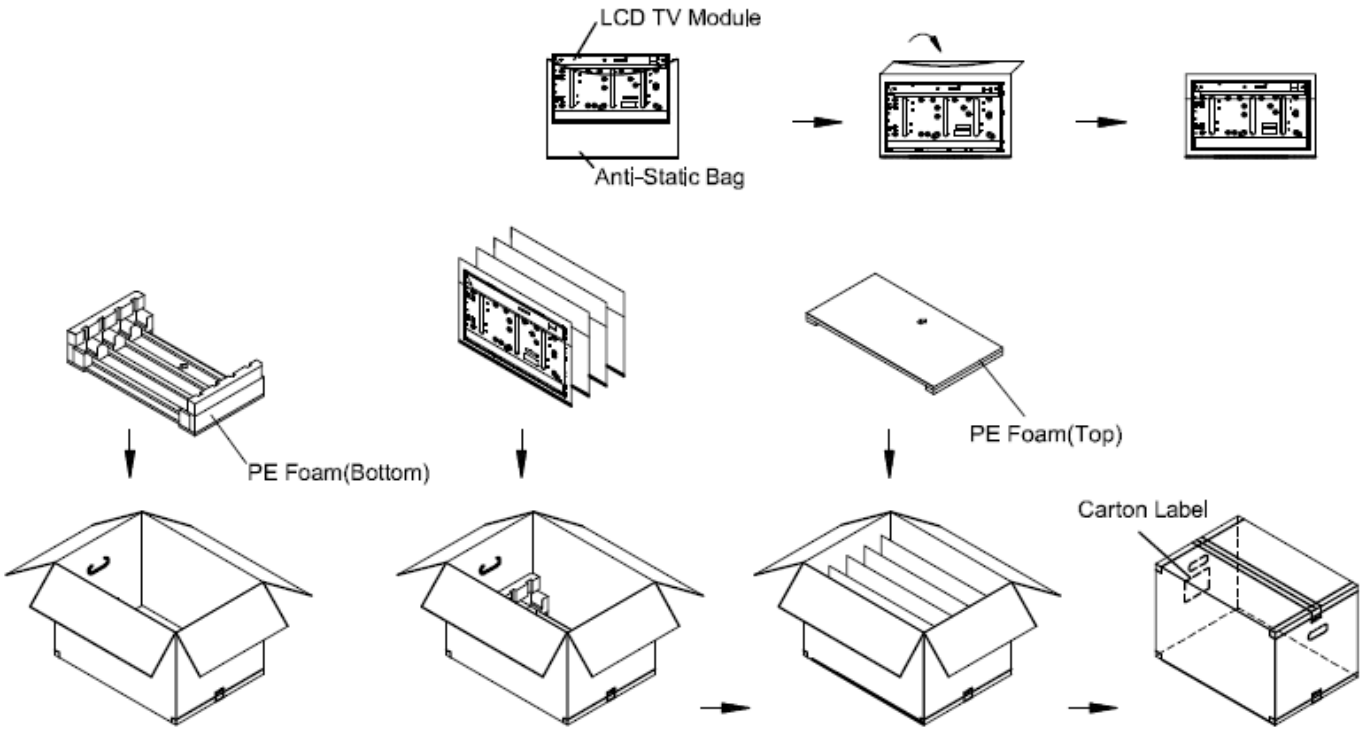
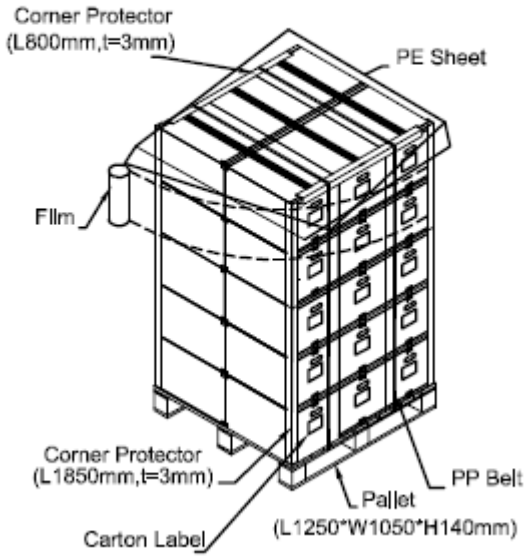



Figure 10-1 packing method

Sea / Land Transportation
(40ft Container)




Air Transportation

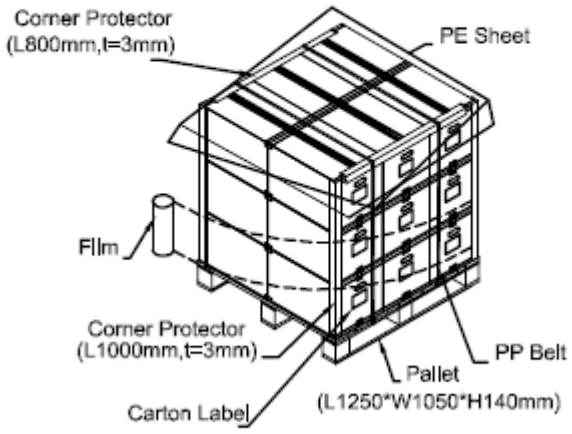



Figure 10-2 packing method

## 11. MECHANICAL CHARACTERISTIC