

- Tentative Specification
- Preliminary Specification
- Approval Specification

MODEL NO.: V390HK1
SUFFIX: LD1

| | |
|--|------------------|
| Customer: | |
| APPROVED BY | SIGNATURE |
| Name / Title _____ | _____ |
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| Approved By | Checked By | Prepared By |
|-----------------|-------------|-------------|
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REVISION HISTORY

| Version | Date | Page(New) | Section | Description |
|----------|---------------|-----------|---------|--|
| Ver. 2.0 | Feb. 02, 2012 | All | All | Approval Specification was first issued. |

1. GENERAL DESCRIPTION

1.1 OVERVIEW

V390HK1-LD1 is a 39" TFT Liquid Crystal Display module with LED Backlight unit and 2ch-LVDS interface. This module supports 1920 x 1080 Full HDTV format and can display 16.7M colors (8-bit). and without converter.

1.2 FEATURES

- High brightness (350 nits)
- High contrast ratio (5000:1)
- Fast response time (Gray to gray average 6.5 ms)
- High color saturation (NTSC 68%)
- Full HDTV (1920 x 1080 pixels) resolution, true HDTV format
- LVDS (Low Voltage Differential Signaling) interface
- Ultra wide viewing angle : Super MVA technology
- Viewing Angle : 176(H)/176(V) (CR ≥ 20) VA Technology
- RoHs compliance

1.3 APPLICATION

- Standard Living Room TVs
- Public Display Application
- Home Theater Application
- MFM Application

1.4 GENERAL SPECIFICATIONS

| Item | Specification | Unit | Note |
|------------------------|---|-------|------|
| Active Area | 853.92 (H) x480.33 (V) | mm | (1) |
| Bezel Opening Area | 858.92 (H) x485.33 (V) | mm | |
| Driver Element | a-si TFT active matrix | - | - |
| Pixel Number | 1920 x R.G.B. x 1080 | pixel | - |
| Pixel Pitch(Sub Pixel) | 0.14825 (H) x 0.44475 (V) | mm | - |
| Pixel Arrangement | RGB vertical stripe | - | - |
| Power consumption | 64.2W (LVDS input Power 11.64 W + LED Backlight Power 52.51W) | Watt | (2) |
| Display Colors | 16.7M | color | - |
| Display Operation Mode | Transmissive mode / Normally Black | - | - |
| Surface Treatment | Anti-Glare coating (Haze 3.5%) Hard Coating (3H) | - | (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) | 897.92 | 898.92 | 899.92 | mm | (1) |
| | Vertical (V) | 524.33 | 525.33 | 526.33 | mm | (1) |
| | Depth (D) | 54.5 | 55.5 | 56.5 | mm | (2) |
| Weight | | 6200 | 6500 | 6800 | g | - |

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

Note (2) Module Depth is between bezel to rear.

2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

| Item | Symbol | Value | | Unit | Note |
|-------------------------------|--------|-------|------|------|----------|
| | | Min. | Max. | | |
| Storage Temperature | TST | -20 | +60 | °C | (1) |
| Operating Ambient Temperature | TOP | 0 | 50 | °C | (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. ($T_a \leq 40$ °C).

(b) Wet-bulb temperature should be 39 °C Max. ($T_a > 40$ °C).

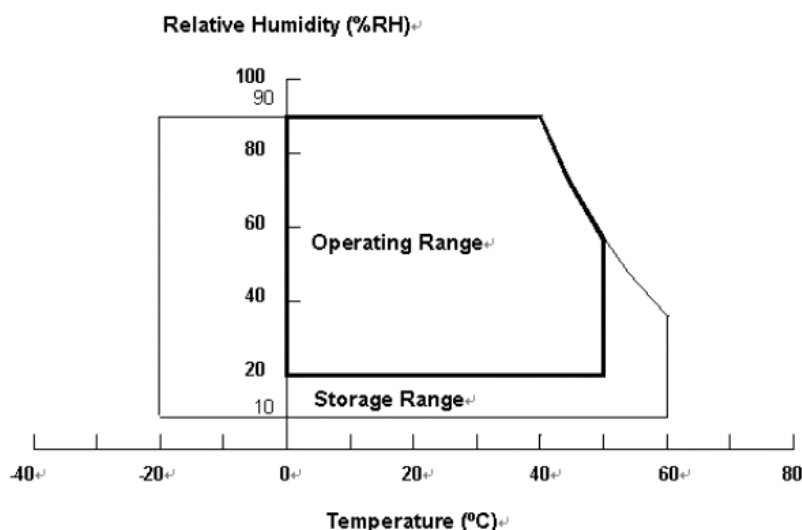
(c) No condensation.

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 °C 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 °C. 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 $\pm X$, $\pm Y$, $\pm Z$.

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 °C 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 | VCC | -0.3 | 13.5 | V | (1) |
| Logic Input Voltage | VIN | -0.3 | 3.6 | V | |

2.3.2 BACKLIGHT UNIT

| Item | Symbol | Value | | Unit | Note |
|-------------------|--------|-------|------|-----------------|------|
| | | Min. | Max. | | |
| Light bar Voltage | VW | - | 210 | V _{DC} | (1) |

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

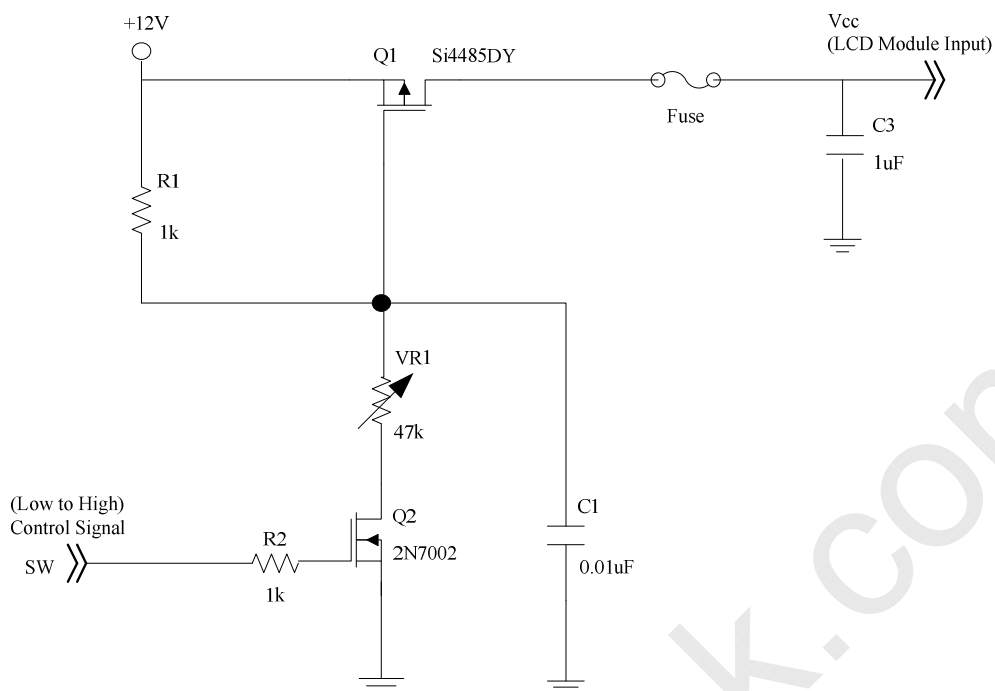
3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE ($T_a = 25 \pm 2 \text{ }^\circ\text{C}$)

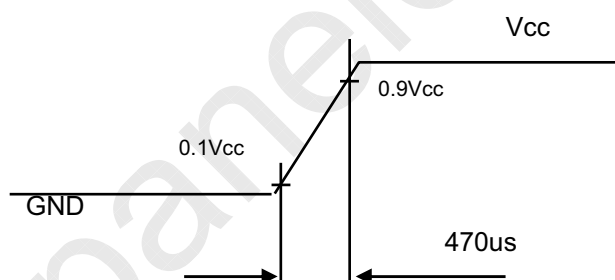
| Parameter | Symbol | Value | | | Unit | Note | |
|----------------------|---|------------|-------|-------|------|------|-----|
| | | Min. | Typ. | Max. | | | |
| Power Supply Voltage | V_{CC} | 10.8 | 12 | 13.2 | V | (1) | |
| Rush Current | I_{RUSH} | - | - | 2.02 | A | (2) | |
| Power Consumption | White Pattern | - | 6.96 | 8.36 | W | (3) | |
| | Black Pattern | - | 6.72 | 8.07 | W | | |
| | Horizontal Stripe | - | 11.64 | 13.97 | W | | |
| Power Supply Current | White Pattern | - | 0.58 | 0.70 | A | | |
| | Black Pattern | - | 0.56 | 0.68 | A | | |
| | Horizontal Stripe | - | 0.97 | 1.17 | A | | |
| LVDS interface | Differential Input High Threshold Voltage | V_{LVTH} | +100 | - | - | mV | (4) |
| | Differential Input Low Threshold Voltage | V_{LVTL} | - | - | -100 | mV | |
| | Common Input Voltage | V_{CM} | 1.0 | 1.2 | 1.4 | V | |
| | Differential input voltage | $ V_{ID} $ | 200 | - | 600 | mV | |
| | 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 the above ranges.

Note (2) Measurement Conditions:



Vcc rising time is 470us



Note (3) The specified power consumption and power supply current is under the conditions at $V_{CC} = 12\text{ V}$, $T_a = 25 \pm 2\text{ }^\circ\text{C}$, $f_v = 120\text{ Hz}$, whereas a power dissipation check pattern below is displayed.

a. White Pattern



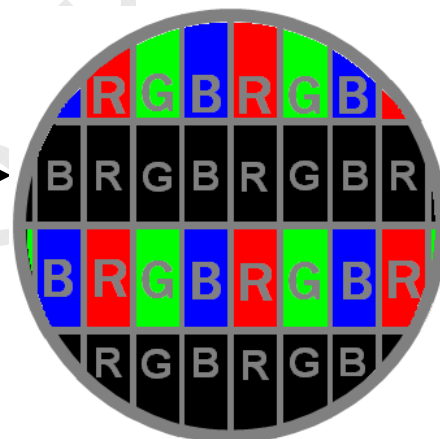
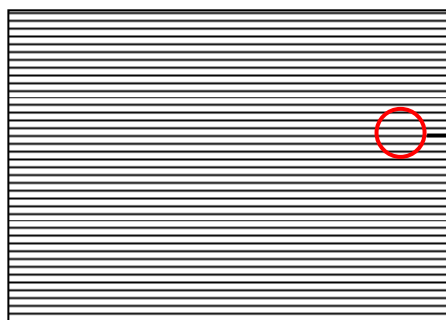
Active Area

b. Black Pattern

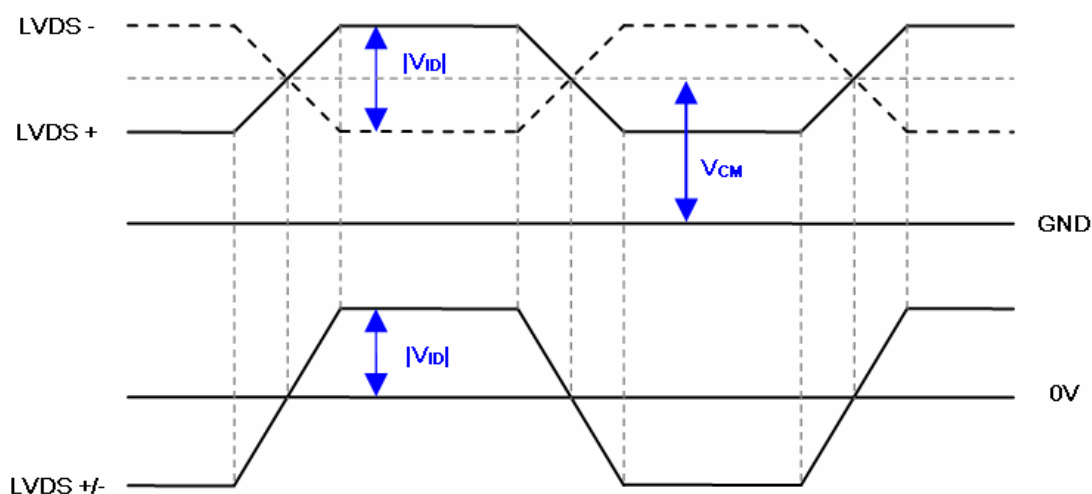


Active Area

c. Horizontal Stripe Pattern



Note (4) The LVDS input characteristics are as follows:



3.2 BACKLIGHT CONVERTER UNIT

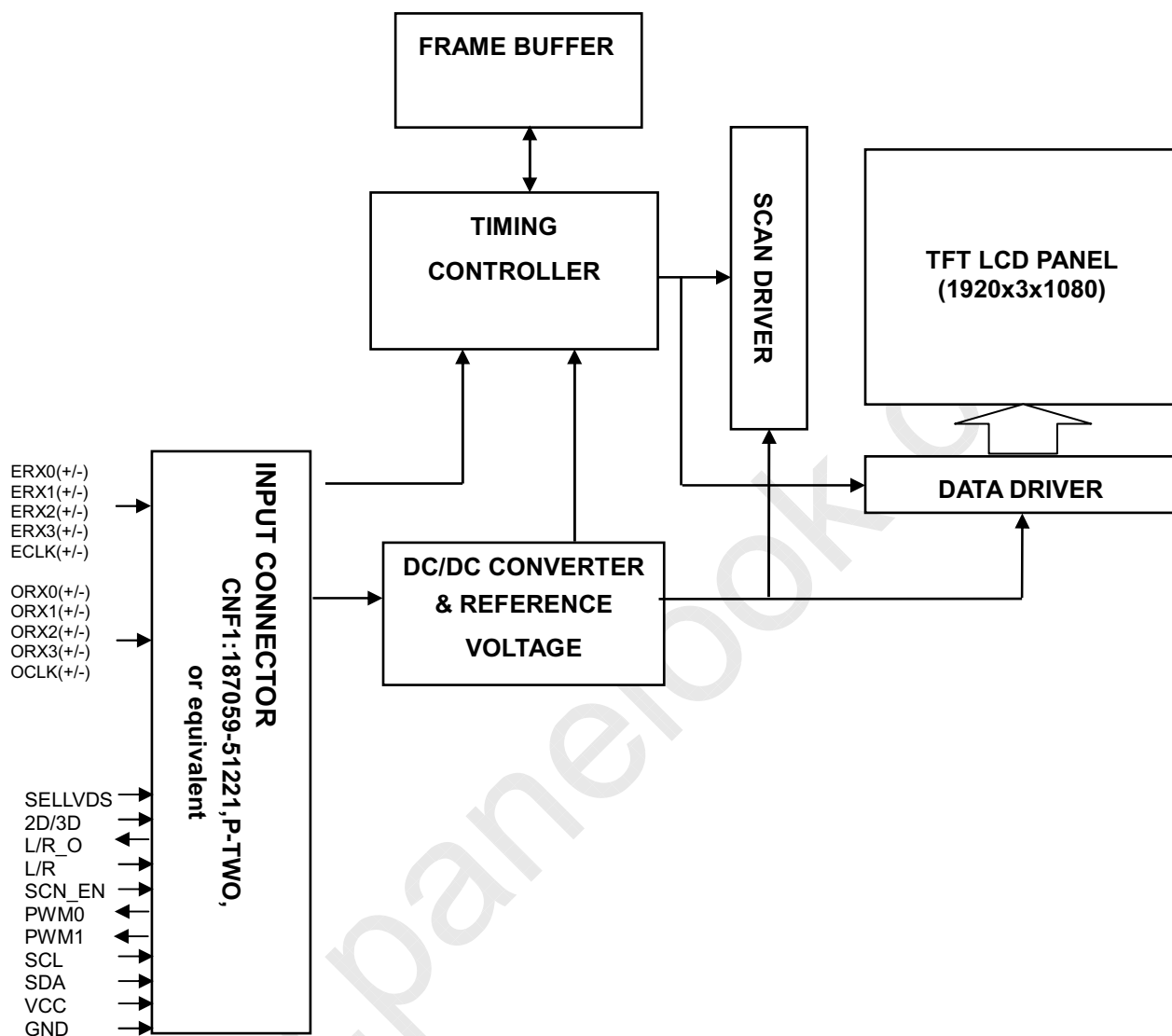
3.2.1 LED LIGHT BAR CHARACTERISTICS (Ta = 25 ± 2 °C)

| Parameter | Symbol | Value | | | Unit | Note |
|-----------------------------|---------------------|--------|--------|--------|-----------------|---|
| | | Min. | Typ. | Max. | | |
| One Light Bar Current | I _{L(2D)} | 159.8 | 170 | 180.2 | mA | |
| | I _{L(3D)} | 423.0 | 450 | 477.0 | mApeak | 3D ENA=ON |
| Light Bar Voltage | V _{W(2D)} | 138.24 | 154.44 | 170.64 | V _{DC} | I _L =170mA |
| | V _{W(3D)} | 157.44 | 183.60 | 209.76 | V _{DC} | I _L =450mA |
| Light Bar Voltage Variation | ΔV _W | - | - | 3.22 | V | For 1 BLU I _L =170mA |
| | ΔV _{W(3D)} | - | - | 3.96 | V | For 1 BLU I _L =450mA |
| Power consumption | P _{BL} | 49.36 | 52.51 | 55.66 | W | only LEDs Duty=100% I _{PIN} =170mA |
| | P _{BL(3D)} | - | 24.79 | 30.02 | W | only LEDs Duty=15% I _{PIN} =450mA |
| Life time | - | 30,000 | - | - | Hrs | (1) |

Note (1) The lifetime is defined as the time which luminance of the LED decays to 50% compared to the initial value, Operating condition: Continuous operating at Ta = 25±2°C, I_L =170mA.

4. BLOCK DIAGRAM OF INTERFACE

4.1 TFT LCD MODULE



5. INTERFACE PIN CONNECTION

5.1 TFT LCD MODULE

CNF1 Connector Pin Assignment: (FI-RE51S-HF(JAE) or equivalent)

| Pin | Name | Description | Note |
|-----|---------|--|-----------|
| 1 | N.C. | No Connection | (1) |
| 2 | SCL | I2C Serial Clock (for 3D format selection function) | (10) |
| 3 | SDA | I2C Serial Data (for 3D format selection function) | |
| 4 | N.C. | No Connection | (1) |
| 5 | L/R_O | Output signal for Left Right Glasses control | (9) |
| 6 | N.C. | No Connection | (1) |
| 7 | SELLVDS | Input signal for LVDS Data Format Selection | (2)(6) |
| 8 | N.C. | No Connection | (1) |
| 9 | PWM0 | Upper side scanning B/L signal in 3D mode (no reverse panel) | (11) |
| 10 | PWM1 | Lower side scanning B/L signal in 3D mode (no reverse panel) | |
| 11 | GND | Ground | |
| 12 | ORX0- | Odd pixel Negative LVDS differential data input. Channel 0 | (8) |
| 13 | ORX0+ | Odd pixel Positive LVDS differential data input. Channel 0 | |
| 14 | ORX1- | Odd pixel Negative LVDS differential data input. Channel 1 | |
| 15 | ORX1+ | Odd pixel Positive LVDS differential data input. Channel 1 | |
| 16 | ORX2- | Odd pixel Negative LVDS differential data input. Channel 2 | |
| 17 | ORX2+ | Odd pixel Positive LVDS differential data input. Channel 2 | |
| 18 | GND | Ground | |
| 19 | OCLK- | Odd pixel Negative LVDS differential clock input | (8) |
| 20 | OCLK+ | Odd pixel Positive LVDS differential clock input | |
| 21 | GND | Ground | |
| 22 | ORX3- | Odd pixel Negative LVDS differential data input. Channel 3 | (8) |
| 23 | ORX3+ | Odd pixel Positive LVDS differential data input. Channel 3 | |
| 24 | N.C. | No Connection | |
| 25 | N.C. | No Connection | |
| 26 | 2D/3D | Input signal for 2D/3D Mode Selection | (3)(5)(7) |
| 27 | L/R | Input signal for Left Right eye frame synchronous(Frame sequence mode) | (4)(7) |
| 28 | ERX0- | Even pixel Negative LVDS differential data input. Channel 0 | (8) |

| | | | |
|----|--------|---|--------|
| 29 | ERX0+ | Even pixel Positive LVDS differential data input. Channel 0 | |
| 30 | ERX1- | Even pixel Negative LVDS differential data input. Channel 1 | |
| 31 | ERX1+ | Even pixel Positive LVDS differential data input. Channel 1 | |
| 32 | ERX2- | Even pixel Negative LVDS differential data input. Channel 2 | |
| 33 | ERX2+ | Even pixel Positive LVDS differential data input. Channel 2 | |
| 34 | GND | Ground | |
| 35 | ECLK- | Even pixel Negative LVDS differential clock input. | (8) |
| 36 | ECLK+ | Even pixel Positive LVDS differential clock input. | |
| 37 | GND | Ground | |
| 38 | ERX3- | Even pixel Negative LVDS differential data input. Channel 3 | (8) |
| 39 | ERX3+ | Even pixel Positive LVDS differential data input. Channel 3 | |
| 40 | N.C. | No Connection | (1) |
| 41 | N.C. | No Connection | |
| 42 | N.C. | No Connection | |
| 43 | SCN_EN | Input signal for Scanning Enable | (5)(7) |
| 44 | GND | Ground | |
| 45 | GND | Ground | |
| 46 | GND | Ground | |
| 47 | N.C. | No Connection | (1) |
| 48 | VCC | +12V power supply | |
| 49 | VCC | +12V power supply | |
| 50 | VCC | +12V power supply | |
| 51 | VCC | +12V power supply | |

Note (1) Reserved for internal use. Please leave it open.

Note (2) LVDS format selection.

L= Connect to GND, H=Connect to +3.3V or Open

| SELLVDS | Note |
|-----------|--------------|
| L | JEIDA Format |
| H or Open | VESA Format |

Note (3) 2D/3D mode selection.

L= Connect to GND or Open, H=Connect to +3.3V

| 2D/3D | Note |
|-----------|---------|
| L or Open | 2D Mode |
| H | 3D Mode |

Note (4) Input signal for Left Right eye frame synchronous

$$V_{IL}=0\sim 0.8\text{ V}, V_{IH}=2.0\sim 3.3\text{ V}$$

| L/R | Note |
|-----|--------------------------|
| L | Right synchronous signal |
| H | Left synchronous signal |

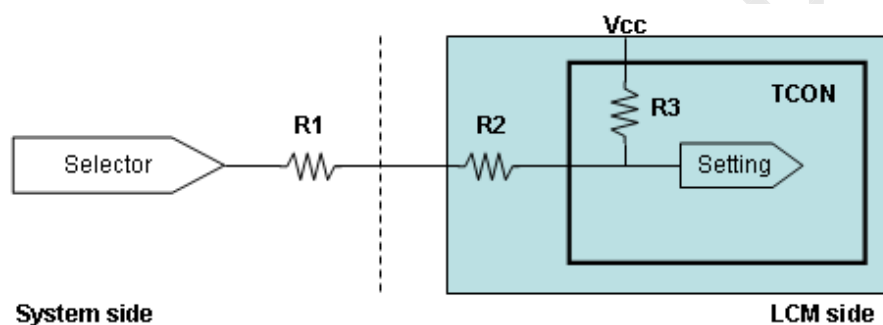
Note (5) Scanning enable selection.

L= Connect to GND or Open, H=Connect to +3.3V

| SCN_EN | Note |
|-----------|------------------|
| L or Open | Scanning Disable |
| H | Scanning Enable |

Note (6) SELLVDS signal pin connected to the LCM side has the following diagram.

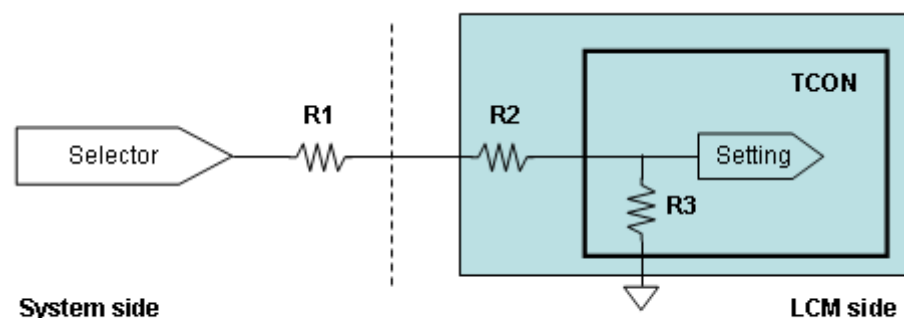
R1 in the system side should be less than 1K Ohm. ($R1 < 1\text{K Ohm}$)



System side
 $R1 < 1\text{K}$

Note (7) 2D/3D, L/R, and SCN_EN signal pin connected to the LCM side has the following diagram.

R1 in the system side should be less than 1K Ohm. ($R1 < 1\text{K Ohm}$)



System side: $R1 < 1\text{K}$

Note (8) 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.

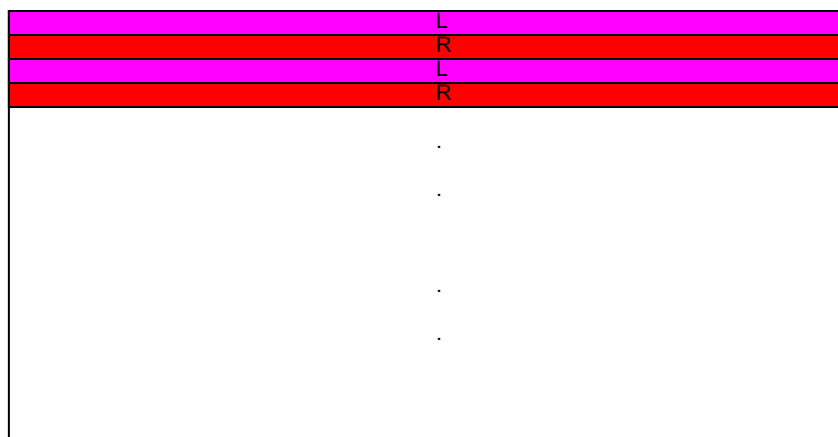
Note (9) The definition of L/R_O signal as follows

L= 0V , H= +3.3V

| L/R_O | Note |
|-------|---------------------|
| L | Right glass turn on |
| H | Left glass turn on |

Note (10) Please reference Appendix A

Currently, we only support line alternative format (1st line is left signal), show as the attached block diagram. In the future, we will support other format.



Line alternative format

Note (11) The definition of PWM 0/1 signal as follows

L= 0V , H= +3.3V

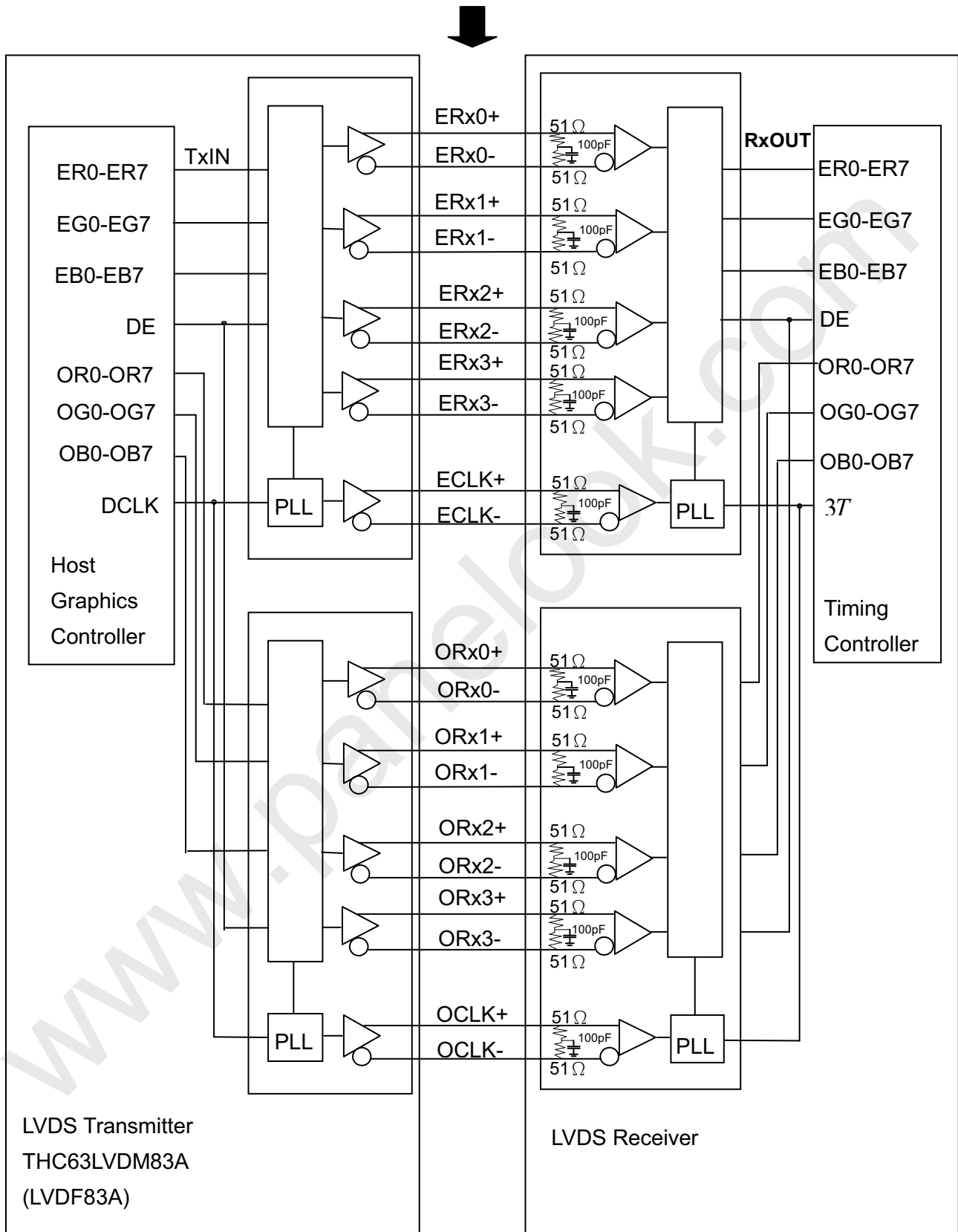
| PWM 0/1 | Note |
|---------|---------|
| L | LED off |
| H | LED on |

5.2 BACKLIGHT UNIT

CN : CI0112M1HR0-LA (CviILux)

| Pin No | Symbol | Feature |
|--------|--------|-------------------------|
| 1 | LB2+ | Positive of Light Bar 2 |
| 2 | NC | No Connection |
| 3 | NC | No Connection |
| 4 | NC | No Connection |
| 5 | LB2- | Negative of Light Bar 2 |
| 6 | NC | No Connection |
| 7 | LB1+ | Positive of Light Bar 1 |
| 8 | NC | No Connection |
| 9 | NC | No Connection |
| 10 | NC | No Connection |
| 11 | LB1- | Negative of Light Bar 1 |
| 12 | NC | No Connection |

5.3 BLOCK DIAGRAM OF INTERFACE



ER0~ER7: Even pixel R data

EG0~EG7: Even pixel G data

EB0~EB7: Even pixel B data

OR0~OR7: Odd pixel R data

OG0~OG7: Odd pixel G data

OB0~OB7: Odd pixel B data

DE: Data enable signal

DCLK: Data clock signal

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

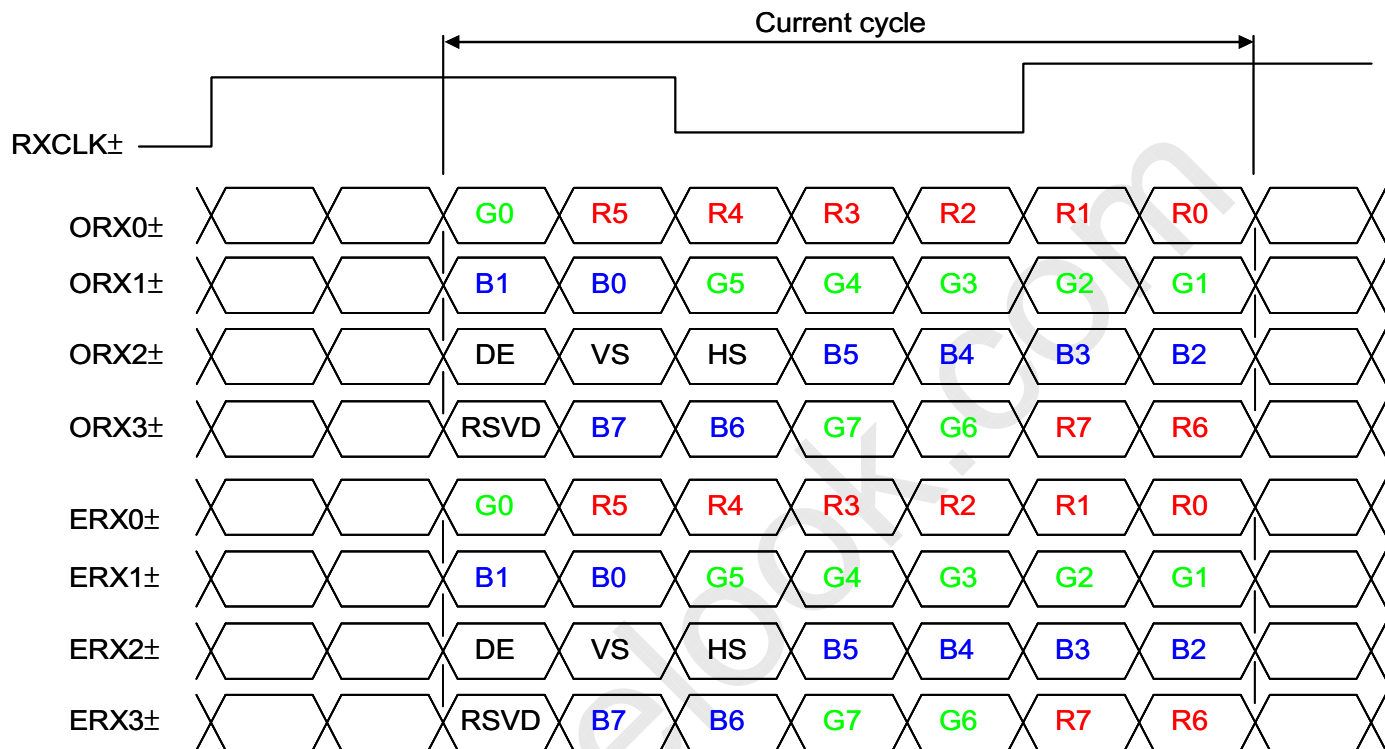
Notes (2) LVDS cable impedance shall be 50 ohms per signal line or about 100 ohms per twist-pair line when it is used differentially.

5.4 LVDS INTERFACE

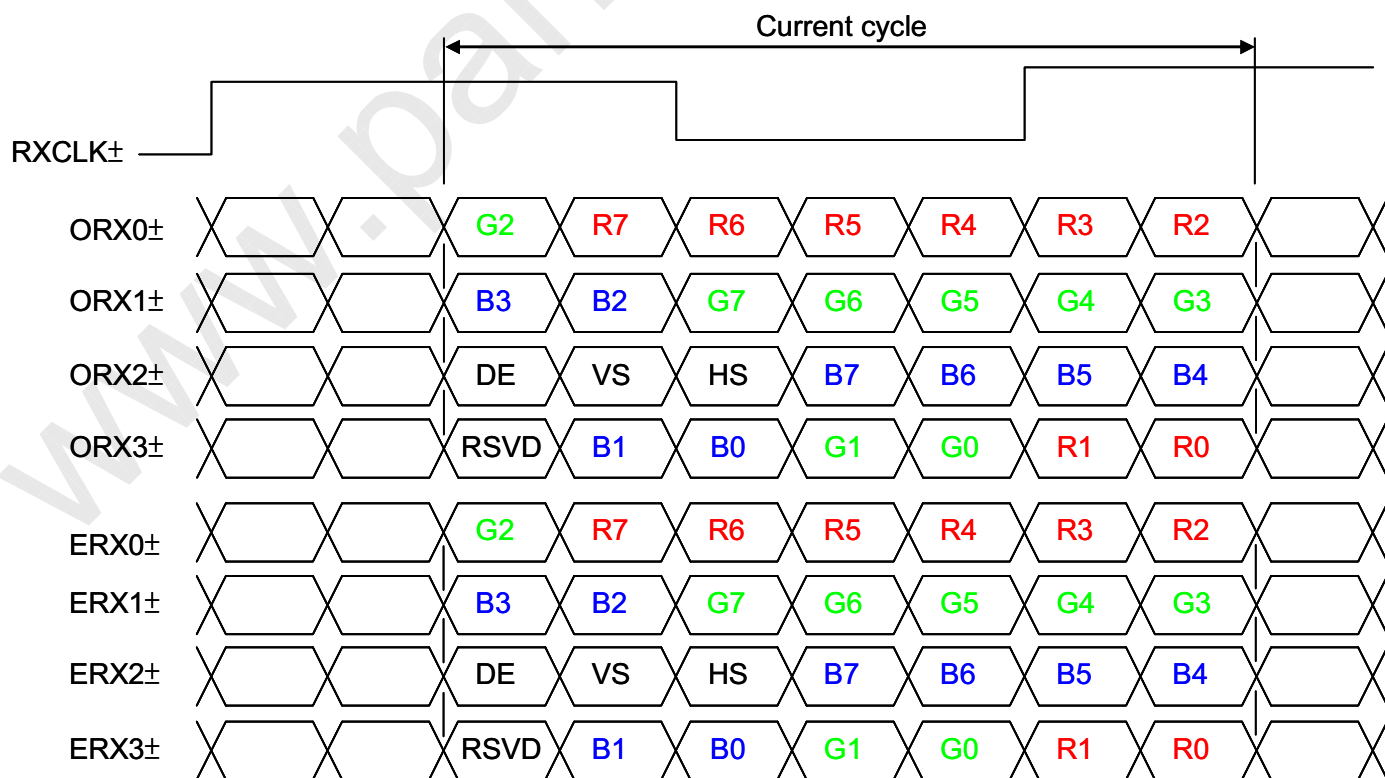
JEIDA Format : SELLVDS = L

VESA Format : SELLVDS = H or Open

VESA LVDS format



JEDIA LVDS format



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 |
| Basic Colors | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Cyan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Magenta | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Yellow | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | White | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Gray Scale Of Red | Red (0) / Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | Red (1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | Red (2) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | |
| | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | |
| | Red (253) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | Red (254) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | Red (255) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Gray Scale Of Green | Green (0) / Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | Green (1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 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 | |
| | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | |
| | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | |
| | Green (253) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | Green (254) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | Green (255) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 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 | |
| | Blue (1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| | Blue (2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | |
| | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | |
| | Blue (253) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | |
| | Blue (254) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | |
| | Blue (255) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 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 (Ta = 25 ± 2 °C)

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 | $F_{clk_{in}}$ (=1/TC) | 60 | 74.25 | 77 | MHz | |
| | Input cycle to cycle jitter | T_{rcd} | - | - | 200 | ps | (2) |
| | Spread spectrum modulation range | $F_{clk_{in_mod}}$ | $F_{clk_{in}}-2\%$ | - | $F_{clk_{in}}+2\%$ | MHz | (3) |
| | Spread spectrum modulation frequency | F_{SSM} | - | - | 200 | KHz | |
| LVDS Receiver Data | Setup Time | T_{lvsu} | 600 | - | - | ps | (4) |
| | Hold Time | T_{lvhd} | 600 | - | - | ps | |

6.1.1 TIMING SPEC FOR FRAME RATE = 50Hz

| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note | |
|--------------------------------|---------|----------|----------|------|------|------|-------|---------------------|
| Frame rate | 2D mode | F_{r5} | 47 | 50 | 53 | Hz | | |
| | 3D mode | F_{r5} | 50 | 50 | 50 | Hz | (6) | |
| Vertical Active Display Term | 2D Mode | Total | T_v | 1115 | 1125 | 1380 | Th | $T_v=T_{vd}+T_{vb}$ |
| | | Display | T_{vd} | 1080 | 1080 | 1080 | Th | - |
| | | Blank | T_{vb} | 35 | 45 | 300 | Th | - |
| | 3D Mdoe | Total | T_v | 1350 | | | Th | (5), (7) |
| | | Display | T_{vd} | 1080 | | | Th | |
| | | Blank | T_{vb} | 270 | | | Th | |
| Horizontal Active Display Term | 2D Mode | Total | T_h | 1050 | 1100 | 1150 | T_c | $T_h=T_{hd}+T_{hb}$ |
| | | Display | T_{hd} | 960 | 960 | 960 | T_c | - |
| | | Blank | T_{hb} | 90 | 140 | 190 | T_c | - |
| | 3D Mdoe | Total | T_h | 1050 | 1100 | 1150 | T_c | $T_h=T_{hd}+T_{hb}$ |
| | | Display | T_{hd} | 960 | 960 | 960 | T_c | - |
| | | Blank | T_{hb} | 90 | 140 | 190 | T_c | - |

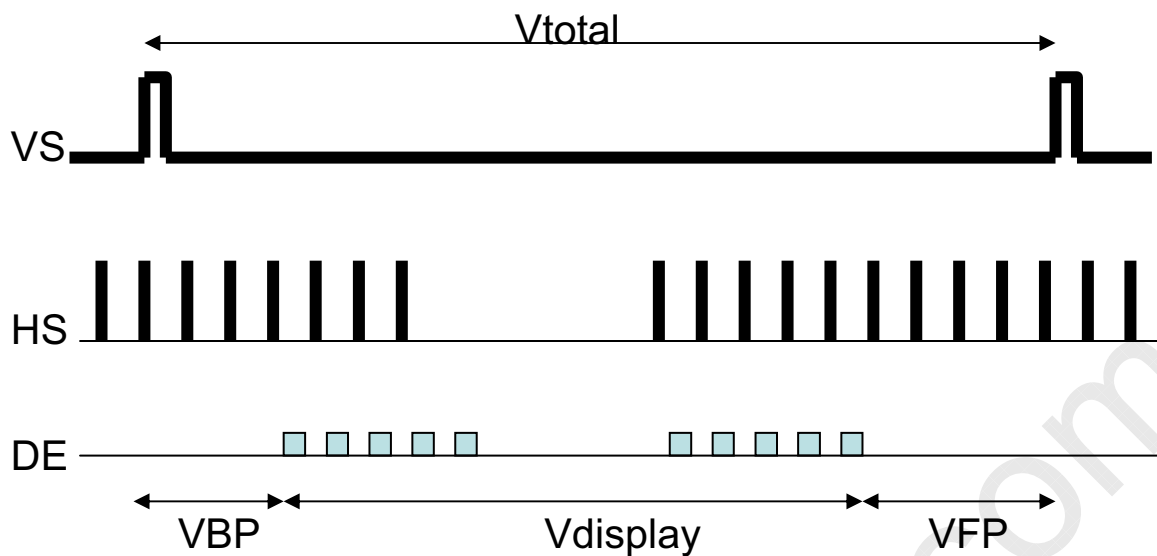
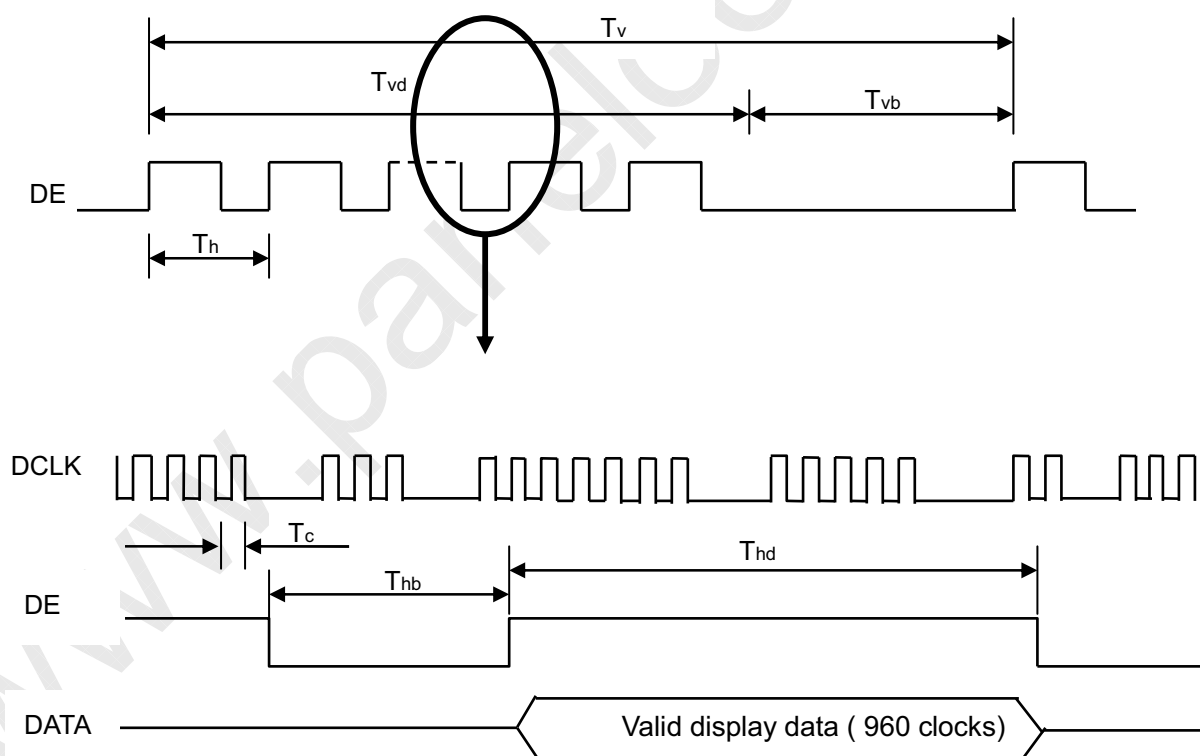
6.1.2 TIMING SPEC FOR FRAME RATE = 60Hz

| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note | |
|--------------------------------|---------|----------|----------|------|------|------|------|---------------------|
| Frame rate | 2D mode | F_{r6} | 57 | 60 | 62.5 | Hz | | |
| | 3D mode | F_{r6} | 60 | 60 | 60 | Hz | (6) | |
| Vertical Active Display Term | 2D Mode | Total | T_v | 1115 | 1125 | 1380 | Th | $T_v=T_{vd}+T_{vb}$ |
| | | Display | T_{vd} | 1080 | 1080 | 1080 | Th | — |
| | | Blank | T_{vb} | 35 | 45 | 300 | Th | — |
| | 3D Mdoe | Total | T_v | 1125 | | | Th | (5), (7) |
| | | Display | T_{vd} | 1080 | | | Th | |
| | | Blank | T_{vb} | 45 | | | Th | |
| Horizontal Active Display Term | 2D Mode | Total | T_h | 1050 | 1100 | 1150 | Tc | $T_h=T_{hd}+T_{hb}$ |
| | | Display | T_{hd} | 960 | 960 | 960 | Tc | — |
| | | Blank | T_{hb} | 90 | 140 | 190 | Tc | — |
| | 3D Mdoe | Total | T_h | 1050 | 1100 | 1150 | Tc | $T_h=T_{hd}+T_{hb}$ |
| | | Display | T_{hd} | 960 | 960 | 960 | Tc | — |
| | | Blank | T_{hb} | 90 | 140 | 190 | Tc | — |

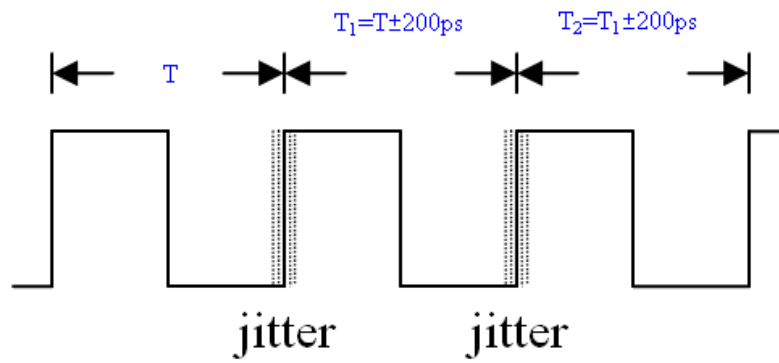
Note (1) Please make sure the range of pixel clock has follow the below equation:

$$F_{clk(in)(max)} \geq F_{r6} \times T_v \times T_h$$

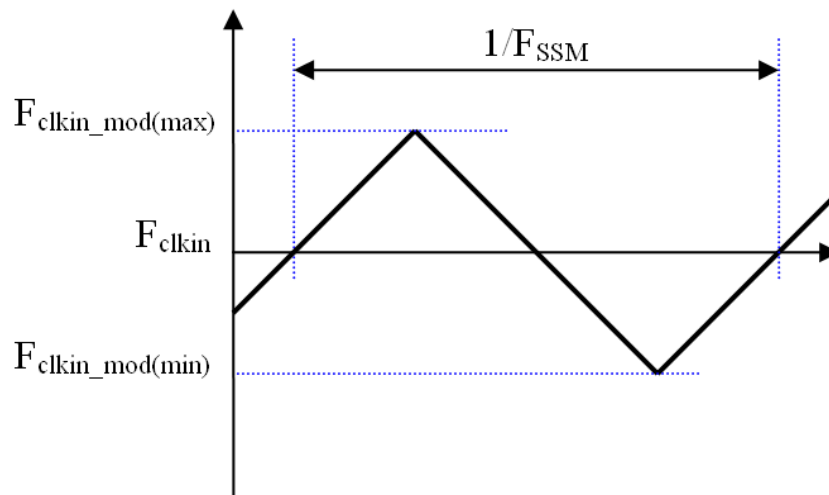
$$F_{r5} \times T_v \times T_h \geq F_{clk(in)(min)}$$


INPUT SIGNAL TIMING DIAGRAM


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

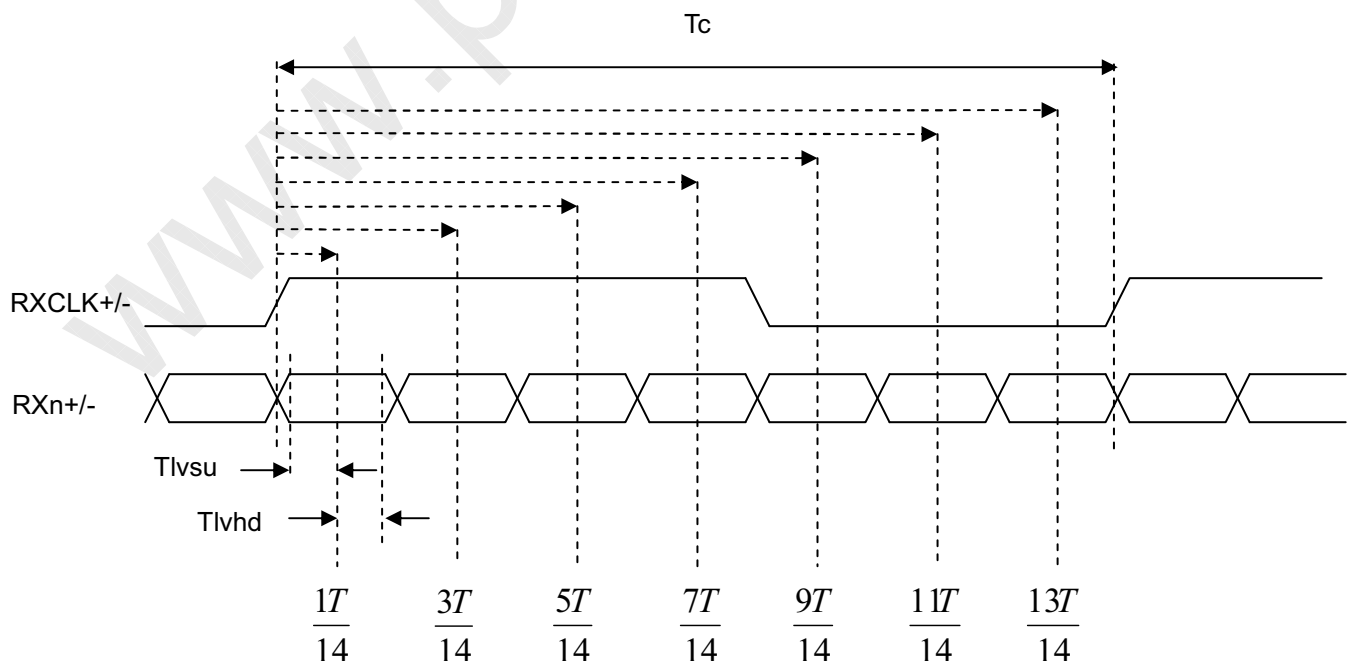


Note (3) The SSCG (Spread spectrum clock generator) is defined as below figures.



Note (4) The LVDS timing diagram and setup/hold time is defined and showing as the following figures.

LVDS RECEIVER INTERFACE TIMING DIAGRAM



Note (5) Please fix the Vertical timing (Vertical Total =1350 / Display =1080 / Blank = 270) in 100Hz 3D mode and Vertical timing (Vertical Total =1125 / Display =1080 / Blank = 45) in 120Hz 3D mode

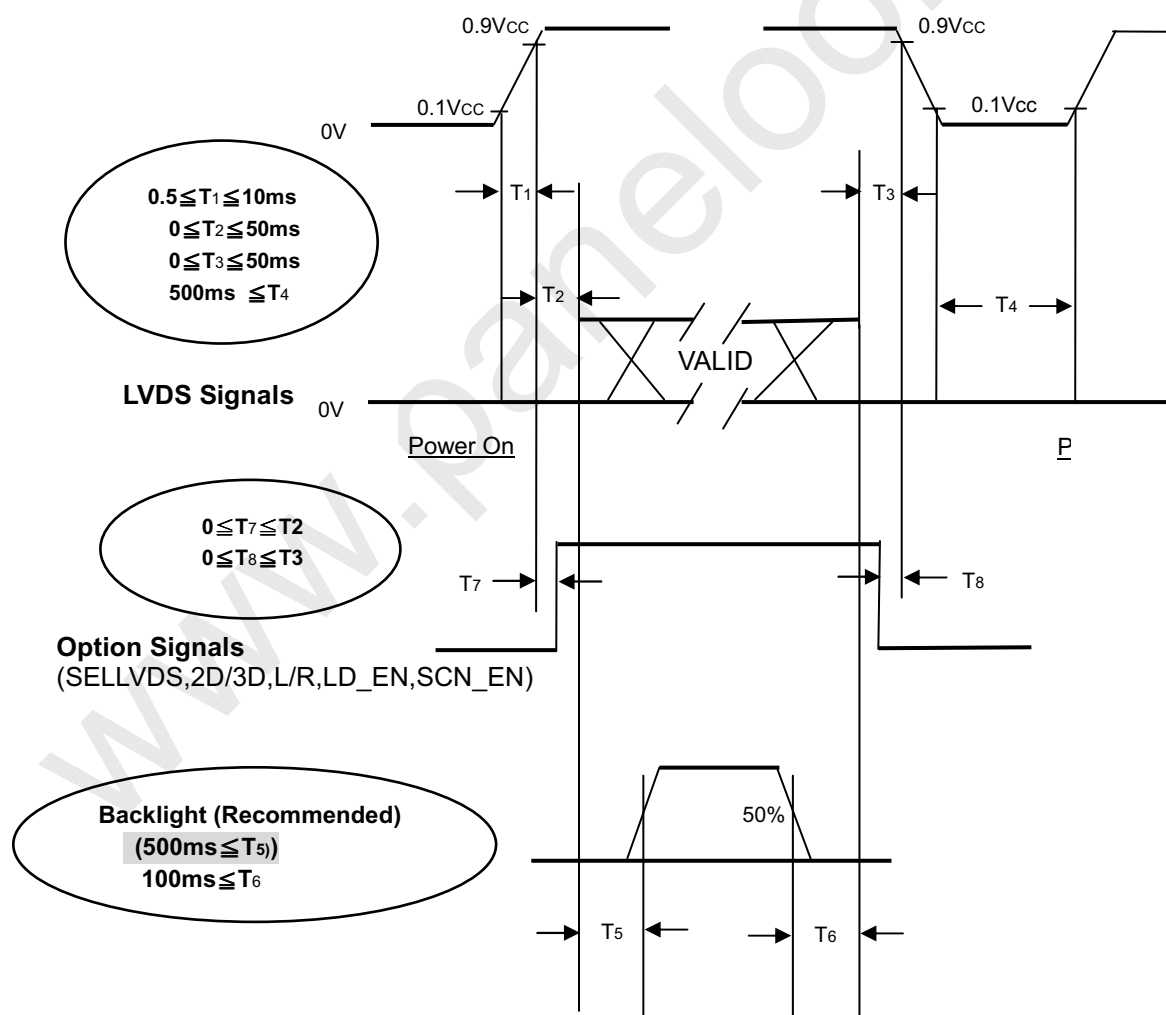
Note (6) In 3D mode, the set up Fr5 and Fr6 in Typ. ± 3 HZ .In order to ensure that the electric function performance to avoid no display symptom.(Except picture quality symptom.)

Note (7) In 3D mode, the set up Tv and Tvb in Typ. ± 30 .In order to ensure that the electric function performance to avoid no display symptom.(Except picture quality symptom.)

6.2 POWER ON/OFF SEQUENCE

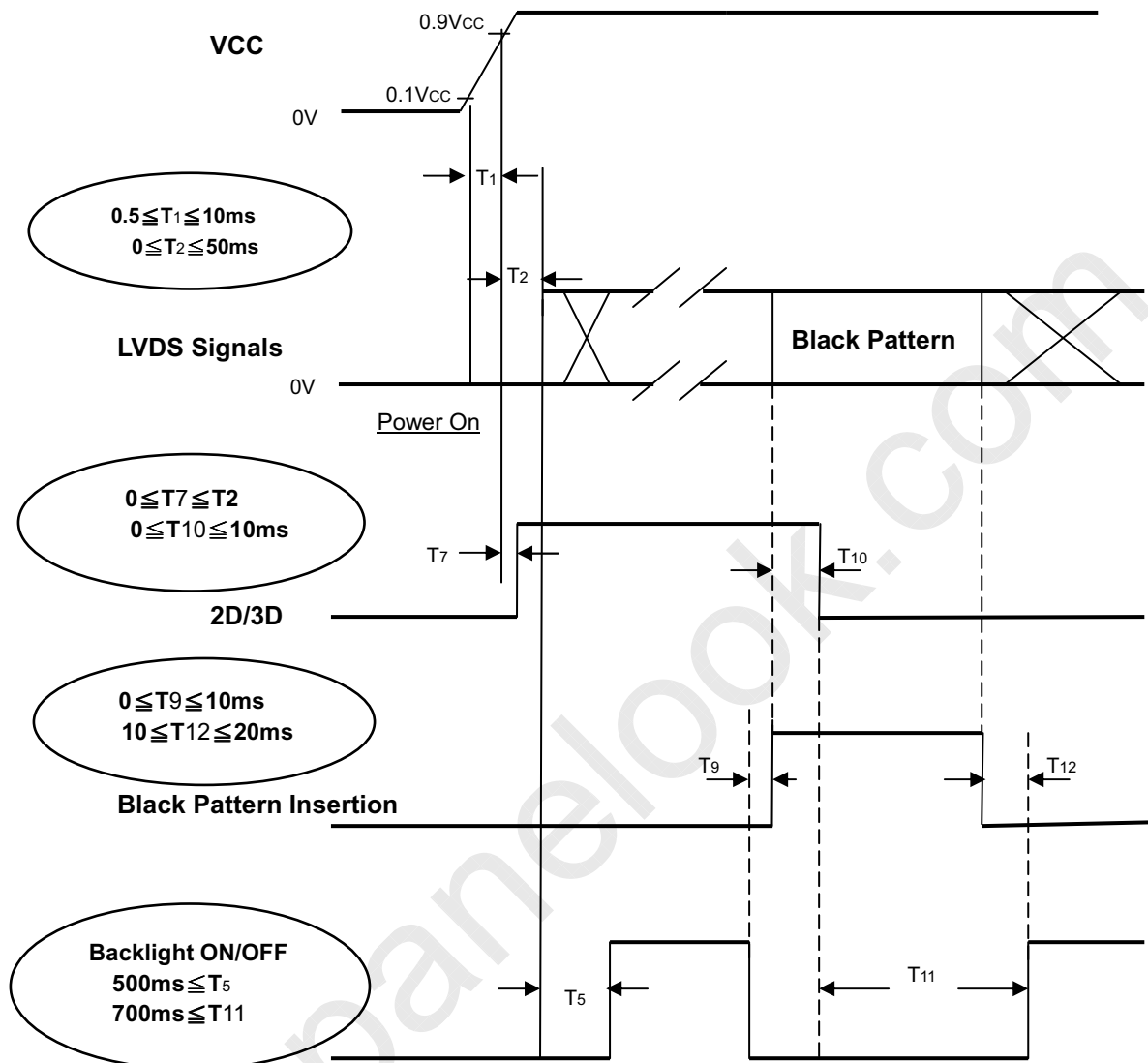
6.2.1 POWER ON/OFF SEQUENCE ($T_a = 25 \pm 2$ °C)

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

6.2.2 (2D/3D MODE CHANGE SIGNAL SEQUENCE WITHOUT VCC TURN OFF AND TURN ON)



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

Note (2) Apply the LED 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 is in off level, please keep the level of input signals on the low or high impedance. If $T_2 < 0$, that maybe cause electrical overstress failure.

Note (4) T_4 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) When 2D/3D mode is changed, TCON will insert black pattern internally. During black insertion, TCON would load required optical table and TCON parameter setting. The black insertion time should be longer than 650ms because TCON must recognize 2D or 3D format and set the correct parameter.

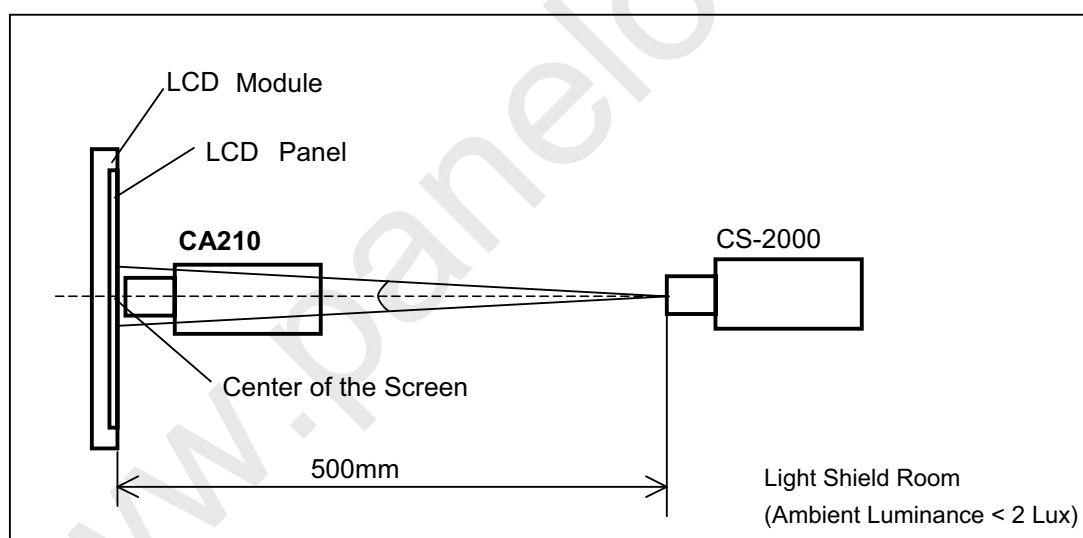
Note (7) 2D/3D switching time should be larger than 500ms

7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

| Item | Symbol | Value | Unit |
|---------------------|---|--------|------|
| Ambient Temperature | Ta | 25±2 | oC |
| Ambient Humidity | Ha | 50±10 | %RH |
| Supply Voltage | VCC | 12 | V |
| Input Signal | According to typical value in "3. ELECTRICAL CHARACTERISTICS" | | |
| LED Current | IL | 170±10 | mA |
| Vertical Frame Rate | Fr | 120 | Hz |

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.



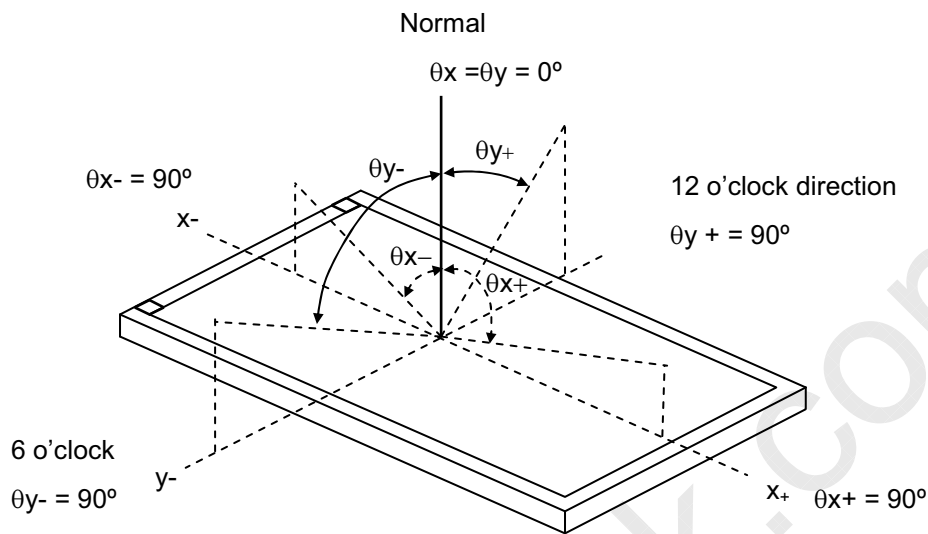
7.2 OPTICAL SPECIFICATIONS

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 | $\theta_x=0^\circ, \theta_y=0^\circ$ Viewing angle at normal direction | 3500 | 5000 | | - | (2) | |
| Response Time (VA) | | Gray to gray | | | 6.5 | | ms | (3) | |
| Center Luminance of White | | L _c | | 2D | 280 | 350 | | cd/m ² | (4) |
| | | | | 3D | | 43 | | cd/m ² | (8) |
| White Variation | | δW | | | | | - | (6) | |
| Cross Talk | | CT | | 2D | | | 4 | % | (5) |
| | | | | 3D-W | - | 6 | - | % | (8) |
| | | | | 3D-D | - | 14 | - | % | (8) |
| Color Chromaticity | Red | R _x | | $\theta_x=0^\circ, \theta_y=0^\circ$ Viewing angle at normal direction | Typ. -0.03 | Typ. +0.03 | | | - |
| | | R _y | | | | | | | - |
| | Green | G _x | - | | | | | | |
| | | G _y | - | | | | | | |
| | Blue | B _x | - | | | | | | |
| | | B _y | - | | | | | | |
| | White | W _x | - | | | | | | |
| | | W _y | - | | | | | | |
| Correlated color temperature | | | - | | 10000 | - | K | - | |
| Color Gamut | C.G. | - | 68 | | - | % | NTSC | | |
| Viewing Angle | Horizontal | θ_{x+} | CR \geq 20 | 80 | 88 | - | Deg. | (1) | |
| | | θ_{x-} | | 80 | 88 | - | | | |
| | Vertical | θ_{y+} | | 80 | 88 | - | | | |
| | | θ_{y-} | | 80 | 88 | - | | | |
| Transmission direction of the up polarizer | | Φ_{up} | - | - | 90 | - | Deg. | (7) | |

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

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.

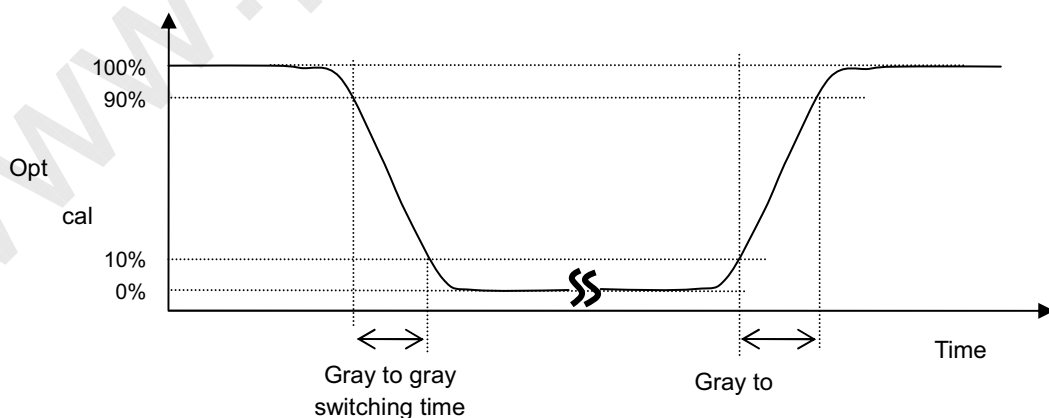
$$\text{Contrast Ratio (CR)} = \frac{\text{Surface Luminance of L255}}{\text{Surface Luminance of L0}}$$

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 Gray-to-Gray Switching Time:



The driving signal means the signal of gray level gray level (0,1,15, 63, 191, 223, 255)..Gray to gray average.

Gray to gray average time means the average switching time of gray level (0,1,15, 63, 191, 223, 255)..Gray to gray average

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

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

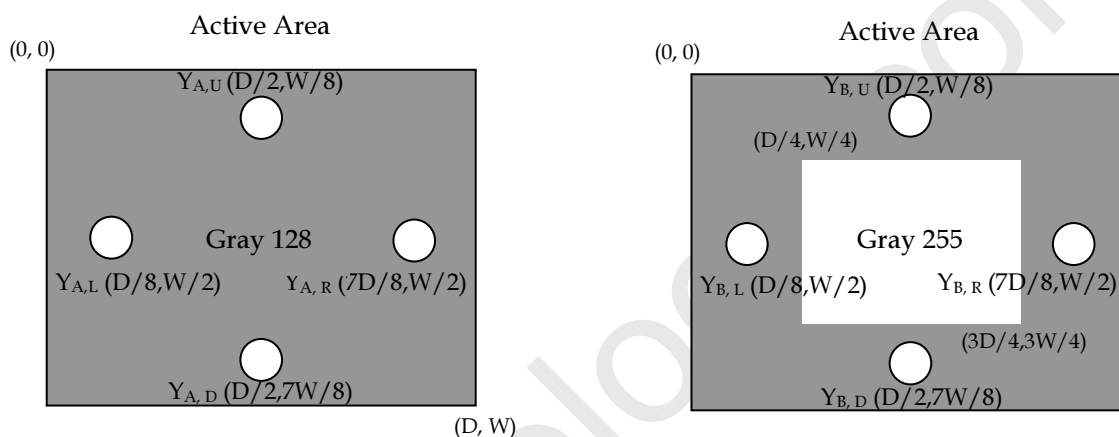
$L_C = L(5)$, where $L(X)$ is corresponding to the luminance of the point X at the figure in Note (6).

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

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

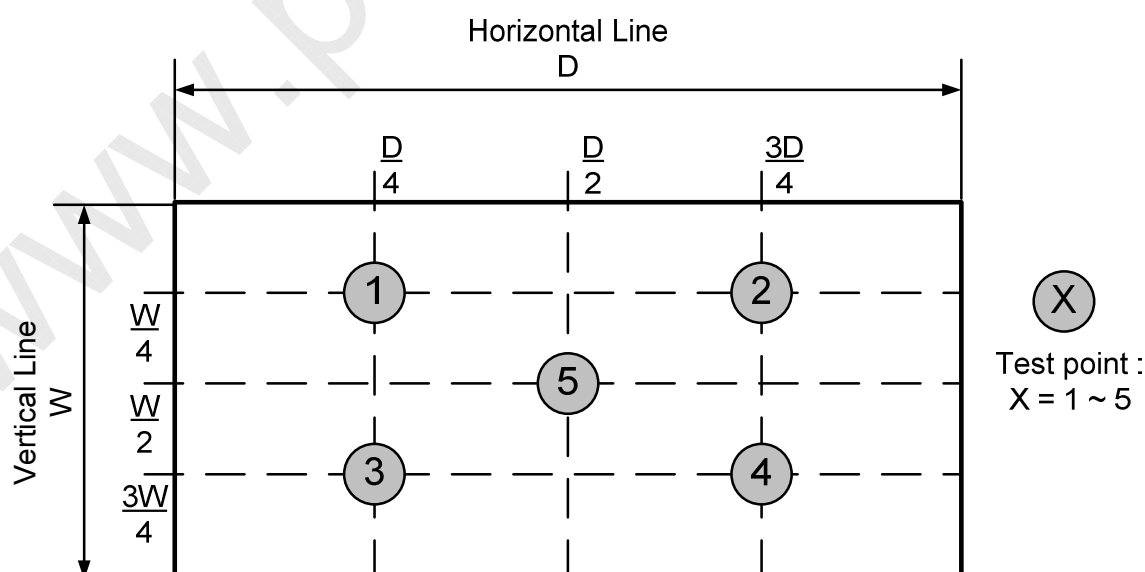
Y_A = Luminance of measured location without gray level 255 pattern (cd/m^2)

Y_B = Luminance of measured location with gray level 255 pattern (cd/m^2)


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

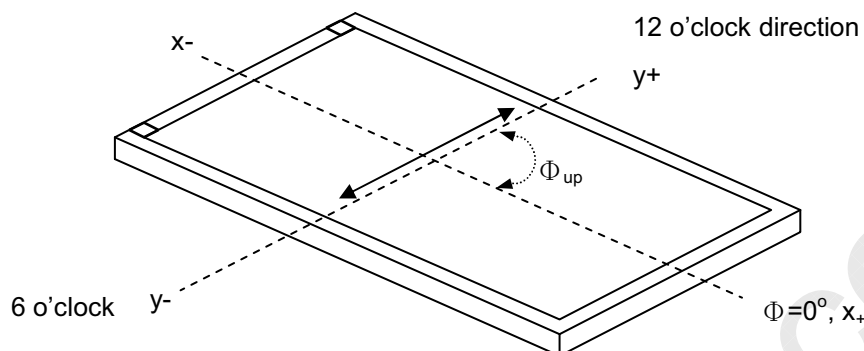
Measure the luminance of gray level 255 at 5 points

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

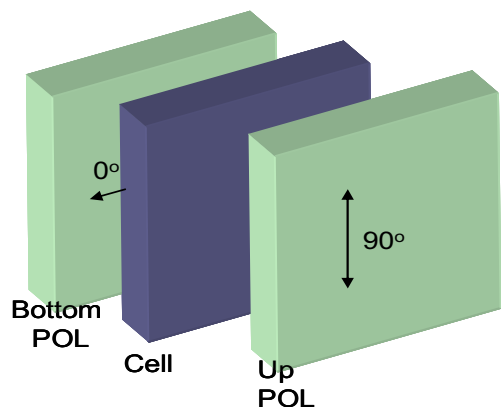


Note (7) This is a reference for designing the shutter glasses of 3D application. (VA)

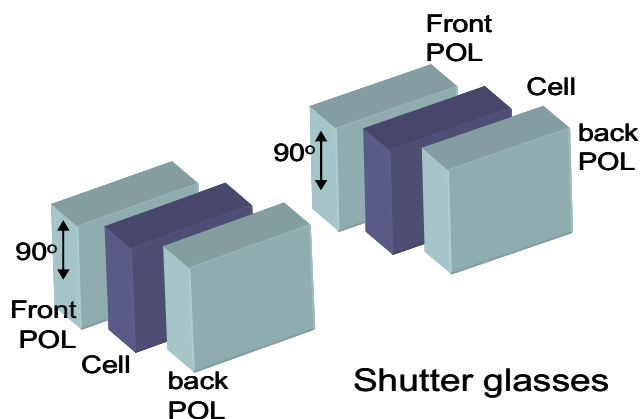
Definition of the transmission direction of the up polarizer:



The transmission axis of the front polarizer of the shutter glasses should be parallel to this panel transmission direction to get a maximum 3D mode luminance.



LCD module




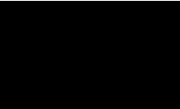
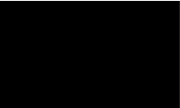





Shutter glasses

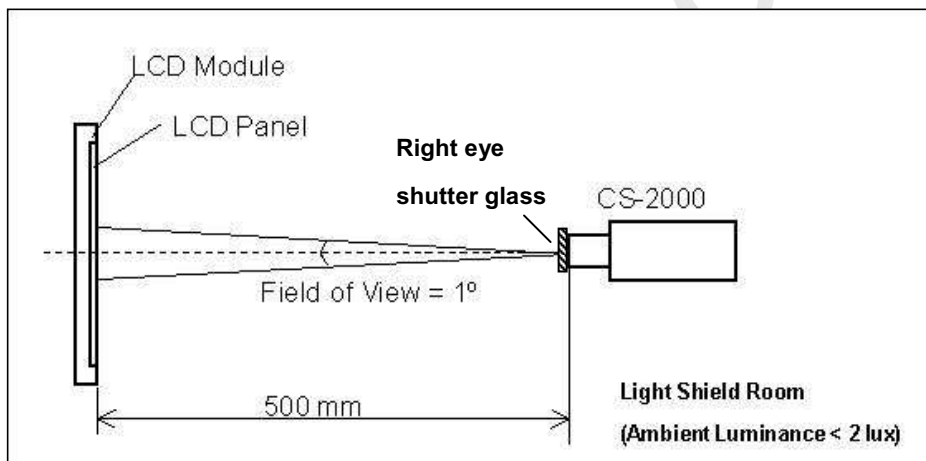
Note (8) Definition of the 3D mode performance (measured under 3D mode, use CMI's shutter glass):

a. Test pattern

Left eye image and right eye image are displayed alternated

| | | |
|---|---|---|
|  |  | WW Left eye image: W255; Right eye image: W255 |
|  |  | WB Left eye image: W255; Right eye image: W0 |
|  |  | BW Left eye image: W0; Right eye image: W255 |
|  |  | BB Left eye image: W0; Right eye image: W0 |

b. Measurement setup



Shutter glasses are well controlled under suitable timing, and measure the luminance of the center point of the panel through the right eye glass. The transmittance of the glass should be larger than 40.0% under 3D mode operation.

The luminance of the test pattern "WW", denoted $L(WW)$; the luminance of the test pattern "WB", denoted $L(WB)$; the luminance of the test pattern "BW", denoted $L(BW)$; the luminance of the test pattern "BB", denoted $L(BB)$

c. Definition of the Center Luminance of White, $L_c(3D)$: $L(WW)$

d. Definition of the 3D mode white crosstalk, $CT(3D-W)$: $CT(3D-W) \equiv \frac{L(WB) - L(BB)}{L(WW) - L(BB)}$

e. Definition of the 3D mode dark crosstalk, $CT(3D-D)$: $CT(3D-D) \equiv \frac{L(WW) - L(BW)}{L(WW) - L(BB)}$

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°C 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 10°C, 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.

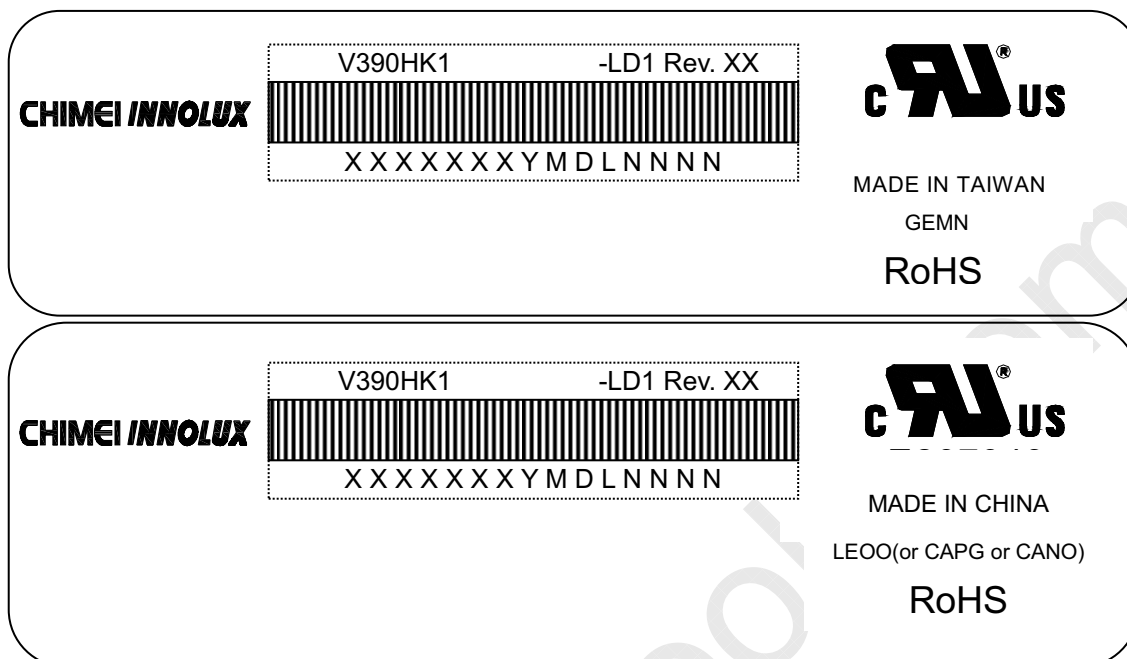
8.2 SAFETY PRECAUTIONS

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

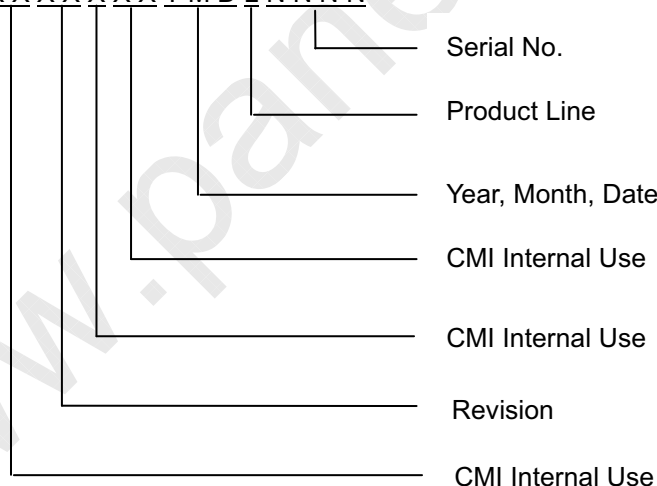
9. DEFINITION OF LABELS

9.1 CMI MODULE LABEL

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



- (a) Model Name: V390HK1-LD1
 (b) Revision: Rev. XX, for example: A0, A1... B1, B2... or C1, C2...etc.
 (c) Serial ID: X X X X X X X Y M D L N N N N



Serial ID includes the information as below:

- (a) Manufactured Date: Year: 0~9, for 2010~2019
 Month: 1~9, A~C, for Jan. ~ Dec.
 Day: 1~9, A~Y, for 1st to 31st, exclude I, O, and U.
- (b) Revision Code: Cover all the change
- (c) Serial No.: Manufacturing sequence of product
- (d) Product Line: 1 -> Line1, 2 -> Line 2, ...etc.

10. PACKAGING

10.1 PACKAGING SPECIFICATIONS

- (1) 4 LCD TV modules / 1 Box
- (2) Box dimensions : 1060(L)x378(W)x650(H)mm
- (3) Weight : Approx. 30.5Kg(4 modules per carton)

10.2 PACKAGING METHOD

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

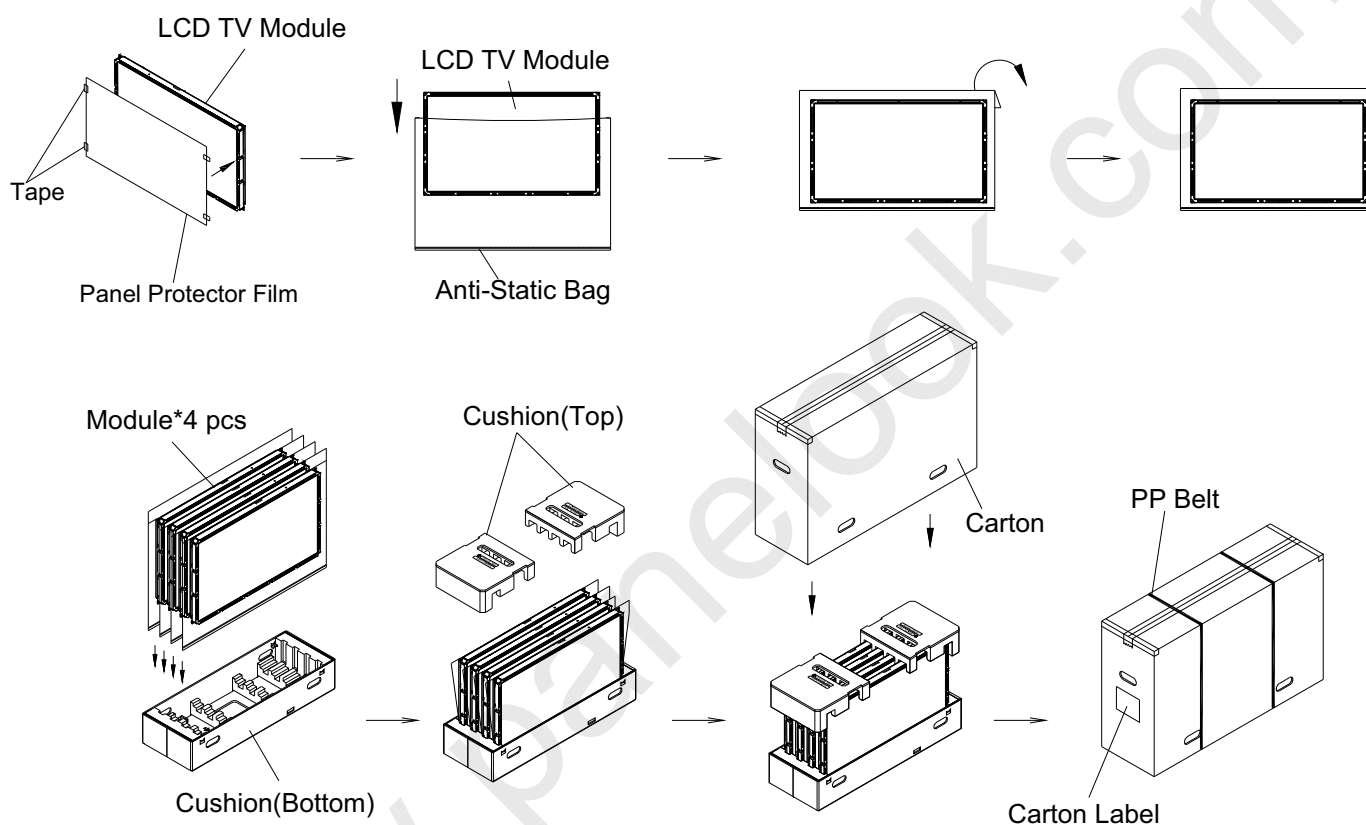
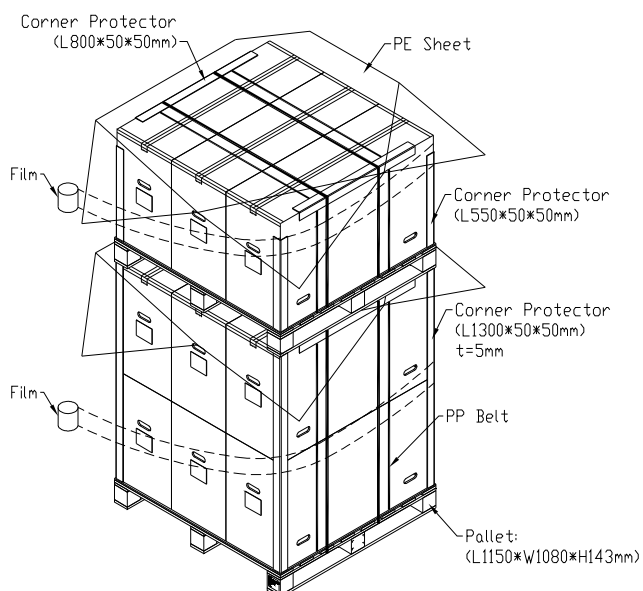


Figure 10-1 packing method

Sea / Land Transportation (40ft Container)



Air Transportation

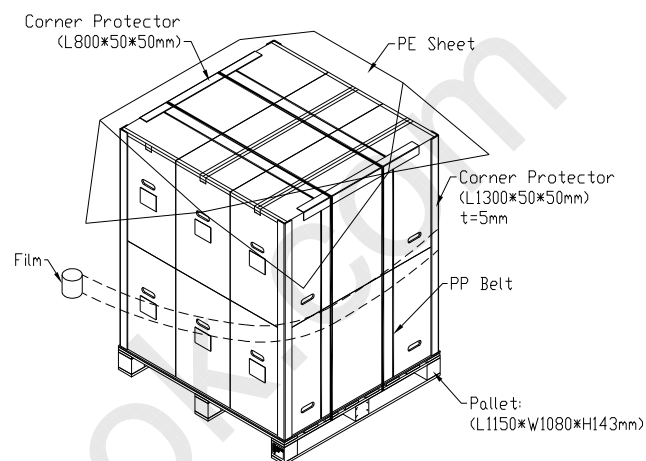
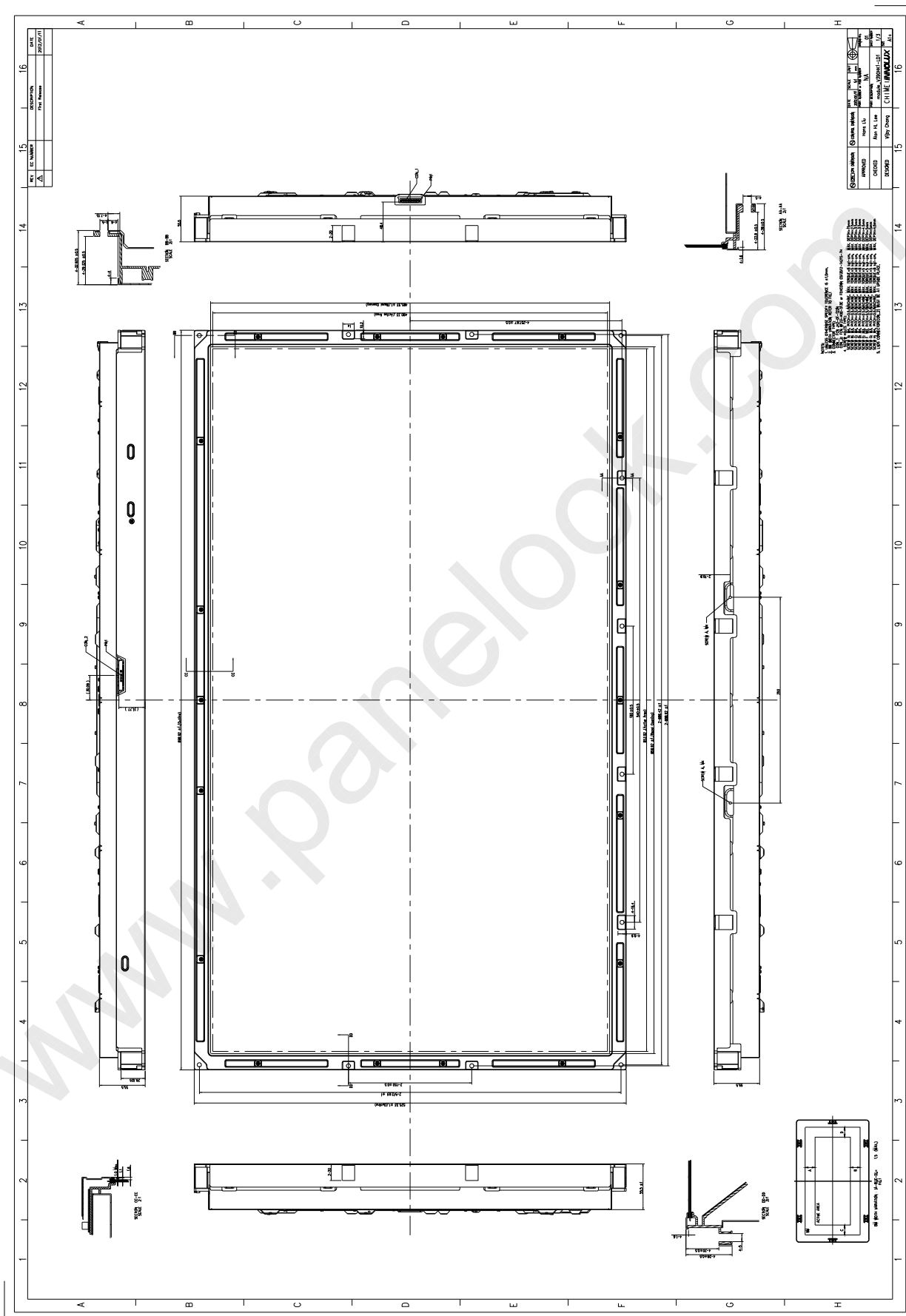


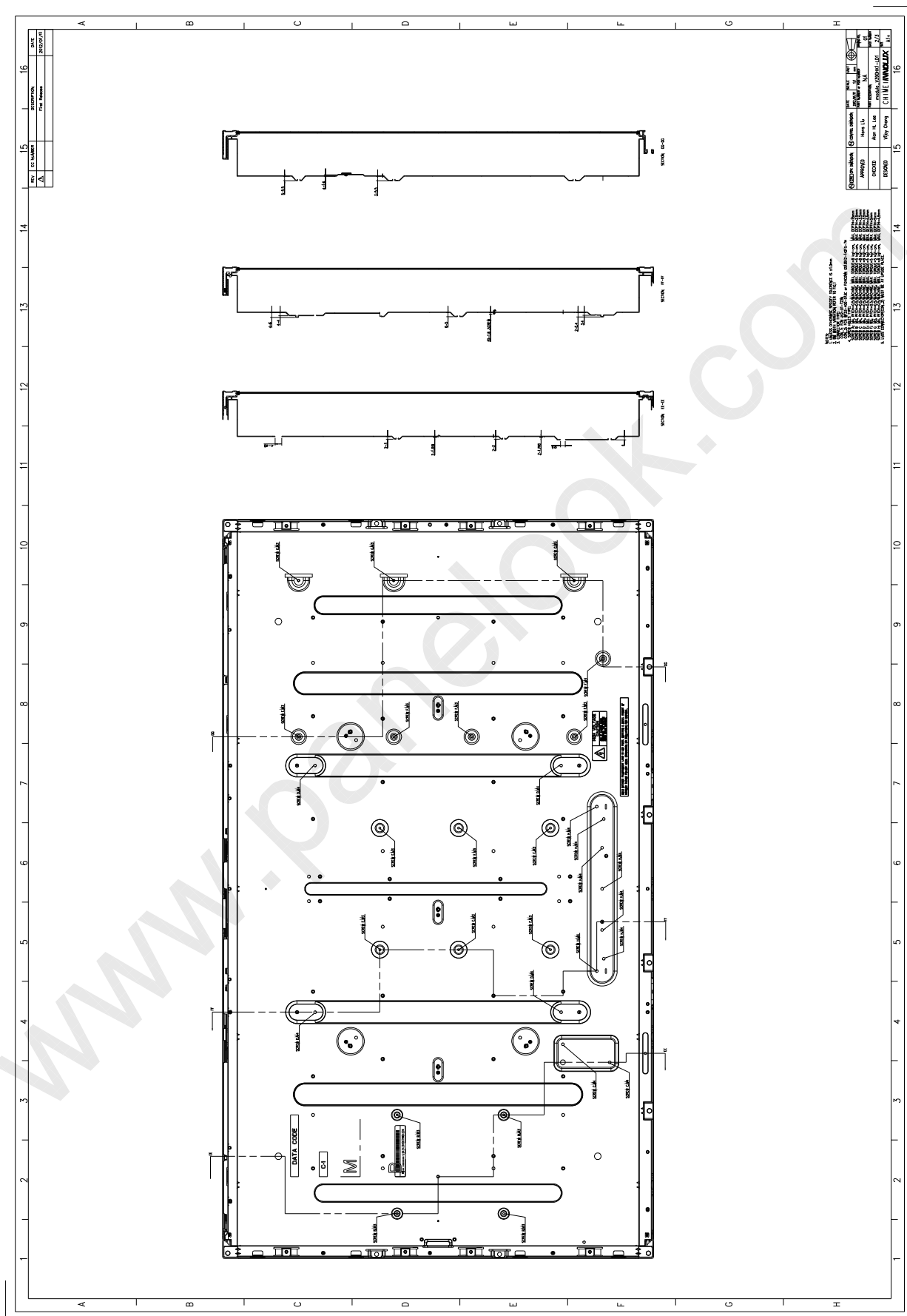
Figure 10-2 packing method



PRODUCT SPECIFICATION

11. MECHANICAL CHARACTERISTIC

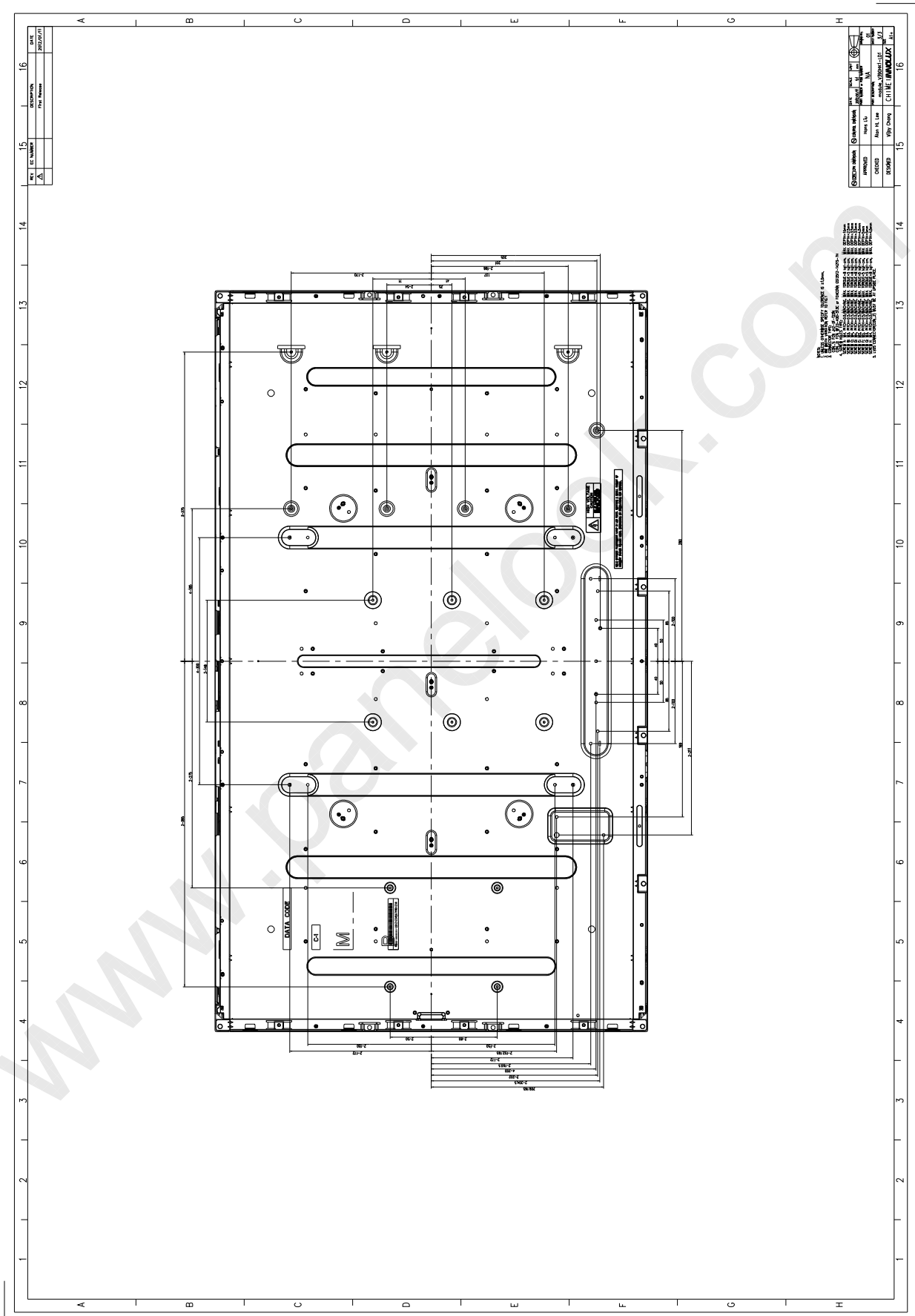




| | | | |
|------|-----------|---------------|------------|
| REV. | LC NUMBER | DESCRIPTION | DATE |
| A | | First Release | 2007/07/11 |

| | | | | |
|---------------|-----------------|-----------------|-----------------|----|
| STANDARD MARK | ① | CHIMEI INNO LUX | TRADE MARK | TM |
| DESIGNER | INNO LUX | DESIGNER | INNO LUX | |
| DRIVER | INNO LUX | DRIVER | INNO LUX | |
| MANUFACTURER | CHIMEI INNO LUX | MANUFACTURER | CHIMEI INNO LUX | |

| | | | |
|----------|-------------|-----|------|
| ITEM NO. | ITEM NAME | QTY | UNIT |
| 1 | FRONT COVER | 1 | PC |
| 2 | REAR COVER | 1 | PC |
| 3 | BEZEL | 1 | PC |
| 4 | SPACER | 1 | PC |
| 5 | SCREW | 1 | PC |
| 6 | SCREW | 1 | PC |
| 7 | SCREW | 1 | PC |
| 8 | SCREW | 1 | PC |
| 9 | SCREW | 1 | PC |
| 10 | SCREW | 1 | PC |
| 11 | SCREW | 1 | PC |
| 12 | SCREW | 1 | PC |
| 13 | SCREW | 1 | PC |
| 14 | SCREW | 1 | PC |
| 15 | SCREW | 1 | PC |
| 16 | SCREW | 1 | PC |
| 17 | SCREW | 1 | PC |
| 18 | SCREW | 1 | PC |
| 19 | SCREW | 1 | PC |
| 20 | SCREW | 1 | PC |
| 21 | SCREW | 1 | PC |
| 22 | SCREW | 1 | PC |
| 23 | SCREW | 1 | PC |
| 24 | SCREW | 1 | PC |
| 25 | SCREW | 1 | PC |
| 26 | SCREW | 1 | PC |
| 27 | SCREW | 1 | PC |
| 28 | SCREW | 1 | PC |
| 29 | SCREW | 1 | PC |
| 30 | SCREW | 1 | PC |
| 31 | SCREW | 1 | PC |
| 32 | SCREW | 1 | PC |
| 33 | SCREW | 1 | PC |
| 34 | SCREW | 1 | PC |
| 35 | SCREW | 1 | PC |
| 36 | SCREW | 1 | PC |
| 37 | SCREW | 1 | PC |
| 38 | SCREW | 1 | PC |
| 39 | SCREW | 1 | PC |
| 40 | SCREW | 1 | PC |
| 41 | SCREW | 1 | PC |
| 42 | SCREW | 1 | PC |
| 43 | SCREW | 1 | PC |
| 44 | SCREW | 1 | PC |
| 45 | SCREW | 1 | PC |
| 46 | SCREW | 1 | PC |
| 47 | SCREW | 1 | PC |
| 48 | SCREW | 1 | PC |
| 49 | SCREW | 1 | PC |
| 50 | SCREW | 1 | PC |



| | |
|-----------|-------------|
| REV. | DATE |
| 1 | 2012/02/01 |
| REVISIONS | |
| NO. | DESCRIPTION |
| 1 | 1st Release |

| | | |
|---------|----------|------|
| GROUP | NAME | DATE |
| DESIGN | DESIGNER | DATE |
| CHECK | CHECKER | DATE |
| APPROVE | APPROVER | DATE |
| DATE | TIME | DATE |
| TIME | DATE | TIME |

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