☐ Tentative Specification
☐ Preliminary Specification
■ Approval Specification

# MODEL NO.: G150XNE
# SUFFIX: L03

**Customer:**

**APPROVED BY**　　　　**SIGNATURE**

**Name / Title**

Note

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

| Approved By | Checked By | Prepared By |
|:---:|:---:|:---:|
| 阮泰郎 | 林秋森 | 吳承旻 |

# CONTENTS

# REVISION HISTORY

| Version | Date | Page | Description |
|---|---|---|---|
| Ver 3.0 | 10 Apr 2017 | All | Approval Specification was first issued. |
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# 1. GENERAL DESCRIPTION

## 1.1 OVERVIEW

G150XNE-L03 is a 15.0" TFT Liquid Crystal Display IAV module with LED Backlight units and 20 pins LVDS interface. This module supports 1024 x 768 XGA mode and can display 16.2M/262k colors.

The PSWG is to establish a set of displays with standard mechanical dimensions and select electrical interface requirements for an industry standard 15.0" XGA LCD panel and the LED driving device for Backlight is built in PCBA.

## 1.2 FEATURE

- XGA (1024 x 768 pixels) resolution

- DE (Data Enable) only mode

- LVDS Interface with 1pixel/clock

- PSWG (Panel Standardization Working Group)

- Wide operating temperature.

- RoHS compliance

## 1.3 APPLICATION

-TFT LCD Monitor

- Factory Application

- Amusement

- Vehicle

## 1.4 GENERAL SPECIFICATI0NS

| Item | Specification | Unit | Note |
|---|---|---|---|
| Active Area | 304.1 (H) x 228.1(V) (15.0" diagonal) | mm | (1) |
| Bezel Opening Area | 307.4(H) x 231.3(V) | mm | |
| Driver Element | a-Si TFT active matrix | - | - |
| Pixel Number | 1024 x R.G.B x 768 | pixel | - |
| Pixel Pitch | 0.297(H) x 0.297(W) | mm | - |
| Pixel Arrangement | RGB vertical Stripe | - | - |
| Display Colors | 16.2M / 262K | color | - |
| Display Mode | Normally Black | - | - |
| Surface Treatment | Hard Coating (3H), Anti-Glare | - | - |
| Module Power Consumption | 7.4 | W | Max. |

## 1.5 MECHANICAL SPECIFICATIONS

| Item | | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Module Size | Horizontal(H) | 326.0 | 326.5 | 327.0 | mm | (1) |
| | Vertical(V) | 253.0 | 253.5 | 254.0 | mm | |
| | Depth(D) | 8.6 | 9.1 | 9.6 | mm | (1)(2) |
| Bezel Area | Horizontal | 307.1 | 307.4 | 307.7 | mm | - |
| | Vertical | 231.0 | 231.3 | 231.6 | mm | |
| Active Area | Horizontal | - | 304.1 | - | mm | |
| | Vertical | - | 228.1 | - | mm | |
| Weight | | - | 960 | 1000 | g | |

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

Note (2) The depth is without connector.
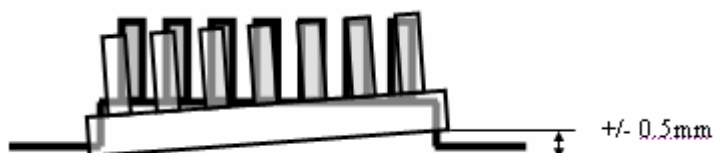
## 2. ABSOLUTE MAXIMUM RATINGS

### 2.1 ABSOLUTE RATINGS OF ENVIRONMENT

| Item | Symbol | Value | | Unit | Note |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Operating Ambient Temperature | $T_{OP}$ | -20 | +70 | ℃ | (1)(2)(3) |
| Storage Temperature | $T_{ST}$ | -30 | +70 | ℃ | (1)(2)(3) |

Note (1) Temperature and relative humidity range is shown in the figure below.

Note (2) 90 %RH Max. (Ta < 40℃).

Note (3) Wet-bulb temperature should be 39℃ Max.
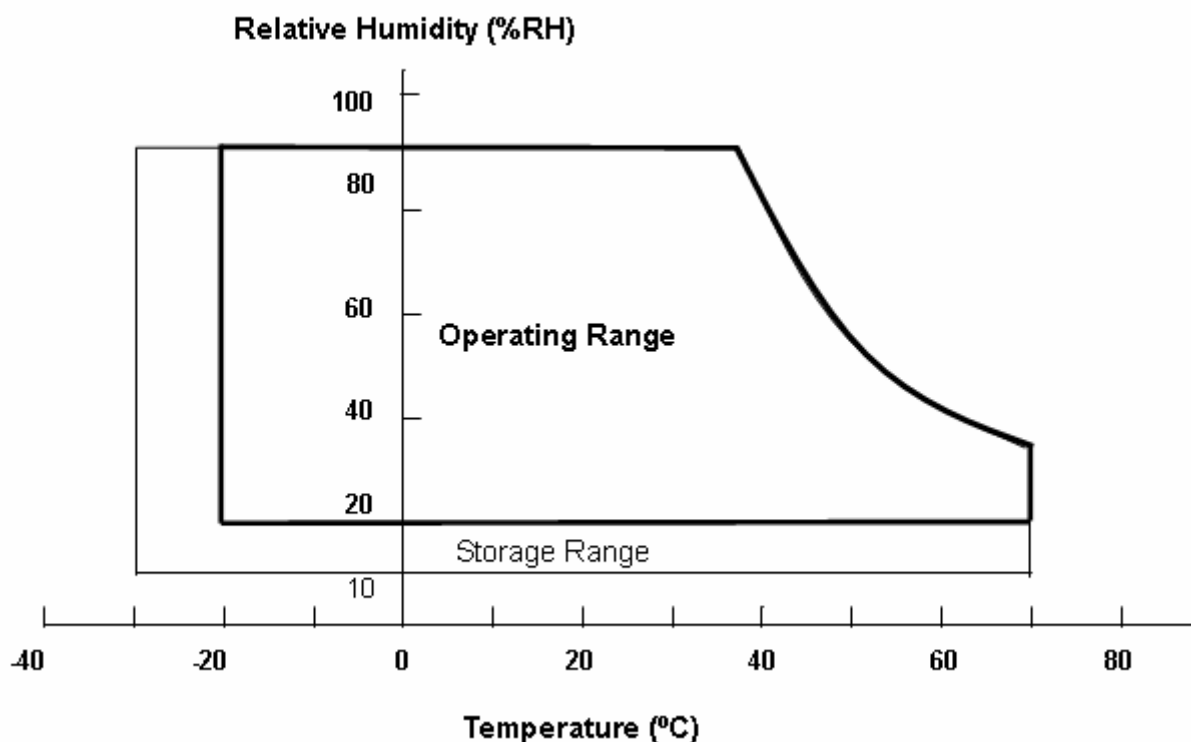
## 2.2 ELECTRICAL ABSOLUTE RATINGS

### 2.2.1 TFT LCD MODULE

| Item | Symbol | Value | | Unit | Note |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Power Supply Voltage | VCC | -0.3 | 4 | V | (1) |

### 2.2.2 BACKLIGHT UNIT

| Item | Symbol | Value | | Unit | Note |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Converter Voltage | Vi | -0.3 | 18 | V | (1) , (2) |
| Enable Voltage | EN | --- | 5.5 | V | |
| Backlight Adjust | Dimming | --- | 5.5 | V | |

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation

should be restricted to the conditions described under Normal Operating Conditions.

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

# 3. ELECTRICAL CHARACTERISTICS

## 3.1 TFT LCD MODULE

| Parameter | | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| Power Supply Voltage | | $V_{CC}$ | 3.0 | 3.3 | 3.6 | V | - |
| Ripple Voltage | | $V_{RP}$ | - | - | 100 | mVp-p | |
| Rush Current | | $I_{RUSH}$ | - | - | 2.0 | A | (2) |
| Power Supply Current | White | Icc | - | 800 | 960 | mA | (3)a |
| | Black | | - | 670 | 800 | mA | (3)b |
| LVDS differential input voltage | | Vid | 200 | - | 600 | mV | |
| LVDS common input voltage | | Vic | 1.0 | 1.2 | 1.4 | V | |
| Differential Input Voltage for LVDS Receiver Threshold | "H" Level | $V_{IH}$ | - | - | 100 | mV | - |
| | "L" Level | $V_{IL}$ | -100 | - | - | mV | - |
| Terminating Resistor | | $R_T$ | - | 100 | - | Ohm | - |

Note (1)The module should be always operated within above ranges.
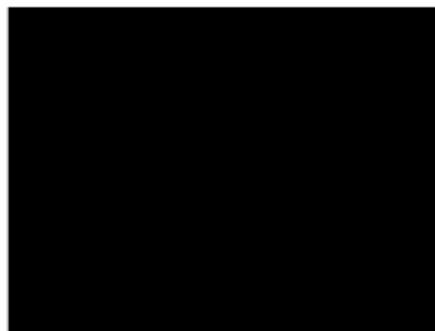
Note (2)Measurement Conditions:





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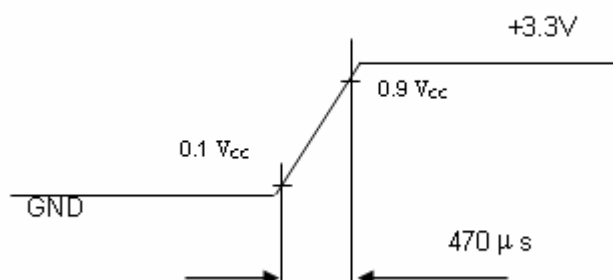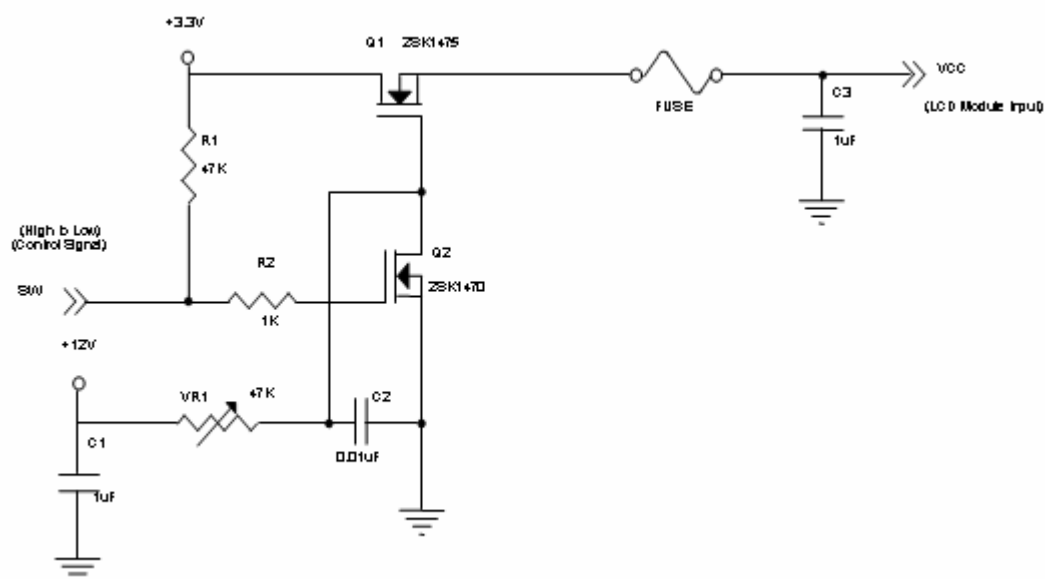
Note (3) The specified power supply current is under the conditions at $V_{DD}$ =3.3V, Ta = 25 ± 2 ℃, DC Current and $f_v$ = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern

Active Area

b. Black Pattern

Active Area

## 3.2 BACKLIGHT UNIT

Ta = 25 ± 2 ℃

| Parameter | | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| Converter Power Supply Voltage | | $V_i$ | 10.8 | 12.0 | 13.2 | V | |
| Converter Power Supply Current | | $I_i$ | 0.23 | 0.29 | 0.35 | A | @ Vi = 12V (Duty 100%) |
| Backlight Power Consumption | | $P_{BL}$ | - | 3.5 | 4.2 | W | @ Vi = 12V (Duty 100%) |
| EN Control Level | Backlight on | - | 2.0 | 3.3 | 5.0 | V | |
| | Backlight off | | 0 | --- | 0.8 | V | |
| PWM Dimming Control Level | PWM High Level | - | 2.0 | 3.3 | 5.0 | V | |
| | PWM Low Level | | 0 | - | 0.15 | V | |
| PWM Dimming Control Duty Ratio | | - | 1 | - | 100 | % | @200Hz |
| PWM Dimming Control Frequency | | $f_{PWM}$ | 190 | 200 | 20k | Hz | (2) |
| LED Life Time | | $L_L$ | 50,000 | 70,000 | - | Hrs | (3) |

Note (1)  LED current is measured by utilizing a high frequency current meter as shown below:
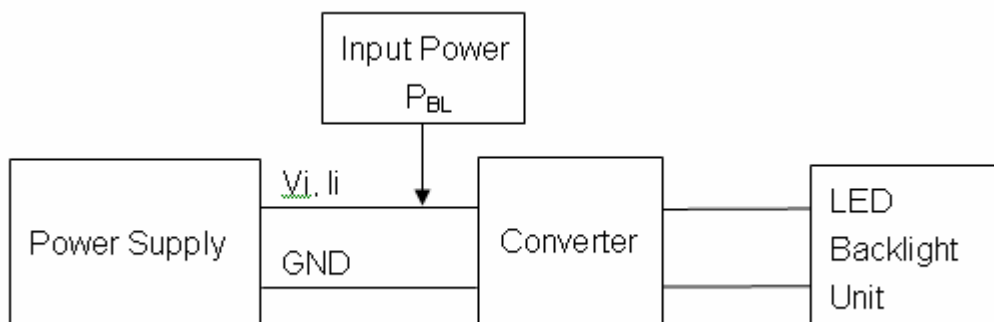
Note (2) At 20k Hz PWM control frequency，duty ratio range is restricted from 20% to 100%.

Note (3) The lifetime of LED is estimated data and defined as the time when it continues to operate under the conditions at Ta = 25 ±2 ℃ and Duty 100% until the brightness becomes ≦ 50% of its original value. Operating LED under high temperature environment will reduce life time and lead to color shift.

Power sequence and control signal timing are shown in the following figure
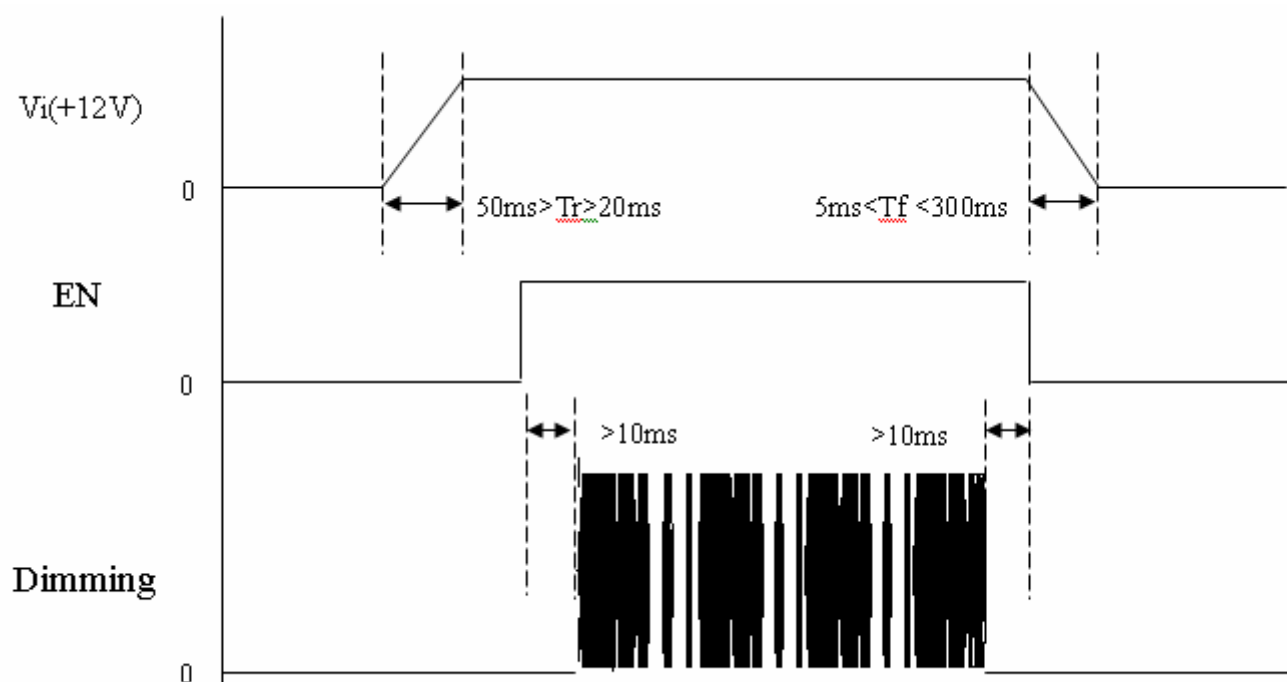


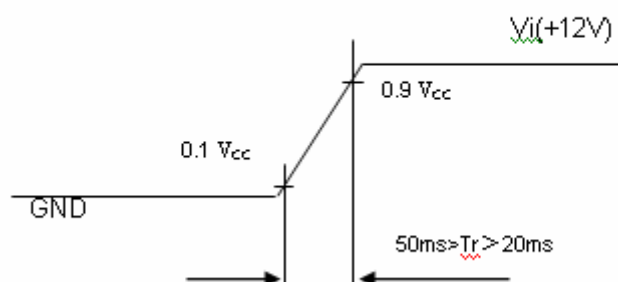Note： While system is turned ON or OFF, the power sequences must follow as below descriptions
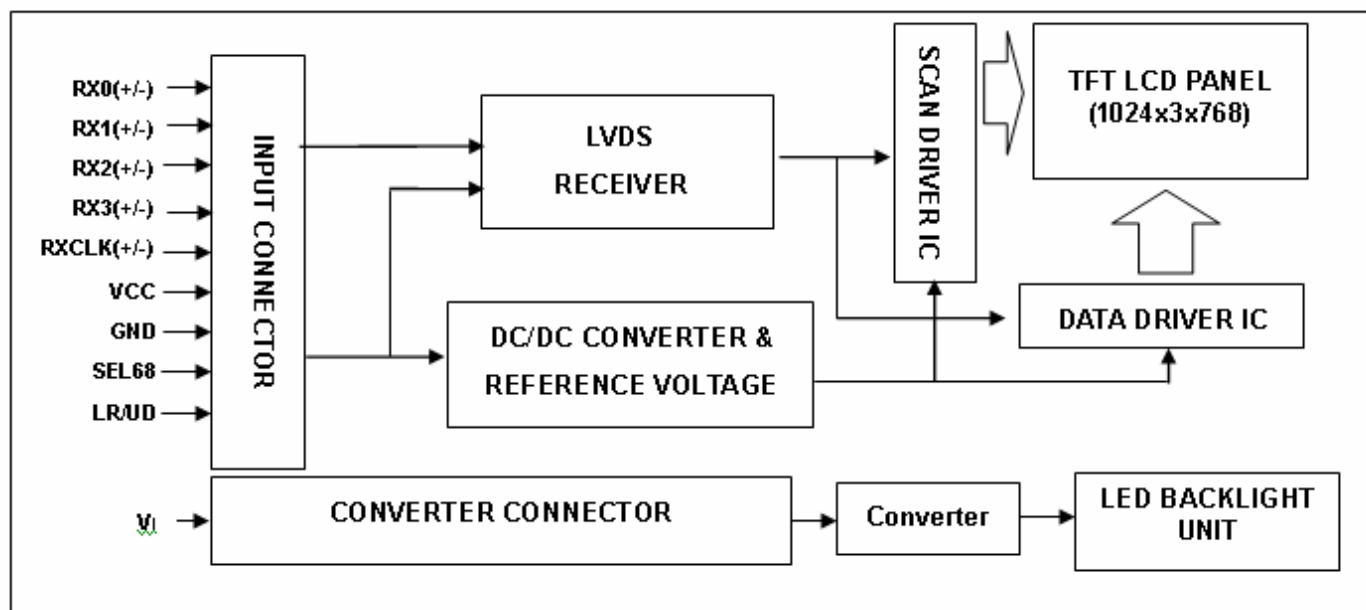
Turn ON sequence: Vi(+12V) → EN → Dimming

Turn OFF sequence: Dimming → EN → Vi(+12V)

Note (4)

## 4. BLOCK DIAGRAM

### 4.1 TFT LCD MODULE

## 5. INPUT TERMINAL PIN ASSIGNMENT

### 5.1 TFT LCD MODULE

| Pin No. | Symbol | Function | Polarity | Note |
|---------|--------|----------|----------|------|
| 1 | VCC | Power Supply +3.3V(typical) | | |
| 2 | VCC | Power Supply +3.3V(typical) | | |
| 3 | GND | Ground | | |
| 4 | LR/UD | Reverse Scan Control H or NC = Normal Mode. L = Horizonta/ Vertical Reverse Scan. | | Note (3) |
| 5 | RX0- | LVDS Differential Data Input | Negative | |
| 6 | RX0+ | LVDS Differential Data Input | Positive | |
| 7 | GND | Ground | | |
| 8 | RX1- | LVDS Differential Data Input | Negative | |
| 9 | RX1+ | LVDS Differential Data Input | Positive | |
| 10 | GND | Ground | | |
| 11 | RX2- | LVDS Differential Data Input | Negative | |
| 12 | RX2+ | LVDS Differential Data Input | Positive | |
| 13 | GND | Ground | | |
| 14 | RXCLK- | LVDS Differential Data Input | Negative | |
| 15 | RXCLK+ | LVDS Differential Data Input | Positive | |
| 16 | GND | Ground | | |
| 17 | RX3- | LVDS Differential Data Input | Negative | |
| 18 | RX3+ | LVDS Differential Data Input | Positive | |
| 19 | GND | Ground | | |
| 20 | SEL68 | LVDS 6/8 bit select function control, High → 6bit Input Mode Low or NC → 8bit Input Mode | | Note (3) |

Note (1) Connector Part No.: Cvilux CID520D1HR0-NH or equivalent.

Note (2) User's connector Part No.: Hirose DF14-20S-1.25C or equivalent.

Note (3) "Low" stands for 0V. "High" stands for 3.3V. "NC" stands for "No Connection".
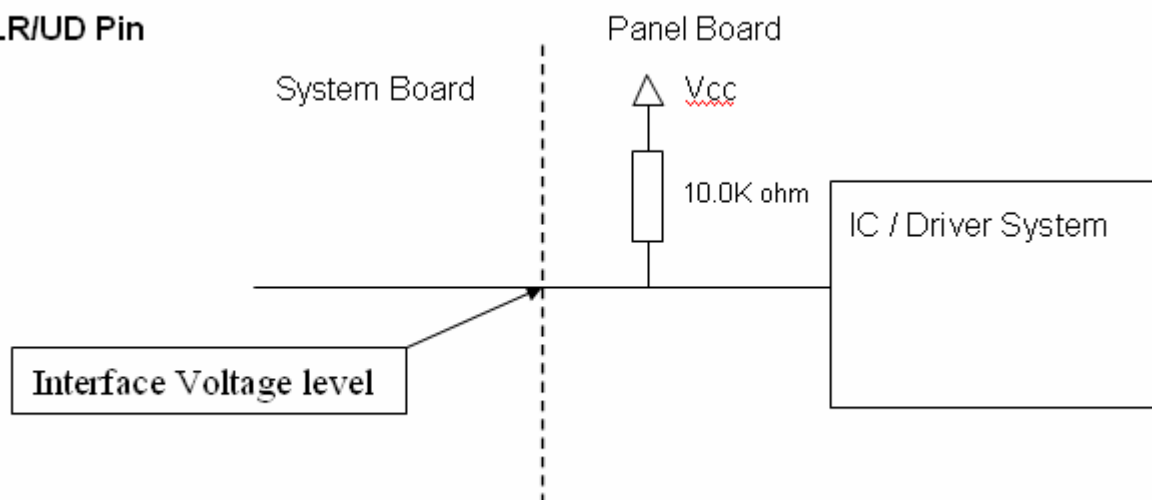
SEL68 Pin
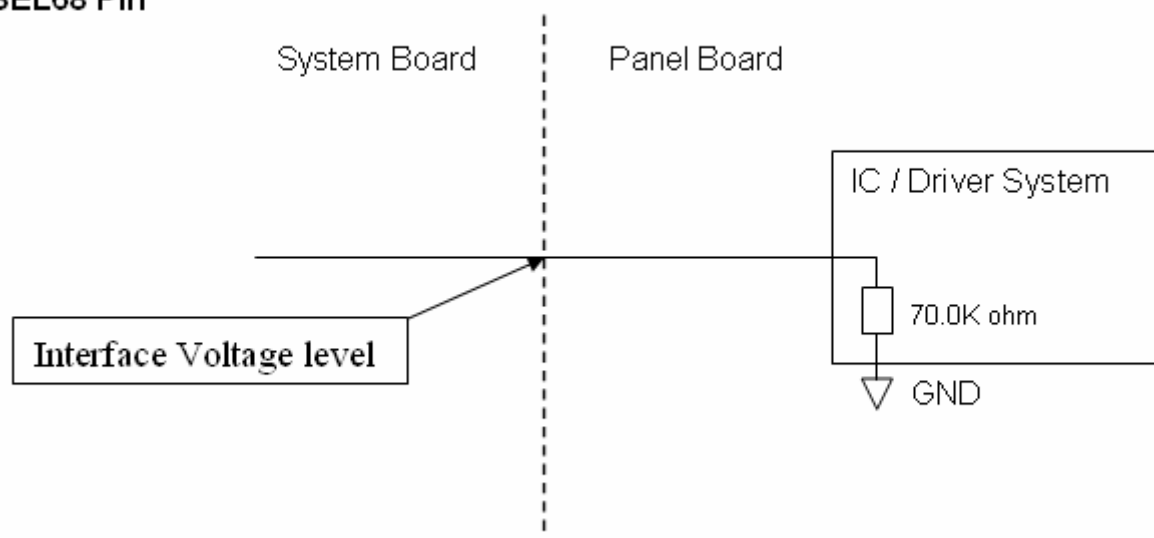


## 5.2 BACKLIGHT UNIT(Converter connector pin)

| Pin | Symbol | Description | Remark |
|---|---|---|---|
| 1 | $V_i$ | Converter input voltage | 12V |
| 2 | $V_{GND}$ | Converter ground | Ground |
| 3 | EN | Enable pin | 3.3V |
| 4 | Dimming | Backlight Adjust | PWM Dimming (Hi: $3.3V_{DC}$, Lo: $0V_{DC}$) |
| 5 | NC | Not Connect | |

Note (1)Connector Part No.: CI4205M2HRP-NH (Cvilux) or equivalent.

Note (2)User's connector Part No.: MOLEX 51146-0500 or equivalent.
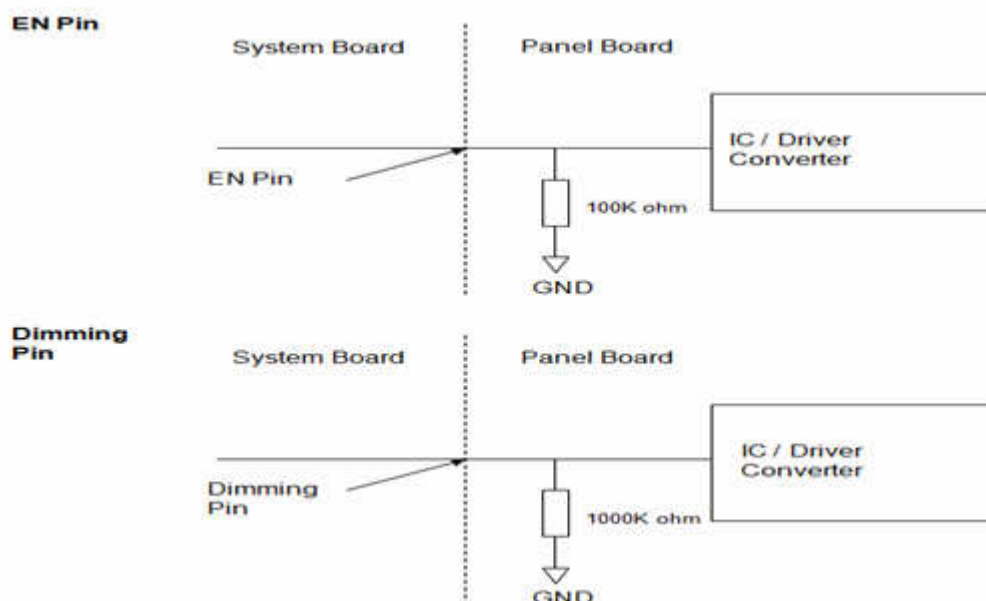
## 5.3 COLOR DATA INPUT ASSIGNMENT

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(252) | 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(252) | 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(252) | 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(252) | 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(252) | 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(252) | 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(252) | 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(252) | 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(252) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

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

## 6. INTERFACE TIMING

### 6.1 INPUT SIGNAL TIMING SPECIFICATIONS

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

| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| LVDS Clock | Frequency | Fc | 53.35 | 65 | 80 | MHz | - |
| | Period | Tc | 12.5 | 15.38 | 18.75 | ns | |
| | Input cycle to cycle jitter | $T_{rcl}$ | --- | --- | 200 | ns | (a) |
| | Input Clock to data skew | TLVCCS | -0.02*Tc | - | 0.02*Tc | ps | (b) |
| | Spread spectrum modulation range | $F_{clkin\_mod}$ | - | - | 1.02*Fc | MHz | (c) |
| | Spread spectrum modulation frequency | $F_{SSM}$ | - | - | 200 | KHz | |
| Vertical Display Term | Frame Rate | Fr | 55 | 60 | 70 | Hz | Tv=Tvd+Tvb |
| | Total | Tv | 780 | 806 | 840 | Th | - |
| | Active Display | Tvd | 768 | 768 | 768 | Th | - |
| | Blank | Tvb | Tv-Tvd | 38 | Tv-Tvd | Th | - |
| Horizontal Display Term | Total | Th | 1240 | 1344 | 1360 | Tc | Th=Thd+Thb |
| | Active Display | Thd | 1024 | 1024 | 1024 | Tc | - |
| | Blank | Thb | Th-Thd | 320 | Th-Thd | Tc | - |

Note (1) Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to

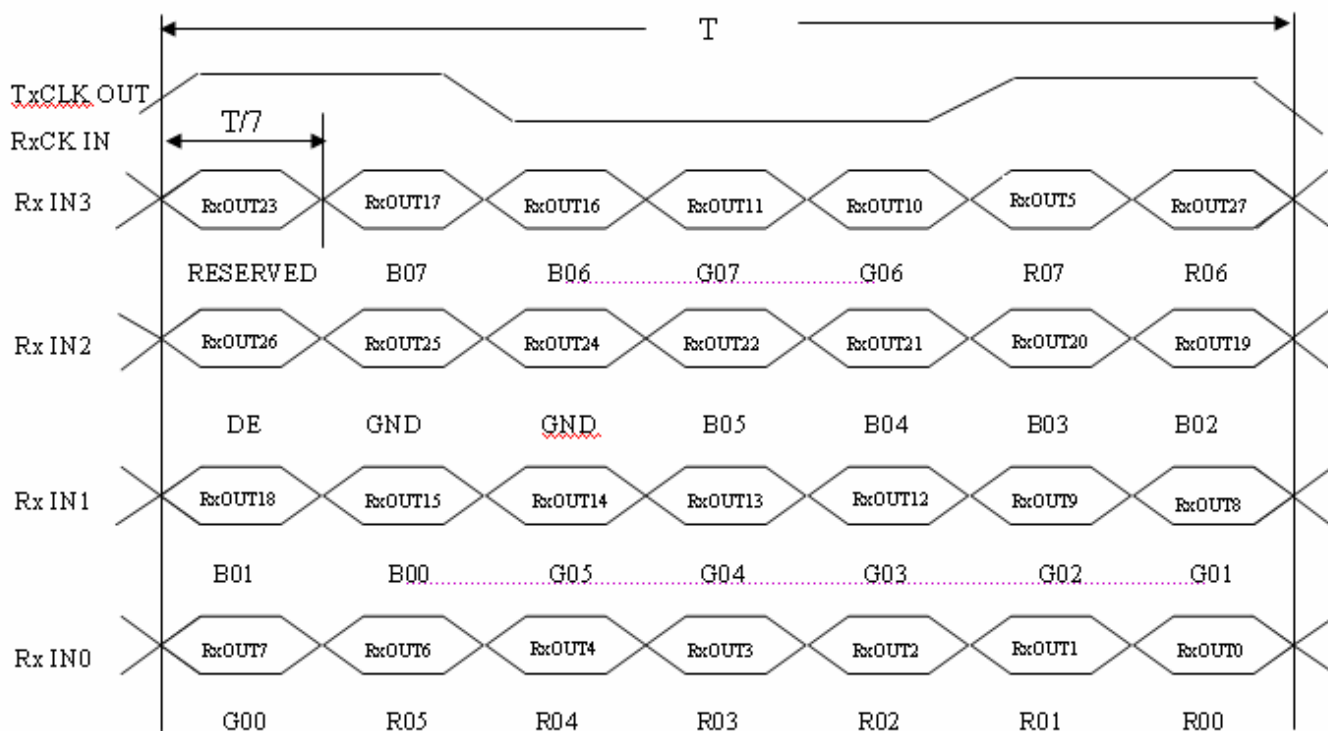low logic level or ground. Otherwise, this module would operate abnormally.

Note (2) The Tv(Tvd+Tvb) must be integer, otherwise, the module would operate abnormally.
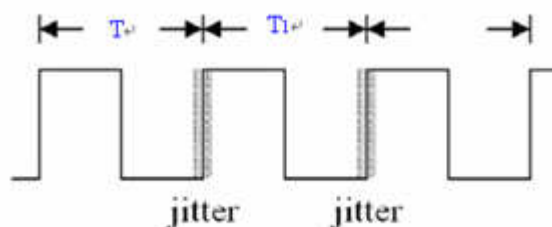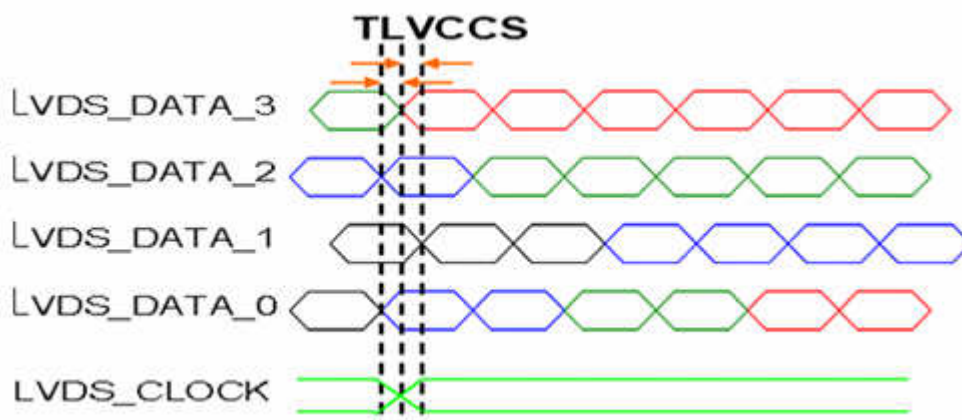
**INPUT SIGNAL TIMING DIAGRAM**
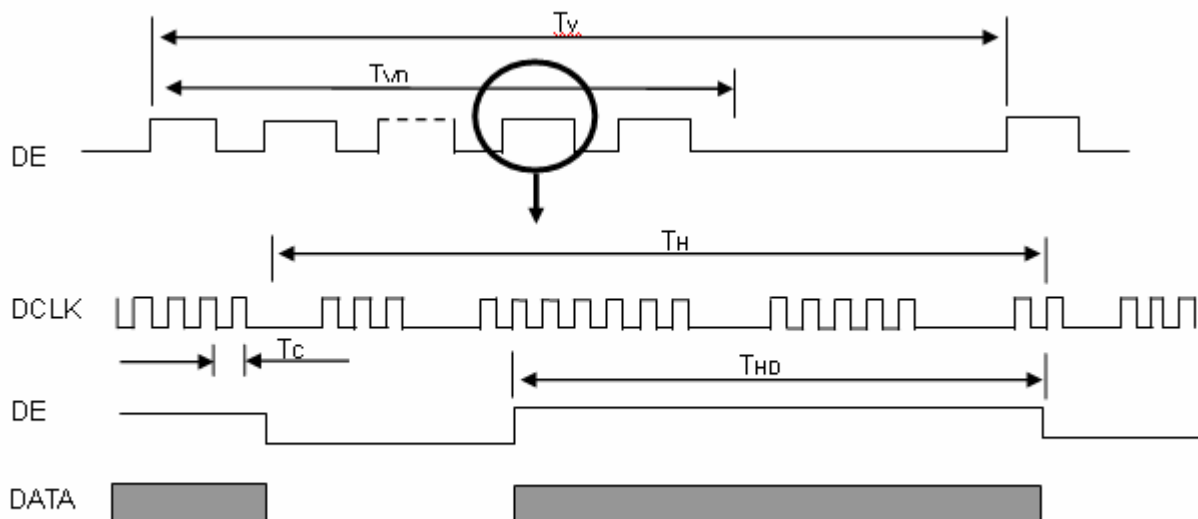
**TIMING DIAGRAM of LVDS**


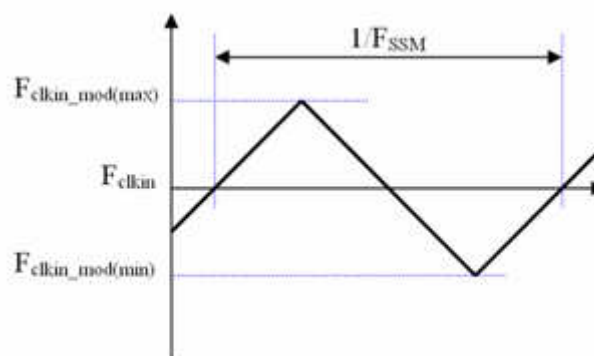
Note (a) The input clock cycle-to-cycle jitter is defined as below figures. Trcl = I T1 – TI



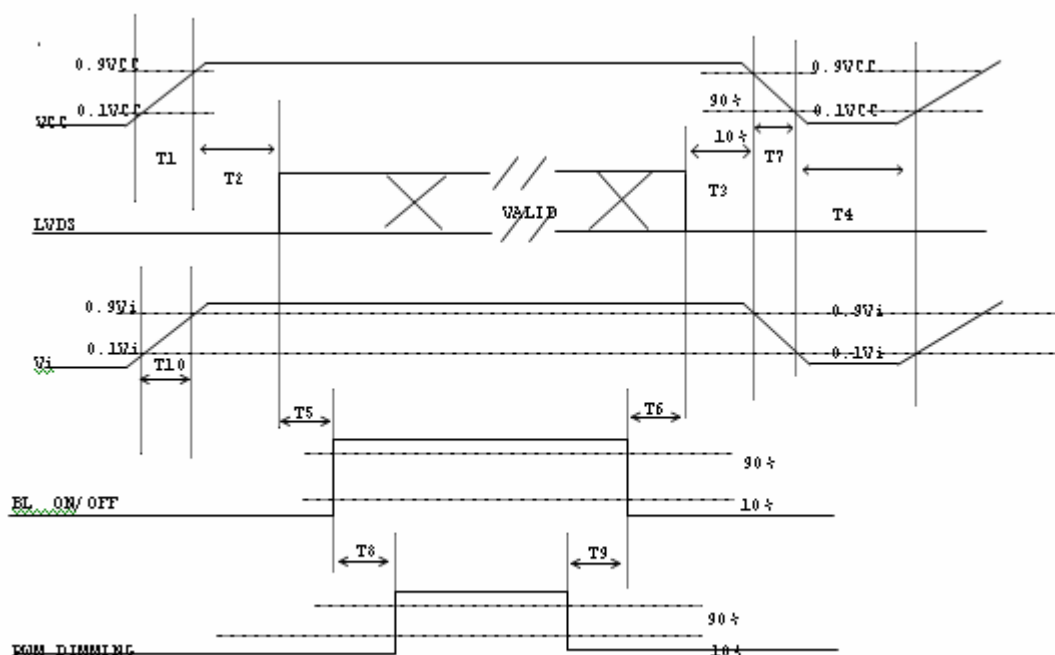Note (b) Input Clock to data skew is defined as below figures.

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



## 6.2 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 | 200 | - | - | ms |
| T6 | 200 | - | - | ms |
| T7 | 5 | - | 300 | ms |
| T8 | 10 | - | - | ms |
| T9 | 10 | - | - | ms |
| T10 | 20 | | 50 | ms |

## 6.3 SCANNING DIRECTION

The following figures show the image see from the front view. The arrow indicates the direction of scan.



**Fig.1 Normal Scan**

**Fig.2 Reverse Scan**

Fig. 1    Normal scan ( pin 4, LR/UD = High or NC )

Fig. 2    Reverse scan (pin 4, LR/UD = Low )

## 7. OPTICAL CHARACTERISTICS

### 7.1 TEST CONDITIONS

| Item | Value | Unit |
|---|---|---|
| Ambient Temperature (Ta) | 25±2 | ℃ |
| Ambient Humidity (Ha) | 50±10 | %RH |
| Supply Voltage | According to typical value in "ELECTRICAL CHARACTERISTICS" | |
| Input Signal | | |
| LED Light Bar Input Current Per Input Pin | | |

### 7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2 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 7.1 and stable environment shown in Note (5).

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Color Chromaticity | Red | Rx | $\theta_x=0°$, $\theta_Y=0°$ CS-1000T | Typ - 0.05 | 0.647 | Typ+ 0.05 | - | (1), (5) |
| | | Ry | | | 0.338 | | | |
| | Green | Gx | | | 0.321 | | | |
| | | Gy | | | 0.606 | | | |
| | Blue | Bx | | | 0.157 | | | |
| | | By | | | 0.039 | | | |
| | White | Wx | | | 0.313 | | | |
| | | Wy | | | 0.329 | | | |
| Center Luminance of White | | $L_C$ | | 240 | 300 | | cd/m$^2$ | (4), (5) |
| Contrast Ratio | | CR | | 1300 | 2000 | | - | (2), (5) |
| Response Time | | $T_R$ | $\theta_x=0°$, $\theta_Y=0°$ | - | 16 | 21 | ms | (3) |
| | | $T_F$ | | - | 7 | 14 | | |
| White Variation | | $\delta W$ | $\theta_x=0°$, $\theta_Y=0°$ USB2000 | - | 1.25 | 1.33 | - | (5), (6) |
| Viewing Angle | Horizontal | $\theta_x+$ | CR $\geqq$ 10 USB2000 | 80 | 88 | - | Deg. | (1), (5) |
| | | $\theta_x-$ | | 80 | 88 | - | | |
| | Vertical | $\theta_Y+$ | | 80 | 88 | - | | |
| | | $\theta_Y-$ | | 80 | 88 | - | | |

Note (1)Definition of Viewing Angle ($\theta x$, $\theta y$):
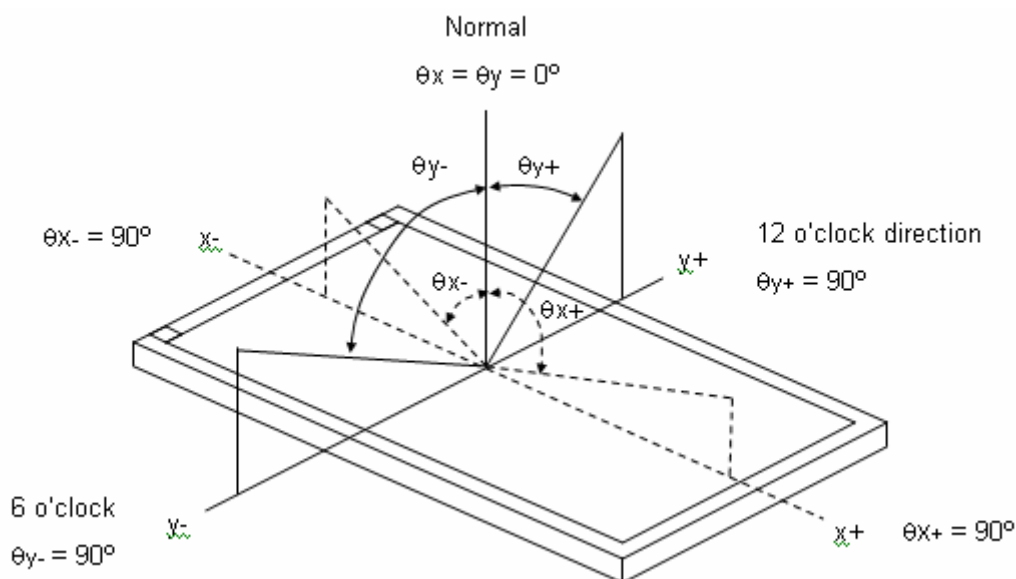


Note (2)Definition of Contrast Ratio (CR):

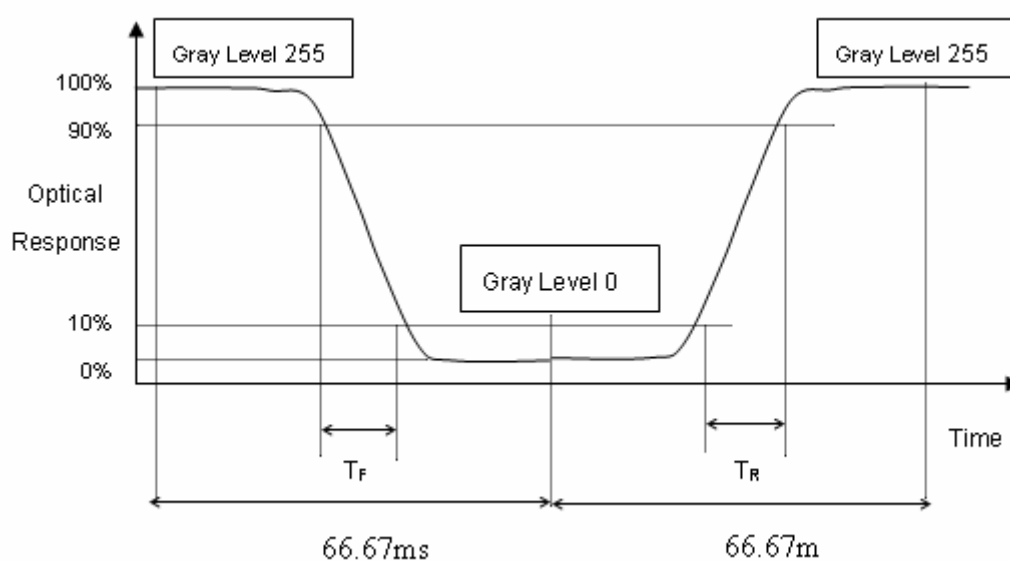The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L255 / L0

L255: Luminance of gray level 255

L0: 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 (TR, TF):

Note (4) Definition of Luminance of White ($L_C$):
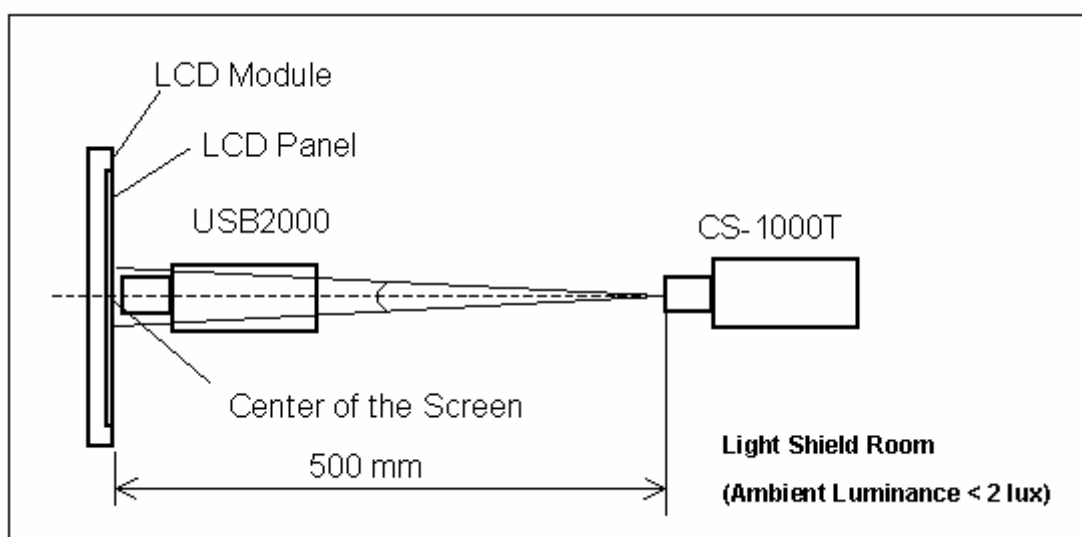
Measure the luminance of gray level 255 at center point

LC = L (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 ($\delta W$):

Measure the luminance of gray level 63 (255) at 9 points

$$\delta W = \frac{\text{Maximum} [L (1), L (2), L (3), L (4), L (5), L (6), L (7), L (8), L (9)]}{\text{Minimum} [L (1), L (2), L (3), L (4), L (5), L (6), L (7), L (8), L (9)]}$$
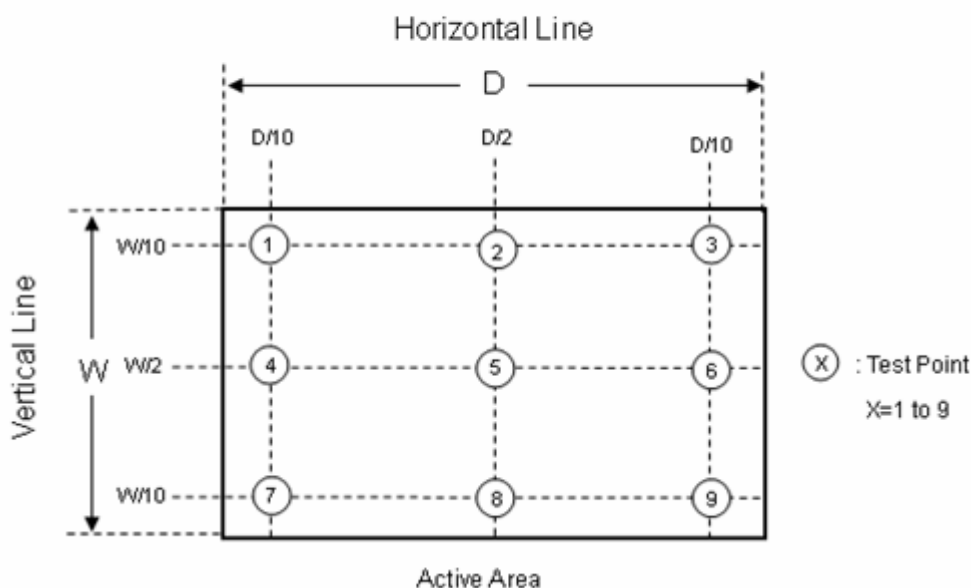
## 8. RELIABILITY TEST CRITERIA

| Test Item | Test Condition | Note |
|---|---|---|
| High Temperature Storage Test | 70℃, 240 hours | (1),(2) (4),(5) |
| Low Temperature Storage Test | -30℃, 240 hours | |
| Thermal Shock Storage Test | -30℃, 0.5 hour⟵⟶70℃, 0.5 hour; 100cycles, 1 hour/cycle) | |
| High Temperature Operation Test | 70℃, 240 hours | |
| Low Temperature Operation Test | -20℃, 240 hours | |
| High Temperature & High Humidity Operation Test | 60℃, RH 90%, 240 hours | (1),(2) (4),(6) |
| ESD Test (Operation) | 150pF, 330Ω, 1 sec/cycle<br>Condition 1 : panel contact, ±8 KV<br>Condition 2 : panel non-contact ±15 KV | (1), (4) |
| Shock (Non-Operating) | 50G, 11ms, 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 73ºC 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.

# 9. PACKAGING

## 9.1 PACKING SPECIFICATIONS

(1) 16pcs LCD modules / 1 Box

(2) Box dimensions: 511 (L) X 420 (W) X 360 (H) mm

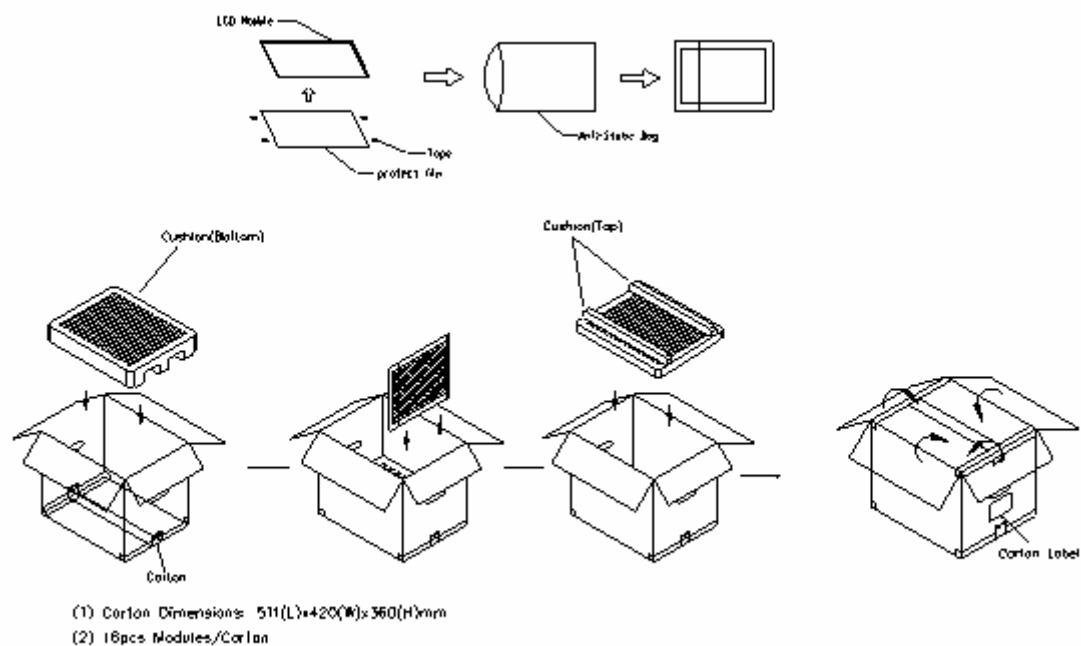(3) Weight: approximately 18Kg (16 modules per box)

## 9.2 PACKING METHOD



(1) Carton Dimensions: 511(L)x420(W)x360(H)mm
(2) 16pcs Modules/Carton

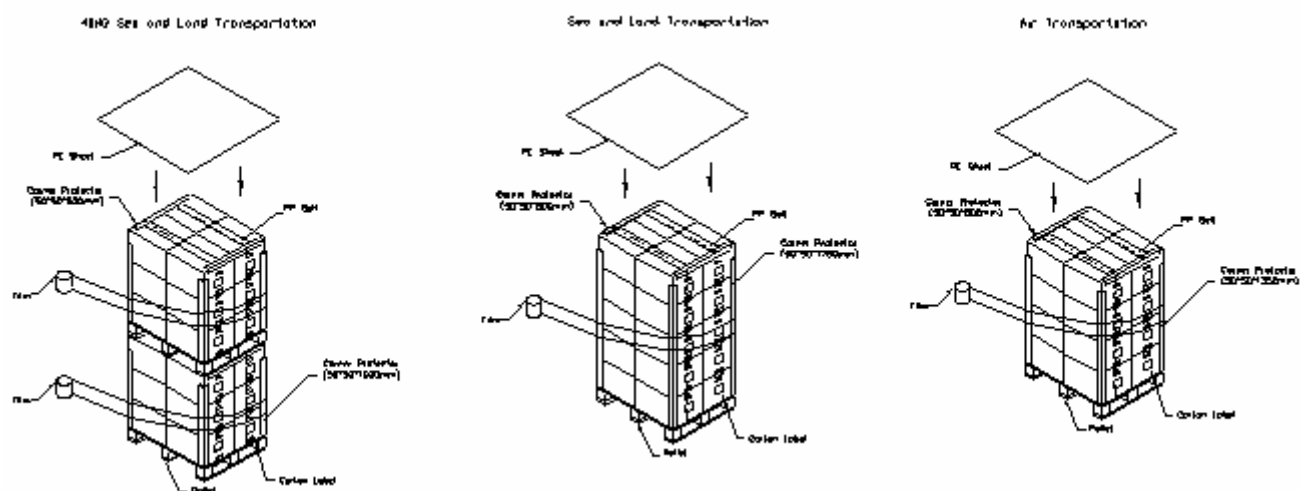**Figure. 9-1 Packing method**



**Figure. 9-2 Packing method**
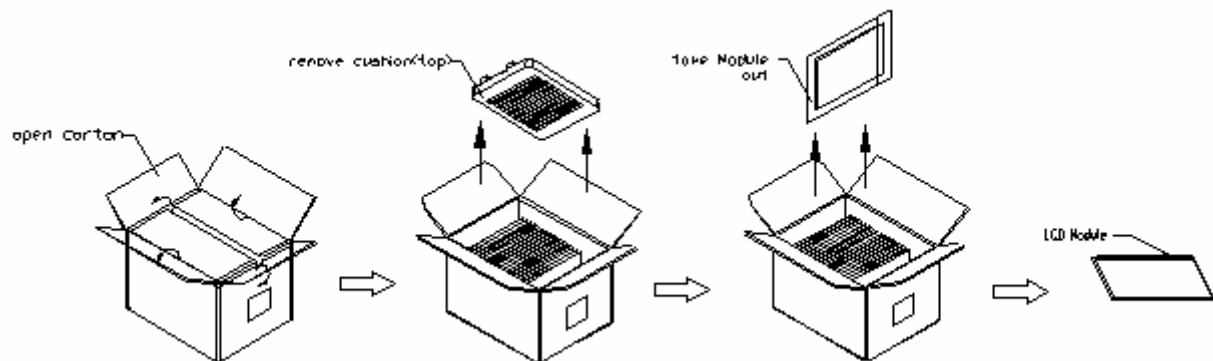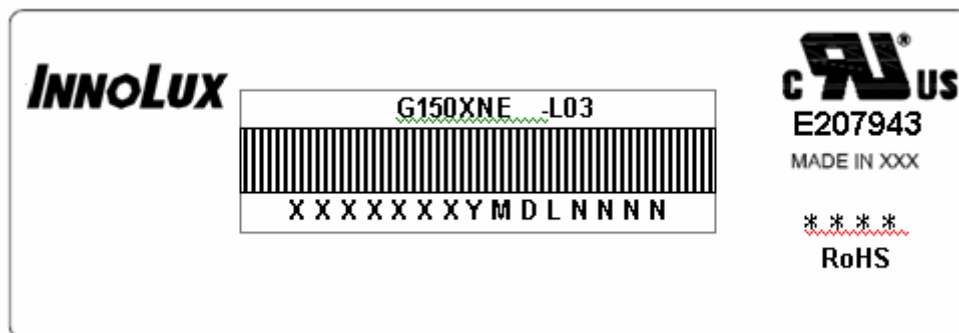
## 9.3 UN-PACKING METHOD



**Figure. 9-3 UN-Packing method**
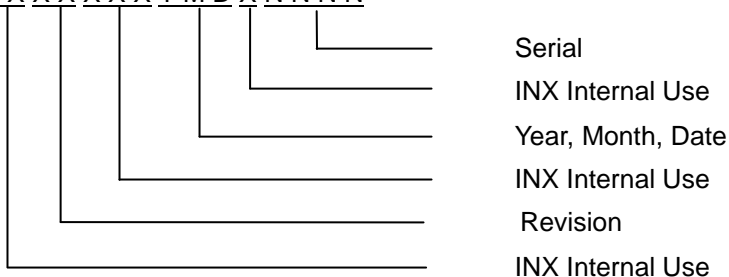
## 10. DEFINITION OF LABELS

### 10.1 INX MODULE LABEL

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



(a)Model Name: G150XNE    -L03

(b)∗ ∗ ∗ ∗ : Factory ID

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



                               Serial

                               INX Internal Use

                               Year, Month, Date

                               INX Internal Use

                               Revision

                               INX Internal Use

Serial ID includes the information as below:

(a)Manufactured Date: Year: 1~9, for 2011~2019

                    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

## 11. PRECAUTIONS

### 11.1 ASSEMBLY AND HANDLING PRECAUTIONS

(1) Do not apply rough force such as bending or twisting to the module during assembly.

(2) To assemble or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.

(3) It's not permitted to have pressure or impulse on the module because the LCD panel and Backlight will be damaged.

(4) Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.

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

(6) Do not disassemble the module.

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

(8) It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.

(9) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.

(10) When ambient temperature is lower than 10℃ may reduce the display quality. For example, the response time will become slowly.

(11) Do not keep same pattern in a long period of time. It may cause image sticking on LCD.

### 11.2 SAFETY PRECAUTIONS

(1) 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.

## 12. MECHANICAL CHARACTERISTICS