

Doc. Number :

- Tentative Specification
- Preliminary Specification
- Approval Specification

MODEL NO.: G121ICE
SUFFIX: L02

| | |
|--|------------------|
| Customer: | |
| APPROVED BY | SIGNATURE |
| <u>Name / Title</u> | _____ |
| Note | |
| _____ | |
| Please return 1 copy for your confirmation with your signature and comments. | |

| Approved By | Checked By | Prepared By |
|-------------|------------|-------------|
| | | |

CONTENTS

| | | |
|---------------------------------------|-------|----|
| REVISION HISTORY | ----- | 3 |
| 1. GENERAL DESCRIPTION | ----- | 4 |
| 1.1 OVERVIEW | | |
| 1.2 GENERAL SPECIFICATIONS | | |
| 2. MECHANICAL SPECIFICATIONS | ----- | 4 |
| 3. ABSOLUTE MAXIMUM RATINGS | ----- | 4 |
| 3.1 ABSOLUTE RATINGS OF ENVIRONMENT | | |
| 3.2 ELECTRICAL ABSOLUTE RATINGS | | |
| 3.2.1 TFT LCD MODULE | | |
| 3.2.2 BACKLIGHT UNIT | | |
| 4. ELECTRICAL SPECIFICATION | ----- | 6 |
| 4.1 FUNCTION BLOCK DIAGRAM | | |
| 4.2 INTERFACE CONNECTIONS | | |
| 4.3 ELECTRICAL CHARACTERISTICS | | |
| 4.3.1 LCD ELECTRONICS SPECIFICATION | | |
| 4.3.2 BACKLIGHT UNIT | | |
| 4.4 LVDS INPUT SIGNAL SPECIFICATIONS | | |
| 4.4.1 COLOR DATA INPUT ASSIGNMENT | | |
| 4.5 DISPLAY TIMING SPECIFICATIONS | | |
| 4.6 POWER ON/OFF SEQUENCE | | |
| 5. OPTICAL CHARACTERISTICS | ----- | 17 |
| 5.1 TEST CONDITIONS | | |
| 5.2 OPTICAL SPECIFICATIONS | | |
| 6. Reliability Test Criteria | ----- | 20 |
| 7.Packing | ----- | 21 |
| 7.1 PACKING SPECIFICATIONS | | |
| 7.2 PACKING METHOD | | |
| 7.3 UN-PACKING METHOD | | |
| 8. MODULE LABEL | ----- | 24 |
| 8.1 MODULE LABEL | | |
| 9 PRECAUTIONS | ----- | 25 |
| 9.1 ASSEMBLY AND HANDLING PRECAUTIONS | | |
| 9.2 STORAGE PRECAUTIONS | | |
| 9.3 OPERATION PRECAUTIONS | | |
| 9.4 OTHER PRECAUTIONS | | |
| 10.MECHANICAL CHARACTERISTICS | ----- | 26 |

REVISION HISTORY

| Version | Date | Section | Description |
|----------|-------------|---------|----------------------------------|
| Ver. 0.0 | Feb.15,2019 | All | Tentative Spec was first issued. |
| Ver. 0.1 | Mar.15,2019 | All | Tentative Spec was first issued. |

1. GENERAL DESCRIPTION

1.1 OVERVIEW

G121ICE-L02 is a 12.1" TFT Liquid Crystal Display module with LED Backlight unit LVDS interface. This module supports 1280 x 800 Wide-XGA MVA mode and can display 262k/16.7M colors . The LED converter for Backlight is built in control board.

1.2 GENERAL SPECIFICATIONS

| Item | Specification | Unit | Note |
|-------------------|--------------------------|-------|------|
| Screen Size | 12.1" real diagonal | | |
| Driver Element | a-si TFT active matrix | - | - |
| Pixel Number | 1280 x R.G.B. x 800 | pixel | - |
| Pixel Pitch | 0.204(H) x 0.204 (V) | mm | - |
| Pixel Arrangement | RGB vertical stripe | - | - |
| Display Colors | 262k/16.7M | color | - |
| Transmissive Mode | Normally Black | - | - |
| Surface Treatment | AG type, 3H hard coating | - | - |
| Luminance, White | 400 | Cd/m2 | |
| Power Consumption | TBD | | |

2. MECHANICAL SPECIFICATIONS

| Item | | Min. | Typ. | Max. | Unit | Note |
|-------------|----------------|--------|--------|--------|------|------|
| Module Size | Horizontal (H) | 277.5 | 278 | 278.5 | mm | (1) |
| | Vertical (V) | 183.5 | 184 | 184.5 | mm | |
| | Thickness (T) | (9.5) | (10) | (10.5) | mm | |
| Bezel Area | Horizontal | 263.82 | 264.12 | 264.42 | mm | |
| | Vertical | 165.9 | 166.2 | 166.5 | mm | |
| Active Area | Horizontal | - | 261.12 | - | mm | |
| | Vertical | - | 163.2 | - | mm | |
| Weight | | - | (485) | (505) | g | |

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

3. ABSOLUTE MAXIMUM RATINGS

3.1 ABSOLUTE RATINGS OF ENVIRONMENT

| Item | Symbol | Value | | Unit | Note |
|-------------------------------|--------|-------|------|------|----------|
| | | Min. | Max. | | |
| Storage Temperature | TST | (-20) | (70) | °C | (1) |
| Operating Ambient Temperature | TOP | (-20) | (70) | °C | (1), (2) |

Note (1)

(a) 90 %RH Max. (Ta <= 40 °C).

(b) Wet-bulb temperature should be 39 °C Max.

(c) No condensation.

3.2 ELECTRICAL ABSOLUTE RATINGS

3.2.1 TFT LCD MODULE

| Item | Symbol | Value | | Unit | Note |
|----------------------|-----------------|-------|----------------------|------|------|
| | | Min. | Max. | | |
| Power Supply Voltage | VCCS | -0.3 | +4.0 | V | (1) |
| Logic Input Voltage | V _{IN} | -0.3 | V _{CC} +0.3 | V | |

3.2.2 BACKLIGHT UNIT

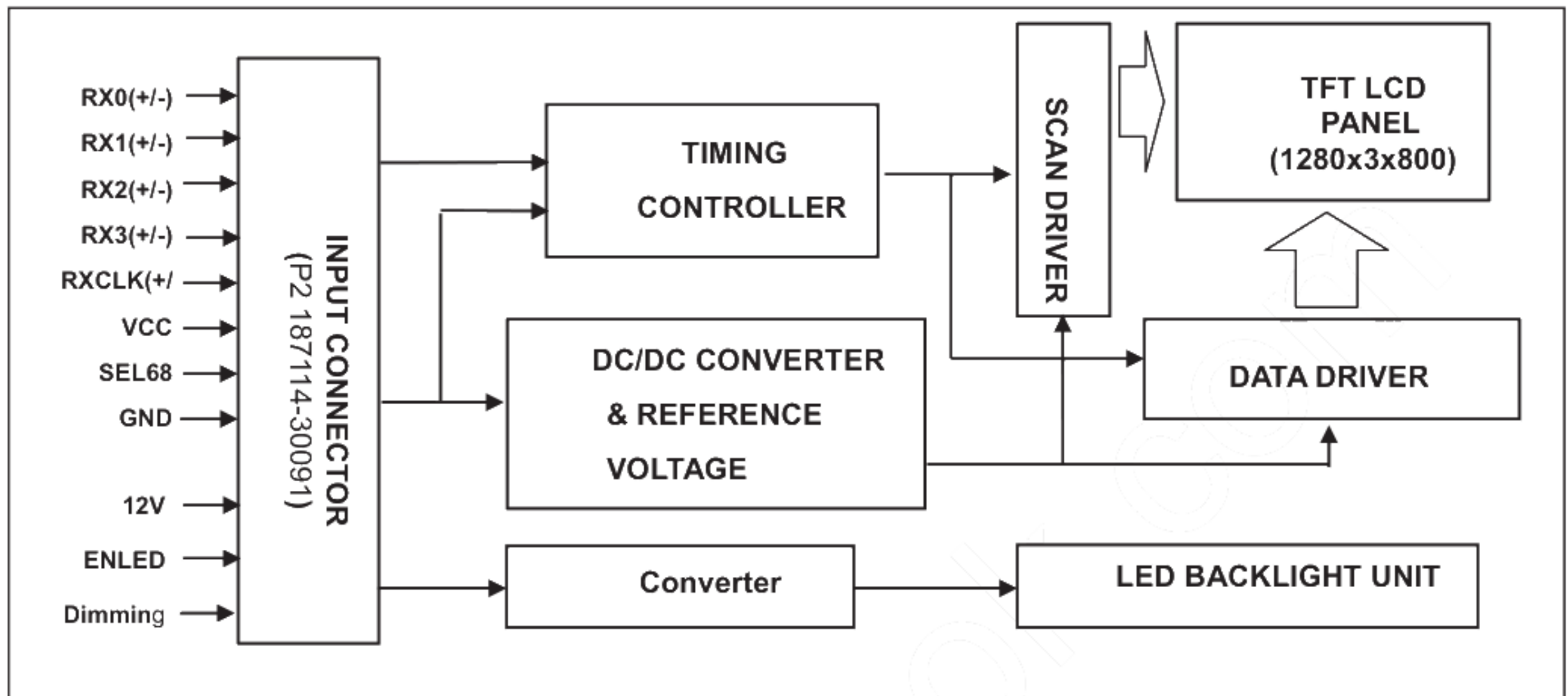
| Item | Value | | | Unit | Note |
|-----------------------------|-------|--------|------|-----------------|----------|
| | Min | Typ. | Max. | | |
| LED Converter Input voltage | 10.8 | 12.0 | 13.2 | V _{DC} | (1), (2) |
| LED Converter Input Current | - | (0.53) | - | A _{DC} | |

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for LED (Refer to Section 3.2 for further information).

4. ELECTRICAL SPECIFICATIONS

4.1 FUNCTION BLOCK DIAGRAM



4.2. INTERFACE CONNECTIONS

PIN ASSIGNMENT

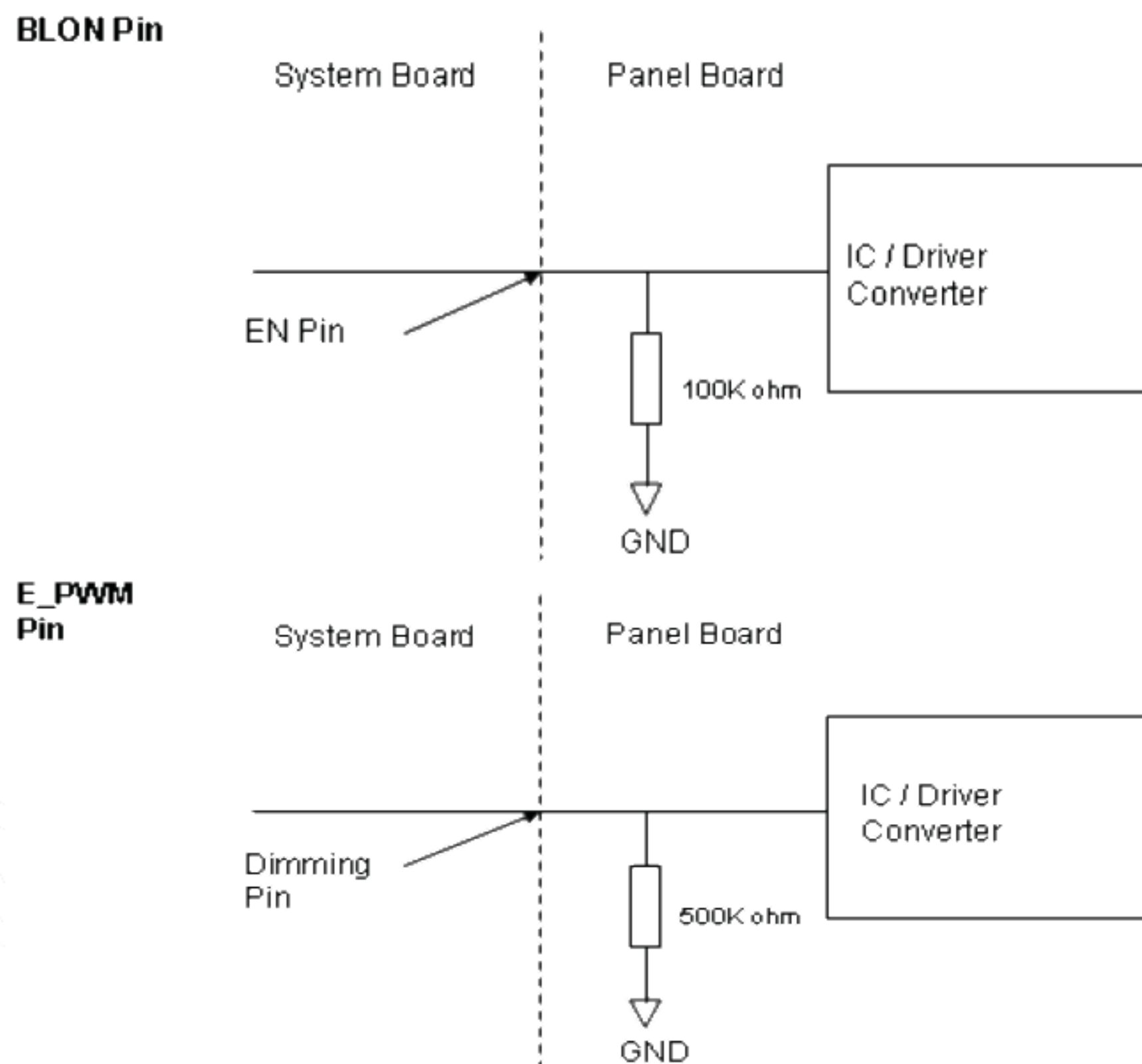
| Pin No. | Symbol | Description | Note |
|---------|---------|---------------------------------------|------|
| 1 | 12V | LED power | - |
| 2 | 12V | LED power | - |
| 3 | 12V | LED power | - |
| 4 | 12V | LED power | - |
| 5 | ENLED | Enable pin | (3) |
| 6 | Dimming | Backlight Adjust | (3) |
| 7 | NC | No Connection or Ground | - |
| 8 | NC | No Connection or Ground | - |
| 9 | VCC | Power supply: +3.3V | - |
| 10 | VCC | Power supply: +3.3V | - |
| 11 | GND | Ground | - |
| 12 | GND | Ground | - |
| 13 | RX0- | Negative transmission data of pixel 0 | - |
| 14 | RX0+ | Positive transmission data of pixel 0 | - |
| 15 | GND | Ground | - |
| 16 | RX1- | Negative transmission data of pixel 1 | - |
| 17 | RX1+ | Positive transmission data of pixel 1 | - |
| 18 | GND | Ground | - |
| 19 | RX2- | Negative transmission data of pixel 2 | - |
| 20 | RX2+ | Positive transmission data of pixel 2 | - |

| | | | |
|----|--------|---------------------------------------|---------|
| 21 | GND | Ground | - |
| 22 | RXCLK- | Negative of clock | - |
| 23 | RXCLK+ | Positive of clock | - |
| 24 | GND | Ground | - |
| 25 | RX3- | Negative transmission data of pixel 3 | - |
| 26 | RX3+ | Positive transmission data of pixel 3 | - |
| 27 | GND | Ground | - |
| 28 | SEL6/8 | LVDS 6/8 bit select function control, | (2) (3) |
| | | Low → 6 bit Input Mode | |
| | | High → 8bit Input Mode | |
| 29 | GND | Ground | - |
| 30 | NC | No Connection or Ground | - |

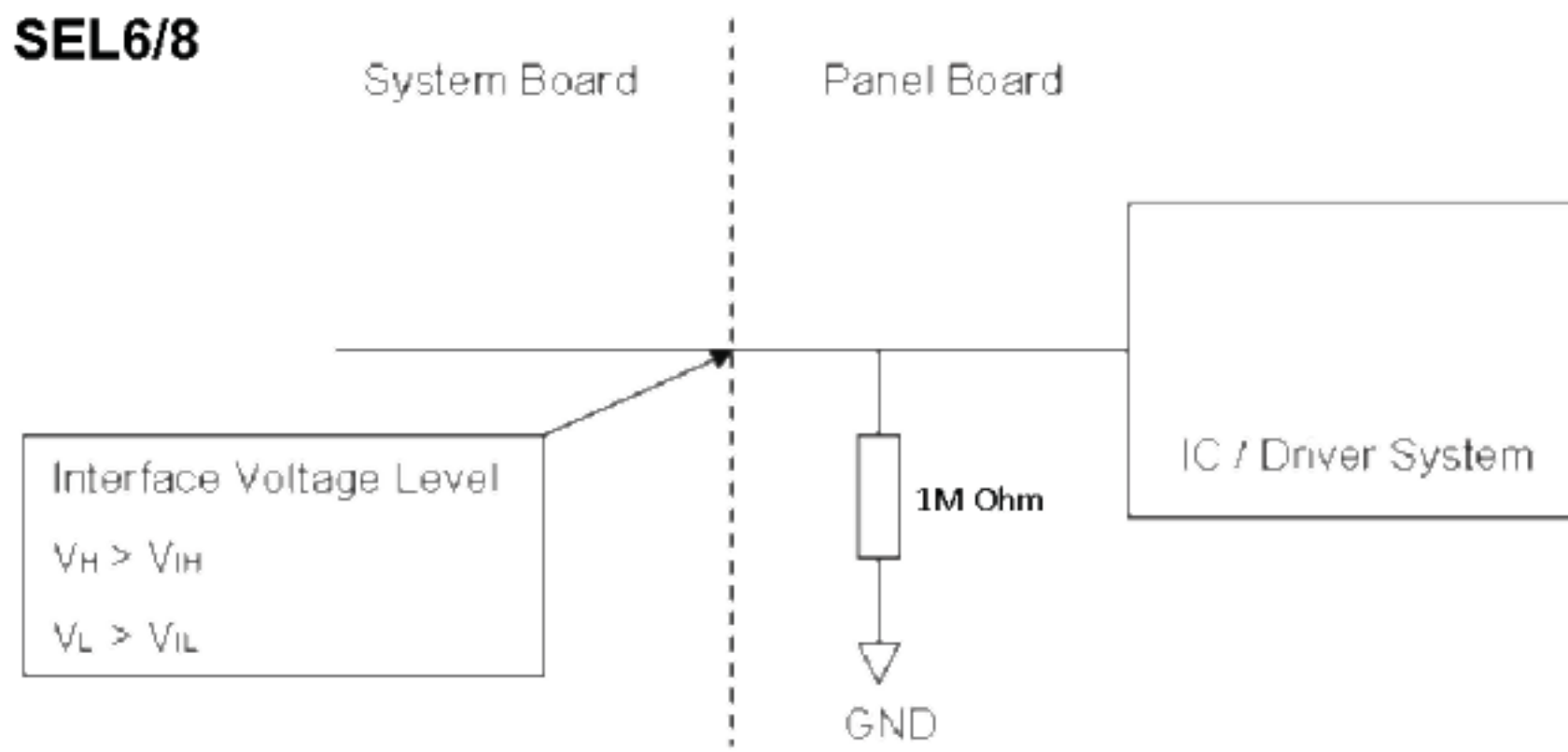
Note (1) Connector Part No.: P2 187114-30091

Note (2) "Low" stands for 0V. "High" stands for 3.3V

Note (3) ENLED(BLON), Dimming(E_PWM), SEL6/8 as shown below :



SEL6/8



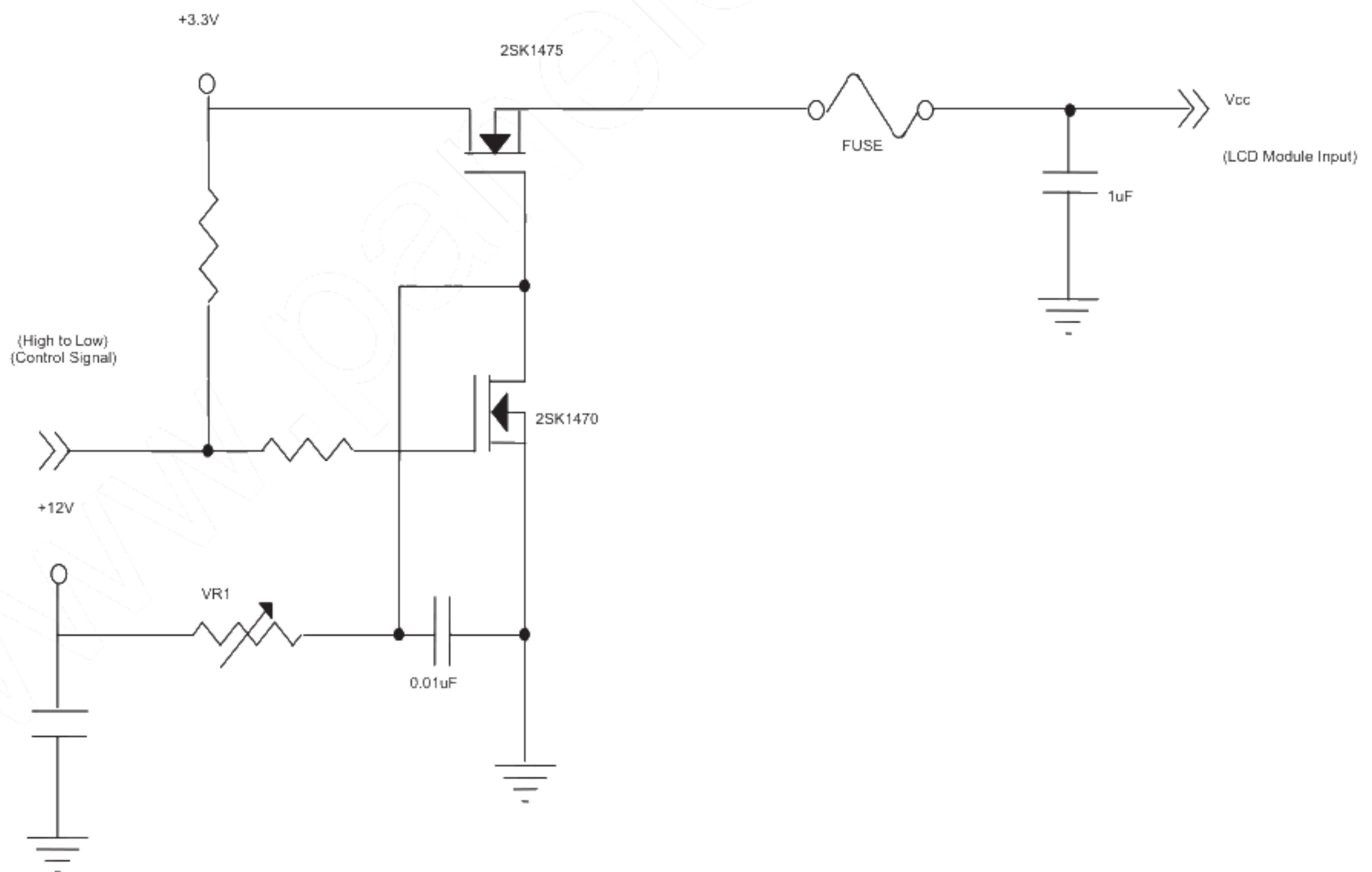
4.3 ELECTRICAL CHARACTERISTICS

4.3.1 LCD ELETRONICS SPECIFICATION

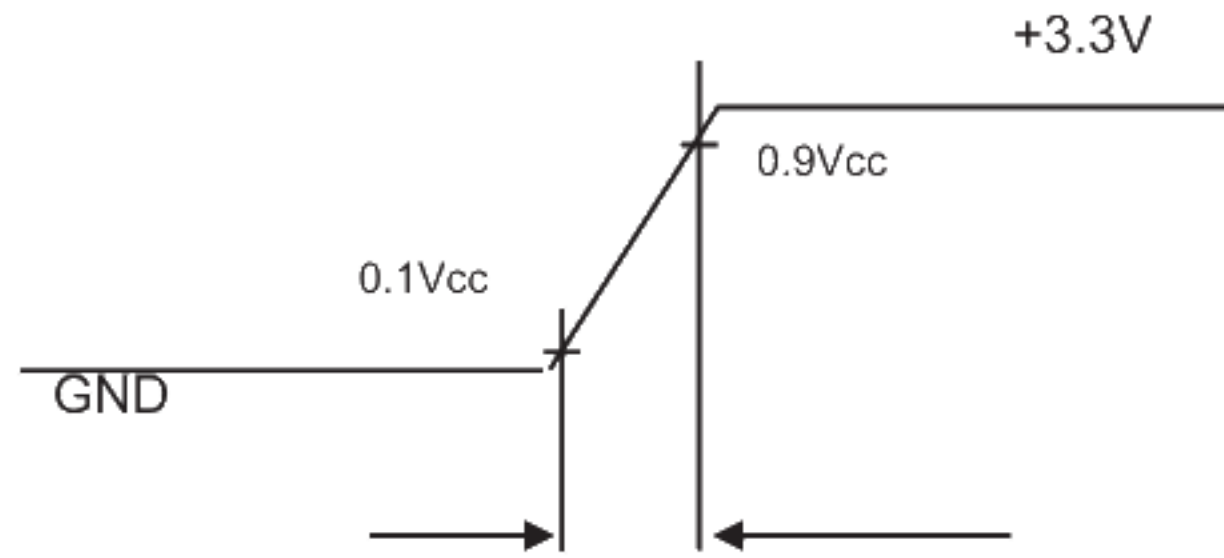
| Parameter | Symbol | Value | | | Unit | Note |
|--|-----------------------|---------|-------|---------|------|-----------------------|
| | | Min. | Typ | Max. | | |
| Power Supply Voltage | V _{CC} | (3.0) | (3.3) | (3.6) | V | - |
| Permissive Ripple Voltage | V _{RP} | - | (50) | - | mV | - |
| Rush Current | I _{RUSH} | TBD | | | A | (2) |
| Initial Stage Current | I _{IS} | - | - | TBD | A | (2) |
| Power Supply Current | White | - | TBD | TBD | mA | (3)a |
| | Black | - | TBD | TBD | mA | (3)b |
| LVDS Differential Input High Threshold | V _{TH(LVDS)} | +100 | - | - | mV | V _{CM} =1.2V |
| LVDS Differential Input Low Threshold | V _{TL(LVDS)} | - | - | -100 | mV | V _{CM} =1.2V |
| LVDS Common Mode Voltage | V _{CM} | (1.125) | - | (1.375) | V | |
| LVDS Differential Input Voltage | V _{ID} | (100) | - | (600) | mV | |
| Terminating Resistor | R _T | - | 100 | - | Ohm | |

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

Note (2) Measurement Conditions:

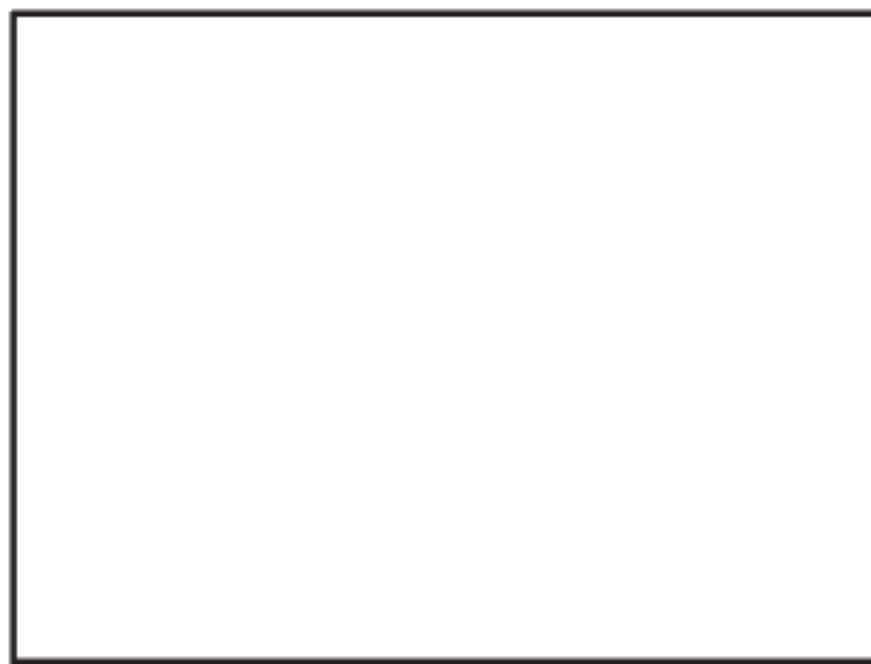


VCC rising time is 470us



Note (3) The specified power supply current is under the conditions at $V_{cc} = 3.3\text{ V}$, $T_a = 25 \pm 2\text{ }^\circ\text{C}$, $f_v = 60\text{ Hz}$, whereas a power dissipation check pattern below is

a. White Pattern



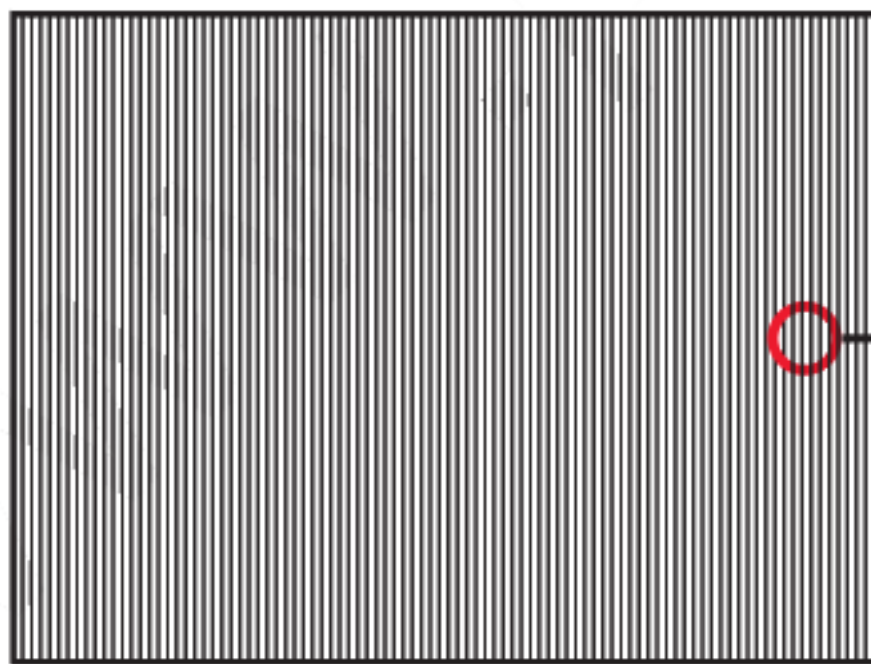
Active Area

b. Black Pattern

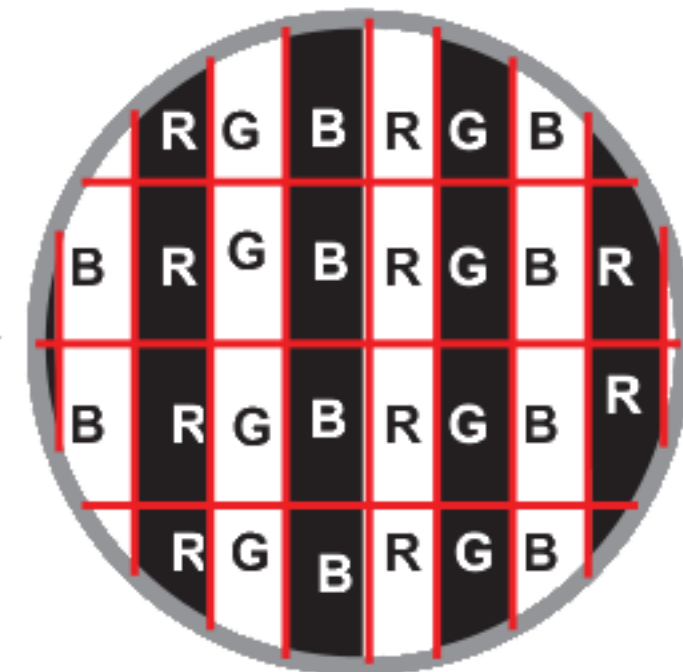


Active Area

c. Vertical Stripe Pattern



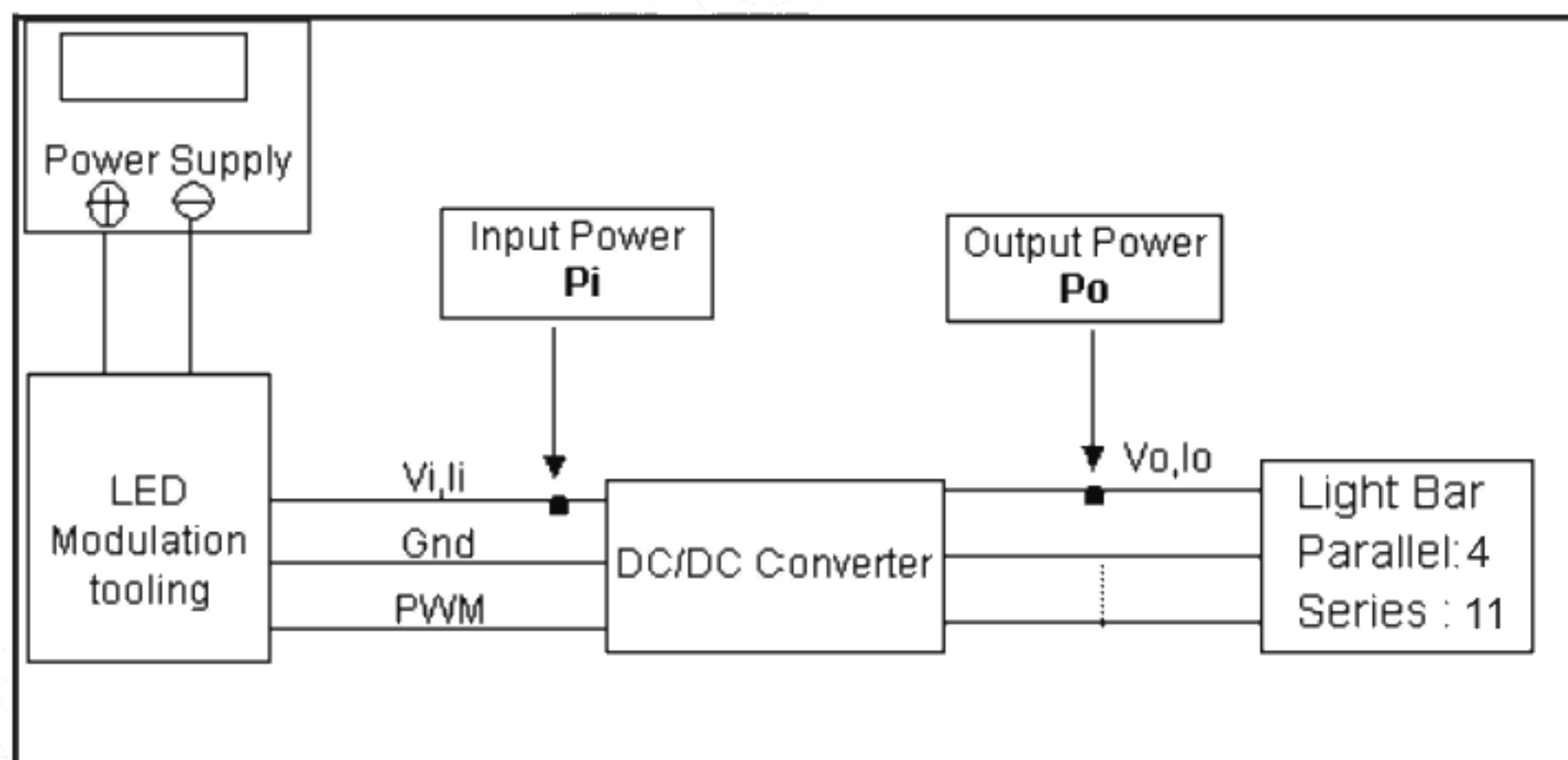
Active Area



4.3.2 BACKLIGHT UNIT

| Parameter | Symbol | Value | | | Unit | Note | |
|-------------------------------|----------------|-----------------|--------|------|----------|--------------------------|--|
| | | Min. | Typ. | Max. | | | |
| (LED Converter input voltage) | V_i | 10.8 | 12.0 | 13.2 | V_{DC} | (Duty 100%) | |
| (LED light bar input current) | I_i | 160 | 180 | 200 | A_{DC} | (Duty 100%) | |
| LED Lightbar Voltage | V_f | - | (31.9) | - | V_{DC} | $I_f = 45 \text{ mA/EA}$ | |
| LED Current | I_f | - | 45 | - | mA | Per EA | |
| Input Power Consumption | P_i | - | (6.3) | - | W | (1) | |
| EN Control Level | Backlight on | ENLED (BLON) | 2.5 | 3.3 | 5.0 | V | |
| | Backlight off | | 0 | --- | 0.3 | V | |
| PWM Control Level | PWM High Level | Dimming (E_PWM) | 2.5 | --- | 5.0 | V | |
| | PWM Low Level | | 0 | --- | 0.15 | V | |
| PWM Control Frequency | f_{PWM} | 190 | 200 | 20k | Hz | (3) | |
| PWM Control Duty Ratio | | 2 | | 100 | % | (3), @200Hz | |
| LED Life Time | L_{BL} | 50000 | - | - | Hrs | (3) | |

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



Note (2) The lifetime of LED is estimated data and defined as the time when it continues to operate under the conditions at $T_a = 25 \pm 2 \text{ }^\circ\text{C}$ and Duty 100% until the brightness becomes $\leq 50\%$ of its original value. Operating LED at high temperature condition will reduce life time and lead to color shift.

Note (3) At 200Hz PWM control frequency, duty ratio range is restricted from 2% to 100%, When PWM control frequency is 20kHz, duty ratio range is restricted from 10% to 100%.

4.4 LVDS INPUT SIGNAL SPECIFICATIONS

4.4.1 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color.

| Color | | Data Signal | | | | | | | | | | | | | | | | | |
|---------------------|---------------|-------------|----|----|----|----|----|-------|----|----|----|----|----|------|----|----|----|----|----|
| | | Red | | | | | | Green | | | | | | Blue | | | | | |
| | | R5 | R4 | R3 | R2 | R1 | R0 | G5 | G4 | G3 | G2 | G1 | G0 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Colors | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Cyan | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Magenta | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Yellow | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | White | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Gray Scale Of Red | Red(0)/Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(1) | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(2) | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Red(61) | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(62) | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(63) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale Of Green | Green(0)/Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Green(61) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(62) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(63) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale Of Blue | Blue(0)/Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | Blue(2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Blue(61) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 |
| | Blue(62) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| | Blue(63) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |

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

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.

| 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 | |
| | 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 | |
| | 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 | |
| | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | |
| | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | |
| | 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 | |
| | 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 | |
| | 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 | |
| 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 | |
| | Green(1) | 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 | 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 | |
| | Green(254) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 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 | 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 | |
| | Blue(1) | 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 | 1 | 0 | |
| | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | |
| | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | |
| | Blue(253) | 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 | 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 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |

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

4.5 DISPLAY TIMING SPECIFICATIONS

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

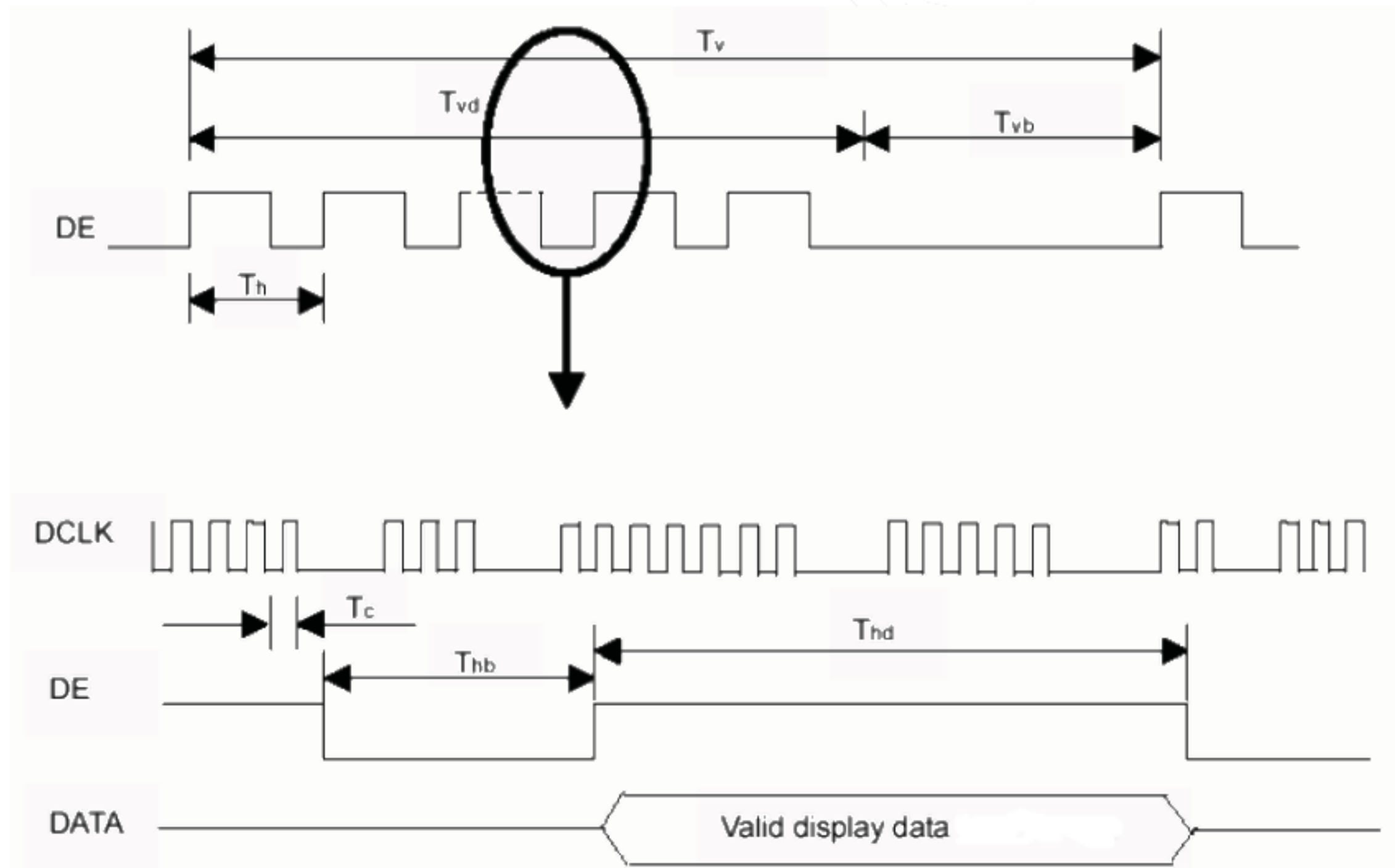
| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|--------|----------------------------|--------|--------|--------|--------|------|------|
| DCLK | Frequency | 1/Tc | (66.1) | (71) | (89.7) | MHz | - |
| DE | Vertical Total Time | Tv | (810) | (823) | (890) | Th | (3) |
| | Vertical Addressing Time | Tvd | (800) | (800) | (800) | Th | - |
| | Horizontal Total Time | Th | (1360) | (1440) | (1680) | Tc | - |
| | Horizontal Addressing Time | Thd | (1280) | (1280) | (1280) | Tc | - |

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

(2) Frame rate is 60Hz

(3) The Tv must be integer, otherwise, this module would operate abnormally.

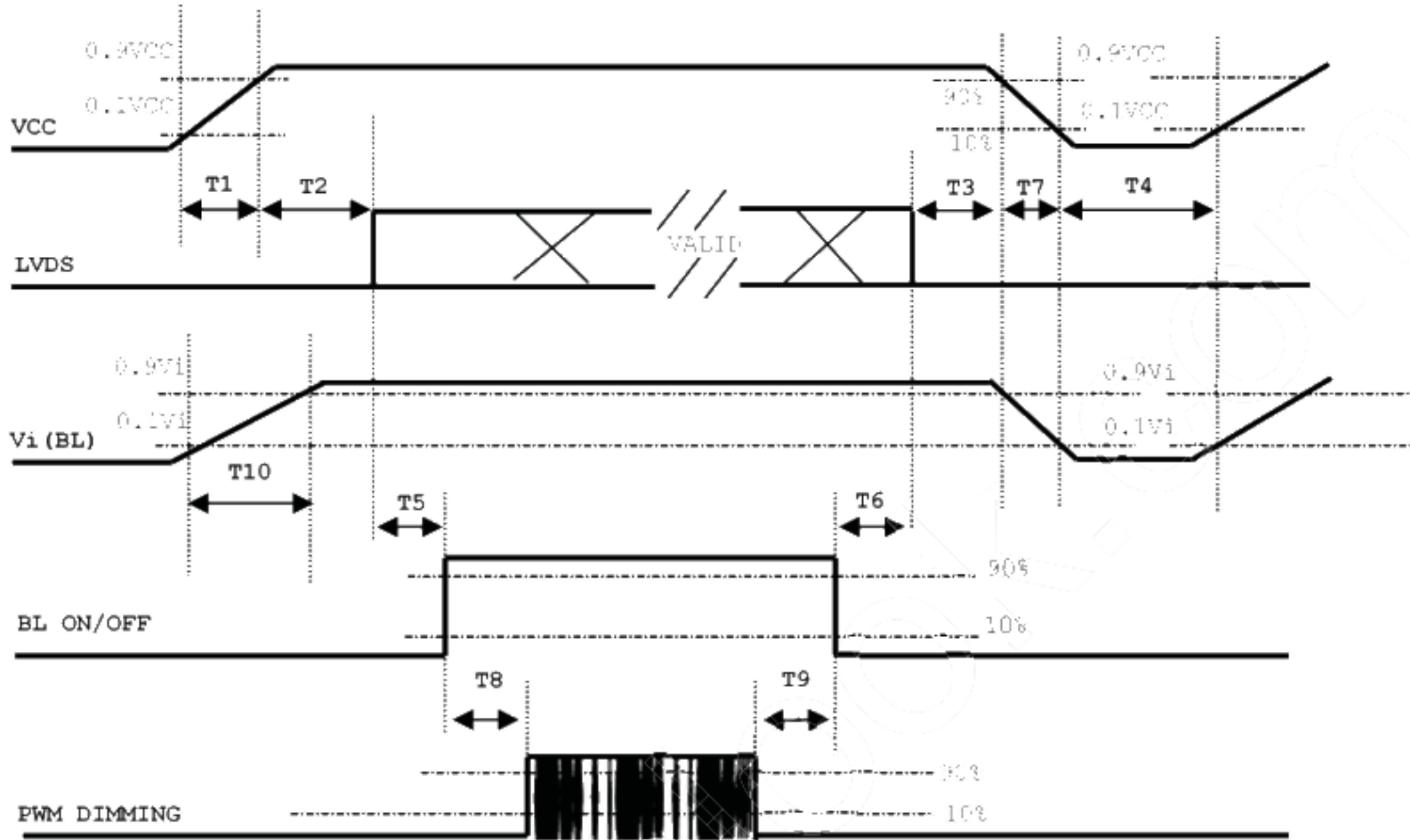
INPUT SIGNAL TIMING DIAGRAM



4.6 POWER ON/OFF SEQUENCE

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

Power ON/OFF sequence



Note (1) Please avoid floating state of interface signal at invalid period.

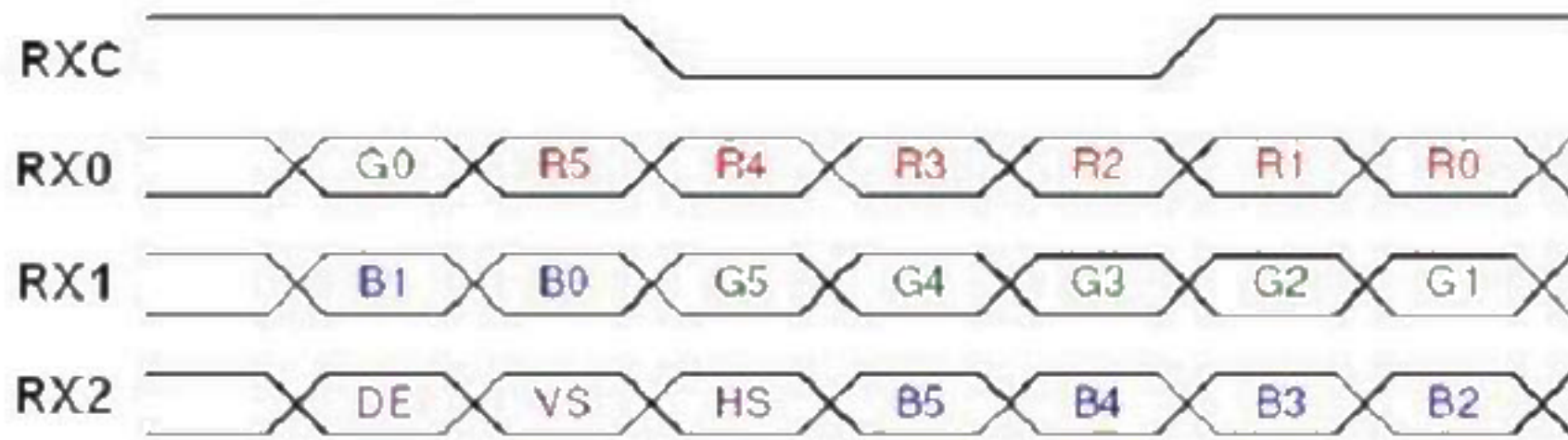
Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD VCC to 0 V.

Note (3) The Backlight converter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight converter power must be turned off before the power supply for the logic and the interface signal is invalid.

| Parameter | Value | | | Units |
|-----------|-------|-----|-----|-------|
| | Min | Typ | Max | |
| T1 | 0.5 | --- | 10 | ms |
| T2 | 0 | --- | 50 | ms |
| T3 | 0 | --- | 50 | ms |
| T4 | 500 | --- | --- | ms |
| T5 | 450 | --- | --- | ms |
| T6 | 200 | --- | --- | ms |
| T7 | 10 | --- | 100 | ms |
| T8 | 10 | --- | --- | ms |
| T9 | 10 | --- | --- | ms |
| T10 | 20 | --- | 50 | ms |

The Input Data Format

SEL 6/8="Low" or "NC" for 6 Bits LVDS



SEL 6/8="High" for 8 Bits LVDS



Note (1) R/G/B data 7: MSB, R/G/B data 0: LSB

Note (2) Please follow PSWG

| Signal Name | Description | Remark |
|----------------------|--------------------|---|
| R7 | Red Data 7 (MSB) | Red-pixel Data Each red pixel's brightness data consists of these 8 bits pixel data. |
| R6 | Red Data 6 | |
| R5 | Red Data 5 | |
| R4 | Red Data 4 | |
| R3 | Red Data 3 | |
| R2 | Red Data 2 | |
| R1 | Red Data 1 | |
| R0 | Red Data 0 (LSB) | |
| G7 | Green Data 7 (MSB) | Green-pixel Data Each green pixel's brightness data consists of these 8 bits pixel data. |
| G6 | GreenData 6 | |
| G5 | GreenData 5 | |
| G4 | GreenData 4 | |
| G3 | GreenData 3 | |
| G2 | GreenData 2 | |
| G1 | GreenData 1 | |
| G0 | GreenData 0 (LSB) | |
| B7 | Blue Data 7 (MSB) | Blue-pixel Data Each blue pixel's brightness data consists of these 8 bits pixel data. |
| B6 | Blue Data 6 | |
| B5 | Blue Data 5 | |
| B4 | Blue Data 4 | |
| B3 | Blue Data 3 | |
| B2 | Blue Data 2 | |
| B1 | Blue Data 1 | |
| B0 | Blue Data 0 (LSB) | |
| RXCLKIN+ RXCLKIN- | LVDS Clock Input | |
| DE | Display Enable | |
| VS | Vertical Sync | |
| HS | Horizontal Sync | |

5. OPTICAL CHARACTERISTICS

5.1 TEST CONDITIONS

| Item | Symbol | Value | Unit |
|---------------------|---|-------|------|
| Ambient Temperature | Ta | 25±2 | °C |
| Ambient Humidity | Ha | 50±10 | %RH |
| Supply Voltage | V _{CC} | 3.3 | V |
| Convertor Voltage | According to typical value in "3. ELECTRICAL CHARACTERISTICS" | | |
| Convertor Duty | | | |

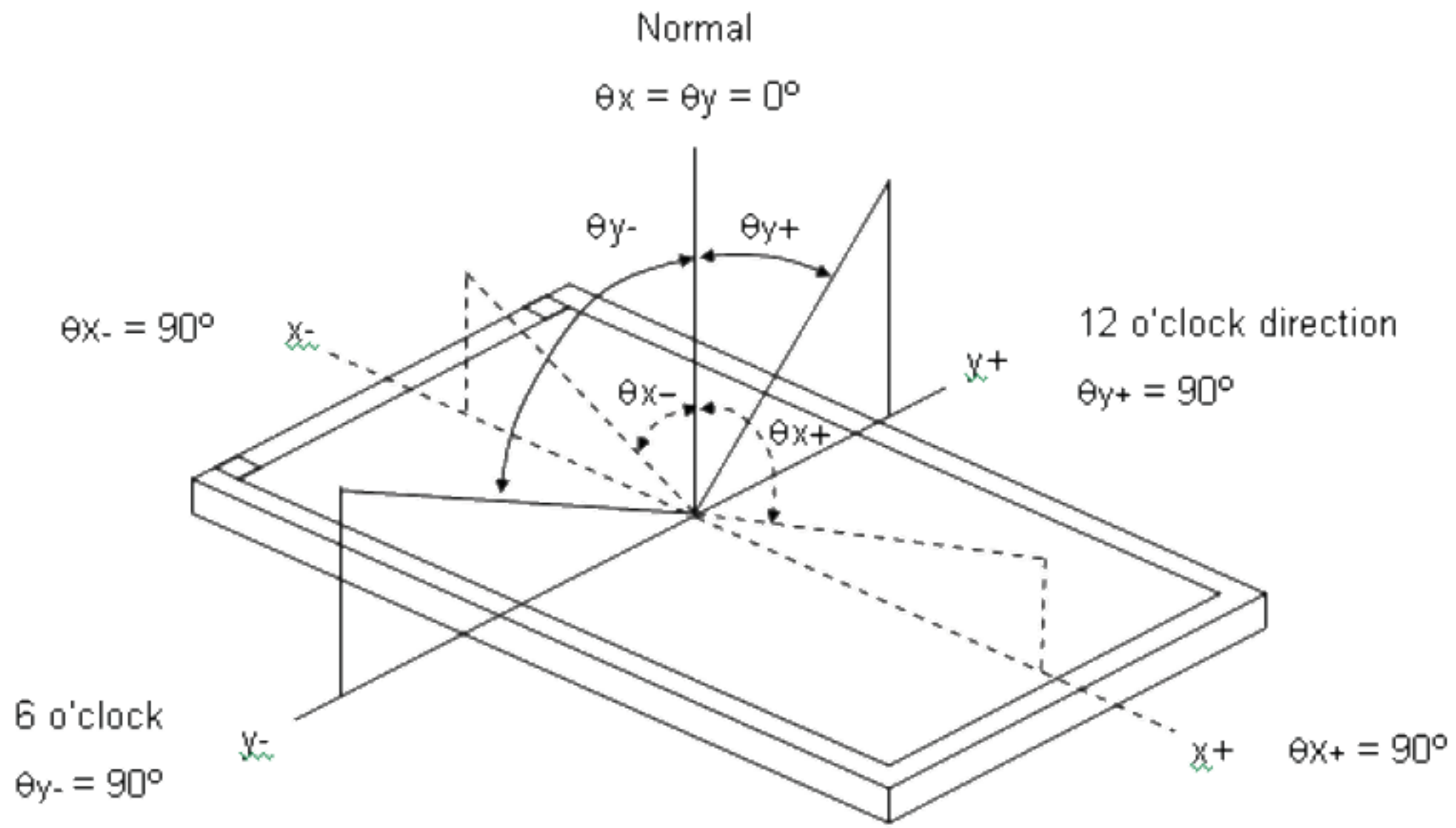
The relative measurement methods of optical characteristics are shown in 5.2. and all items are measured at the center point of screen except white variation. The following items should be measured under the test conditions described in 5.1 and stable environment shown in Note (5).

5.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 5.2. The following items should be measured under the test conditions described in 5.1 and stable environment shown in Note (5).

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit | Note | |
|-------------------------|------------------|--|----------------|-------------------|---------|-------------------|-------------------|----------|
| Contrast Ratio | CR | $\theta_x=0^\circ, \theta_y=0^\circ$ Viewing Normal Angle | | (1000) | - | - | (2), (5) | |
| Response Time | T _R | | - | (15) | | ms | (3) | |
| | T _F | | - | (12) | | ms | | |
| Luminance of White (5P) | L _{AVE} | | | (320) | (400) | - | cd/m ² | (4), (5) |
| White Variation | δW | | | - | (1.25) | | - | (5), (6) |
| Color Chromaticity | Red | | R _x | Typ. - 0.05 | (0.652) | Typ. + 0.05 | - | (1), (5) |
| | | | R _y | | (0.338) | | - | |
| | Green | | G _x | | (0.326) | | - | |
| | | | G _y | | (0.608) | | - | |
| | Blue | | B _x | | (0.150) | | - | |
| | | B _y | (0.053) | | - | | | |
| | White | W _x | (0.313) | | - | | | |
| | | W _y | (0.329) | | - | | | |
| Viewing Angle | Horizontal | θ_{x+} | CR≥10 | (88) | - | Deg | (1), (5) | |
| | | θ_{x-} | | (88) | - | | | |
| | Vertical | θ_{y+} | | (88) | - | | | |
| | | θ_{y-} | | (88) | - | | | |

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



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

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

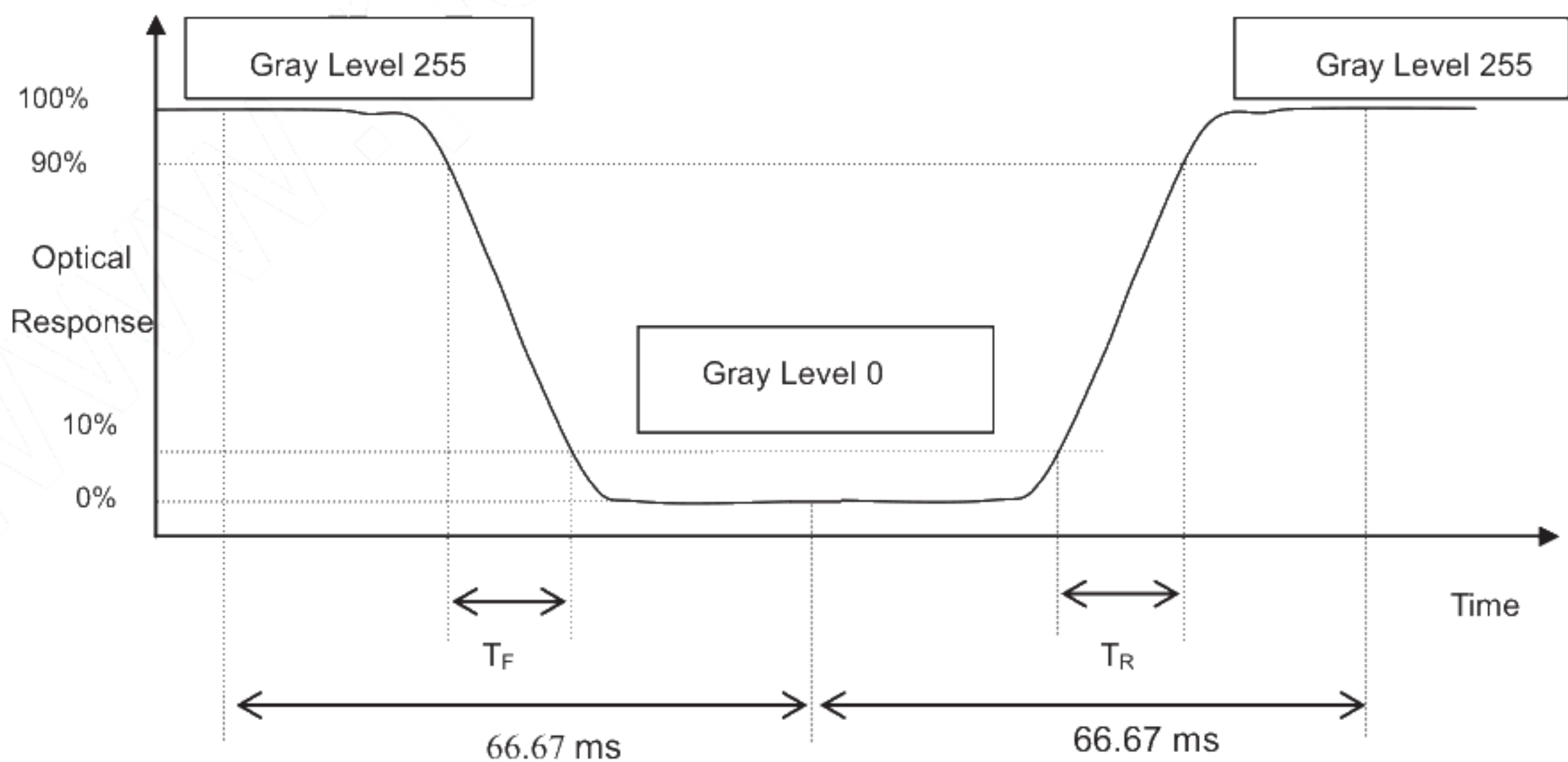
L_{255} : Luminance of gray level 255

L_0 : Luminance of gray level 0

$$CR = CR(5)$$

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

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



Note (4) Definition of Average Luminance of White (L_{AVE}):

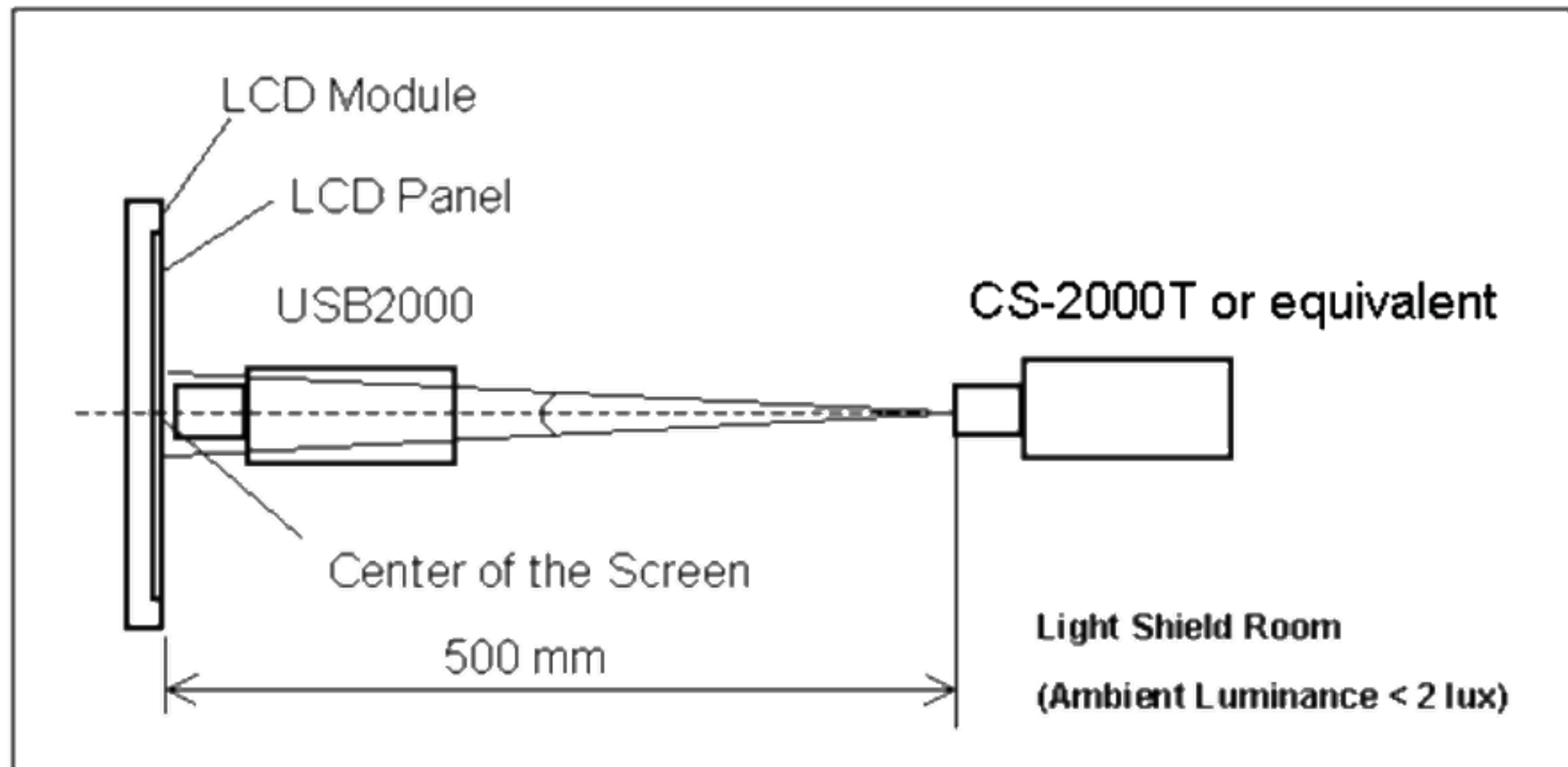
Measure the luminance of gray level 255 at 5 points

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

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

Note (5) Measurement Setup:

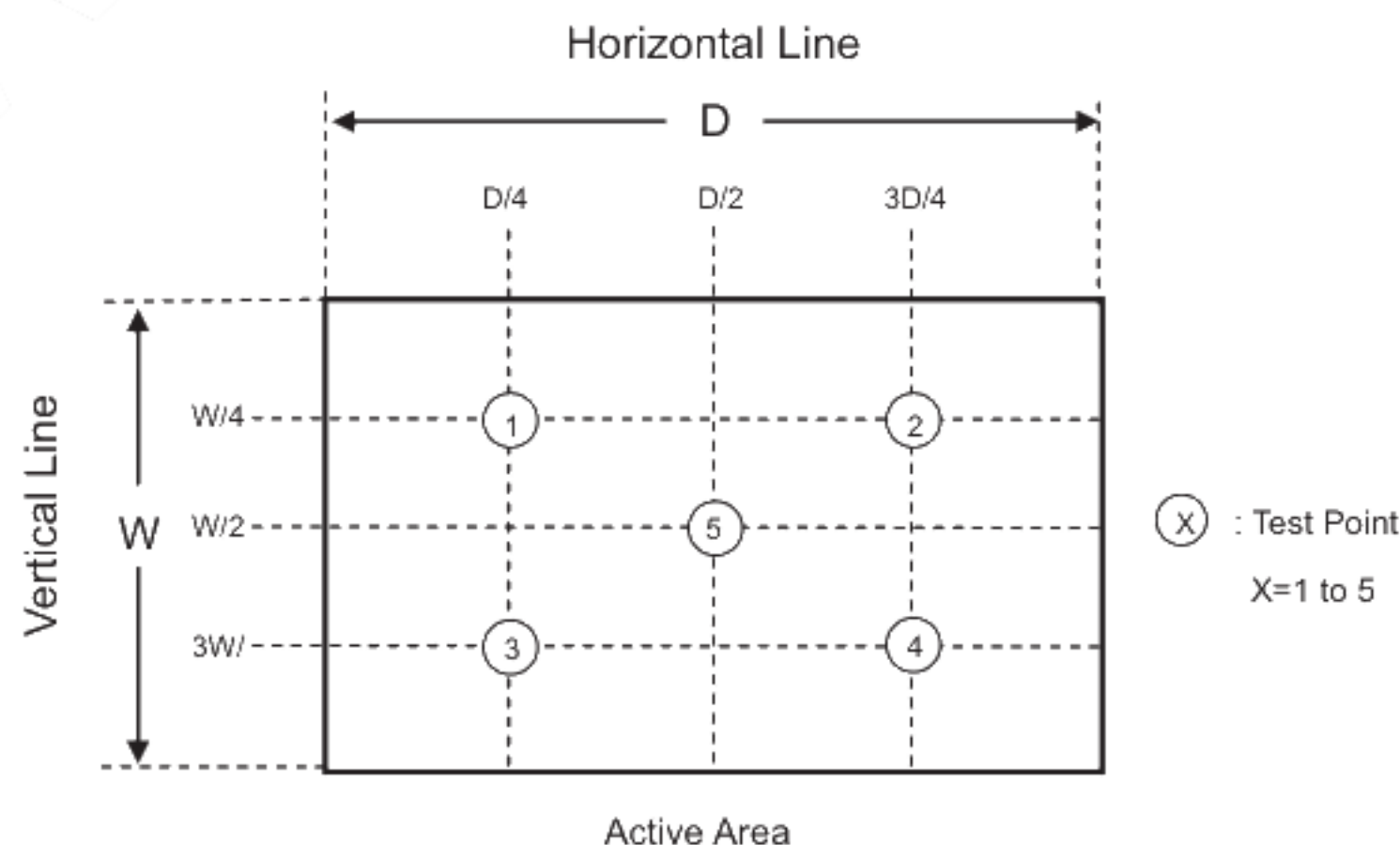
The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



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

Measure the luminance of gray level 255 at 5 points

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



6. Reliability Test Criteria

| Test Item | Test Condition | Note |
|---|--|--------------------|
| High Temperature Storage Test | 70°C, 240 hours | (1),(2) (4),(5) |
| Low Temperature Storage Test | -20°C, 240 hours | |
| Thermal Shock Storage Test | -20°C, 0.5hour< >70°C, 0.5hour; 100cycles, 1hour/cycle | |
| High Temperature Operation Test | 70°C, 240 hours | |
| Low Temperature Operation Test | -20°C, 240 hours | |
| High Temperature & High Humidity Operation Test | 60°C, 90%RH, 240hours | (1),(2) (4),(6) |
| Shock (Non-Operating) | 200G, 2ms, half sine wave, 1 time for ± X, ± Y, ± Z direction | (2), (3) |
| Vibration (Non-Operating) | 1.5G, 10 ~ 300 Hz sine wave, 10 min/cycle, 3 cycles each X, Y, Z direction | (2), (3) |

Note (1) There should be no condensation on the surface of panel during test.

Note (2) Temperature of panel display surface area should be 73°C Max.

Note (3) 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.

Note (4) In the standard conditions, there is no function failure issue occurred. All the cosmetic specification

is judged before reliability test.

Note (5) Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

Note (6) Before cosmetic and function test, the product must have enough recovery time, at least 24 hours at room temperature.

7. PACKAGING

7.1 PACKING SPECIFICATIONS

- (1) 20pcs LCD modules / 1 Box
- (2) Box dimensions: 465 (L) X 362 (W) X 314 (H) mm
- (3) Weight: approximately 17Kg (20 modules per box)

7.2 PACKING METHOD

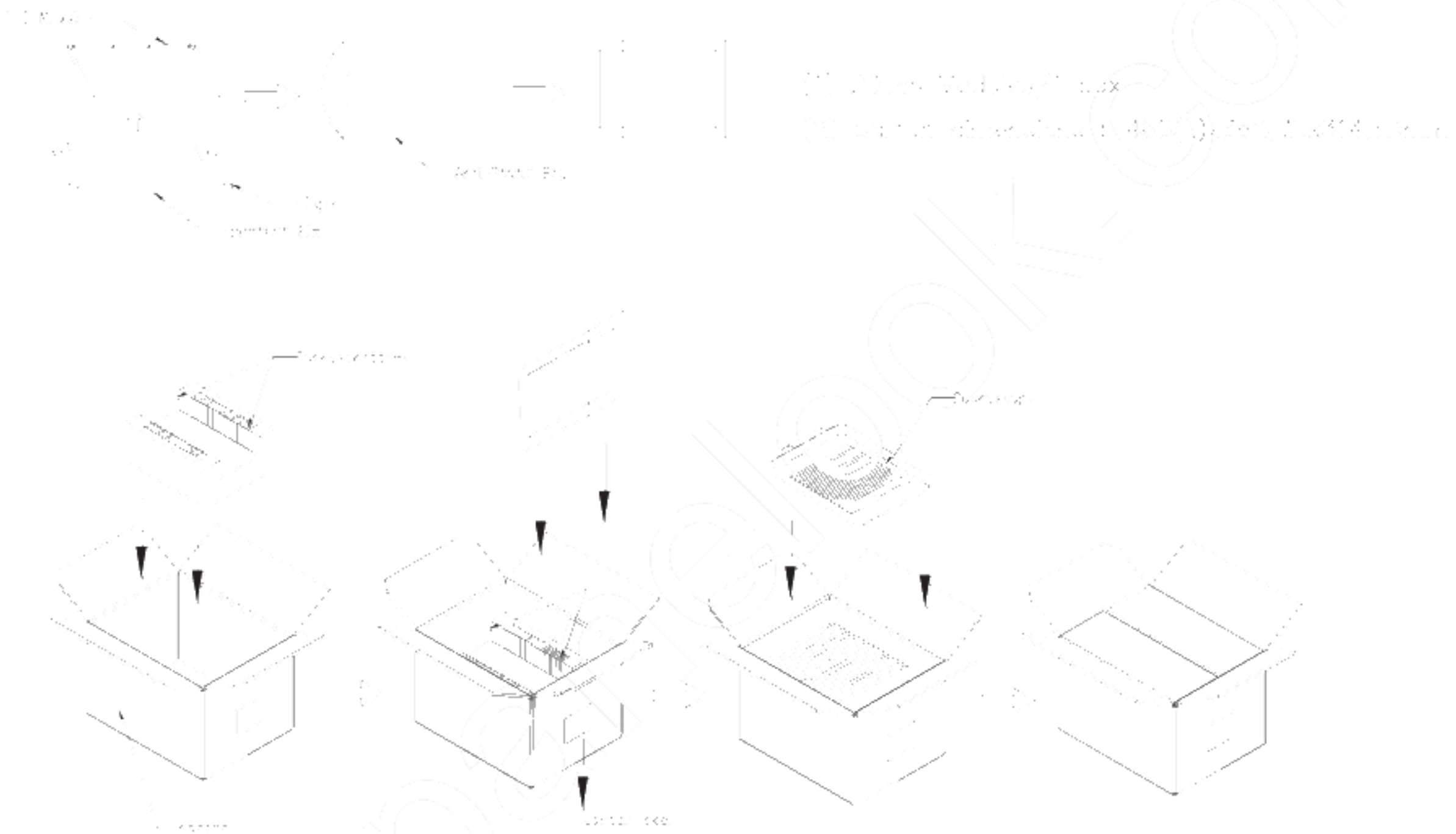


Figure. 7-1 Packing

Sea / Land Transportation (40ft Container)

Air Transportation

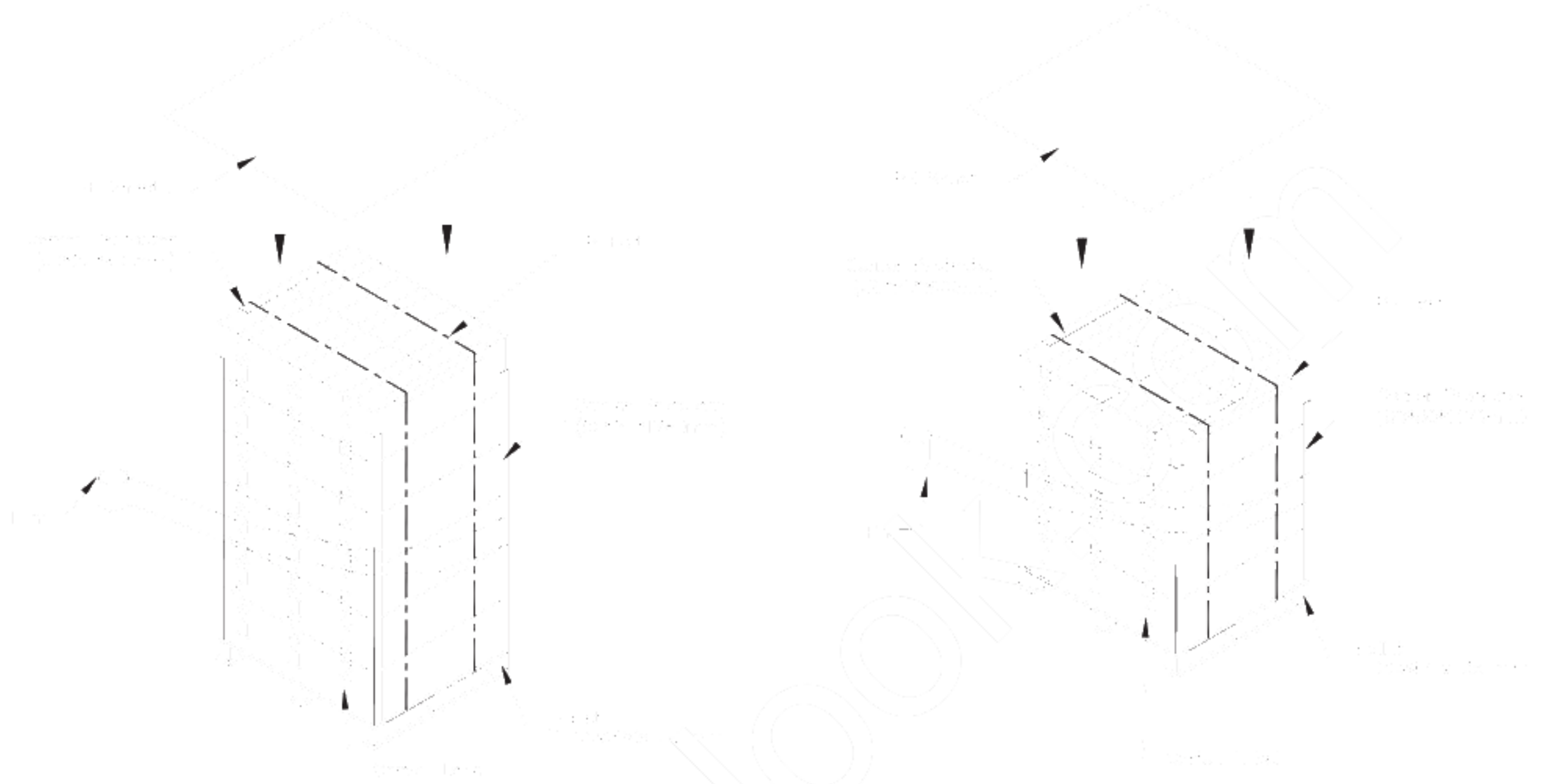


Figure. 7-2 Packing

7.3 UN-PACKING METHOD

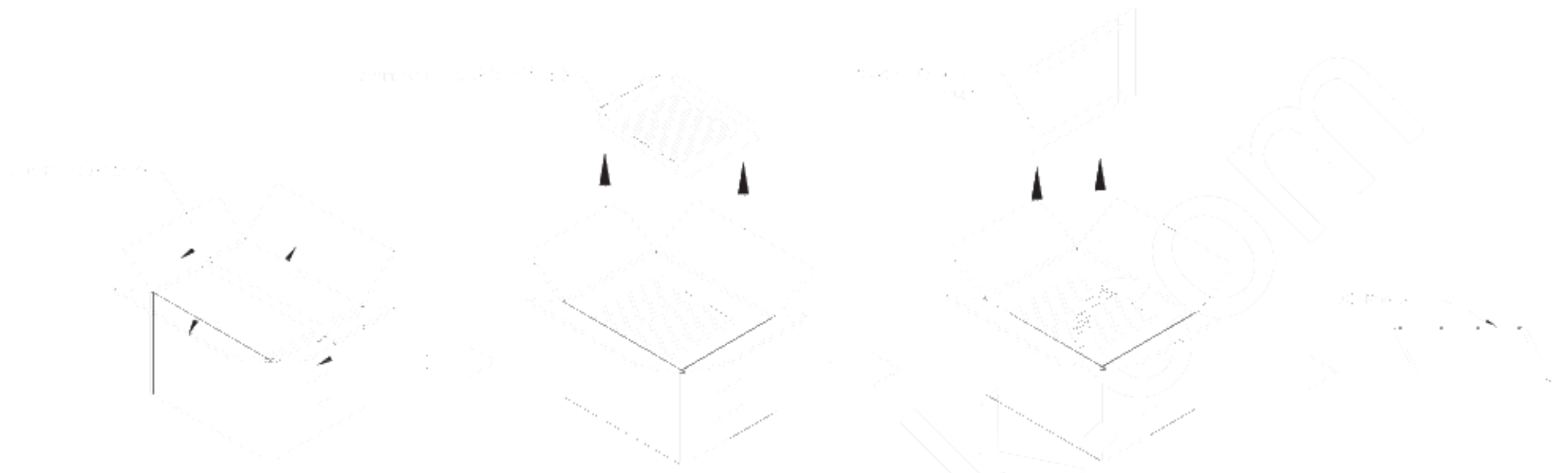
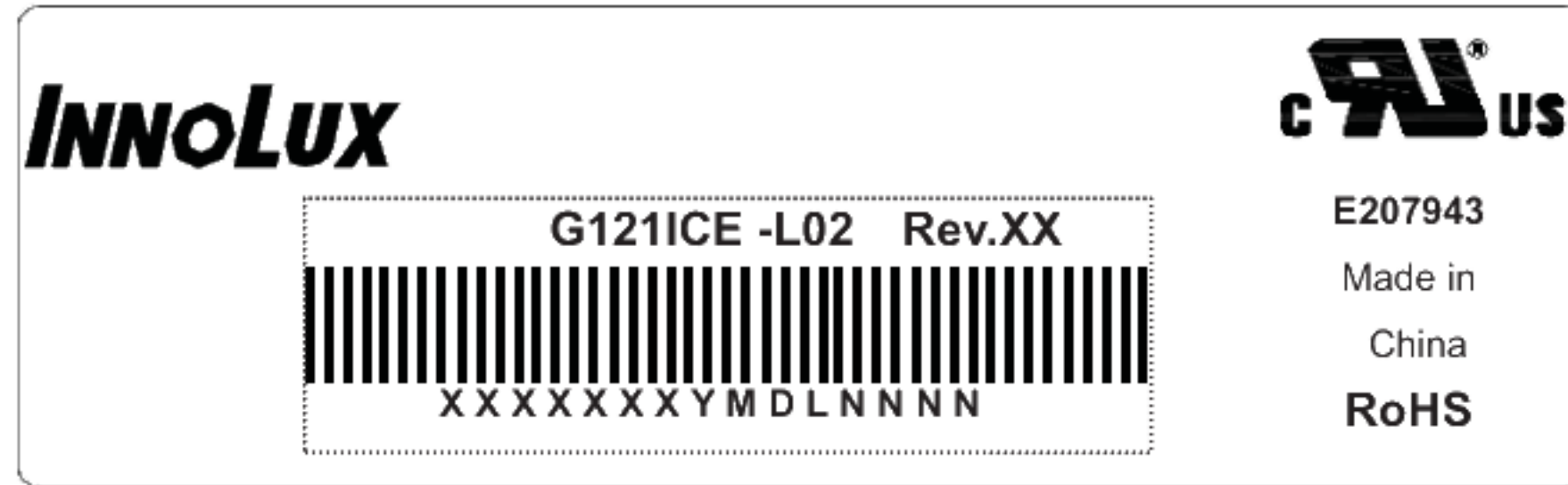


Figure. 7-3 UN-Packing

8. MODULE LABEL

8.1 MODULE LABEL

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



(a) Model Name: G121ICE-L02

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

(c) INX barcode definition:

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

| Code | Meaning | Description |
|------|------------------|---|
| XX | INX internal use | - |
| XX | Revision | Cover all the change |
| X | INX internal use | - |
| XX | INX internal use | - |
| YMD | Year, month, day | Year: 0~9, 2001=1, 2002=2, 2003=3...2010=0, 2011=1, 2012=2... Month: 1~12=1, 2, 3, ~, 9, A, B, C Day: 1~31=1, 2, 3, ~, 9, A, B, C, ~, W, X, Y, exclude I, O, and U. |
| L | Product line # | Line 1=1, Line 2=2, Line 3=3, ... |
| NNNN | Serial number | Manufacturing sequence of product |

9. PRECAUTIONS

9.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.
- (2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.
- (3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.
- (5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.
- (6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.
- (7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.
- (8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.
- (9) Do not disassemble the module.
- (10) Do not pull or fold the lamp wire.
- (11) Pins of I/F connector should not be touched directly with bare hands.

9.2 STORAGE PRECAUTIONS

- (1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.
- (3) It may reduce the display quality if the ambient temperature is lower than 10 °C. For example, the response time will become slowly, and the starting voltage of lamp will be higher than the room temperature.

9.3 OPERATION PRECAUTIONS

- (1) Do not pull the I/F connector in or out while the module is operating.
- (2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.
- (3) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with converter. Do not disassemble the module or insert anything into the Backlight unit.

9.4 OTHER PRECAUTIONS

- (1) When fixed patterns are displayed for a long time, remnant image is likely to occur.

10. MECHANICAL CHARACTERISTICS

