

Doc. Number :

- ☐ Tentative Specification  
☐ Preliminary Specification  
☒ Approval Specification

MODEL NO.: G121XCE  
 SUFFIX: LM1

**Customer: Common**

**APPROVED BY**

**SIGNATURE**

**Name / Title** \_\_\_\_\_

Note

Product Version

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

| Approved By | Checked By | Prepared By |
|-------------|------------|-------------|
| 林秋森         | 吳承旻        | 許文進         |

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## REVISION HISTORY

| Version | Date    | Page | Description                                                                                 |
|---------|---------|------|---------------------------------------------------------------------------------------------|
| 2.0     | 2021.12 | All  | Approval Specification was first issued.                                                    |
| 2.1     | 2023.08 | 7    | 2.1 ABSOLUTE RATINGS OF ENVIRONMENT<br>To modify some wording of note(1)                    |
|         |         | 25   | 7.2 OPTICAL SPECIFICATIONS<br>To transfer the method of White Variation as the note(6)      |
|         |         | 31   | 11.3 OTHER PRECAUTIONS<br>To remove two terms (a) & (c)                                     |
|         |         | All  | Driver IC Type changed from EK77221 to EK77526.<br>(Optical & EE characteristics unchanged) |
|         |         |      |                                                                                             |
|         |         |      |                                                                                             |
|         |         |      |                                                                                             |

## 1. GENERAL DESCRIPTION

### 1.1 OVERVIEW

The G121XCE-LM1 model is a 12.1" TFT-LCD IAV module with a white LED Backlight Unit and a 20-pin 1ch-LVDS interface. This module supports 1024 x 768 XGA mode and displays 262k/16.7M colors. The converter for the Backlight Unit is built in.

### 1.2 FEATURES

- Wide viewing angle
- High contrast ratio
- XGA (1024 x 768 pixels) resolution
- Wide operating temperature
- DE (Data Enable) mode
- LVDS (Low Voltage Differential Signaling) interface
- Reversible-scan direction
- RoHS Compliance

### 1.3 APPLICATION

- TFT LCD Monitor
- Industrial Application
- Amusement

### 1.4 GENERAL SPECIFICATIONS

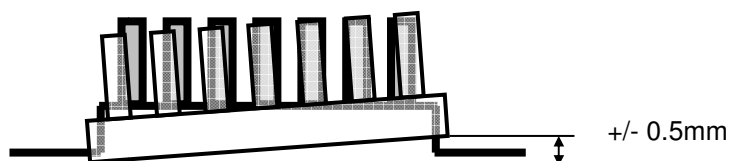
| Item                     | Specification                 | Unit  | Note     |
|--------------------------|-------------------------------|-------|----------|
| Diagonal Size            | 12.1                          | inch  | (1)      |
| Active Area              | 245.76(H) x 184.32(V)         | mm    |          |
| Bezel Opening Area       | 249.0 x 187.5                 | mm    |          |
| Driver Element           | a-si TFT active matrix        | -     | -        |
| Pixel Number             | 1024 x R.G.B. x 768           | pixel | -        |
| Pixel Pitch              | 0.240(H) x 0.240(V)           | mm    | -        |
| Pixel Arrangement        | RGB vertical stripe           | -     | -        |
| Display Colors           | 262k/16.7M                    | color | -        |
| Display Mode             | Normally black                | -     | -        |
| Surface Treatment        | Hard coating (3H), Anti-Glare | -     | -        |
| Module Power Consumption | 13.716 (white pattern)        | W     | Typ. (3) |

## 1.5 MECHANICAL SPECIFICATIONS

| Item                            |                | Min.                                                                                                           | Typ.  | Max.  | Unit | Note |
|---------------------------------|----------------|----------------------------------------------------------------------------------------------------------------|-------|-------|------|------|
| Module Size                     | Horizontal (H) | 260                                                                                                            | 260.5 | 261   | mm   | (1)  |
|                                 | Vertical (V)   | 203.5                                                                                                          | 204   | 204.5 | mm   |      |
|                                 | Depth (D)      | 7.9                                                                                                            | 8.4   | 8.9   | mm   |      |
| Weight                          |                |                                                                                                                | 490   | 510   | g    | -    |
| I/F connector mounting position |                | The mounting inclination of the connector makes the screen center within $\pm 0.5\text{mm}$ as the horizontal. |       |       | -    | (2)  |

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

(2) Connector mounting position



(3) The Module Power Consumption is specified at 3.3V, white pattern and 100% duty for LED backlight.

## 2. ABSOLUTE MAXIMUM RATINGS

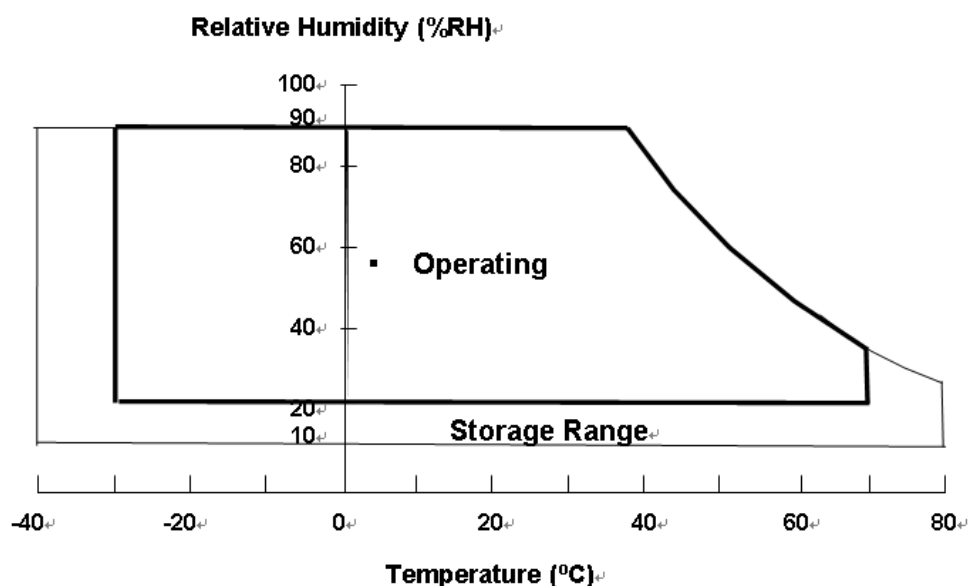
### 2.1 ABSOLUTE RATINGS OF ENVIRONMENT

| Item                          | Symbol          | Value |      | Unit | Note   |
|-------------------------------|-----------------|-------|------|------|--------|
|                               |                 | Min.  | Max. |      |        |
| Operating Ambient Temperature | T <sub>OP</sub> | -30   | +75  | °C   | (1)(2) |
| Storage Temperature           | T <sub>ST</sub> | -40   | +80  | °C   |        |

Note (1)

- (a) 90 %RH Max.
- (b) Wet-bulb temperature should be 39 °C Max.
- (c) No condensation.

Note (2) Panel surface temperature should be 0°C min. and 75°C max under V<sub>CC</sub>=3.3V, f<sub>r</sub>=60Hz, typical LED string current, 25°C ambient temperature, and no humidity control . Any condition of ambient operating temperature ,the surface of active area should be keeping not higher than 75°C



## 2.2 ELECTRICAL ABSOLUTE RATINGS

### 2.2.1 TFT LCD MODULE

| Item                 | Symbol | Value |      | Unit | Note |
|----------------------|--------|-------|------|------|------|
|                      |        | Min.  | Max. |      |      |
| Power Supply Voltage | VCC    | -0.3  | 4.0  | V    | (1)  |

### 2.2.2 LED CONVERTE

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

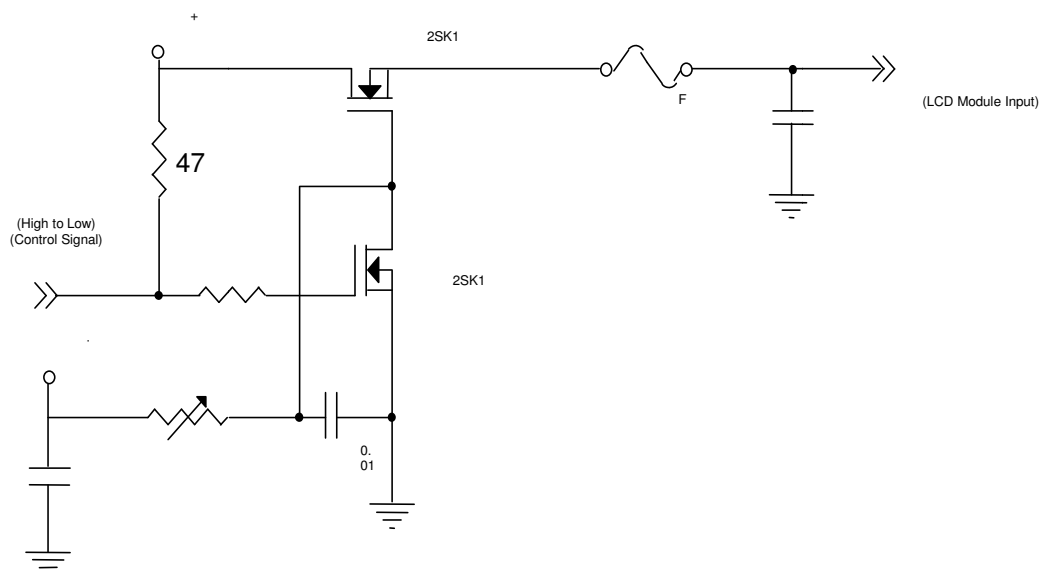
### 3.1 TFT LCD MODULE

Ta = 25 ± 2 °C

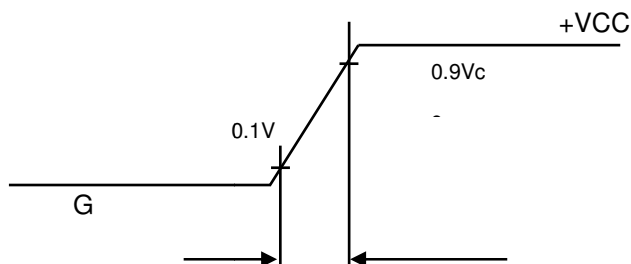
| Parameter                                              | Symbol            | Value           |      |      | Unit  | Note |
|--------------------------------------------------------|-------------------|-----------------|------|------|-------|------|
|                                                        |                   | Min.            | Typ. | Max. |       |      |
| Power Supply Voltage                                   | VCC               | 3.0             | 3.3  | 3.6  | V     |      |
| Ripple Voltage                                         | V <sub>RP</sub>   | -               | -    | 200  | mVp-p |      |
| Rush Current                                           | I <sub>RUSH</sub> | -               | -    | 4    | A     | (2)  |
| Power Supply Current                                   | White             | -               | 520  | 620  | mA    | (3)a |
|                                                        | Black             | -               | 420  | 510  | mA    | (3)b |
| LVDS differential input voltage                        | V <sub>id</sub>   | 100             | -    | 600  | mV    |      |
| LVDS common input voltage                              | V <sub>ic</sub>   | 1.0             | 1.2  | 1.4  | V     |      |
| Power Consumption                                      | P <sub>L</sub>    | -               | 1.72 | 2.05 | W     |      |
| Differential Input Voltage for LVDS Receiver Threshold | "H" Level         | V <sub>IH</sub> | +100 | -    | mV    |      |
|                                                        | "L" Level         | V <sub>IL</sub> | -    | -100 | mV    |      |
| Terminating Resistor                                   | R <sub>T</sub>    | -               | 100  | -    | Ohm   |      |

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

Note (2) Measurement Conditions:

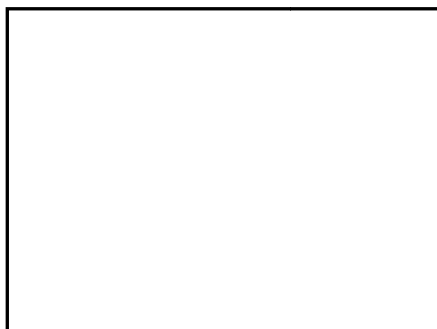


**Vcc rising time is 470μs**



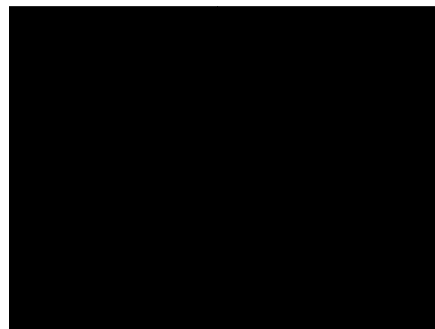
Note (3) The specified power supply current is under the conditions at  $V_{CC} = 3.3V$ ,  $T_a = 25 \pm 2^\circ C$ ,  $f_v = 60$  Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

b. Black Pattern



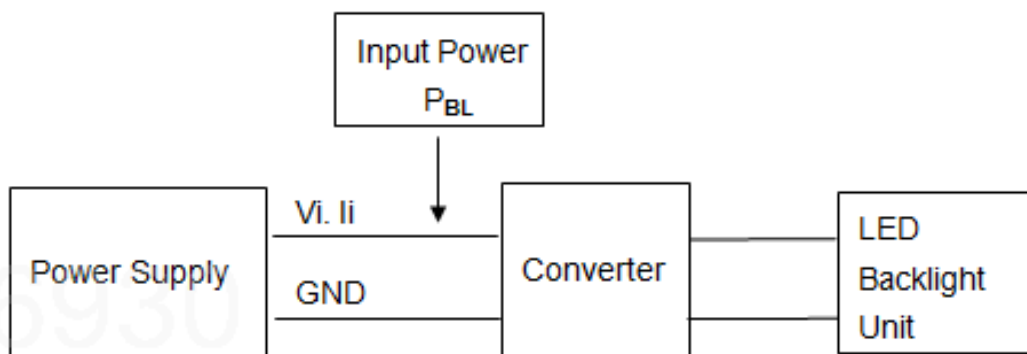
Active Area

## 3.2 LED CONVERTER

$T_a = 25 \pm 2^\circ C$

| Parameter                             |                | Symbol      | Value  |      |      | Unit | Note                                         |
|---------------------------------------|----------------|-------------|--------|------|------|------|----------------------------------------------|
|                                       |                |             | Min.   | Typ. | Max. |      |                                              |
| Converter Power Supply Voltage        |                | $V_i$       | 10.8   | 12.0 | 13.2 | V    |                                              |
| Converter Power Supply Ripple Voltage |                | $V_{iRP}$   | -      | -    | 500  | mV   |                                              |
| Converter Power Supply Current        |                | $I_i$       | -      | 1.0  | 1.16 | A    | @ $V_i = 12V$ (Duty 100%)                    |
| Converter Inrush Current              |                | $I_{iRUSH}$ | -      | -    | 3.0  | A    | @ $V_i$ rising time = 20ms ( $V_i = 12V$ )   |
| Backlight Power Consumption           |                | $P_{BL}$    | -      | 12.0 | 13.9 | W    | @ $V_i = 12V$ (Duty 100%)                    |
| EN Control Level                      | Backlight on   | BLON        | 2.5    | 3.3  | 5.0  | V    |                                              |
|                                       | Backlight off  |             | 0      | ---  | 0.3  | V    |                                              |
| PWM Control Level                     | PWM High Level | $E_{PWM}$   | 2.5    | 3.3  | 5.0  | V    |                                              |
|                                       | PWM Low Level  |             | 0      | -    | 0.15 | V    |                                              |
| PWM Noise Range                       |                | $V_{Noise}$ | -      | -    | 0.1  | V    |                                              |
| PWM Control Frequency                 |                | $f_{PWM}$   | 190    | 200  | 20k  | Hz   | (2)                                          |
| PWM Control Duty Ratio                |                | -           | 5      |      | 100  | %    | (2), Suggestion@ $190Hz \leq f_{PWM} < 1kHz$ |
|                                       |                |             | 20     | -    | 100  | %    | (2), @ $1kHz \leq f_{PWM} \leq 20kHz$        |
| LED Life Time                         |                | $L_L$       | 50,000 | -    | -    | Hrs  | (3)                                          |

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

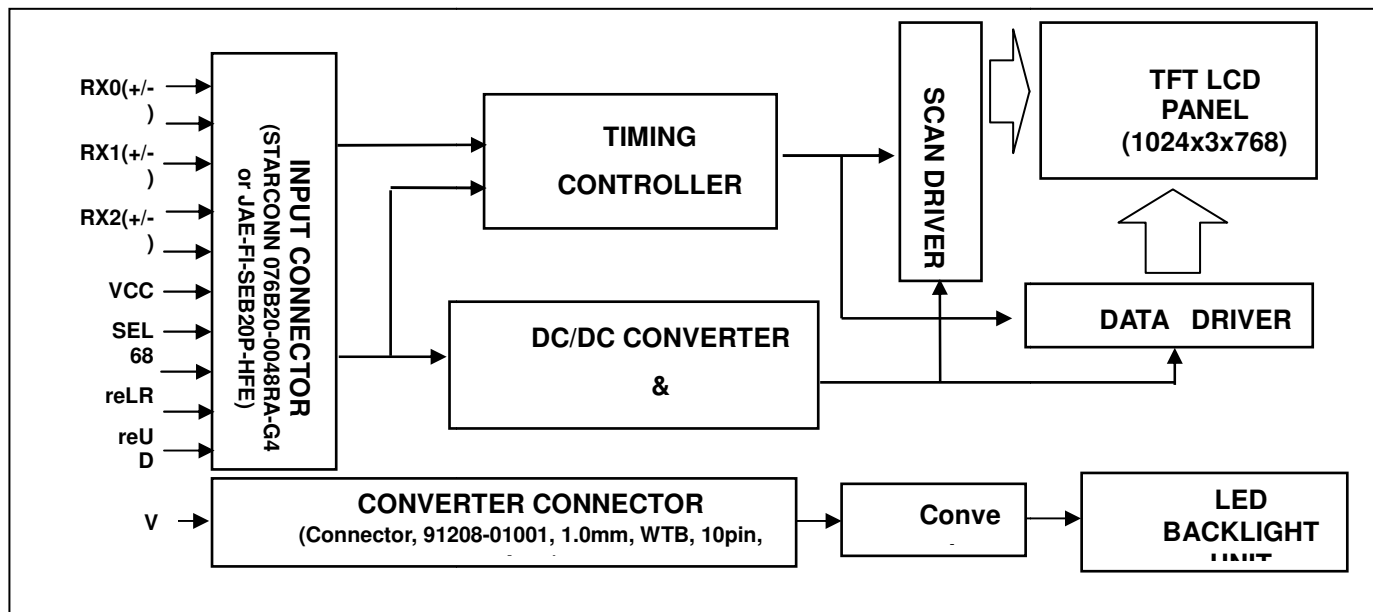


Note (2) At 190 ~1kHz PWM control frequency, duty ratio range is restricted from 5% to 100%. 1K ~20kHz PWM control frequency, duty ratio range is restricted from 20% to 100%. If PWM control frequency is applied in the range from 1KHz to 20KHZ, The “non-linear” phenomenon the Backlight Unit may be found. So It's a suggestion that PWM control frequency should be less than 1KHz.

Note (3) 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.

## 4. BLOCK DIAGRAM

### 4.1 TFT LCD MODULE



## 5. INTERFACE PIN ASSIGNMENT

### 5.1 TFT LCD MODULE

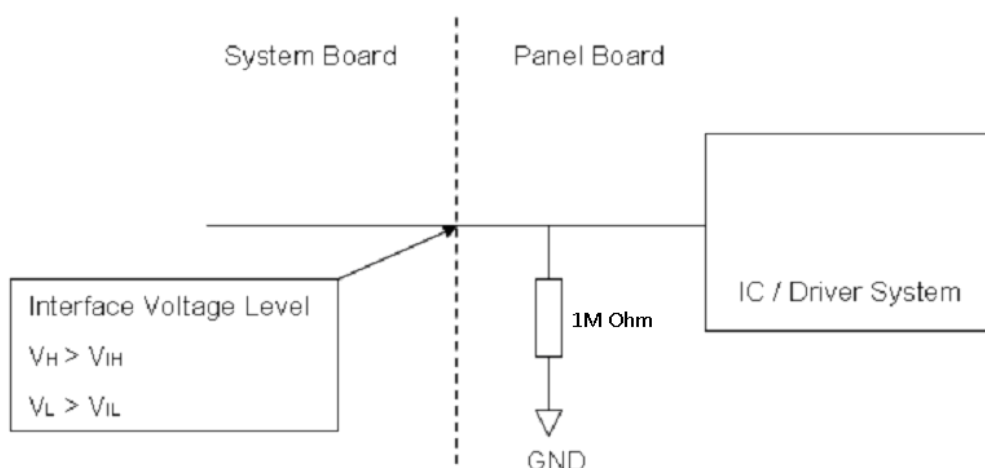
| Pin | Name  | Description                                                                               | Remark       |
|-----|-------|-------------------------------------------------------------------------------------------|--------------|
| 1   | RX3+  | Differential Data Input, CH3 ( Positive )                                                 |              |
| 2   | RX3-  | Differential Data Input, CH3 (Negative )                                                  |              |
| 3   | NC    | NC                                                                                        |              |
| 4   | SEL68 | LVDS 6/8 bit select function control,<br>Low → 6 bit Input Mode<br>High → 8bit Input Mode | Note (3) (4) |
| 5   | GND   | Ground                                                                                    |              |
| 6   | RXC+  | Differential Clock Input ( Positive )                                                     |              |
| 7   | RXC-  | Differential Clock Input ( Negative )                                                     |              |
| 8   | GND   | Ground                                                                                    |              |
| 9   | RX2+  | Differential Data Input , CH2 ( Positive )                                                |              |
| 10  | RX2-  | Differential Data Input , CH2 ( Negative )                                                |              |
| 11  | NC    | For LCD internal use only, Do not connect                                                 |              |
| 12  | RX1+  | Differential Data Input , CH1 ( Positive )                                                |              |
| 13  | RX1-  | Differential Data Input, CH1 ( Negative )                                                 |              |
| 14  | NC    | For LCD internal use only, Do not connect                                                 |              |
| 15  | RX0+  | Differential Data Input, CH0 ( Positive )                                                 |              |
| 16  | RX0-  | Differential Data Input, CH0 (Negative )                                                  |              |
| 17  | reLR  | Horizontal Reverse Scan Control,<br>Low → Normal Mode.<br>High → Horizontal Reverse Scan  | Note (3) (4) |
| 18  | reUD  | Vertical Reverse Scan Control,<br>Low → Normal Mode,<br>High → Vertical Reverse Scan      | Note (3) (4) |
| 19  | VCC   | Power supply                                                                              |              |
| 20  | VCC   | Power supply                                                                              |              |

Note (1) Connector Part No.: P-Two 187191-20101-3 or STARCONN 076B20-0048RA-G4 or equivalent.

Note (2) User's connector Part No.: JAE FI-SE20ME or equivalent.

Note (3) "Low" stands for 0V. "High" stands for 3.3V.

Note (4) SEL68, reLR, reUD



## 5.2 BACKLIGHT UNIT (CONVERTER CONNECTOR PIN)

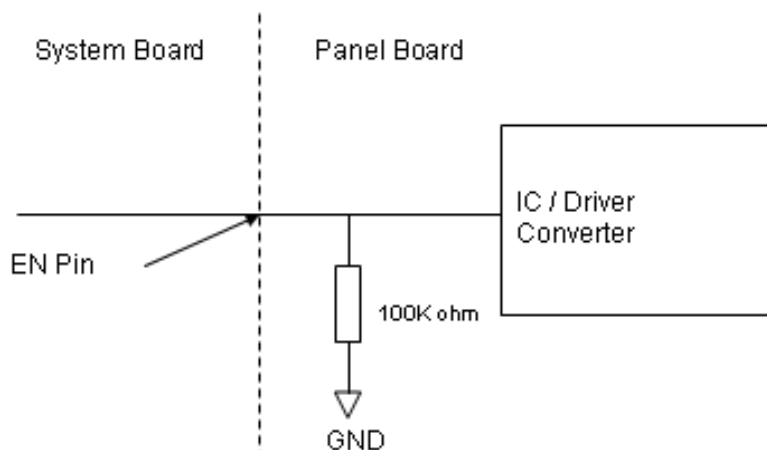
| Pin | Symbol    | Description             | Remark                                                                                  |
|-----|-----------|-------------------------|-----------------------------------------------------------------------------------------|
| 1   | $V_i$     | Converter input voltage | 12V                                                                                     |
| 2   | $V_i$     | Converter input voltage | 12V                                                                                     |
| 3   | $V_i$     | Converter input voltage | 12V                                                                                     |
| 4   | $V_i$     | Converter input voltage | 12V                                                                                     |
| 5   | $V_{GND}$ | Converter ground        | Ground                                                                                  |
| 6   | $V_{GND}$ | Converter ground        | Ground                                                                                  |
| 7   | $V_{GND}$ | Converter ground        | Ground                                                                                  |
| 8   | $V_{GND}$ | Converter ground        | Ground                                                                                  |
| 9   | EN        | Enable pin              | 3.3V, Note (3)                                                                          |
| 10  | ADJ       | Backlight Adjust        | PWM Dimming<br>(190-210Hz, Hi: 3.3V <sub>DC</sub> ,<br>Lo: 0V <sub>DC</sub> ), Note (3) |

Note (1) Connector Part No.: 91208-01001-H01 (ACES) or equivalent.

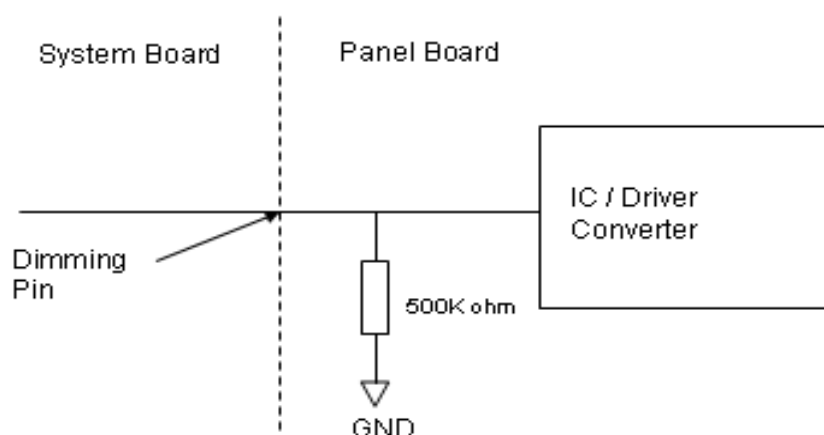
Note (2) User's connector Part No.: 91209-01011 (ACES) or equivalent--

Note (3) EN(BLON), ADJ(E\_PWM) as shown below.

### BLON Pin



### E\_PWM Pin



## 5.3 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 versus data input.

| Color               |                 | Data Signal |    |    |    |    |    |    |    |       |    |    |    |    |    |    |    |      |    |    |    |    |    |    |    |
|---------------------|-----------------|-------------|----|----|----|----|----|----|----|-------|----|----|----|----|----|----|----|------|----|----|----|----|----|----|----|
|                     |                 | Red         |    |    |    |    |    |    |    | Green |    |    |    |    |    |    |    | Blue |    |    |    |    |    |    |    |
|                     |                 | R7          | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G7    | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B7   | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Colors        | Black           | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red             | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green           | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Blue            | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Cyan            | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Magenta         | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Yellow          | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | White           | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
| Gray Scale Of Red   | Red(0) / Dark   | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red(1)          | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red(2)          | 0           | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | :               | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | :               | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | Red(253)        | 1           | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red(254)        | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red(255)        | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| Gray Scale Of Green | Green(0) / Dark | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green(1)        | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green(2)        | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | :               | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | :               | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | Green(253)      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green(254)      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green(255)      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| Gray Scale Of Blue  | Blue(0) / Dark  | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Blue(1)         | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 1  | 0  |
|                     | 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  | 0  |
|                     | :               | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | :               | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | Blue(253)       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 0  | 1  |
|                     | Blue(254)       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 0  |
|                     | Blue(255)       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |

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

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

| Color               |                | Data Signal |    |    |    |    |    |    |    |       |    |    |    |    |    |    |    |      |    |    |    |    |    |    |    |  |  |
|---------------------|----------------|-------------|----|----|----|----|----|----|----|-------|----|----|----|----|----|----|----|------|----|----|----|----|----|----|----|--|--|
|                     |                | Red         |    |    |    |    |    |    |    | Green |    |    |    |    |    |    |    | Blue |    |    |    |    |    |    |    |  |  |
|                     |                | R7          | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G7    | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B7   | B6 | B5 | B4 | B3 | B2 | B1 | B0 |  |  |
| Basic Colors        | Black          | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |
|                     | Red            | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |
|                     | Green          | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |
|                     | Blue           | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |  |  |
|                     | Cyan           | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |  |  |
|                     | Magenta        | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |  |  |
|                     | Yellow         | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |
|                     | White          | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |  |  |
| Gray Scale Of Red   | Red(0) / Dark  | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |
|                     | Red(1)         | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |
|                     | Red(2)         | 0           | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |
|                     | ⋮              | ⋮           | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮     | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮    | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  |    |  |  |
|                     | ⋮              | ⋮           | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮     | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮    | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  |    |  |  |
|                     | Red(253)       | 1           | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |
|                     | Red(254)       | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |
|                     | Red(255)       | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |
| Gray Scale Of Green | Green(0)/ Dark | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |
|                     | Green(1)       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |
|                     | Green(2)       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |
|                     | ⋮              | ⋮           | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮     | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮    | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  |    |  |  |
|                     | ⋮              | ⋮           | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮     | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮    | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  |    |  |  |
|                     | Green(253)     | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |
|                     | Green(254)     | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |
|                     | Green(255)     | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |
| Gray Scale Of Blue  | Blue(0) / Dark | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |
|                     | Blue(1)        | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 1  |  |  |
|                     | Blue(2)        | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 1  | 0  |  |  |
|                     | ⋮              | ⋮           | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮     | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮    | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  |    |  |  |
|                     | ⋮              | ⋮           | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮     | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮    | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  | ⋮  |    |  |  |
|                     | Blue(253)      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 0  | 1  |  |  |
|                     | Blue(254)      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 0  |  |  |
|                     | Blue(255)      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |  |  |

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

## 6. INTERFACE TIMING

### 6.1 INPUT SIGNAL TIMING SPECIFICATIONS

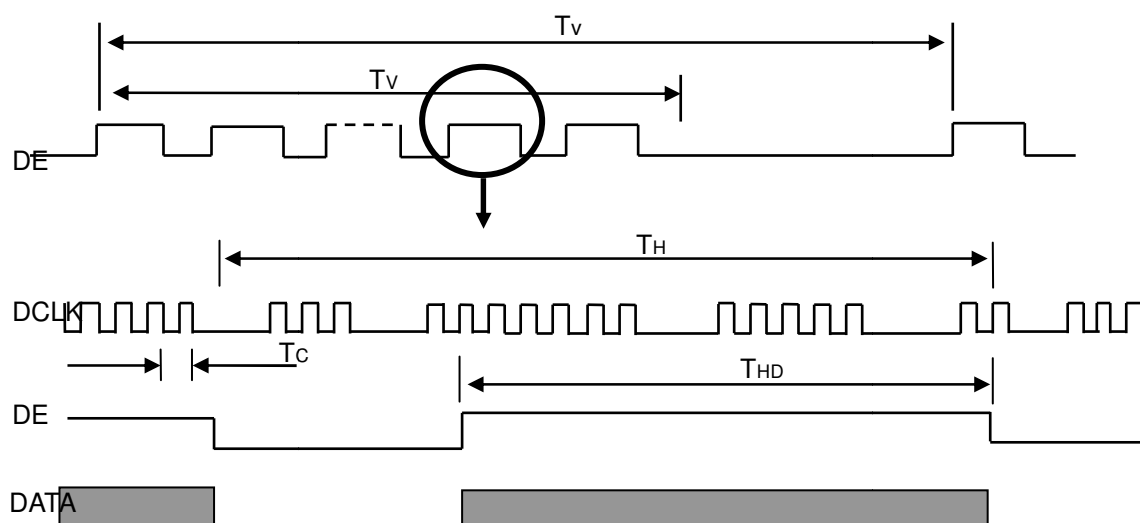
The input signal timing specifications are shown as the following table and timing diagram.

| Signal                  | Item                                 | Symbol                 | Min.                 | Typ. | Max.                 | Unit            | Note                                             |
|-------------------------|--------------------------------------|------------------------|----------------------|------|----------------------|-----------------|--------------------------------------------------|
| LVDS Clock              | Frequency                            | F <sub>c</sub>         | 57.7                 | 65   | 73.6                 | MHz             | -                                                |
|                         | Period                               | T <sub>c</sub>         | 13.6                 | 15.4 | 17.3                 | ns              |                                                  |
|                         | Input cycle to cycle jitter          | T <sub>rcl</sub>       | ---                  | ---  | 200                  | ns              | (a)                                              |
|                         | Input Clock to data skew             | TLVCCS                 | -0.02*T <sub>c</sub> | ---  | 0.02*T <sub>c</sub>  | ps              | (b)                                              |
|                         | Spread spectrum modulation range     | F <sub>clkin_mod</sub> | 0.987*F <sub>c</sub> | ---  | 1.013*F <sub>c</sub> | MHz             | (c)                                              |
|                         | Spread spectrum modulation frequency | F <sub>SSM</sub>       | ---                  | ---  | 200                  | KHz             |                                                  |
|                         | High Time                            | T <sub>ch</sub>        | ---                  | 4/7  | ---                  | T <sub>ch</sub> |                                                  |
|                         | Low Time                             | T <sub>cl</sub>        | ---                  | 3/7  | ---                  | T <sub>ch</sub> |                                                  |
| Vertical Display Term   | Frame Rate                           | Fr                     | ---                  | 60   | ---                  | Hz              | T <sub>v</sub> =T <sub>vd</sub> +T <sub>vb</sub> |
|                         | Total                                | T <sub>v</sub>         | 776                  | 806  | 838                  | Th              | -                                                |
|                         | Active Display                       | T <sub>vd</sub>        | 768                  | 768  | 768                  | Th              | -                                                |
|                         | Blank                                | T <sub>vb</sub>        | 8                    | 38   | 70                   | Th              | -                                                |
| Horizontal Display Term | Total                                | T <sub>h</sub>         | 1240                 | 1344 | 1464                 | T <sub>c</sub>  | T <sub>h</sub> =T <sub>hd</sub> +T <sub>hb</sub> |
|                         | Active Display                       | T <sub>hd</sub>        | 1024                 | 1024 | 1024                 | T <sub>c</sub>  | -                                                |
|                         | Blank                                | T <sub>hb</sub>        | 216                  | 320  | 440                  | T <sub>c</sub>  | -                                                |

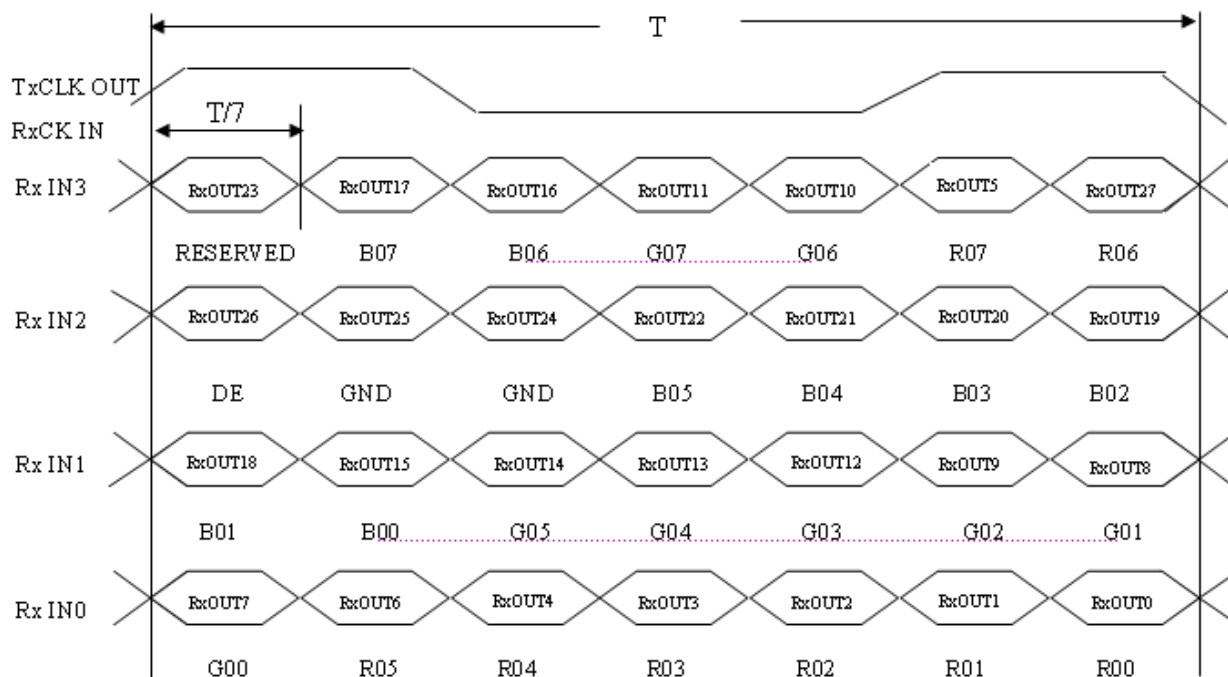
Note (1) Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

Note (2) The T<sub>v</sub>(T<sub>vd</sub>+T<sub>vb</sub>) must be integer, otherwise, the module would operate abnormally.

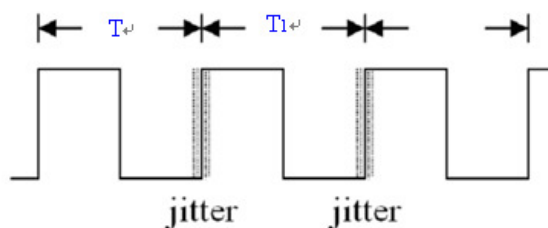
#### INPUT SIGNAL TIMING DIAGRAM



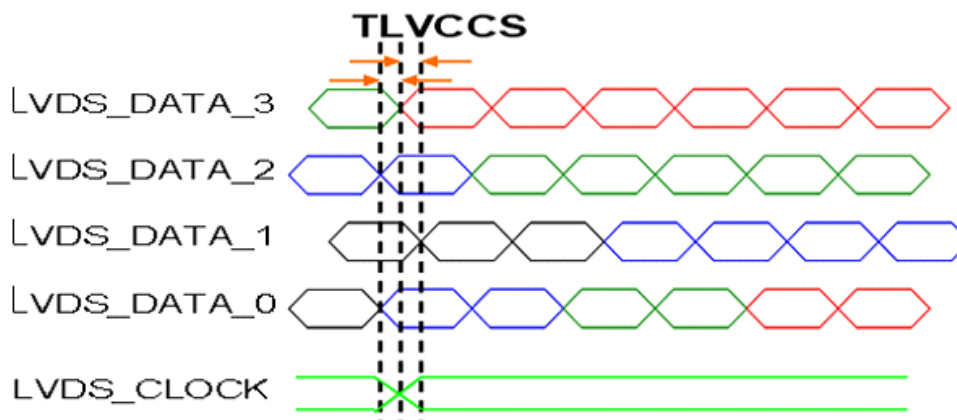
## TIMING DIAGRAM of LVDS



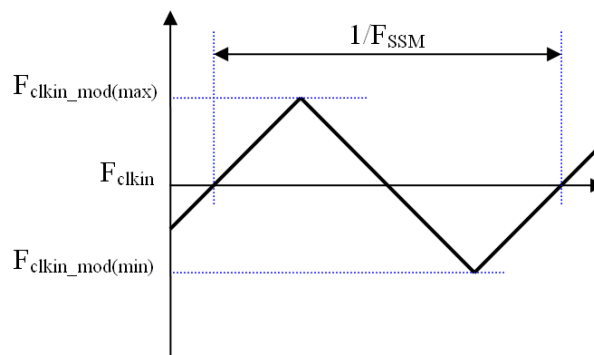
Note (a) The input clock cycle-to-cycle jitter is defined as below figures.  $Trcl = |T_1 - T_2|$



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

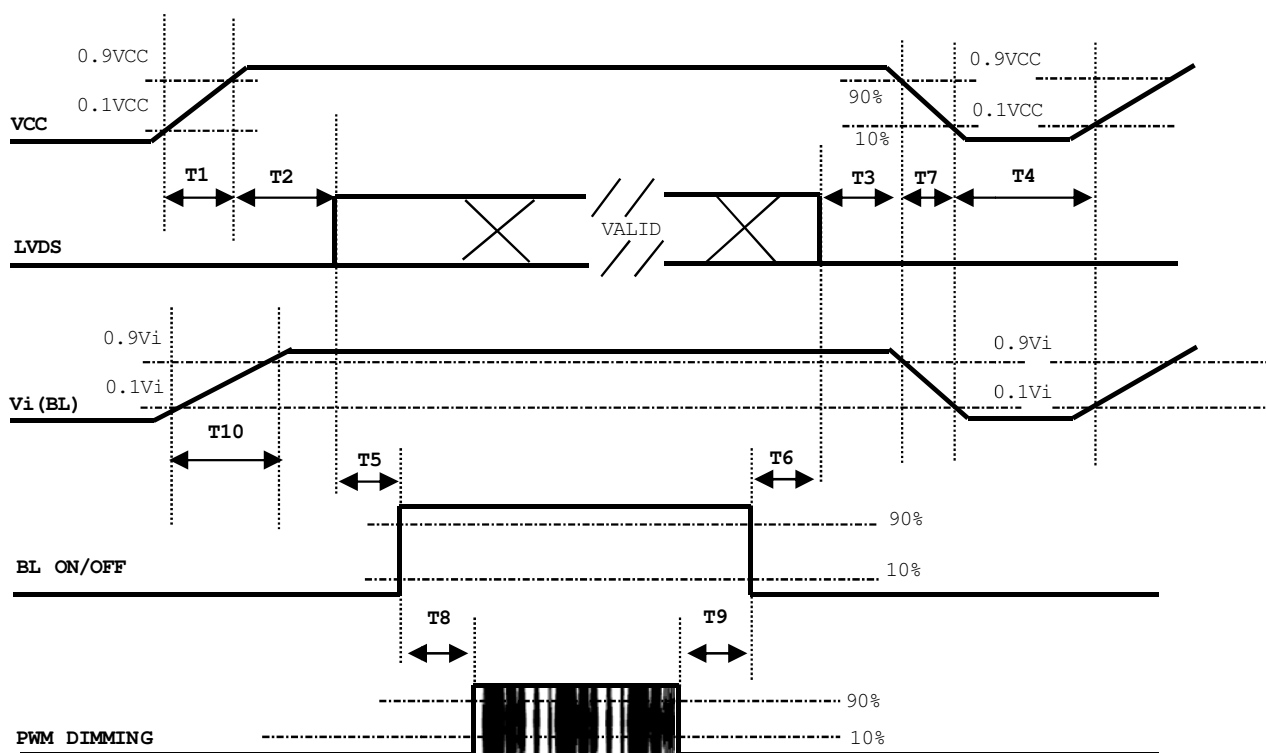


Note (c) The SSCG (Spread spectrum clock generator) is defined as below figures.



## 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.



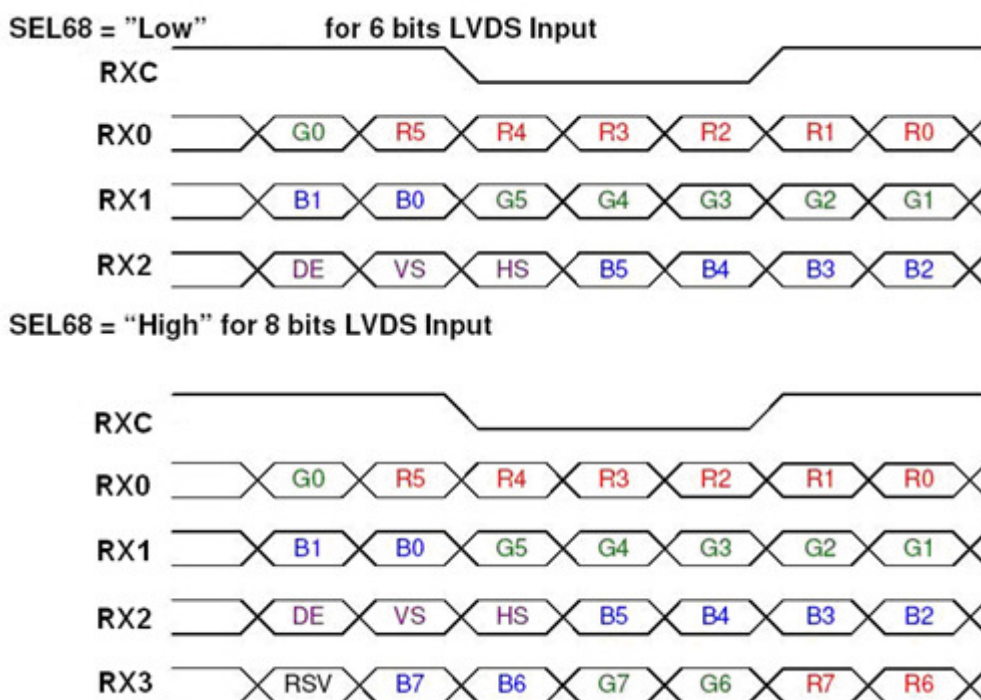
Note:

- (1) The supply voltage of the external system for the module input should be the same as the definition of Vcc.
- (2) When the backlight turns on before the LCD operation of the LCD turns off, the display may momentarily become abnormal screen.

- (3) In case of VCC = off level, please keep the level of input signals on the low or keep a high impedance.
- (4) T4 should be measured after the module has been fully discharged between power off and on period.
- (5) Interface signal shall not be kept at high impedance when the power is on.
- (6) INX won't take any responsibility for the products which are damaged by the customers not following the Power Sequence.
- (7) There might be slight electronic noise when LCD is turned off (even backlight unit is also off). To avoid this symptom, we suggest "Vcc falling timing" to follow "T7 spec".

| 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    |

## 6.3 THE INPUT DATA FORMAT



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

Note (2) Please follow PSWG

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

## 6.4 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.3 Reverse Scan



Fig.4 Reverse Scan



Fig. 1 Normal scan ( pin 17, reLR = Low , pin 18, reUD = Low )

Fig. 2 Reverse scan ( pin 17, reLR = High, pin 18, reUD = Low )

Fig. 3 Reverse scan ( pin 17, reLR = Low , pin 18, reUD = High )

Fig. 4 Reverse scan ( pin 17, reLR = High, pin 18, reUD = High )

## 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      | According to typical value and tolerance in<br>"ELECTRICAL CHARACTERISTICS" |       |      |
| Input Signal        |                                                                             |       |      |
| PWM Duty Ratio      | D                                                                           | 100   | %    |

### 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 above and stable environment shown in Note (5).

| Item                      | Symbol         | Condition                              | Min.  | Typ.  | Max.  | Unit              | Note      |
|---------------------------|----------------|----------------------------------------|-------|-------|-------|-------------------|-----------|
| Color Chromaticity        | Red            | R <sub>x</sub>                         | 0.602 | 0.652 | 0.702 | -                 | (1), (5)  |
|                           |                | R <sub>y</sub>                         | 0.288 | 0.338 | 0.388 | -                 |           |
|                           | Green          | G <sub>x</sub>                         | 0.274 | 0.324 | 0.374 | -                 |           |
|                           |                | G <sub>y</sub>                         | 0.557 | 0.607 | 0.657 | -                 |           |
|                           | Blue           | B <sub>x</sub>                         | 0.103 | 0.153 | 0.203 | -                 |           |
|                           |                | B <sub>y</sub>                         | 0     | 0.048 | 0.098 | -                 |           |
|                           | White          | W <sub>x</sub>                         | 0.263 | 0.313 | 0.363 | -                 |           |
|                           |                | W <sub>y</sub>                         | 0.279 | 0.329 | 0.379 | -                 |           |
| Center Luminance of White | L <sub>c</sub> | θX=0°, θY=0°<br>Grayscale Maximum      | 750   | 1000  | -     | cd/m <sup>2</sup> | (4), (5)  |
| Contrast Ratio            | CR             |                                        | 700   | 1000  | -     | -                 | (2), (5)  |
| Response Time             | T <sub>R</sub> |                                        | -     | 13    | 18    | ms                | (3)       |
|                           | T <sub>F</sub> | θ <sub>x</sub> =0°, θ <sub>y</sub> =0° | -     | 12    | 17    | ms                |           |
| White Variation           | δW             | θ <sub>x</sub> =0°, θ <sub>y</sub> =0° |       | 1.25  | 1.4   | -                 | (5), (6). |
| Viewing Angle             | Horizontal     | θ <sub>x+</sub>                        | 85    | 89    | -     | Deg.              | (1), (5)  |
|                           |                | θ <sub>x-</sub>                        | 85    | 89    | -     |                   |           |
|                           | Vertical       | θ <sub>y+</sub>                        | 85    | 89    | -     |                   |           |
|                           |                | θ <sub>y-</sub>                        | 85    | 89    | -     |                   |           |

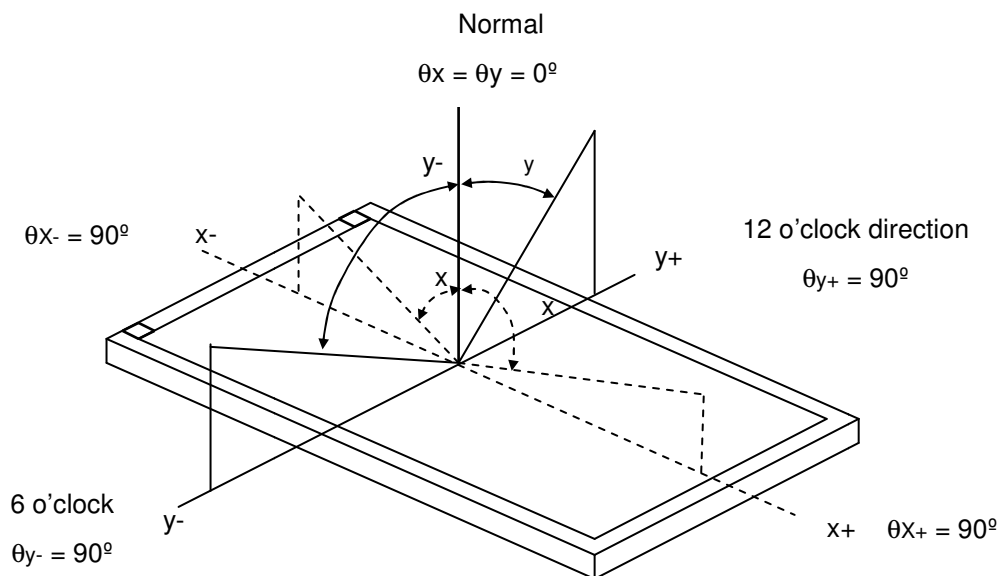
Definition :

Grayscale Maximum : Grayscale 255 (10 bits: grayscale 1023 ; 8 bits : grayscale 255 ; 6 bits: grayscale 63)

White : Luminance of Grayscale Maximum (All R,G,B)

Black : Luminance of grayscale 0 (All R,G,B).

Note (1) Definition of Viewing Angle ( $\theta_x$ ,  $\theta_y$ ):

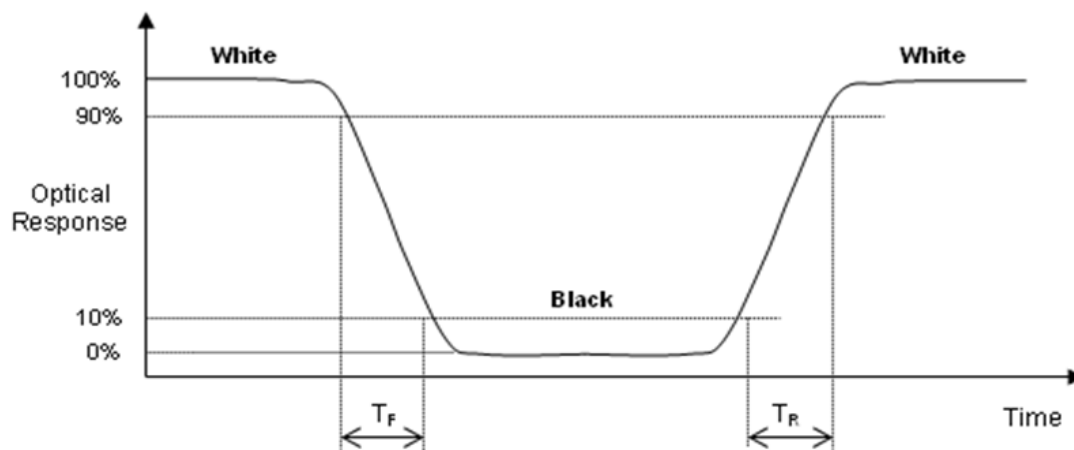


Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression at center point.

Contrast Ratio (CR) = White / Black

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

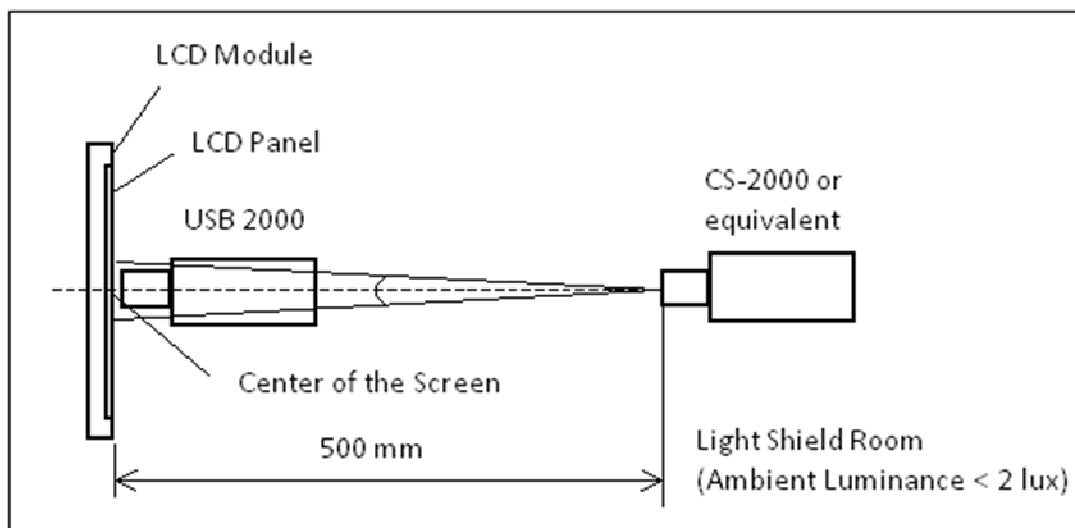


Note (4) Definition of Luminance of White ( $L_C$ ):

Measure the luminance of White at center point

Note (5) Measurement Setup:

The LCD module should be stabilized at given temperature to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 40 minutes in a windless room. The measurement placement of module should be in accordance with the module drawing.

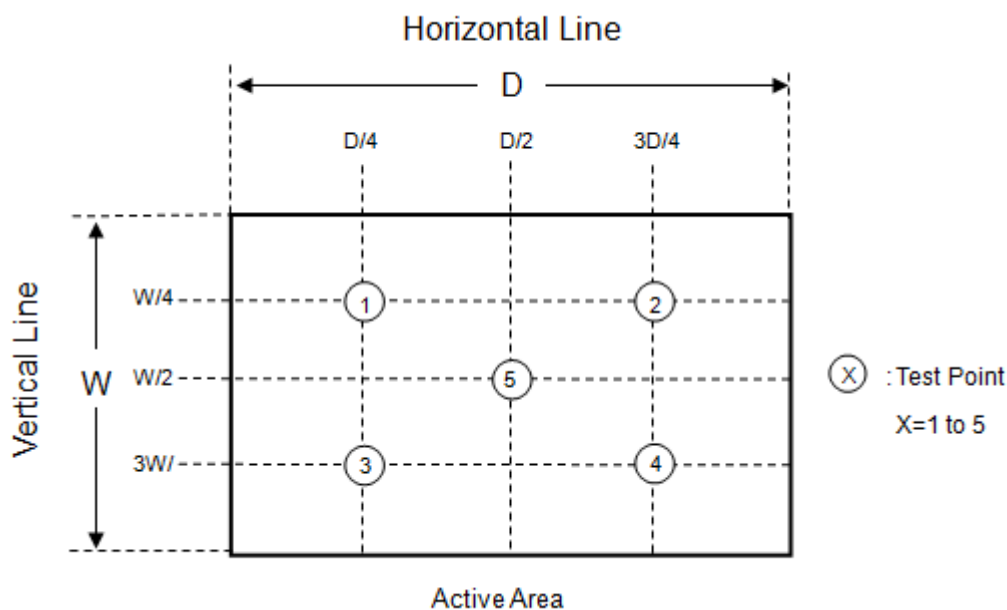


Note (6) Definition of White Variation ( $\delta W$ ):

Measure the luminance of White at 5 points.

Luminance of White :  $L(X)$  , where X is from 1 to 5.

$$\delta W = \frac{\text{Minimum [ } L(1) \text{ to } L(5) \text{ ]}}{\text{Maximum [ } L(1) \text{ to } L(5) \text{ ]}} \times 100\%$$



## 8. Reliability Test Criteria

| Test Item                                       | Test Condition                                                            | Note             |
|-------------------------------------------------|---------------------------------------------------------------------------|------------------|
| High Temperature Storage Test                   | 80°C, 240 hours                                                           | (1)(2)<br>(4)(5) |
| Low Temperature Storage Test                    | -40°C, 240 hours                                                          |                  |
| Thermal Shock Storage Test                      | -30°C, 0.5hour $\longleftrightarrow$ 75°C, 0.5hour; 1hour/cycle,100cycles |                  |
| High Temperature Operation Test                 | 75°C, 240 hours                                                           |                  |
| Low Temperature Operation Test                  | -30°C, 240 hours                                                          |                  |
| High Temperature & High Humidity Operation Test | 50°C, 80%RH, 240hours                                                     | (2)(3)           |
| Shock (Non-Operating)                           | 200G, 2ms, half sine wave, 1 time for $\pm X$ , $\pm Y$ , $\pm Z$ .       |                  |
| Vibration (Non-Operating)                       | 1.5G, 10 ~ 300 Hz, 10min/cycle, 3 cycles each X, Y, Z                     |                  |

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

Note (2) Temperature of panel display surface area should be 75 °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.

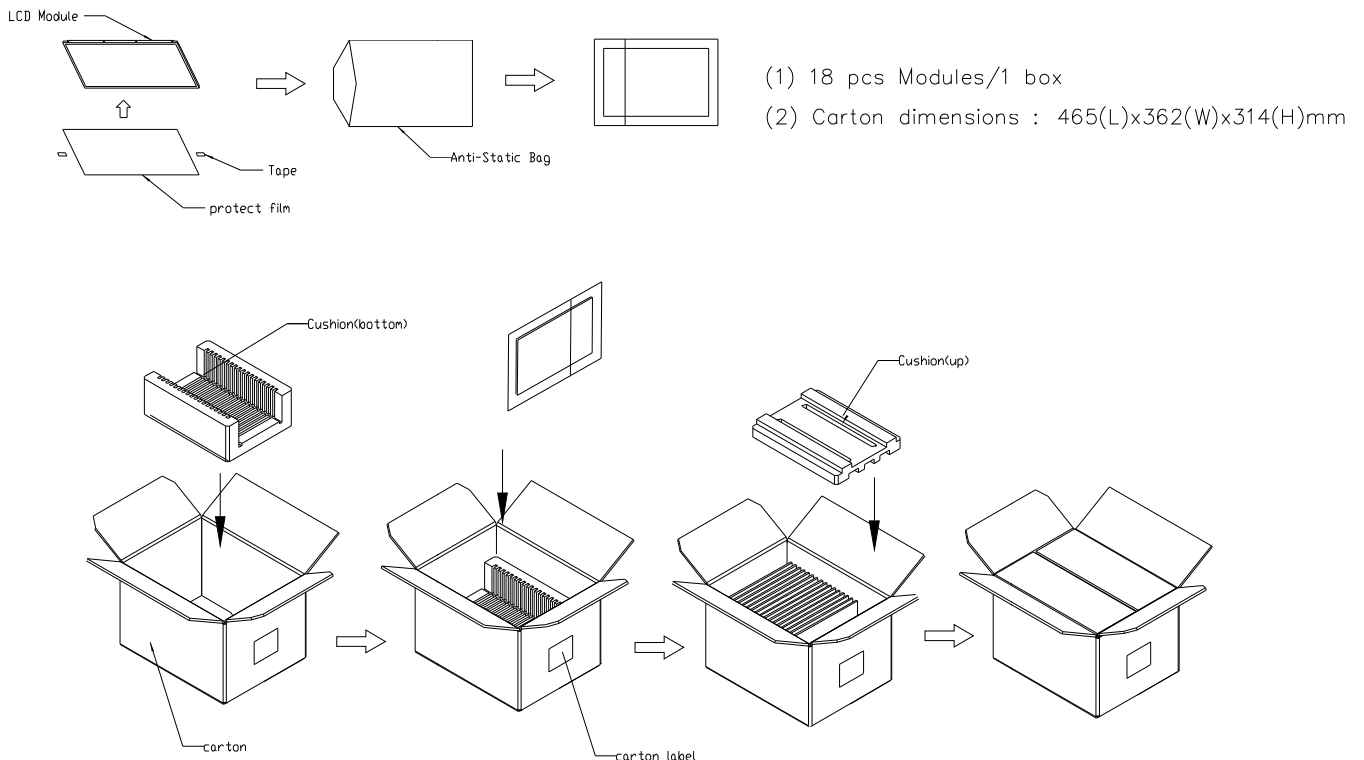
Note (5) Before cosmetic and function test, the product must have enough recovery time, at least 24 hours at room temperature.

## 9. PACKAGING

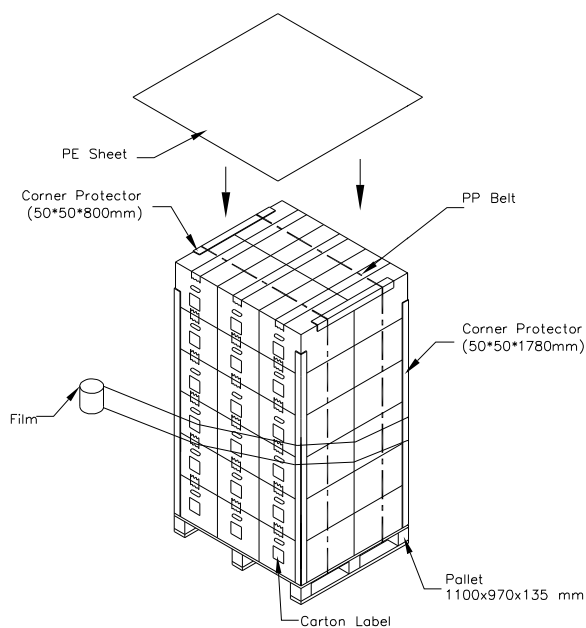
### 9.1 PACKING SPECIFICATIONS

- (1) 18pcs LCD modules / 1 Box
- (2) Box dimensions: 465 (L) X 362 (W) X 314 (H) mm
- (3) Weight: approximately 10.9Kg (18 modules per box)

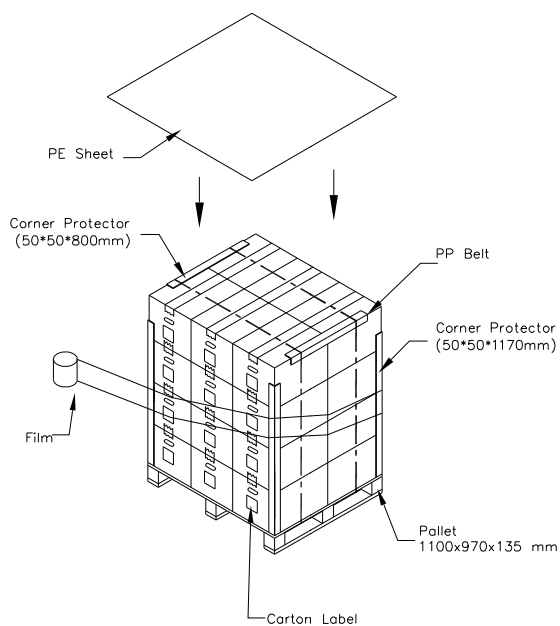
### 9.2 PACKING METHOD



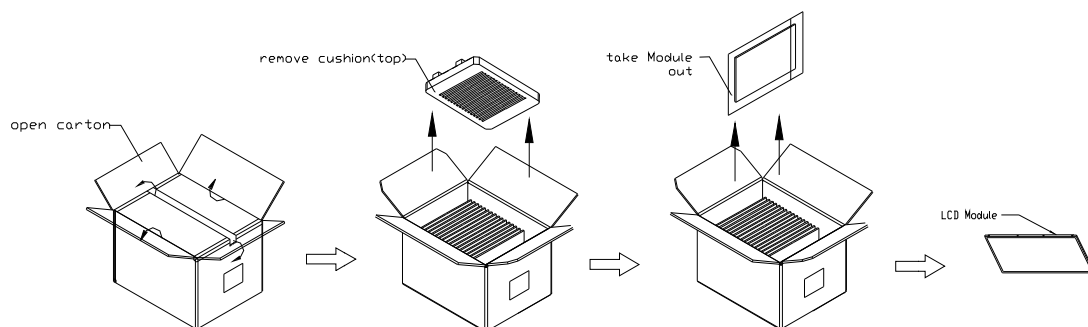
## Sea / Land Transportation (40ft Container)



## Air Transportation



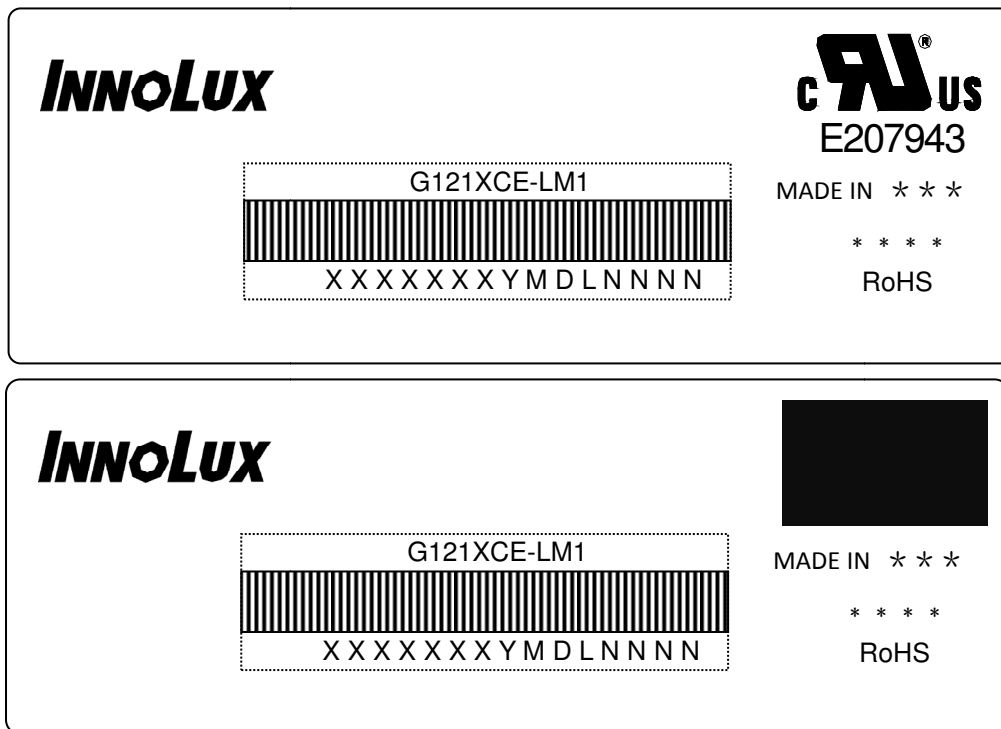
## 9.3 UN-PACKING METHOD



## 10. DEFINITION OF LABELS

### 10.1 INNOLUX MODULE LABEL

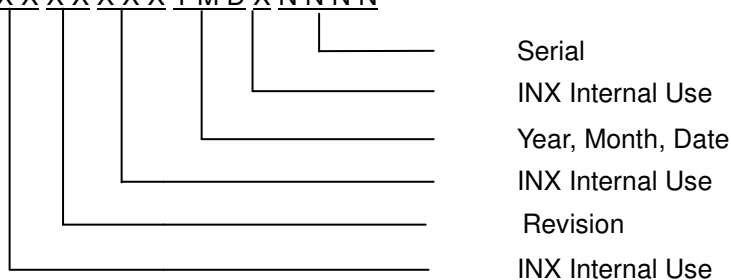
The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



(a) Model Name: G121XCE- LM1

(b) \* \* \* \* : Factory ID

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



Serial ID includes the information as below:

(a) Manufactured Date: Year: 1~9, for 2021~2029

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

Day: 1~9, A~Y, for 1<sup>st</sup> to 31<sup>st</sup>, 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) 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.

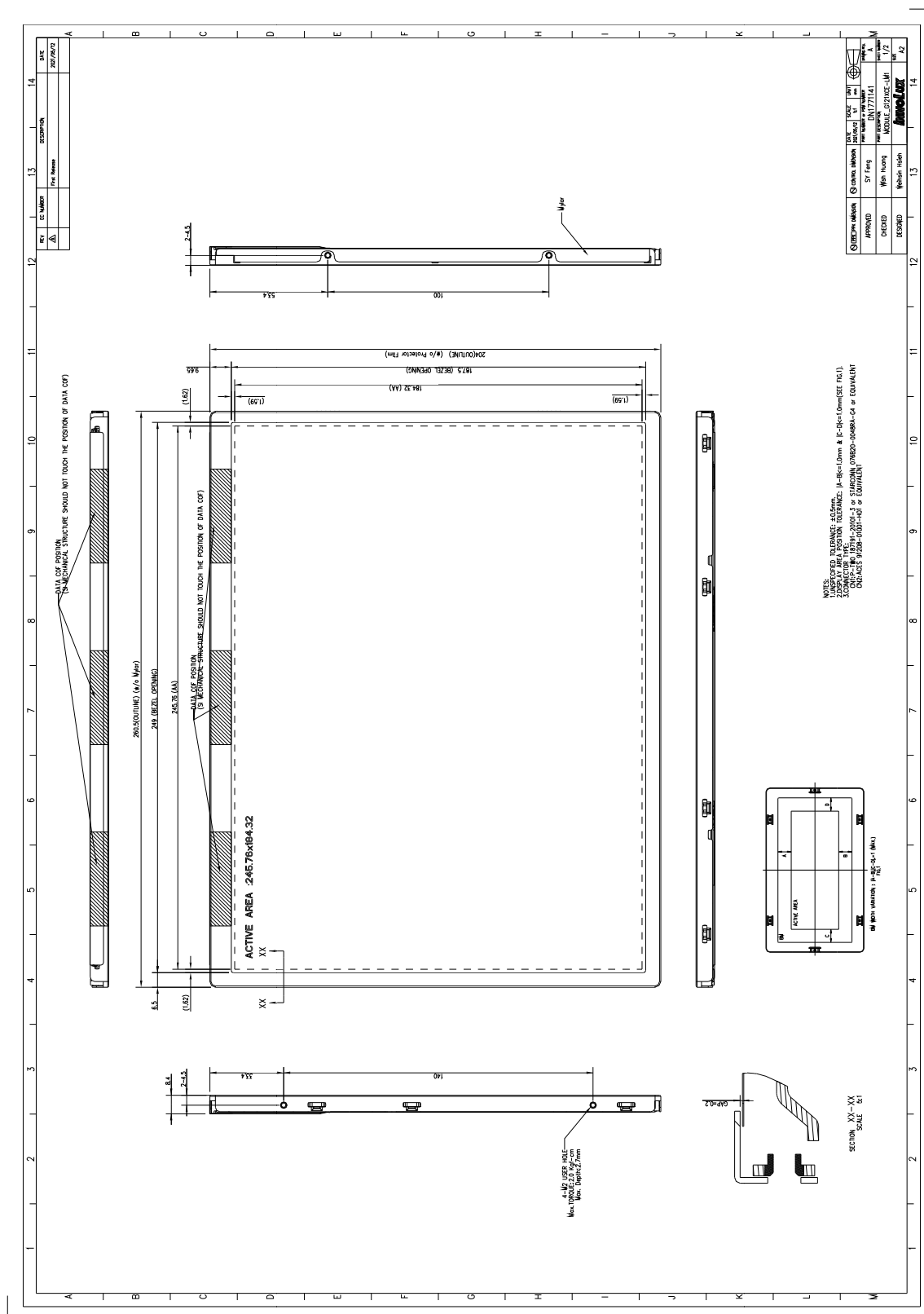
**11.2 SAFETY PRECAUTIONS**

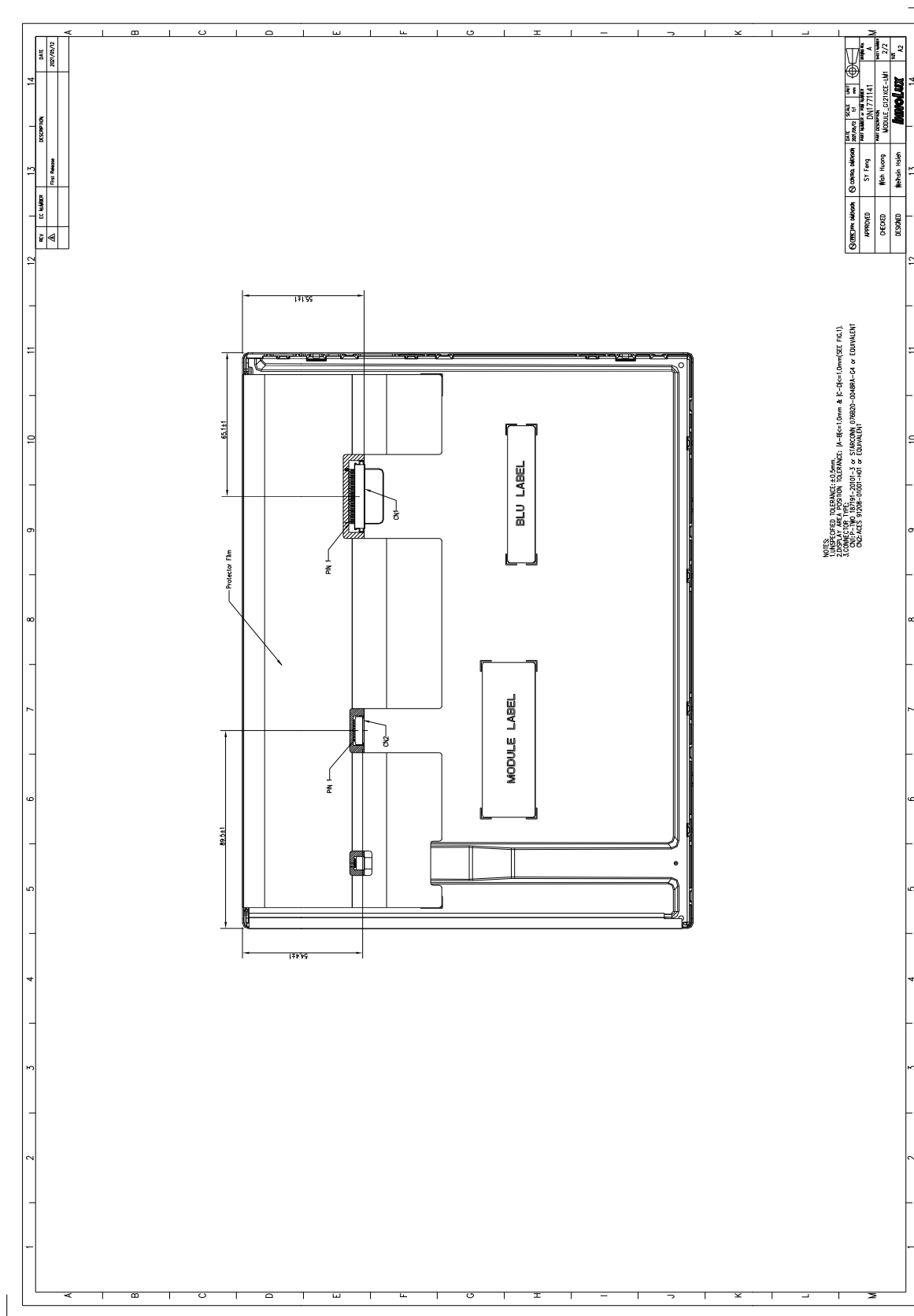
- (1) When storing for a long time, the following precautions are necessary.
  - (a) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 30°C at humidity 50+-10%RH.
  - (b) The polarizer surface should not come in contact with any other object.
  - (c) It is recommended that they be stored in the container in which they were shipped.
  - (d) Storage condition is guaranteed under packing conditions.
  - (e) The phase transition of Liquid Crystal in the condition of the low or high storage temperature will be recovered when the LCD module returns to the normal condition
- (2) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (3) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.
- (4) 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.

## 11.3 OTHER PRECAUTIONS

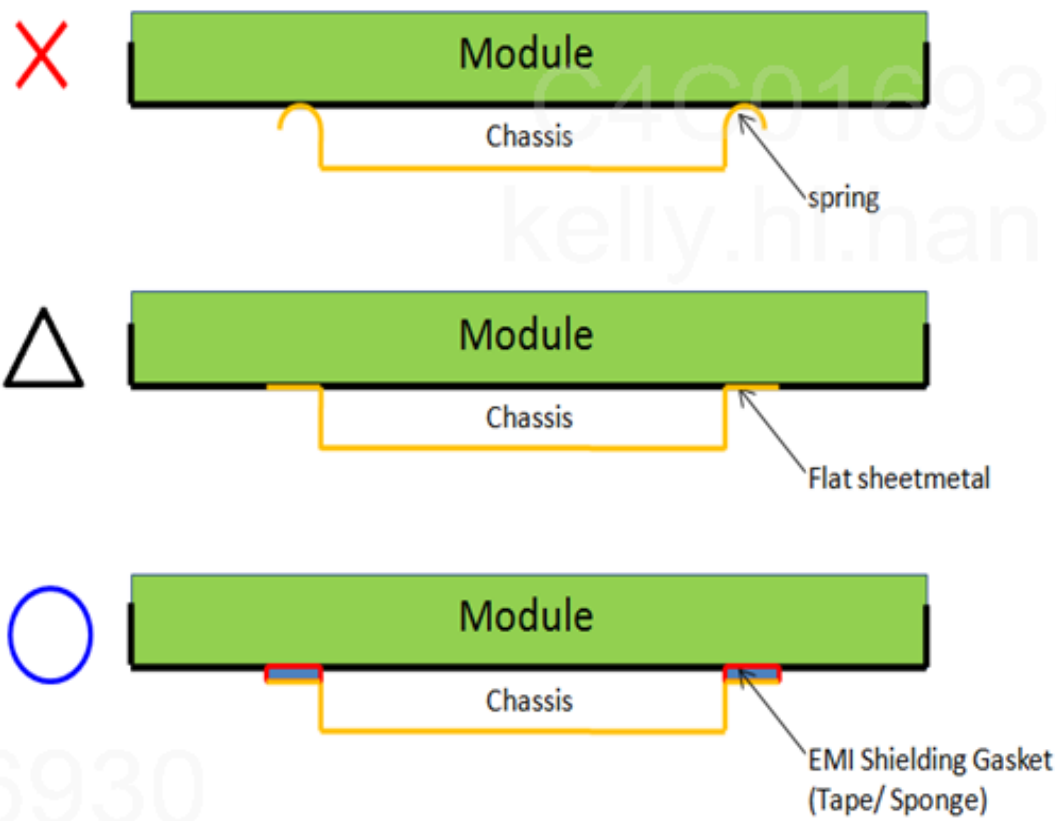
- (1) Normal operating condition
  - (a) Display pattern: dynamic pattern (Real display)
    - (Note) Long-term static display can cause image sticking.
- (2) Operating usages to protect against image sticking due to long-term static display
  - (a) Static information display recommended to use with moving image.
- (3) Abnormal condition just means conditions except normal condition.

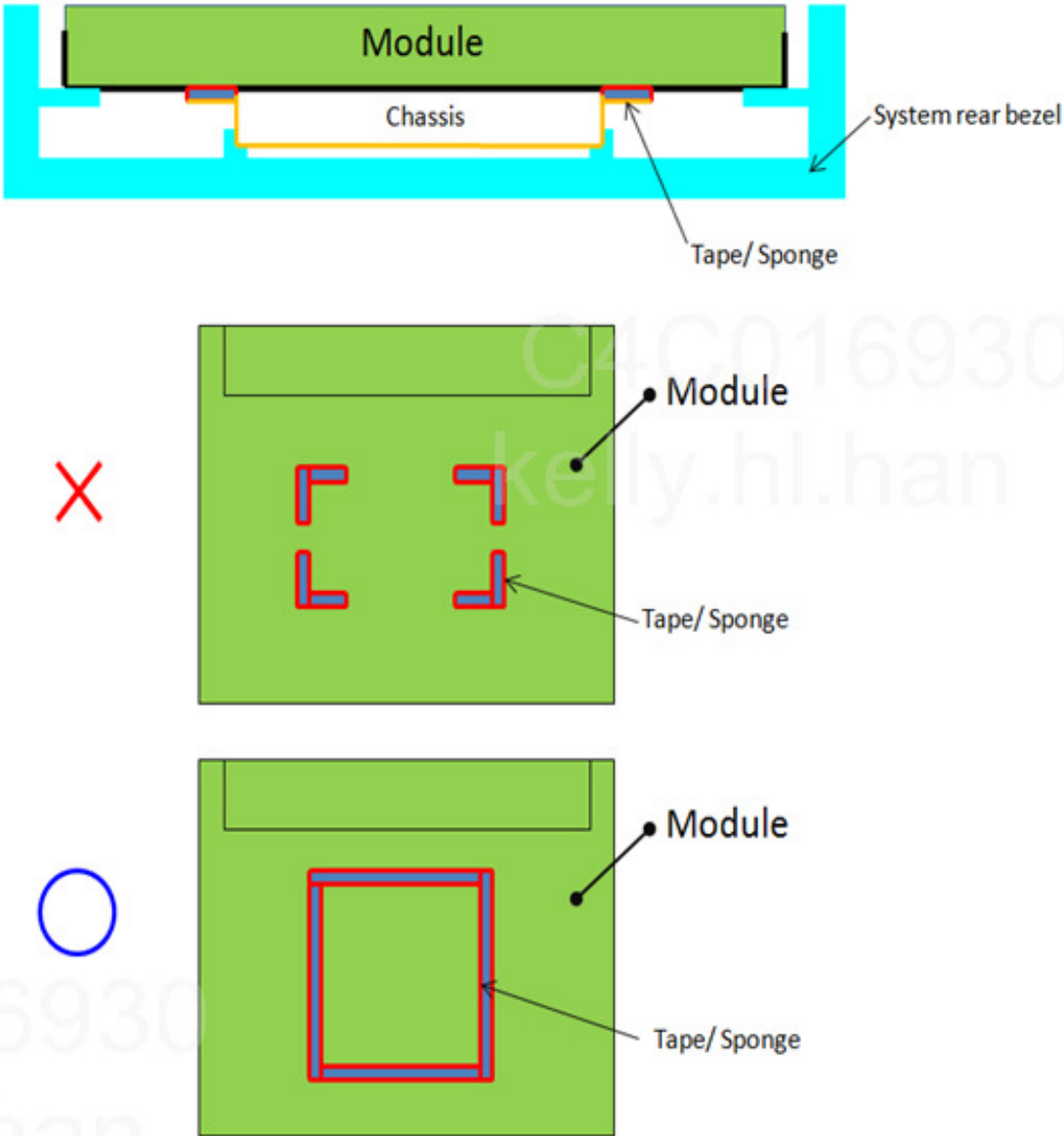
## 12. MECHANICAL CHARACTERISTIC

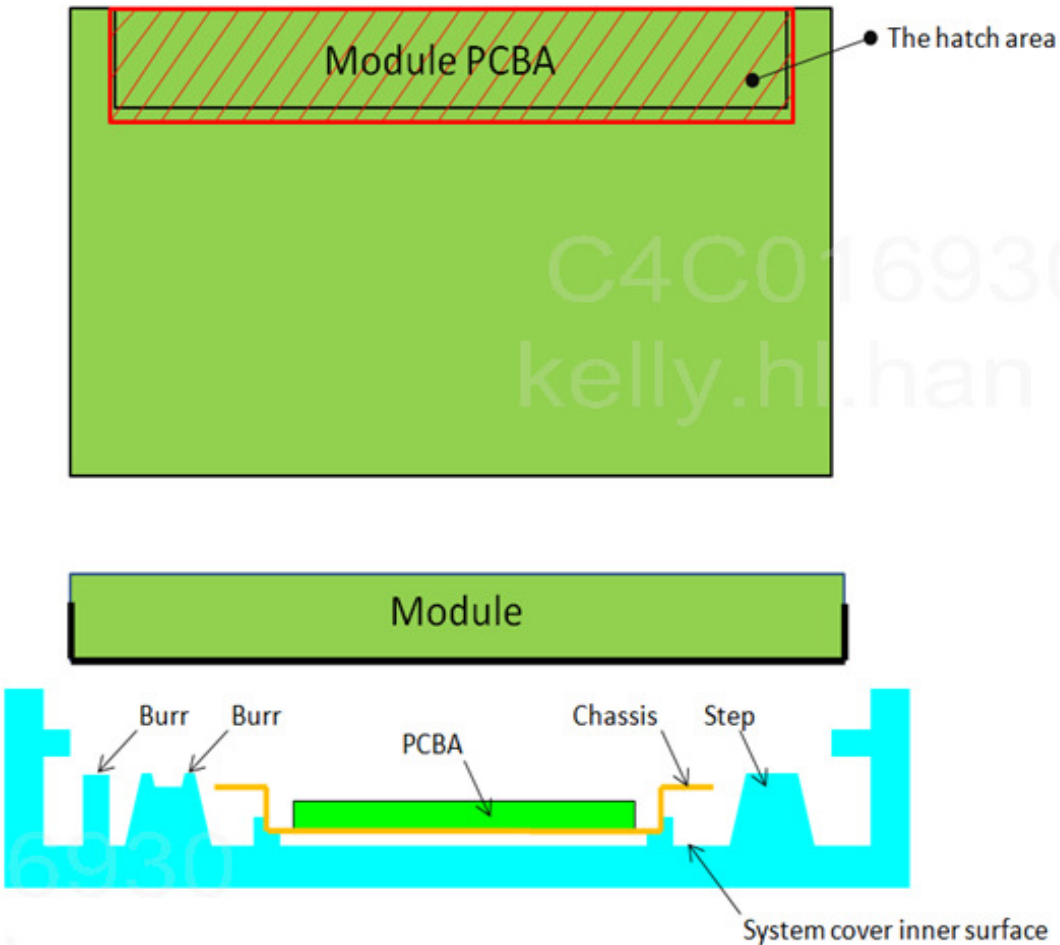


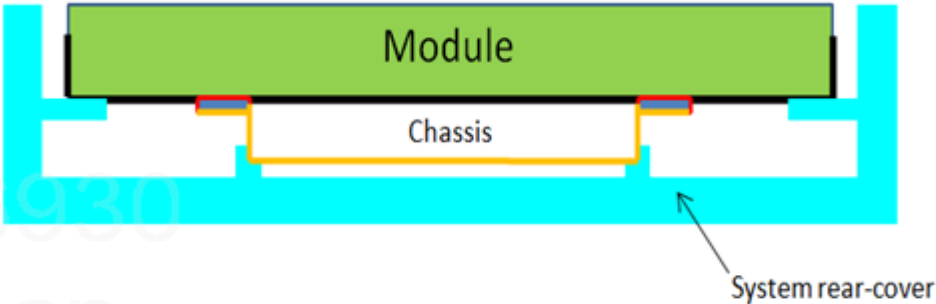


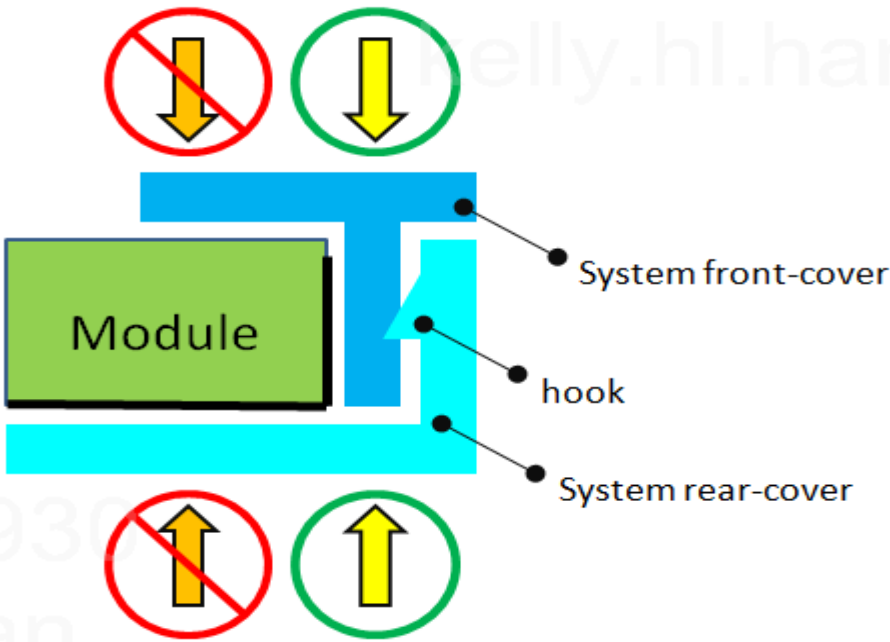
## Appendix . SYSTEM COVER DESIGN NOTICE

| 1          | Set Chassis and IAVM Module touching Mode                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|            |  <p>The diagrams illustrate three methods of connecting a green 'Module' to a yellow 'Chassis':</p> <ul style="list-style-type: none"> <li><b>Top Diagram (Red X):</b> Shows a module connected to a chassis using springs at the ends. This method is marked as incorrect.</li> <li><b>Middle Diagram (Black Triangle):</b> Shows a module connected to a chassis using flat sheet metal at the ends. This method is marked as a warning.</li> <li><b>Bottom Diagram (Blue Circle):</b> Shows a module connected to a chassis using EMI Shielding Gasket (Tape/ Sponge) at the ends. This method is marked as the recommended approach.</li> </ul> |
| Definition | <p>a. To prevent from abnormal display &amp; white spot after mechanical test, it is not recommended to use spring type chassis.</p> <p>b. We suggest the contact mode between Chassis and Module rear cover is Tape/Sponge, second is Flat sheet metal type chassis.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

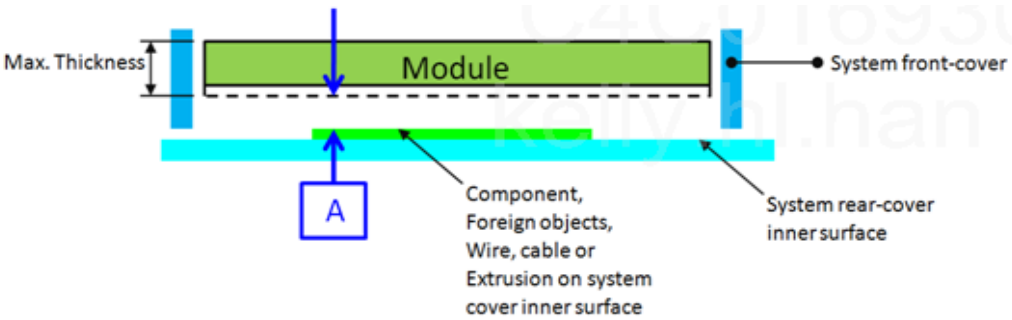
| 2          | Tape/Sponge design on system inner surface                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|            |  <p>The top diagram shows a cross-section of the system assembly. A green 'Module' is mounted on a yellow 'Chassis'. A red 'Tape/Sponge' is placed between the module and the chassis. A blue 'System rear bezel' is shown on the right. The bottom two diagrams show top-down views of the module. The middle diagram, marked with a red 'X', shows four separate red 'Tape/Sponge' pieces placed at the corners of the module. The bottom diagram, marked with a blue circle, shows a single red 'Tape/Sponge' piece placed as a continuous frame around the module.</p> |
| Definition | <p>a. To prevent from abnormal display &amp; white spot after mechanical test, we suggest using Tape/Sponge as medium between chassis and Module rear cover could reduce the occurrence of white spot.</p> <p>b. When using the Tape/Sponge, we suggest it be lay over between set chassis and Module rear cover. It is not recommended to add Tape/Sponge in separate location. Since each Tape/Sponge may act as pressure concentration location.</p>                                                                                                                                                                                                       |

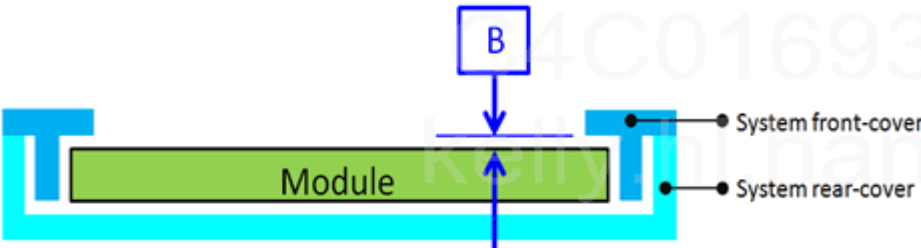
|                                                                                     |                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3                                                                                   | System inner surface examination                                                                                                                                                                                                                           |
|  |                                                                                                                                                                                                                                                            |
| Definition                                                                          | <p>a. The hatch area on Module PCBA should keep at least 1mm gap(X,Y,Z direction) to any structure with system cover inner surface.</p> <p>b. Burr, Step, PCB protrusion may cause stress concentration. White spot may occur during reliability test.</p> |

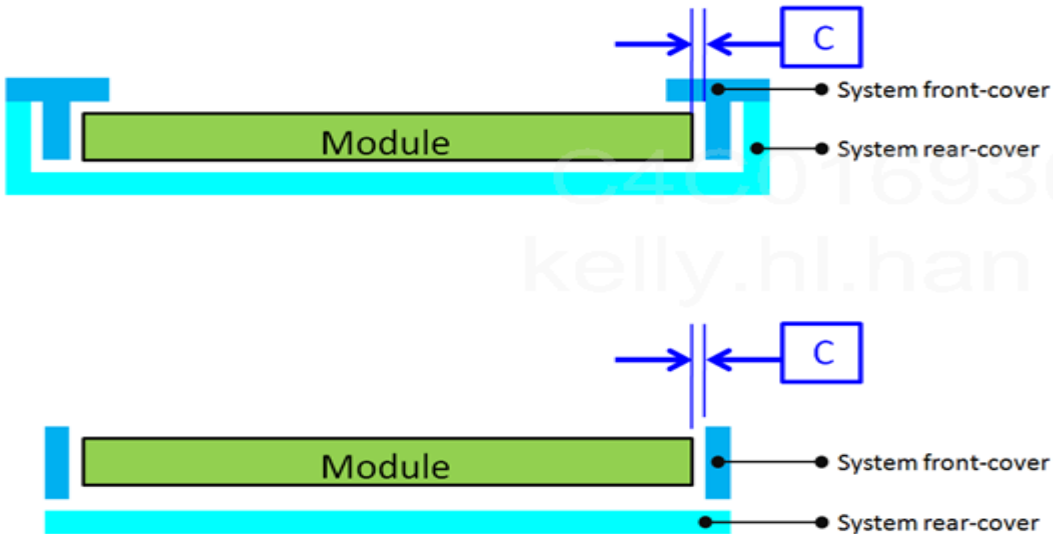
|                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4                                                                                  | <b>Material used for system rear-cover</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Definition                                                                         | <p>System rear-cover material with high rigidity is needed to resist deformation during scuffing test, hinge test, pogo test or backpack test. Abnormal display, white spot, pooling issue may occur if low rigidity material is used. Pooling issue may occur because screw's boss position for module's bracket are deformed open-close test.</p> <p>Solid structure design of system rear-cover may also influence the rigidity of system rear-cover. The deformation of system rear-cover should not caused interference.</p> |

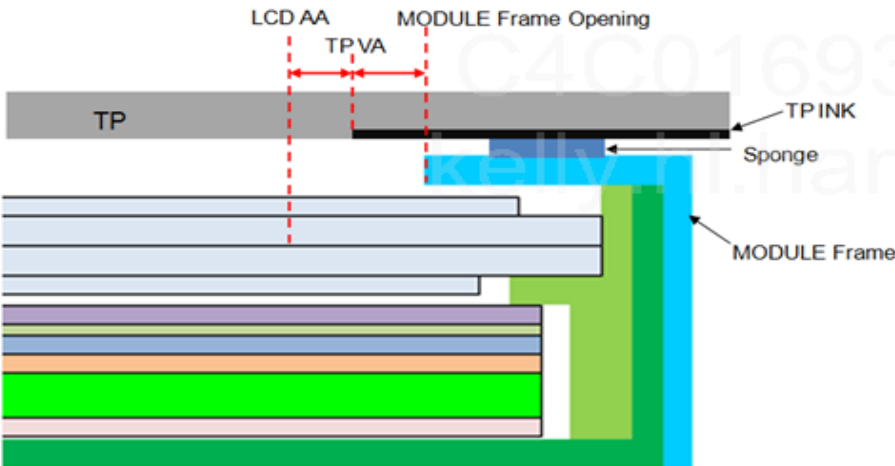
|                                                                                      |                                                                                                                                                                                       |
|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5                                                                                    | <b>Assembly SOP examination for system front-cover with hook structure</b>                                                                                                            |
|  |                                                                                                                                                                                       |
| Definition                                                                           | <p>To prevent panel crack during system front-cover assembly process with hook structure, it is not recommended to press panel or any location that relate directly to the panel.</p> |

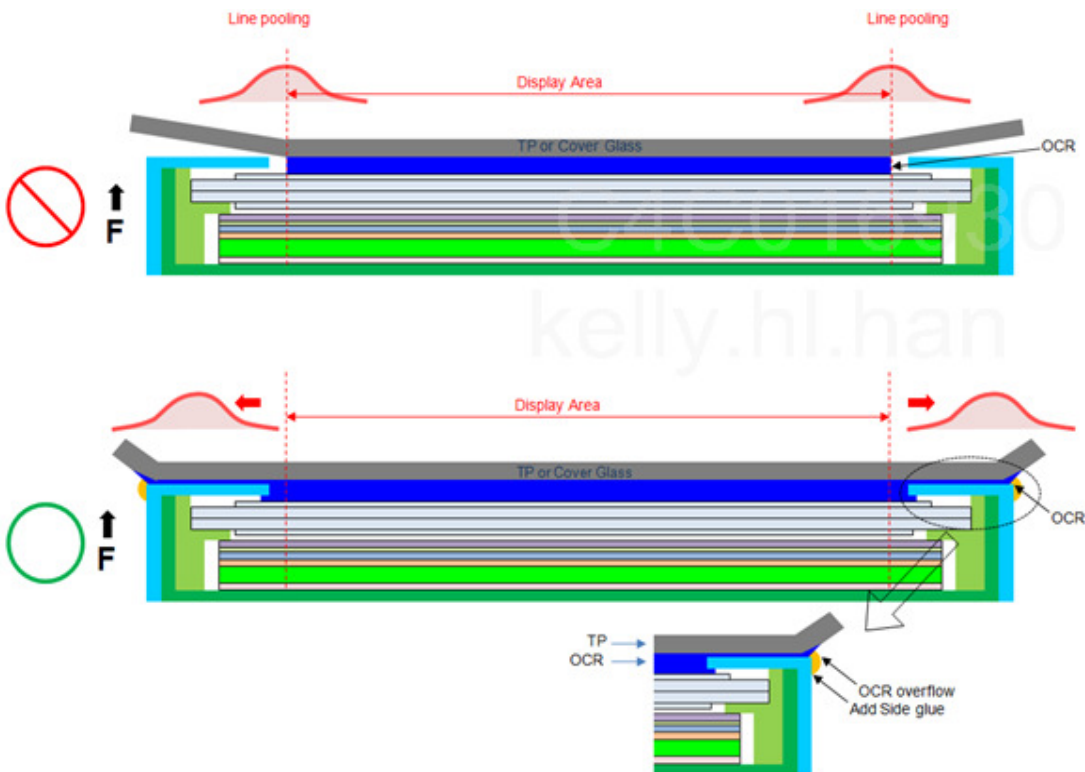
| 6          | Permanent deformation of system cover after reliability test                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Definition | <p>System cover including front cover and rear cover may deform during reliability test. Permanent deformation of system front cover and rear cover after reliability test should not interfere with panel. Because it may cause issue such as pooling, abnormal display, white spot and also cell creak.</p> <p>Note: If the interference cannot be avoided, please feel free to contract INX FAE Engineer for collaboration design. We can help to verify and pass risk assessment for customer reference.</p> |

|                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7                                                                                  | <b>Design gap A between panel &amp; any components on system rear-cover</b>                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Definition                                                                         | <p>System cover including front cover and rear cover may deform during reliability test. Permanent deformation of system front cover and rear cover after reliability test should not interfere with panel. Because it may cause issue such as pooling, abnormal display, white spot and also cell crack.</p> <p>Note: If the interference cannot be avoided, please feel free to contract INX FAE Engineer for collaboration design. We can help to verify and pass risk assessment for customer reference.</p> |

|                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8                                                                                    | <b>Design gap B between system front-cover &amp; panel surface</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Definition                                                                           | <p>Gap between system front-cover &amp; panel surface is needed to prevent pooling or glass broken. Zero gap or interference such as burr and warpage from mold frame may cause pooling issue near system front-cover opening edge. This phenomenon is obvious during swing test, hinge test, knock test or during pooling inspection procedure.</p> <p>To remain sufficient gap, design with system rib higher than maximum panel thickness is recommended.</p> <p>Note: If the interference cannot be avoided, please feel free to contract INX FAE Engineer for collaboration design. We can help to verify and pass risk assessment for customer reference.</p> |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Design gap C between panel & system front-cover or protrusions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|  <p>The diagrams illustrate the required gap C between the module and the system front-cover or protrusions. The top diagram shows a module (green rectangle) with a system front-cover (blue T-shape) and system rear-cover (blue L-shape). A gap C is indicated between the module and the front-cover. The bottom diagram shows a module (green rectangle) with a system front-cover (blue T-shape) and system rear-cover (blue L-shape). A gap C is indicated between the module and the front-cover.</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Definition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <p>Gap between panel &amp; system front-cover or protrusions is needed to prevent shock test failure. Because system front-cover or protrusions with small gap may hit panel during the test. Issue such as cell crack, abnormal display may occur.</p> <p>The gap should be large enough to absorb the maximum displacement during the test.</p> <p>Note: If the interference cannot be avoided, please feel free to contract INX FAE Engineer for collaboration design. We can help to verify and pass risk assessment for customer reference.</p> |

|                                                                                    |                                                                                           |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| 10                                                                                 | <b>Design distance between TP AA to LCD AA</b>                                            |
|  |                                                                                           |
| Definition                                                                         | TP VA should avoid TP ink area covering LCD AA or causing the module frame to be exposed. |

|                                                                                      |                                                                                                                 |
|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| 11                                                                                   | <b>Use OCR Lamination</b>                                                                                       |
|  |                                                                                                                 |
| Definition                                                                           | 1. OCR glue as possible beyond module, in order to avoid Line Pooling<br>2. Add side glue to avoid Line Pooling |