# TFT LCD Approval Specification

# MODEL NO.: V216C1 - L01

| LCD TV Head Division | |
|---|---|
| VP | 郭振隆 |

| QRA Dept. | TVHD/PDD | | |
|---|---|---|---|
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## REVISION HISTORY

| Version | Date | Page (New) | Section | Description |
|---|---|---|---|---|
| Ver 2.0 | May. 26,06 | All | All | Approval Specification was first issued. |
| Ver 2.0 | May. 26,06 | All | All | RoHS Compliance |



# 1. GENERAL DESCRIPTION

## 1.1 OVERVIEW

V216C1-L01 is a 21.66" TFT Liquid Crystal Display module with 6-Ⅰ CCFL Backlight unit and 2ch-LVDS interface. This module supports 1440 x 900 WXGA+ format and displays 16.2M colors(6-bit+FRC).

## 1.2 FEATURES

- High brightness (350 nits)
- High contrast ratio (1000:1)
- Fast response time (Gray to Gray average 6.5ms)
- High color saturation (NTSC 75%)
- WXGA+ (1440 x 900 pixels) resolution
- DE (Data Enable) only mode
- 2ch-LVDS interface

## 1.3 APPLICATION

- TFT LCD TVs, Multi-Function Monitors

## 1.4 GENERAL SPECIFICATI0NS

| Item | Specification | Unit | Note |
|---|---|---|---|
| Active Area | 466.56x291.6 | mm | (1) |
| Bezel Opening Area | 470.6x295.6 | mm | |
| Driver Element | a-si TFT active matrix | - | - |
| Pixel Number | 1440 x R.G.B. x 900 | pixel | - |
| Pixel Pitch(Sub Pixel) | 0.324 | mm | - |
| Pixel Arrangement | RGB vertical stripe | - | - |
| Display Colors | 16.2M | color | - |
| Display Operation Mode | Transmissive mode / Normally black | - | - |
| Surface Treatment | Hardness : 3H<br>Anti-Glare coating (Haze 25%) | - | - |

## 1.5 MECHANICAL SPECIFICATIONS

| Item | | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Module Size | Horizontal(H) | 491.0 | 491.6 | 492.2 | mm | (1) |
| | Vertical(V) | 323.7 | 324.2 | 324.7 | mm | |
| | Depth(D) | 20.63 | 21.43 | 22.23 | mm | - |
| Weight | | - | 3600 | - | gm. | - |

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) | $V_{NOP}$ | - | 1.0 | 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).

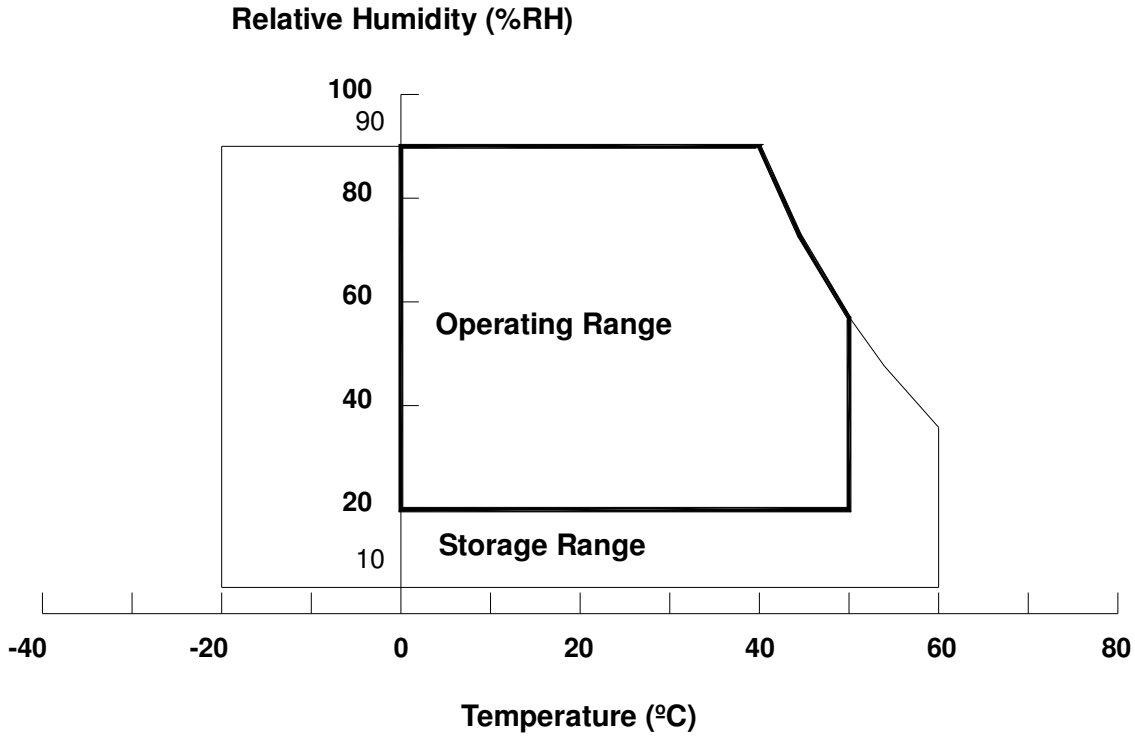
(c) No condensation.

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 60 ºC with LCD module alone in a temperature controlled chamber. Thermal management should be considered in your product design to prevent the surface temperature of display area from being over 60 ºC. The range of operating temperature may degrade in case of improper thermal management in your product design.

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

Note (4) 10 ~ 500 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



## 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 | - |

### 2.2.2 BACKLIGHT UNIT

| Item | Symbol | Value | | Unit | Note |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Lamp Voltage | $V_L$ | - | 3000 | $V_{RMS}$ | - |
| Lamp Current | $I_L$ | - | 7.5 | $mA_{RMS}$ | - |
| Lamp Frequency | $F_L$ | 20 | 80 | KHz | |



## 3. ELECTRICAL CHARACTERISTICS

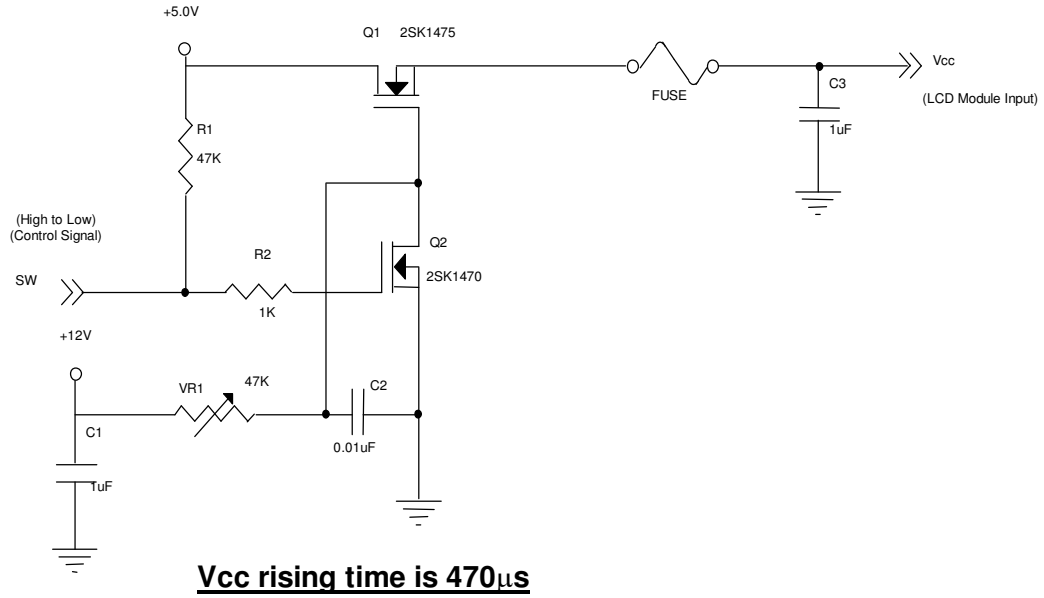
### 3.1 TFT LCD MODULE

Ta = 25 ± 2 ºC

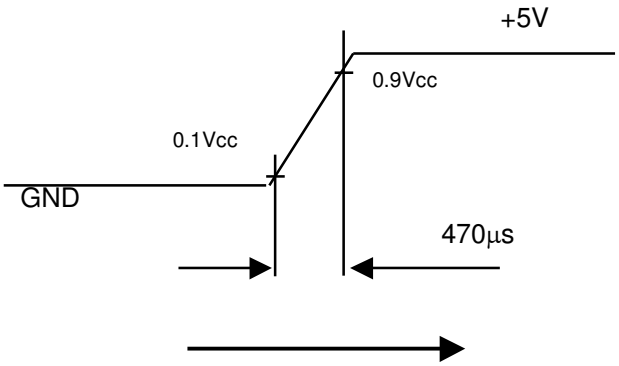
| Parameter | | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| Power Supply Voltage | | $V_{CC}$ | 4.5 | 5.0 | 5.5 | V | (1) |
| Power Supply Ripple Voltage | | $V_{RP}$ | - | - | 100 | mV | - |
| Rush Current | | $I_{RUSH}$ | - | - | 2.5 | A | (2) |
| Power Supply Current | White | $I_{CC}$ | - | 1.5 | 1.7 | A | (3) |
| | Black | | - | 0.7 | - | A | |
| | Vertical Stripe | | - | 0.9 | - | A | |
| LVDS Interface | Differential Input High Threshold Voltage | $V_{LVTH}$ | - | - | +100 | mV | - |
| | Differential Input Low Threshold Voltage | $V_{LVTL}$ | -100 | - | - | mV | - |
| | Common Input Voltage | $V_{LVC}$ | 1.125 | 1.25 | 1.375 | V | - |
| | Terminating Resistor | $R_T$ | - | 100 | - | ohm | - |
| CMOS interface | Input High Threshold Voltage | $V_{IH}$ | 2.7 | - | 3.3 | V | - |
| | Input Low Threshold Voltage | $V_{IL}$ | 0 | - | 0.7 | V | - |

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

Note (2) Measurement Conditions:




**Vcc rising time is 470μs**

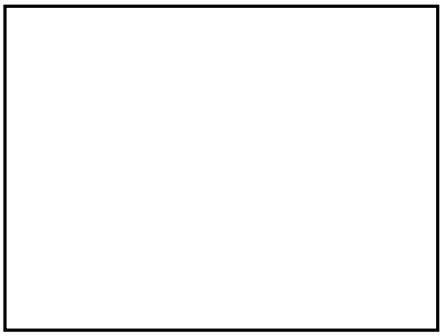




Note (3) The specified power supply current is under the conditions at Vcc = 5 V, Ta = 25 ± 2 ºC, $f_v$ = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern

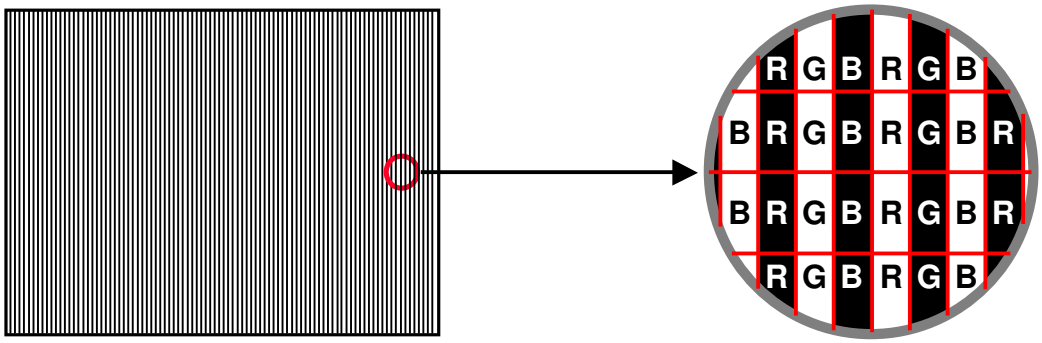


Active Area

b. Black Pattern

Active Area

c. Vertical Stripe Pattern




Active Area

### 3.2 BACKLIGHT UNIT

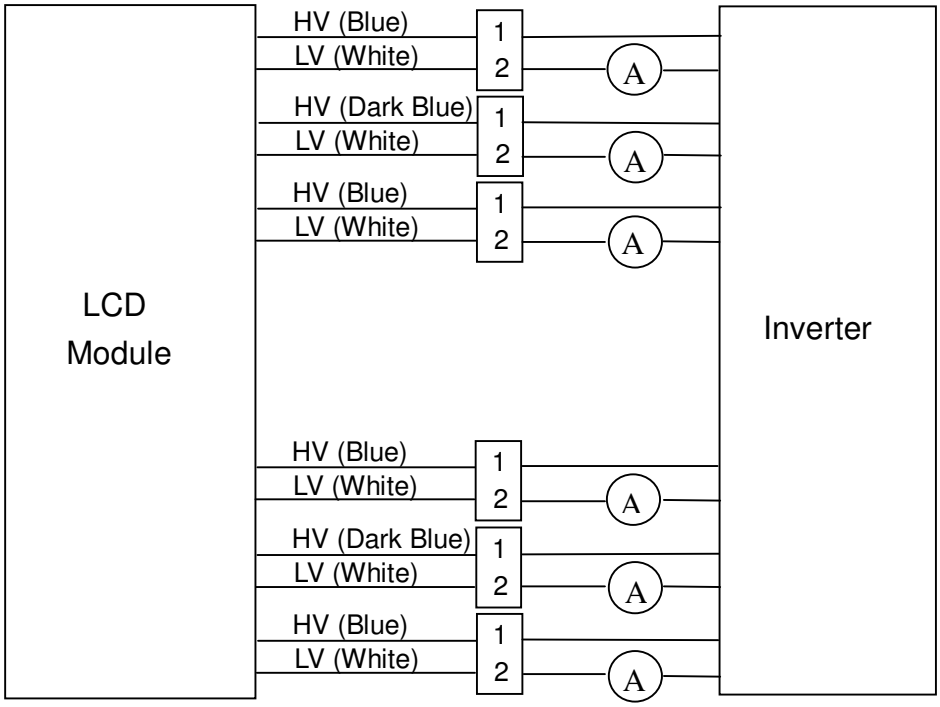
Ta = 25 ± 2 ºC

| Parameter | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Lamp Input Voltage | $V_L$ | - | 766 | .- | $V_{RMS}$ | $I_L$ = 7.0 mA |
| Lamp Current | $I_L$ | 6.5 | 7 | 7.5 | $mA_{RMS}$ | - |
| Lamp Turn On Voltage | $V_S$ | | - | 1500 | $V_{RMS}$ | Ta = 25 ºC |
| | | | - | 1700 | $V_{RMS}$ | Ta = 0 ºC |
| Operating Frequency | $F_L$ | 40 | 50 | 60 | KHz | - |
| Lamp Life Time | $L_{BL}$ | 40000 | 50000 | - | Hrs | - |

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






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

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

Note (4) The lifetime of a lamp is defined as the time in which it continues to operate under the condition Ta = 25 ±2 °C and $I_L$ = (6.5) ~ (7.5) mArms until one of the following events occurs:

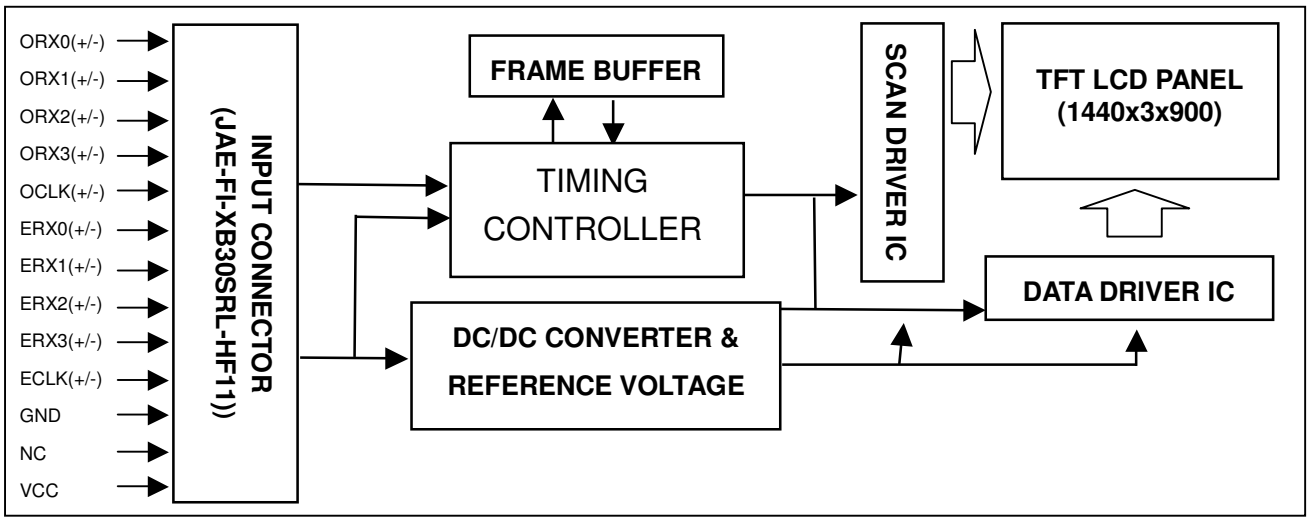
(a) When the brightness becomes equal or less than 50% of its original value.

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

Note (5) The waveform of the voltage output of inverter must be area-symmetric and the design of the inverter must have specifications for the modularized lamp. The performance of the Backlight, such as lifetime or brightness, is greatly influenced by the characteristics of the DC-AC inverter for the lamp. All the parameters of an inverter should be carefully designed to avoid producing too much current leakage from high voltage output of the inverter. When designing or ordering the inverter please make sure that a poor lighting caused by the mismatch of the Backlight and the inverter (miss-lighting, flicker, etc.) never occurs. If the above situation is confirmed, the module should be operated in the same manners when it is installed in your instrument.

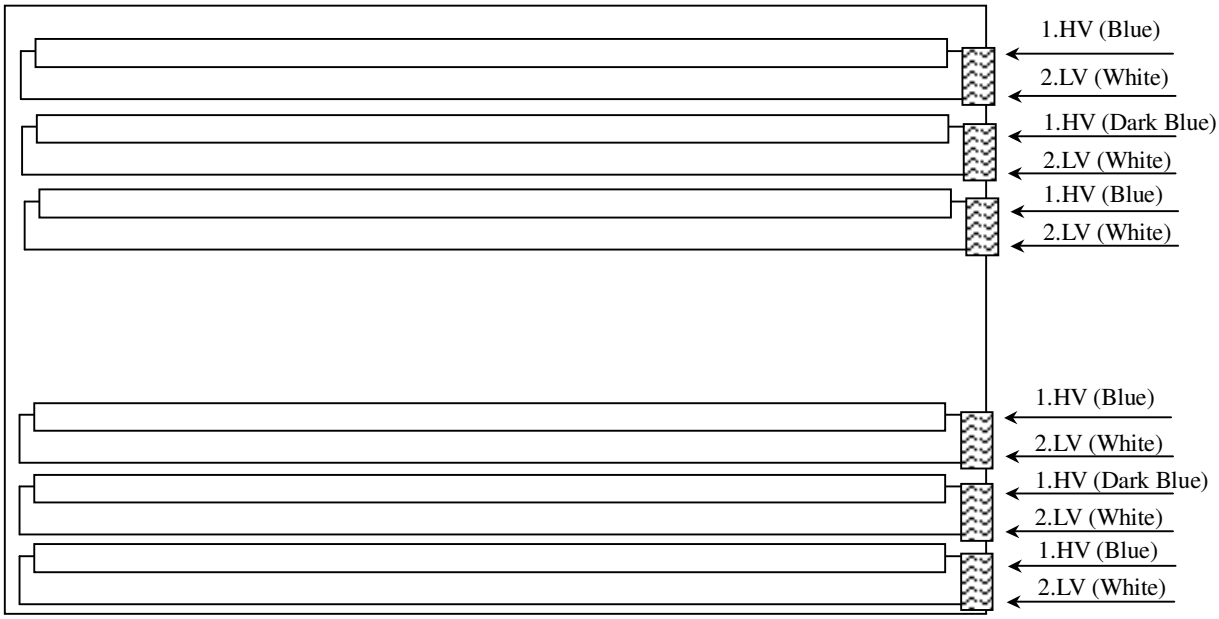
## 4. BLOCK DIAGRAM

### 4.1 TFT LCD MODULE




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

### 4.2 BACKLIGHT UNIT



## 5. INTERFACE PIN CONNECTION

### 5.1 TFT LCD MODULE

**CNF1 Connector Pin Assignment**

| Pin No. | Symbol | Description | Note |
|---|---|---|---|
| 1 | ORX0- | Negative transmission data of Odd pixel 0 | |
| 2 | ORX0+ | Positive transmission data of Odd pixel 0 | |
| 3 | ORX1- | Negative transmission data of Odd pixel 1 | |
| 4 | ORX1+ | Positive transmission data of Odd pixel 1 | |
| 5 | ORX2- | Negative transmission data of Odd pixel 2 | |
| 6 | ORX2+ | Positive transmission data of Odd pixel 2 | |
| 7 | GND | Ground | |
| 8 | OCLK- | Negative of Odd clock | |
| 9 | OCLK+ | Positive of Odd clock | |
| 10 | ORX3- | Negative transmission data of Odd pixel 3 | |
| 11 | ORX3+ | Positive transmission data of Odd pixel 3 | |
| 12 | ERX0- | Negative transmission data of Even pixel 0 | |
| 13 | ERX0+ | Positive transmission data of Even pixel 0 | |
| 14 | GND | Ground | |
| 15 | ERX1- | Negative transmission data of Even pixel 1 | |
| 16 | ERX1+ | Positive transmission data of Even pixel 1 | |
| 17 | GND | Ground | |
| 18 | ERX2- | Negative transmission data of Even pixel 2 | |
| 19 | ERX2+ | Positive transmission data of Even pixel 2 | |
| 20 | ECLK- | Negative of Even clock | |
| 21 | ECLK+ | Positive of Even clock | |
| 22 | ERX3- | Negative transmission data of Even pixel 3 | |
| 23 | ERX3+ | Positive transmission data of Even pixel 3 | |
| 24 | GND | Ground | |
| 25 | GND | Ground | |
| 26 | NC | Not connection. | (4) |
| 27 | NC | Not connection. | |
| 28 | VCC | +5.0V power supply | |
| 29 | VCC | +5.0V power supply | |
| 30 | VCC | +5.0V power supply | |

Note (1) Connector Part No.:JAE-FI-XB30SRL-HF11or equivalent.

Note (2) The first pixel is odd.

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

Note (4) Reserved for internal use. Left it open.

### 5.2 BACKLIGHT UNIT

| Pin | Symbol | Description | Color |
|---|---|---|---|
| 1 | HV1 | High Voltage | Blue or Dark Blue |
| 2 | LV | Ground | White |

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

Note (2) Matching Connector Part No.: SM02-BHSS-1-TB (JST) 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



### 5.4 LVDS INTERFACE

| | SIGNAL | TRANSMITTER THC63LVDM83A | | INTERFACE CONNECTOR | | RECEIVER THC63LVDF84A | | TFT CONTROL INPUT |
|---|---|---|---|---|---|---|---|---|
| | | PIN | INPUT | Host | TFT-LCD | PIN | OUTPUT | |
| 24bit | R0 | 51 | TxIN0 | | | 27 | Rx OUT0 | R0 |
| | R1 | 52 | TxIN1 | | | 29 | Rx OUT1 | R1 |
| | R2 | 54 | TxIN2 | TA OUT0+ | Rx 0+ | 30 | Rx OUT2 | R2 |
| | R3 | 55 | TxIN3 | | | 32 | Rx OUT3 | R3 |
| | R4 | 56 | TxIN4 | | | 33 | Rx OUT4 | R4 |
| | R5 | 3 | TxIN6 | TA OUT0- | Rx 0- | 35 | Rx OUT6 | R5 |
| | G0 | 4 | TxIN7 | | | 37 | Rx OUT7 | G0 |
| | G1 | 6 | TxIN8 | | | 38 | Rx OUT8 | G1 |
| | G2 | 7 | TxIN9 | | | 39 | Rx OUT9 | G2 |
| | G3 | 11 | TxIN12 | TA OUT1+ | Rx 1+ | 43 | Rx OUT12 | G3 |
| | G4 | 12 | TxIN13 | | | 45 | Rx OUT13 | G4 |
| | G5 | 14 | TxIN14 | | | 46 | Rx OUT14 | G5 |
| | B0 | 15 | TxIN15 | TA OUT1- | Rx 1- | 47 | Rx OUT15 | B0 |
| | B1 | 19 | TxIN18 | | | 51 | Rx OUT18 | B1 |
| | B2 | 20 | TxIN19 | | | 53 | Rx OUT19 | B2 |
| | B3 | 22 | TxIN20 | | | 54 | Rx OUT20 | B3 |
| | B4 | 23 | TxIN21 | TA OUT2+ | Rx 2+ | 55 | Rx OUT21 | B4 |
| | B5 | 24 | TxIN22 | | | 1 | Rx OUT22 | B5 |
| | DE | 30 | TxIN26 | | | 6 | Rx OUT26 | DE |
| | R6 | 50 | TxIN27 | TA OUT2- | Rx 2- | 7 | Rx OUT27 | R6 |
| | R7 | 2 | TxIN5 | | | 34 | Rx OUT5 | R7 |
| | G6 | 8 | TxIN10 | | | 41 | Rx OUT10 | G6 |
| | G7 | 10 | TxIN11 | | | 42 | Rx OUT11 | G7 |
| | B6 | 16 | TxIN16 | TA OUT3+ | Rx 3+ | 49 | Rx OUT16 | B6 |
| | B7 | 18 | TxIN17 | | | 50 | Rx OUT17 | B7 |
| | RSVD 1 | 25 | TxIN23 | | | 2 | Rx OUT23 | Not connect |
| | RSVD 2 | 27 | TxIN24 | TA OUT3- | Rx 3- | 3 | Rx OUT24 | Not connect |
| | RSVD 3 | 28 | TxIN25 | | | 5 | Rx OUT25 | Not connect |
| | DCLK | 31 | TxCLK IN | TxCLK OUT+<br>TxCLK OUT- | RxCLK IN+<br>RxCLK IN- | 26 | RxCLK OUT | DCLK |

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”.



## 6. INTERFACE TIMING

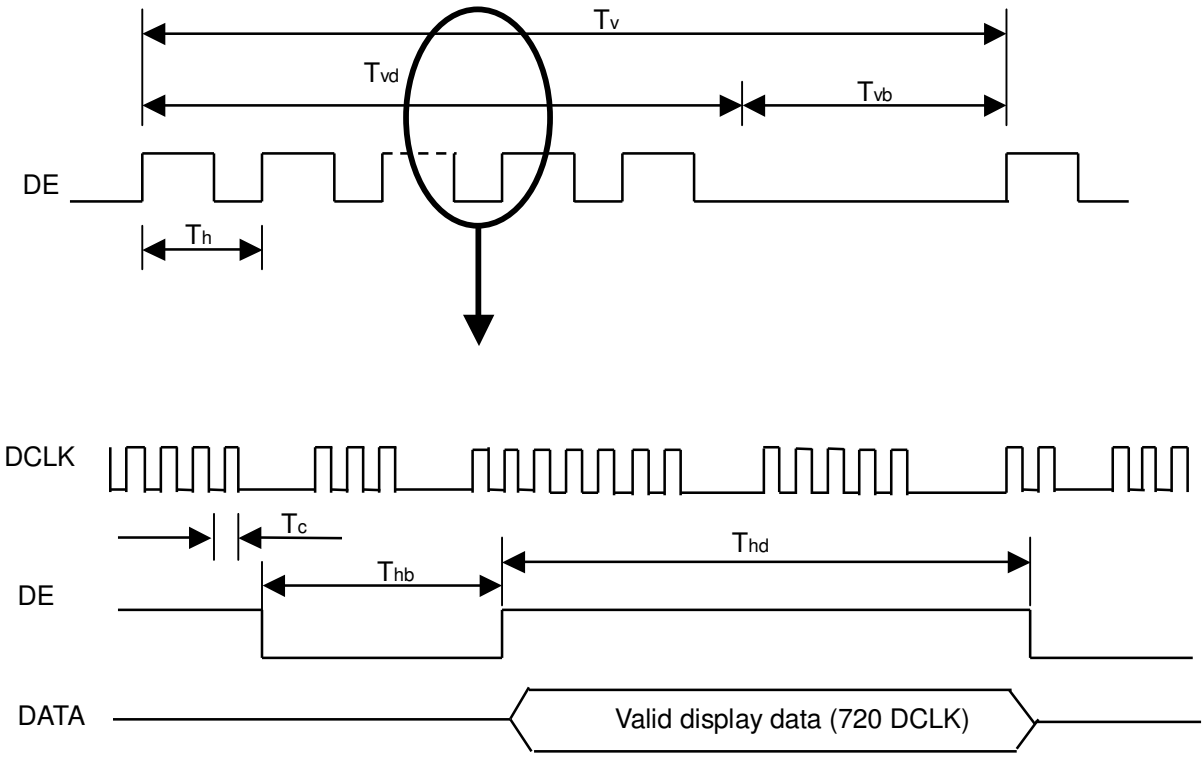
### 6.1 INPUT SIGNAL TIMING SPECIFICATIONS

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

| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| LVDS Receiver Clock | Frequency | 1/Tc | 40- | 45 | (56) | MHz | |
| | Input cycle to cycle Jitter | Trcl | - | - | 200 | ps | |
| LVDS Receiver Data | Setup Time | Tlvsu | 600 | - | - | ps | |
| | Hold Time | Tlvhd | 600 | - | - | ps | |
| Vertical Active Display Term | Frame Rate | Fr | - | 60 | 75 | Hz | |
| | Total | Tv | 915 | 926 | 1050 | Th | Tv=Tvd+Tvb |
| | Display | Tvd | 900 | 900 | 900 | Th | - |
| | Blank | Tvb | 15 | 26 | 150 | Th | - |
| Horizontal Active Display Term | Total | Th | 760 | 800 | 960 | Tc | Th=Thd+Thb |
| | Display | Thd | 720 | 720 | 720 | Tc | - |
| | Blank | Thb | 40 | 80 | 240 | Tc | - |

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

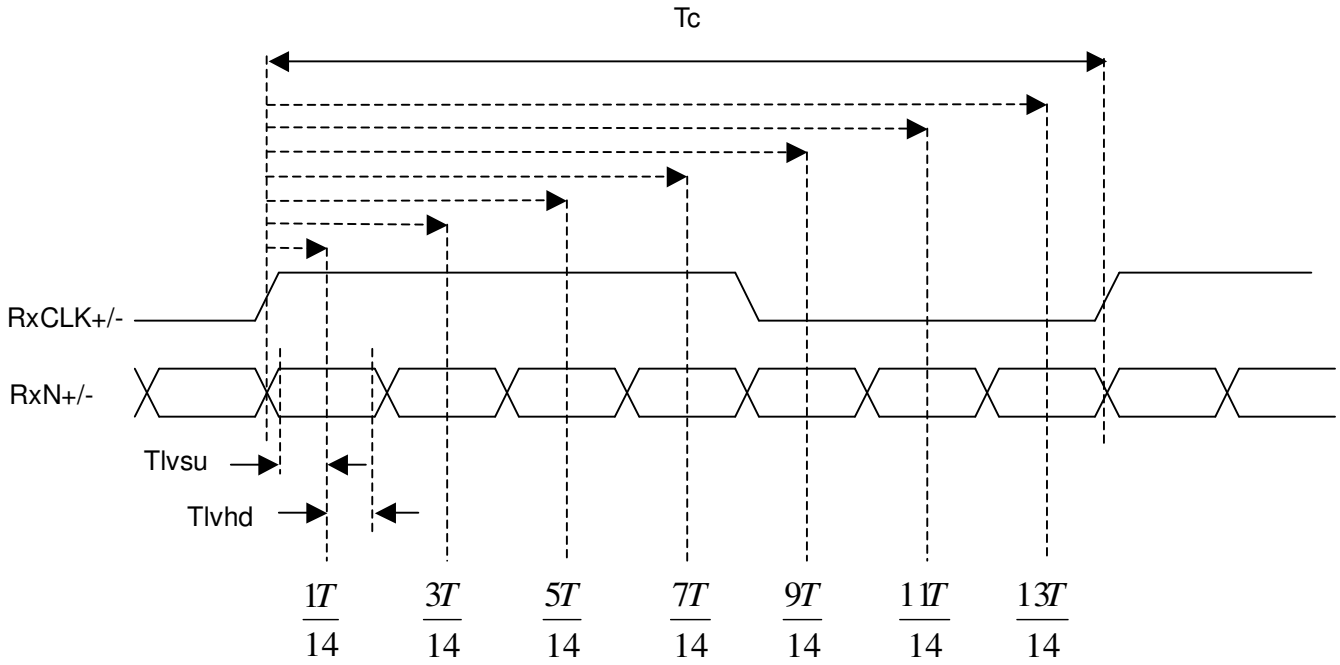
**INPUT SIGNAL TIMING DIAGRAM**





## LVDS RECEIVER INTERFACE TIMING DIAGRAM

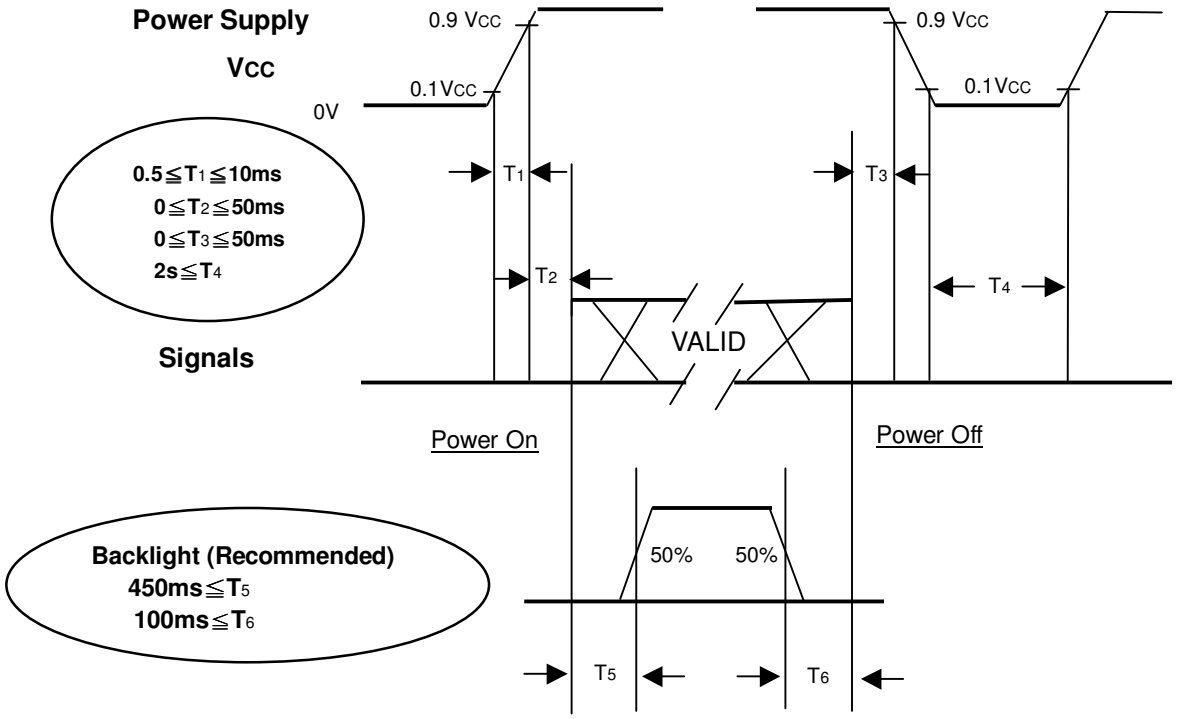




### 6.2 POWER ON/OFF SEQUENCE

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




**Power ON/OFF Sequence**

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

Note (2) Apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight 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) T4 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.



# 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 | $V_{CC}$ | 5.0 | V |
| Input Signal | According to typical value in "3. ELECTRICAL CHARACTERISTICS" | | |
| Lamp Current | $I_L$ | 7.0±0.5 | mA |
| Oscillating Frequency (Inverter) | $F_W$ | 52 ± 3 | KHz |
| Frame rate | $F_r$ | 60 | Hz |

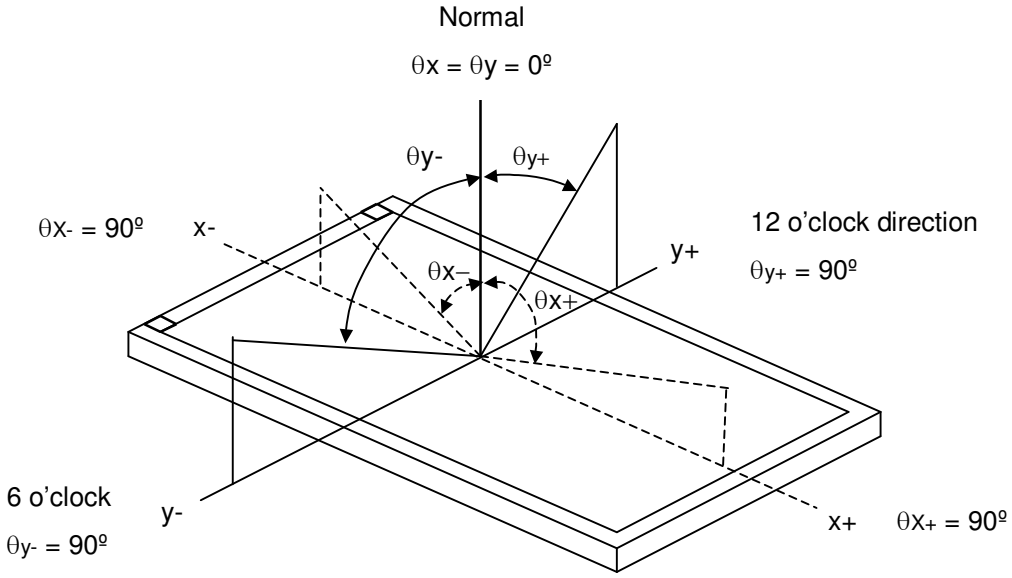
## 7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (6).

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Contrast Ratio | | CR | $\theta_x$=0°, $\theta_Y$ =0° Viewing Normal Angle | 800 | 1000 | - | - | Note(2) |
| Response time | | Gray to gray(Average) | | - | 6.5 | 12 | ms | Note(3) |
| Center Luminance of White | | $L_C$ | | 300 | 350 | - | cd/m$^2$ | Note(4) |
| White Variation | | δW | | - | - | 1.3 | - | Note(7) |
| Cross Talk | | CT | | - | - | 4 | % | Note(5) |
| Color Chromaticity | Red | Rx | | Typ. -0.03 | 0.656 | Typ. +0.03 | - | Note(6) |
| | | Ry | | | 0.333 | | - | |
| | Green | Gx | | | 0.285 | | - | |
| | | Gy | | | 0.605 | | - | |
| | Blue | Bx | | | 0.143 | | - | |
| | | By | | | 0.069 | | - | |
| | White | Wx | | | 0.313 | | - | |
| | | Wy | | | 0.329 | | - | |
| | Color Gamut | | | 72 | 75 | - | % | NTSC |
| Viewing Angle | Horizontal | $\theta_x$+ | CR≥20 | 80 | 88 | - | Deg. | Note(1) |
| | | $\theta_x$- | | 80 | 88 | - | | |
| | Vertical | $\theta_Y$+ | | 80 | 88 | - | | |
| | | $\theta_Y$- | | 80 | 88 | - | | |

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

Viewing angles are measured by Eldim EZ-Contrast 160R




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

The contrast ratio can be calculated by the following expression.

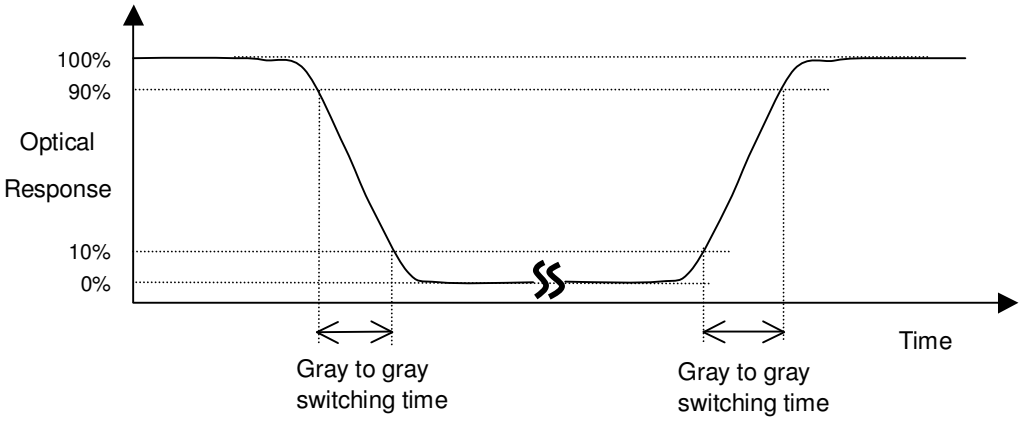
Contrast Ratio (CR) = L255 / L0

L255: Luminance of gray level 255

L 0: Luminance of gray level 0

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

Note (3) Definition of Gray to Gray Switching Time




. The driving signal means the signal of gray level 0, 63, 127, 191, 255.

Gray to gray average time means the average switching time of gray level 0 ,63,127,191,255 to each other.



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

Measure the luminance of gray level 255 at center point.

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

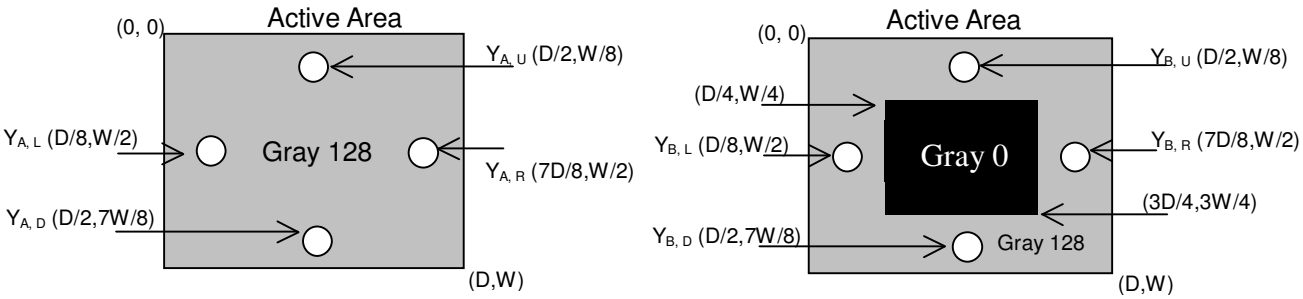
Note (5) Definition of Cross Talk (CT):

$CT = | Y_B - Y_A | / Y_A \times 100$ (%)

Where:

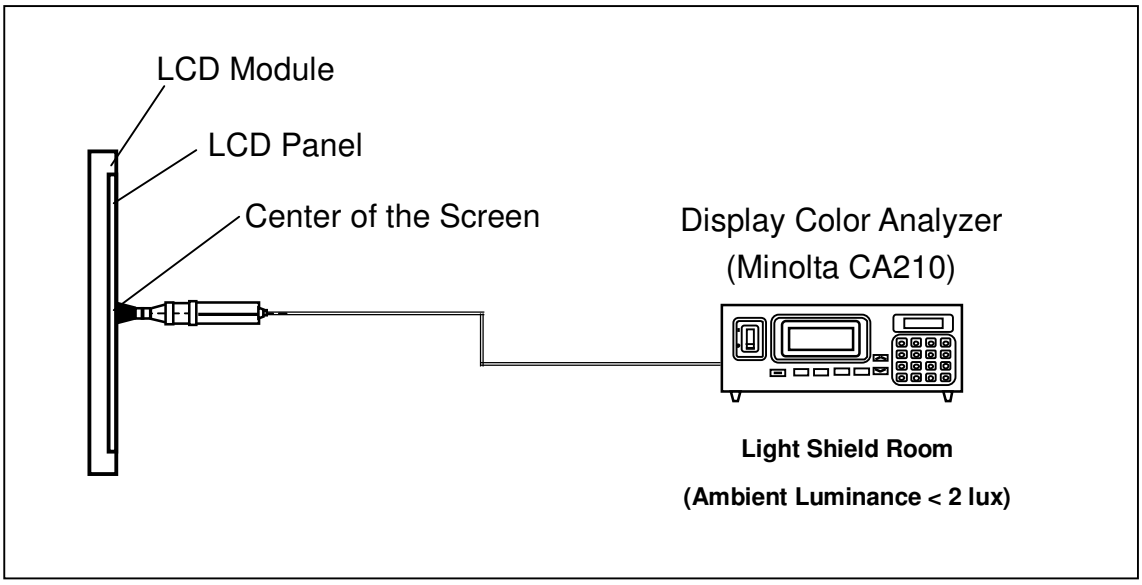
$Y_A$ = Luminance of measured location without gray level 0 pattern (cd/m$^2$)

$Y_B$ = Luminance of measured location with gray level 0 pattern (cd/m$^2$)




Note (6) Measurement Setup:

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



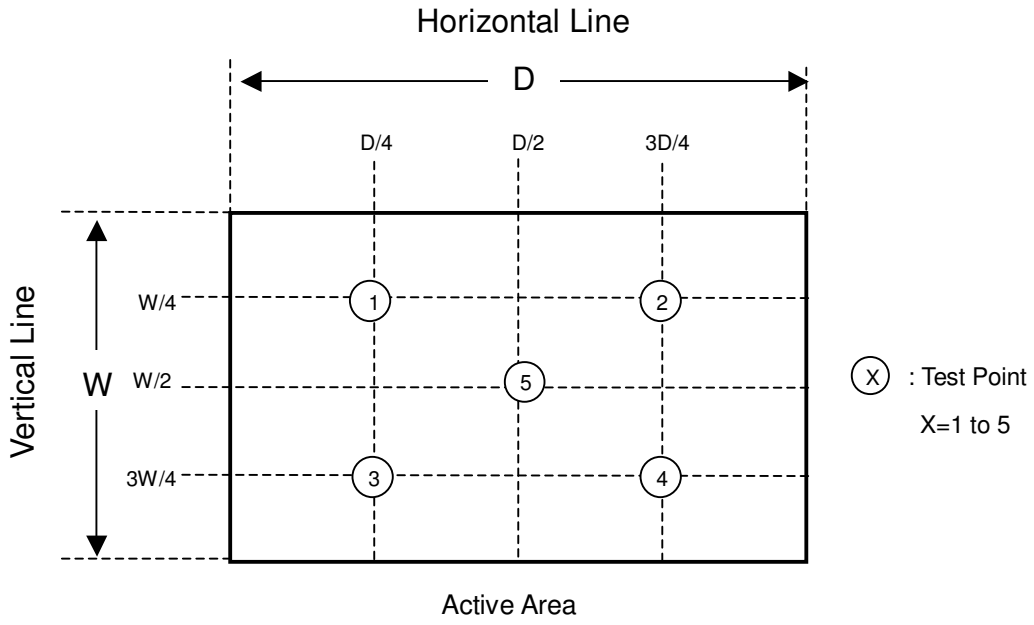


Note (7) Definition of White Variation (δW):

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 CMOS LSI chips.

(5) Do not plug in or pull out the I/F connector while the module is in operation.

(6) Do not disassemble the module.

(7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.

(8) Moisture can easily penetrate into LCD module and may cause the damage during operation.

(9) High temperature or humidity may deteriorate the performance of LCD module. Please store LCD modules in the specified storage conditions.

(10) When ambient temperature is lower than 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.



# 9. PACKAGING

## 9.1 PACKING SPECIFICATIONS

(1) 5 LCD TV modules / carton

(2) carton dimensions :596(L) X 330 (W) X 435 (H)

(3) Weight : approximately 20Kg ( 5 modules per carton)

## 9.2 PACKING Method

Figures 9-1 and 9-2 are the packing method

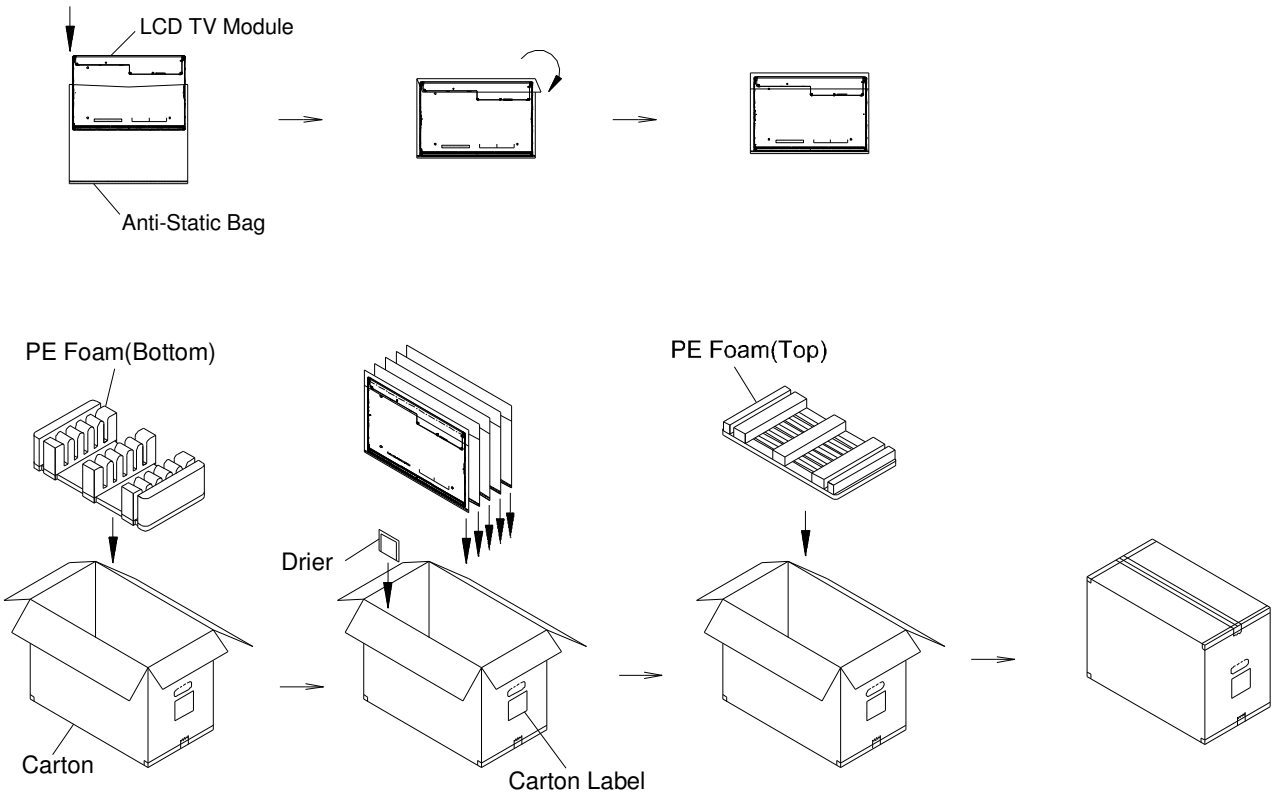



Figure.9-1 packing method



Corner Protector:L1250*50*50mm
L1130*50*50mm
Pallet:L1000*W1200*H140mm
Pallet Stack:L1000*W1200*H1445mm
Gross:375kg

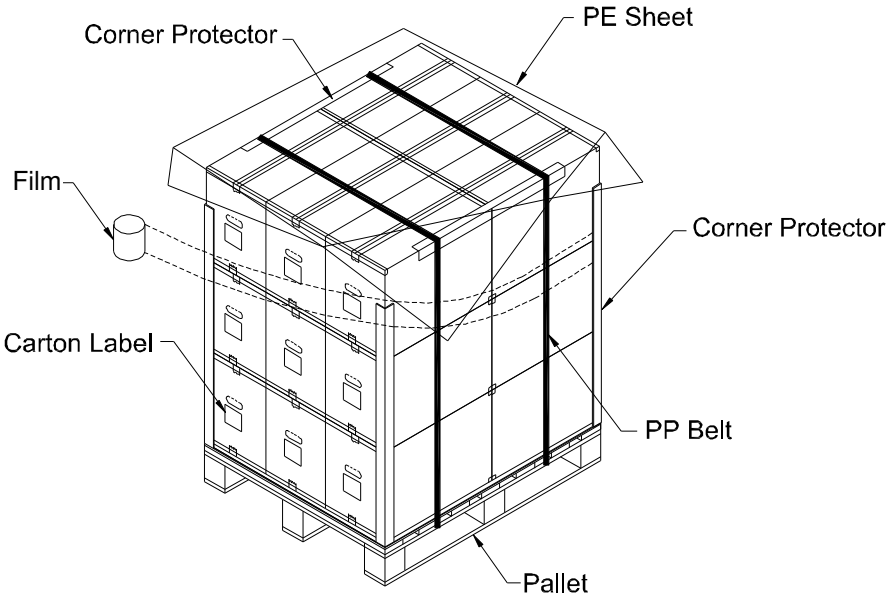



Figure. 9-2 Packing method



## 10. MECHANICAL CHARACTERISTICS