

- ☐ Tentative Specification
- ☐ Preliminary Specification
- ☒ Approval Specification

MODEL NO.: G101ICE  
SUFFIX: LM1

**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 |
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**REVISION HISTORY**

| Version | Date        | Page | Description            |
|---------|-------------|------|------------------------|
| Ver 2.0 | 02 May 2023 | All  | V2.0 was first issued. |
|         |             |      |                        |
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|         |             |      |                        |

## 1. GENERAL DESCRIPTION

### 1.1 OVERVIEW

G101ICE-LM1 is a 10.1" TFT Liquid Crystal Display module with LED Backlight units and 30 pins LVDS interface. This module supports 1280 x 800 WXGA mode and can display 16.7M/ 262k colors. The LED driving device for Backlight is built in PCBA.

### 1.2 FEATURE

- WXGA (1280 x 800 pixels) resolution
- DE (Data Enable) only mode
- LVDS Interface with 1pixel/clock
- Wide operating temperature.
- RoHS compliance

### 1.3 APPLICATION

- TFT LCD Monitor
- Factory Application
- Amusement

### 1.4 GENERAL SPECIFICATIONS

| Item                     | Specification                            | Unit  | Note |
|--------------------------|--|-------|------|
| Active Area              | 216.96 (H) x 135.60 (V) (10.1" diagonal) | mm    | (1)  |
| Driver Element           | a-Si TFT active matrix                   | -     | -    |
| Pixel Number             | 1280 x R.G.B x 800                       | pixel | -    |
| Pixel Pitch              | 0.1695 (H) x 0.1695 (V)                  | mm    | -    |
| Pixel Arrangement        | RGB vertical Stripe                      | -     | -    |
| Display Colors           | 16.7M / 262K                             | color | -    |
| Display Mode             | Normally Black                           | -     | -    |
| Surface Treatment        | Hard Coating (3H), Anti-Glare            | -     | -    |
| Module Power Consumption | 3.1                                      | W     | Typ. |

## 1.5 MECHANICAL SPECIFICATIONS

| Item         |               | Min.   | Typ.                           | Max.        | Unit | Note |
|--------------|---------------|--------|--------------------------------|-------------|------|------|
| Module Size  | Horizontal(H) | 226.92 | 227.42                         | 227.92      | mm   | (1)  |
|              | Vertical(V)   | 147.19 | 147.69                         | 148.19      | mm   |      |
|              | Depth(D)      | -      | 2.55(w/o PCBA)<br>4.35(w/PCBA) | 2.8<br>4.85 | mm   |      |
| CF Polarizer | Horizontal    | 219.06 | 219.31                         | 219.56      | mm   | -    |
|              | Vertical      | 138.0  | 138.25                         | 138.50      | mm   |      |
| Active Area  | Horizontal    | 216.86 | 216.96                         | 217.06      | mm   |      |
|              | Vertical      | 135.50 | 135.60                         | 135.70      | mm   |      |
| Weight       |               | -      | 183                            | 190         | g    |      |

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

## 2. ABSOLUTE MAXIMUM RATINGS

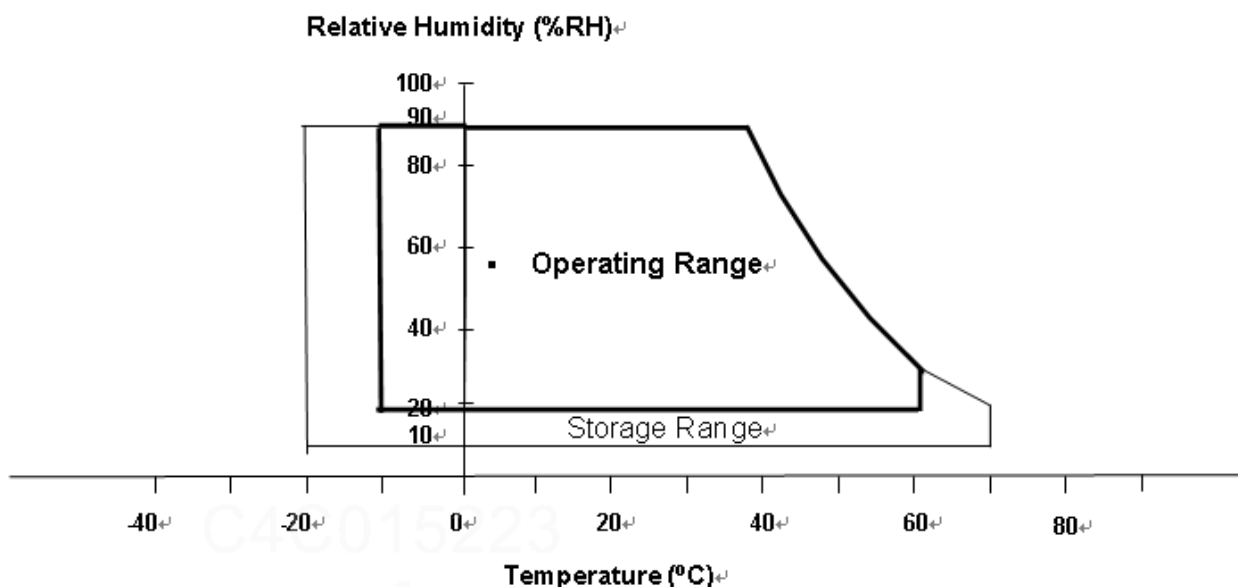
### 2.1 ABSOLUTE RATINGS OF ENVIRONMENT

| Item                          | Symbol          | Value |      | Unit | Note   |
|-------------------------------|-----------------|-------|------|------|--------|
|                               |                 | Min.  | Max. |      |        |
| Operating Ambient Temperature | T <sub>OP</sub> | -10   | +60  | °C   | (1)(2) |
| Storage Temperature           | T <sub>ST</sub> | -20   | +70  | °C   |        |

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

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

Note (2) Any condition of ambient operating temperature ,the surface of active area should be keeping not higher than 60°C.(Panel surface temperature).



## 2.2 ELECTRICAL ABSOLUTE RATINGS

### 2.2.1 TFT LCD MODULE

| Item                 | Symbol          | Value |      | Unit | Note |
|----------------------|-----------------|-------|------|------|------|
|                      |                 | Min.  | Max. |      |      |
| Power Supply Voltage | VCC             | -0.3  | 5.5  | V    | (1)  |
| Logic Input Voltage  | V <sub>IN</sub> | -0.3  | 4.0  | V    |      |

### 2.2.2 BACKLIGHT UNIT

| Item              | Symbol         | Value |      | Unit | Note      |
|-------------------|----------------|-------|------|------|-----------|
|                   |                | Min.  | Max. |      |           |
| Converter Voltage | V <sub>i</sub> | -0.3  | 18   | V    | (1) , (2) |
| Enable Voltage    | EN             | -0.3  | 5.5  | V    |           |
| Backlight Adjust  | Dimming        | -0.3  | 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 LED (Refer to 3.2 for further information).



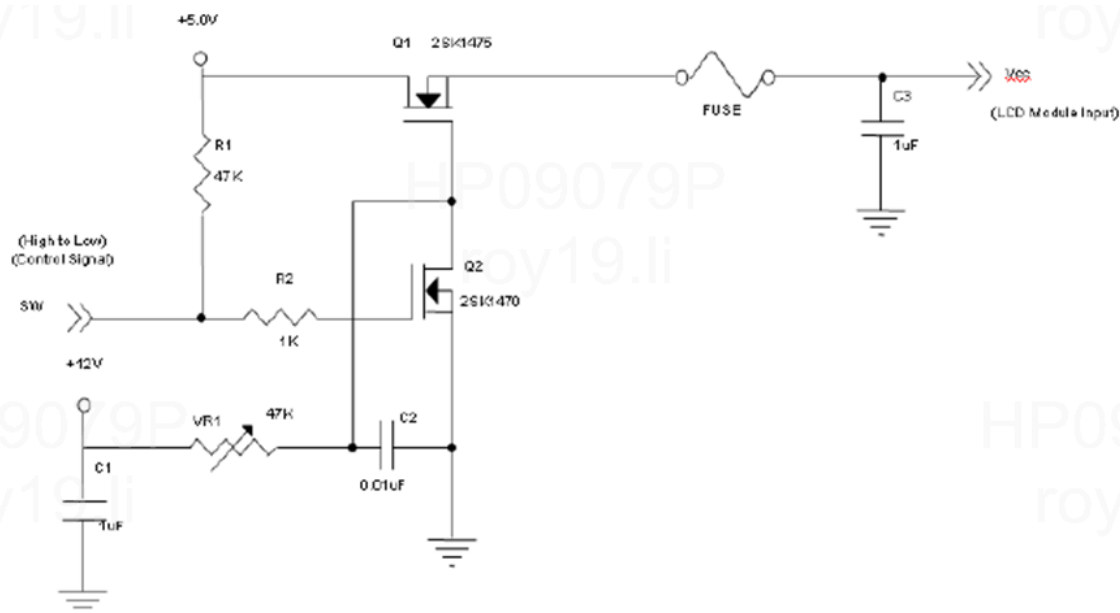
## 3. ELECTRICAL CHARACTERISTICS

### 3.1 TFT LCD MODULE

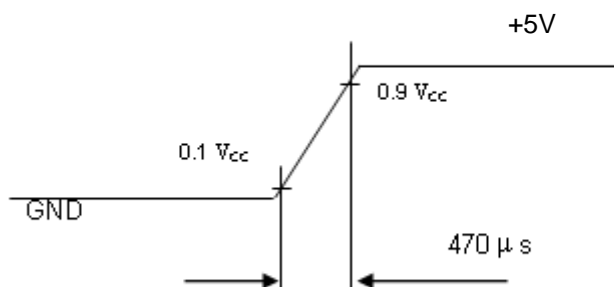
| Parameter  | Symbol       | Value    |      |      | Unit  | Note |
|--|--------------|----------|------|------|-------|------|
|  |              | Min.     | Typ. | Max. |       |      |
| Power Supply Voltage                                   | $V_{CC}$     | 4.5      | 5    | 5.5  | V     | -    |
| Ripple Voltage   | $V_{RP}$     | -        | -    | 300  | mVp-p |      |
| Inrush Current   | $I_{INRUSH}$ | -        | -    | 2.0  | A     | (2)  |
| Power Supply Current                                   | White        |          | 220  | 250  | mA    | (3)a |
|  | Black        |          | 140  | 170  | mA    | (3)b |
| LVDS differential input voltage                        | $V_{id}$     | 200      | -    | 600  | mV    | (5)  |
| LVDS common input voltage                              | $V_{ic}$     | 1.0      | 1.2  | 1.4  | V     | (5)  |
| 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:

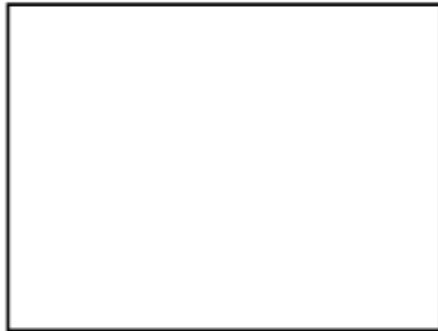


**Vcc 上升時間為 470μs**



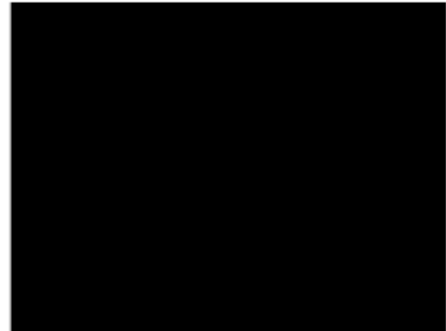
Note (3) The specified power supply current is under the conditions at  $V_{DD} = 5V$ ,  $T_a = 25 \pm 2^\circ C$ , DC Current and  $f_v = 60$  Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

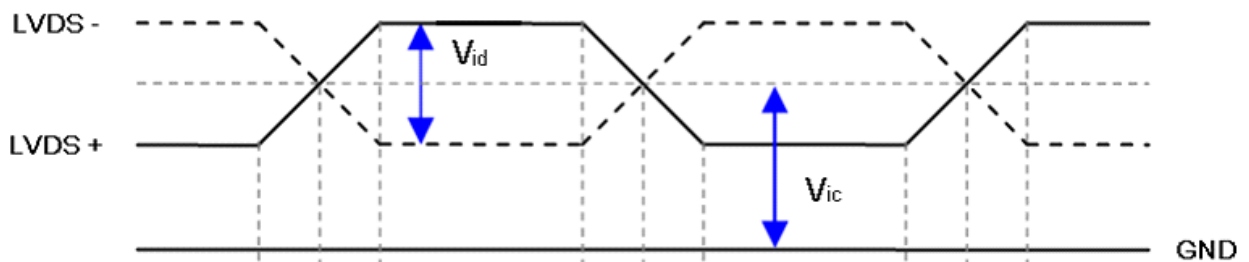
b. Black Pattern



Active Area

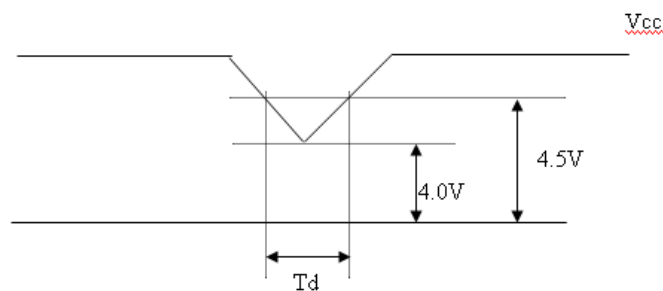
Note (4) The power consumption is specified at the pattern with the maximum current.

Note (5) VID waveform condition



### 3.2 Vcc Power Dip Condition

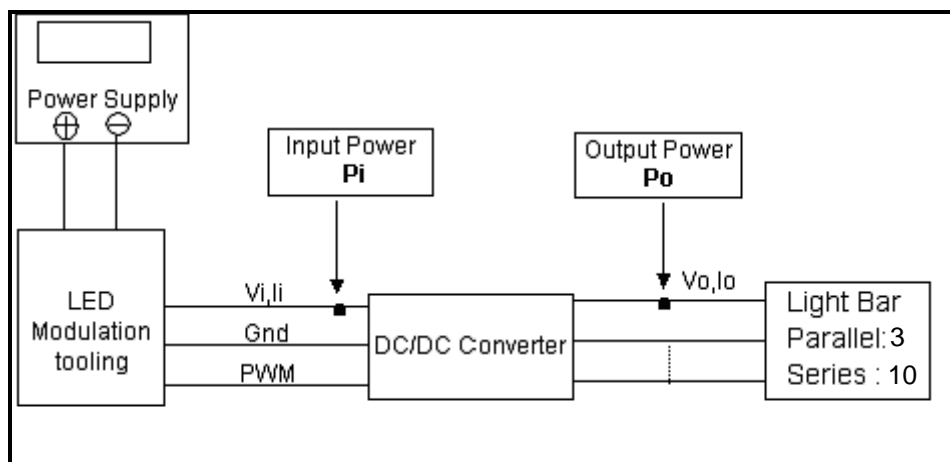
- Dip condition:  $4.0V \leq V_{cc} \leq 4.5V$ ,  $T_d \leq 20ms$



## 3.3 BACKLIGHT UNIT

| Parameter                      |                | Symbol          | Value  |      |      | Unit     | Note   |
|--------------------------------|----------------|-----------------|--------|------|------|----------|--|
|                                |                |                 | Min.   | Typ. | Max. |          |  |
| Converter Input Voltage        |                | $V_i$           | 10.8   | 12.0 | 13.2 | $V_{DC}$ | (Duty 100%)                                      |
| Converter Input Ripple Voltage |                | $V_{iRP}$       | -      | -    | 350  | mV       |  |
| Converter Input Current        |                | $I_i$           | -      | 0.17 | 0.2  | $A_{DC}$ | @ $V_i = 12V$<br>(Duty 100%)                     |
| Converter Inrush Current       |                | $I_{iRUSH}$     | -      | -    | 3.0  | A        | @ $V_i$ rising time =<br>20ms ( $V_i = 12V$ )    |
| Input Power Consumption        |                | $P_i$           | -      | 2.0  | 2.4  | W        | (1), @ $V_i = 12V$ (Duty 100%)                   |
| EN Control Level               | Backlight on   | ENLED (BLON)    | 2.5    | 3.3  | 5.0  |          |  |
|                                | Backlight off  |                 | 0      | ---  | 0.3  |          |  |
| PWM Control Level              | PWM High Level | Dimming (E_PWM) | 2.5    | 3.3  | 5.0  |          |  |
|                                | PWM Low Level  |                 | 0      | -    | 0.15 |          |  |
| PWN Noise Range                |                | $V_{Noise}$     | -      | -    | 0.1  | V        |  |
| PWM Control Frequency          |                | $f_{PWM}$       | 190    | 200  | 20k  | Hz       | (2)  |
| PWM Dimming Control Duty Ratio |                | -               | 5      |      | 100  | %        | (2), Suggestion @<br>$190Hz \leq f_{PWM} < 1kHz$ |
|                                |                |                 | 20     | -    | 100  | %        | (2), @<br>$1kHz \leq f_{PWM} \leq 20kHz$         |
| LED Life Time                  |                | $L_{LED}$       | 12,000 | -    | -    | 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%.

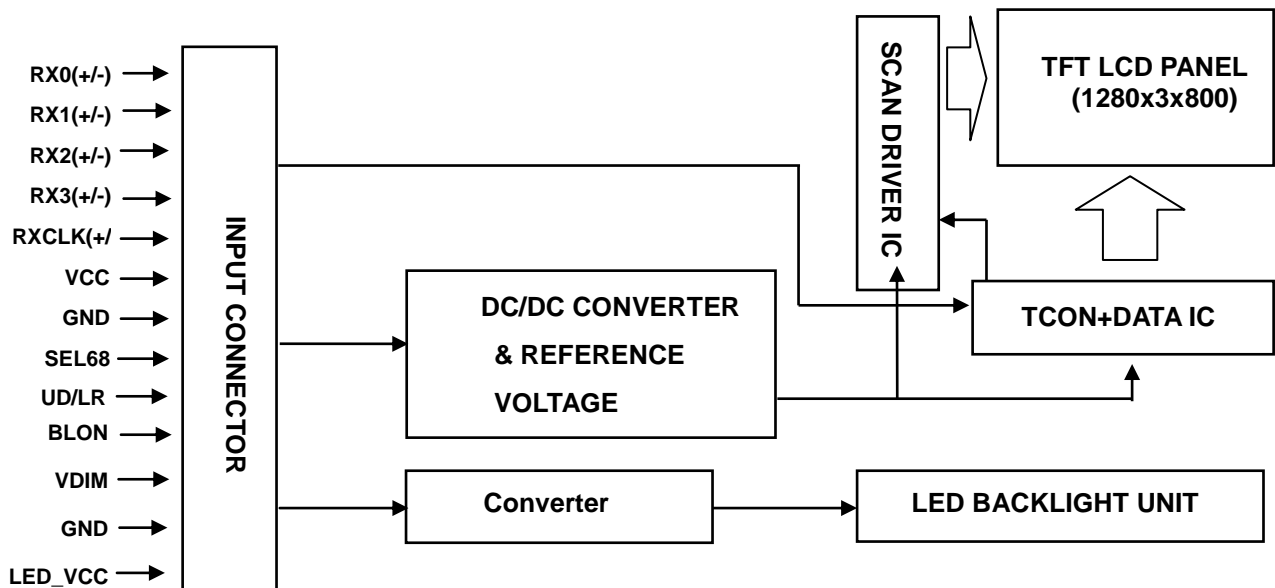
1K ~20kHz PWM control frequency, duty ratio range is restricted from 20% to 100%.

If PWM control frequency is applied in the range from 1KHz to 20KHZ, The "non-linear" phenomenon on 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  $T_a = 25 \pm 2^\circ C$  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. INPUT TERMINAL PIN ASSIGNMENT

### 5.1 TFT LCD MODULE

| Pin No. | Symbol  | Function   | Polarity | Note   |
|---------|---------|--|----------|--------|
| 1       | VCC     | Power supply 5V  |          | (5)    |
| 2       | VCC     | Power supply 5V  |          |        |
| 3       | UD/LR   | Reverse Scan Control,<br>Low → Normal Mode. High → Reverse Scan                          |          | (3)(4) |
| 4       | NC      | Not connection, this pin should be open  |          |        |
| 5       | NC      | Not connection, this pin should be open  |          |        |
| 6       | SEL68   | LVDS 6/8 bit select function control,<br>Low → 6 bit Input Mode. High → 8bit Input Mode. |          | (3)(4) |
| 7       | NC      | Not connection, this pin should be open  |          |        |
| 8       | NC      | Not connection, this pin should be open  |          |        |
| 9       | LED_VCC | Converter input voltage 12V  |          |        |
| 10      | LED_VCC | Converter input voltage 12V  |          |        |
| 11      | LED_VCC | Converter input voltage 12V  |          |        |
| 12      | NC      | Not connection, this pin should be open  |          |        |
| 13      | LED_GND | Converter ground   |          |        |
| 14      | LED_GND | Converter ground   |          |        |
| 15      | LED_GND | Converter ground   |          |        |
| 16      | LED_EN  | Enable pin 3.3V  |          |        |
| 17      | LED_PWM | Backlight Adjust<br>(PWM Dimming 190-210Hz, H: 3.3VDC, L: 0VDC)                          |          |        |
| 18      | NC      | Not connection, this pin should be open  |          |        |
| 19      | GND     | Ground   |          |        |
| 20      | RXO3+   | Positive LVDS differential data input. Channel O3  | Positive |        |
| 21      | RXO3-   | Negative LVDS differential data input. Channel O3  | Negative |        |
| 22      | RXOC+   | Positive LVDS differential clock input.  | Positive |        |
| 23      | RXOC-   | Negative LVDS differential clock input.  | Negative |        |
| 24      | GND     | Ground   |          |        |
| 25      | RXO2+   | Positive LVDS differential data input. Channel O2  | Positive |        |
| 26      | RXO2-   | Negative LVDS differential data input. Channel O2  | Negative |        |
| 27      | RXO1+   | Positive LVDS differential data input. Channel O1  | Positive |        |
| 28      | RXO1-   | Negative LVDS differential data input. Channel O1  | Negative |        |
| 29      | RXO0+   | Positive LVDS differential data input. Channel O0  | Positive |        |
| 30      | RXO0-   | Negative LVDS differential data input. Channel O0  | Negative |        |

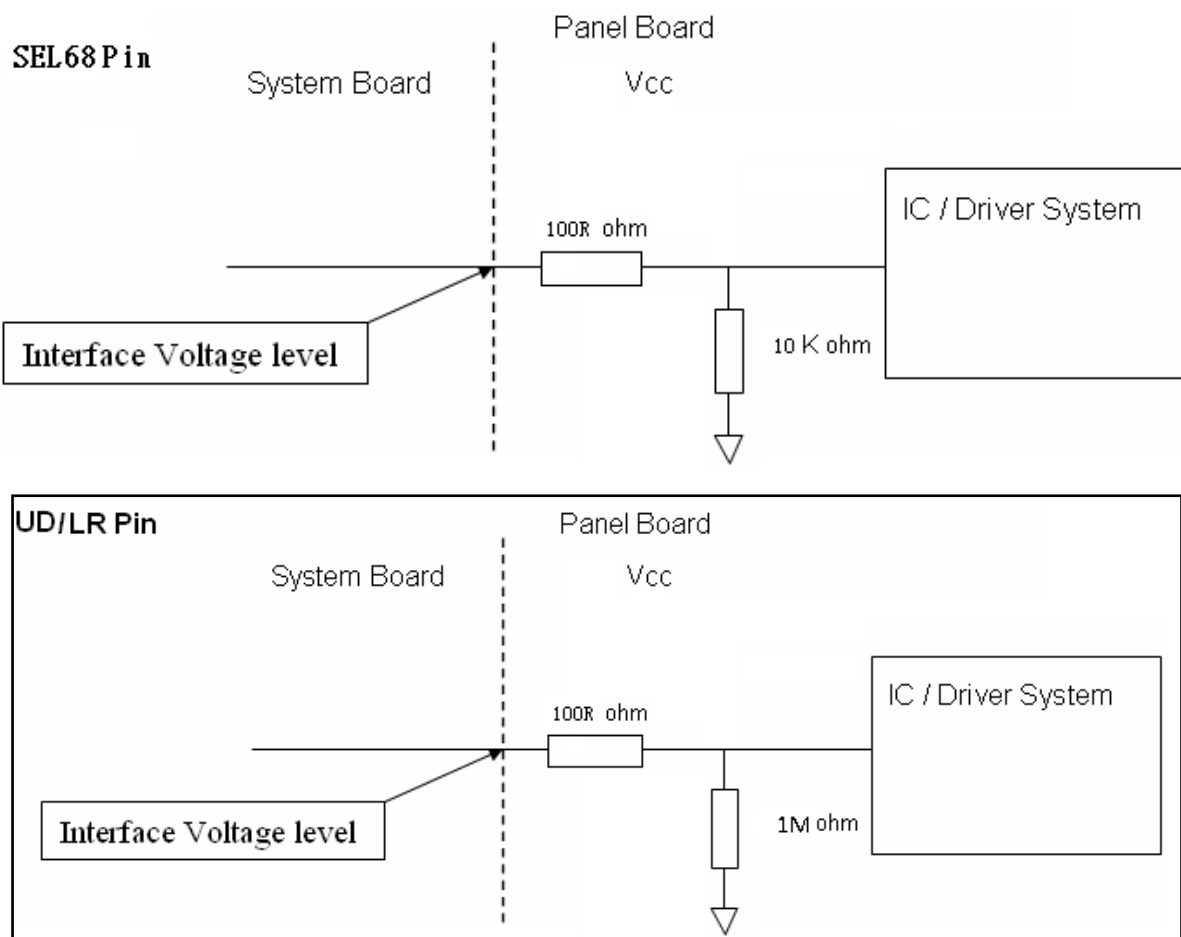
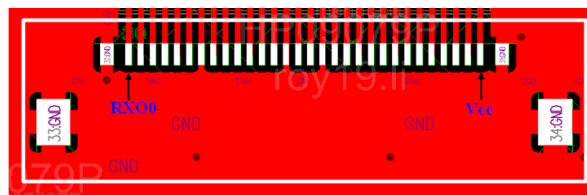
Note (1) Connector Part No.: **STM MSAK24025P30MB(Exterior silver) or I-PEX 20455-030E-76(Exterior gold) or equivalent.**

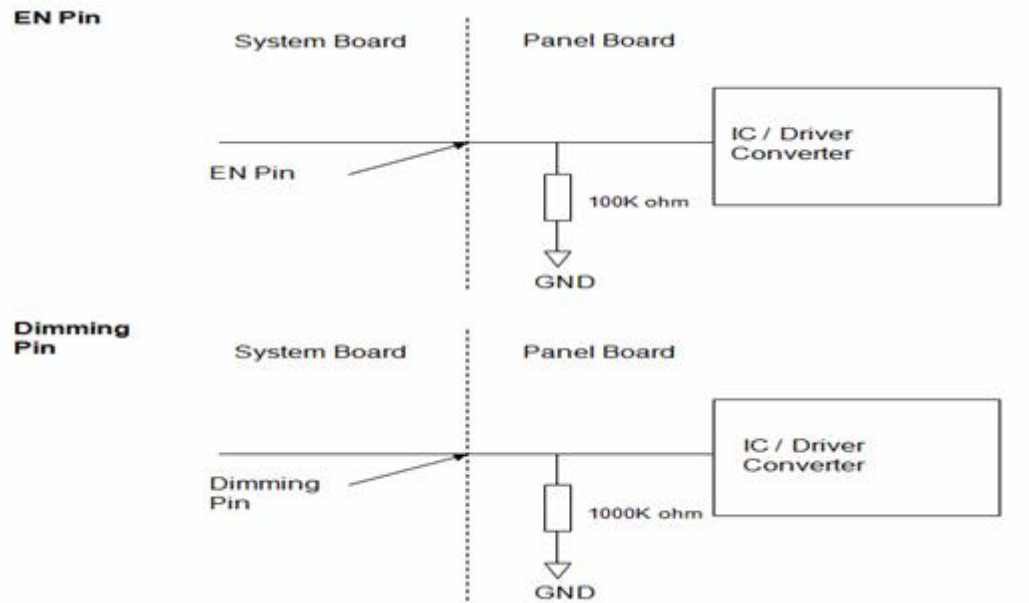
Note (2) User's connector Part No.: I-PEX 20453-030T-03 or equivalent

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

Note (4) Interface optional pin has internal scheme as following diagram, Customer should keep the interface voltage level requirement which including panel board loading as below.

Note (5) Pin1 location is Power supply 5V to comply with MECHANICAL CHARACTERISTICS.





## 5.2 COLOR DATA INPUT ASSIGNMENT

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

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

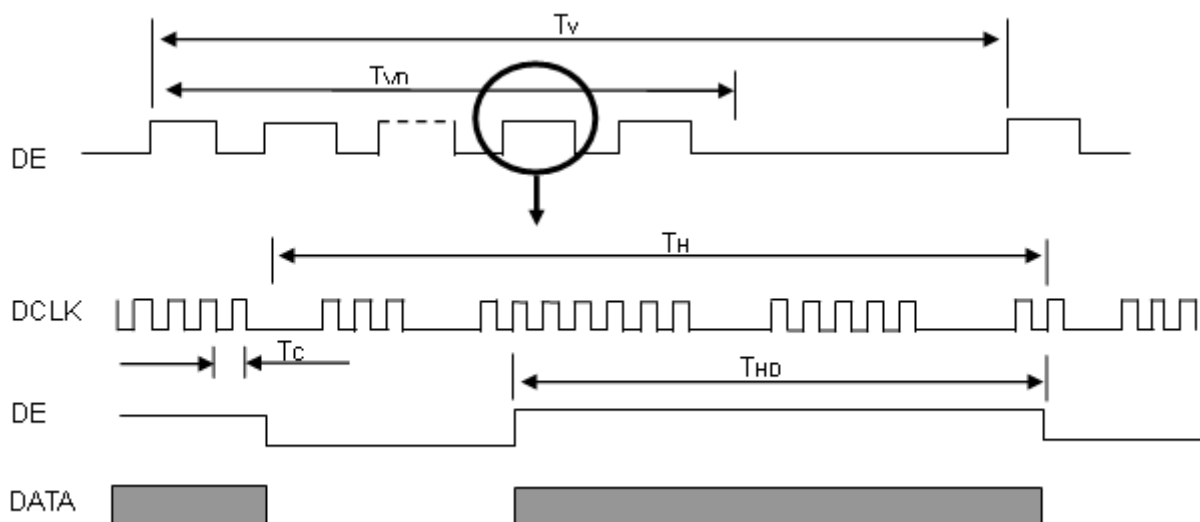
The input signal timing specifications are shown as the following table and timing diagram.

| Signal                  | Item                                 | Symbol                  | Min.  | Typ.  | Max.  | Unit           | Note   |
|-------------------------|--------------------------------------|-------------------------|-------|-------|-------|----------------|--|
| LVDS Clock              | Frequency                            | F <sub>c</sub>          | 65    | 71.1  | 74.7  | MHz            | -  |
|                         | Period                               | T <sub>c</sub>          | 13.38 | 14.06 | 15.38 | ns             |  |
|                         | Input Clock to data skew             | TLVCCS                  | -     | -     | 0.25  | UI             | (a)  |
|                         | Spread spectrum modulation range     | F <sub>clk_in_mod</sub> | -1.5  | -     | 1.5   | %              | (b)  |
|                         | Spread spectrum modulation frequency | F <sub>SSM</sub>        | -     | -     | 90    | KHz            |  |
| Vertical Display Term   | Frame Rate                           | Fr                      | 60    | 60    | 60    | Hz             | -  |
|                         | Total                                | T <sub>v</sub>          | 810   | 823   | 900   | Th             | T <sub>v</sub> =T <sub>vd</sub> +T <sub>vb</sub> |
|                         | Active Display                       | T <sub>vd</sub>         | 800   | 800   | 800   | Th             | -  |
|                         | Blank                                | T <sub>vb</sub>         | 10    | 23    | 100   | Th             | -  |
| Horizontal Display Term | Total                                | T <sub>h</sub>          | 1362  | 1440  | 1480  | T <sub>c</sub> | T <sub>h</sub> =T <sub>hd</sub> +T <sub>hb</sub> |
|                         | Active Display                       | T <sub>hd</sub>         | 1280  | 1280  | 1280  | T <sub>c</sub> | -  |
|                         | Blank                                | T <sub>hb</sub>         | 82    | 160   | 170   | T <sub>c</sub> | -  |

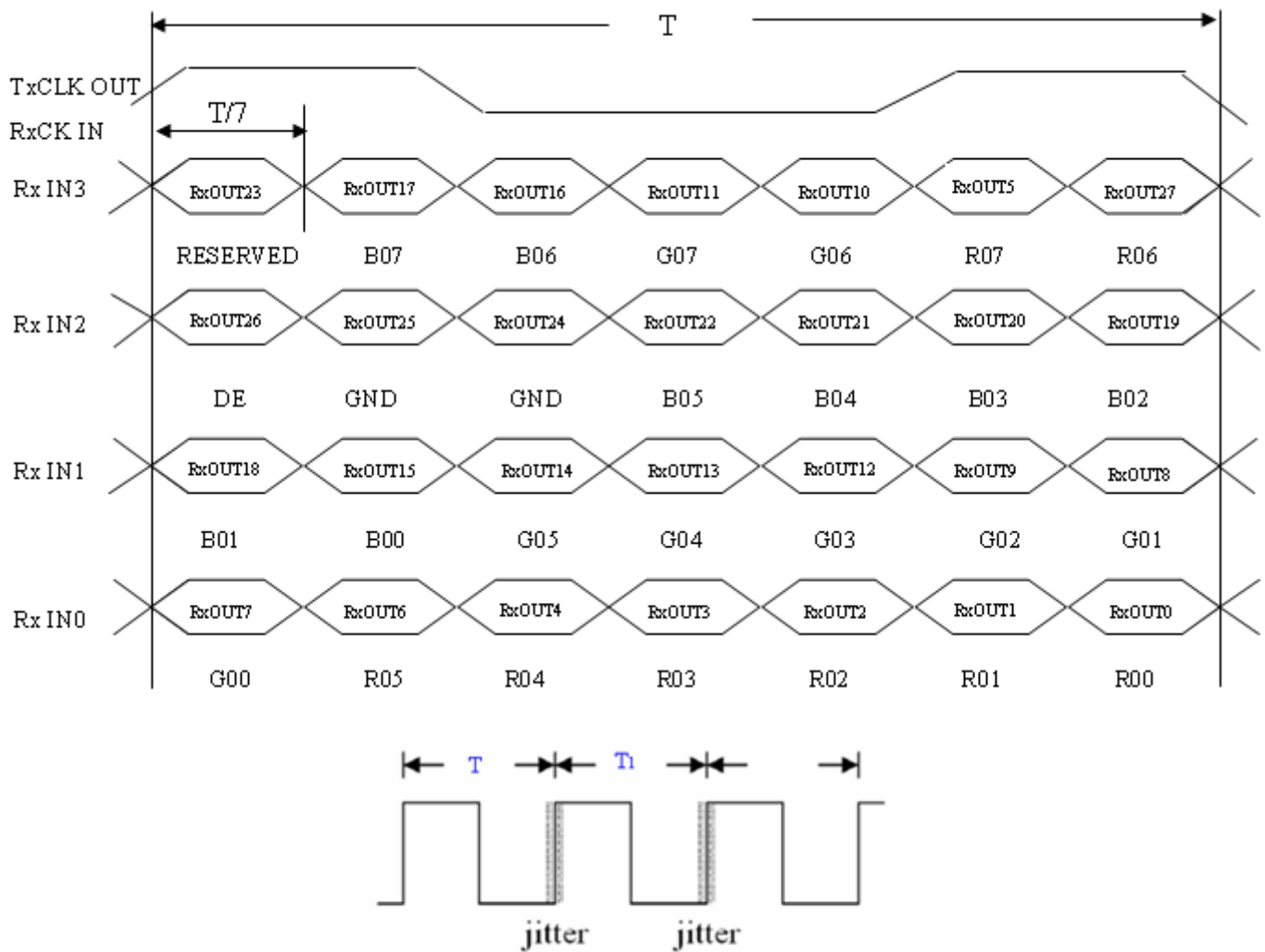
Note (1) Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

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

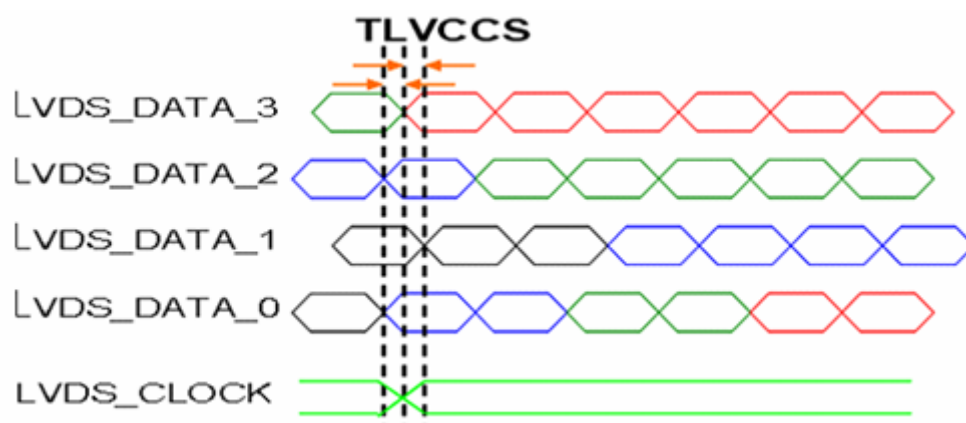
#### INPUT SIGNAL TIMING DIAGRAM



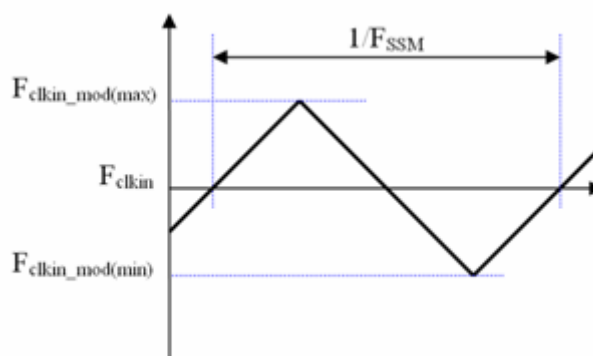
## TIMING DIAGRAM of LVDS



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

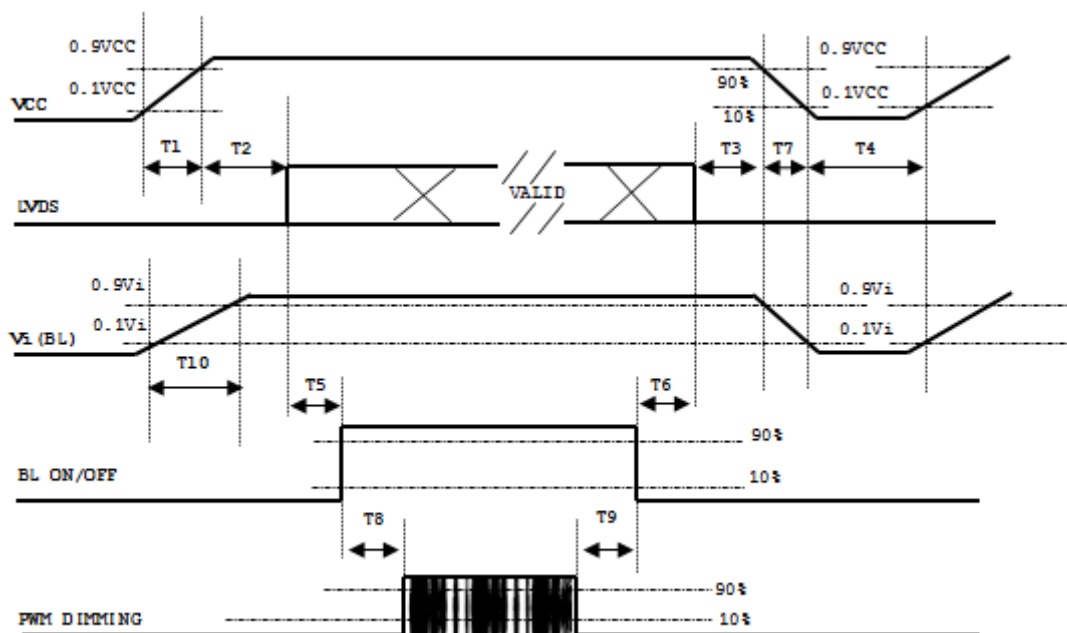


Note (b) The SSCG (Spread spectrum clock generator) is defined as below figures.



## 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.



| 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    |

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"..

### 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**



PCBA on the bottom side

**Fig.2 Reverse Scan**



PCBA on the bottom side

Fig. 1 Normal scan ( pin 3, UD/LR = Low )

Fig. 2 Reverse scan (pin 3, UD/LR = High )

## 7. OPTICAL CHARACTERISTICS

### 7.1 TEST CONDITIONS

| Item                | Symbol   | Value | Unit |
|---------------------|--|-------|------|
| Ambient Temperature | Ta   | 25±2  | °C   |
| Ambient Humidity    | Ha   | 50±10 | %RH  |
| Supply Voltage      | According to typical value and tolerance in "ELECTRICAL CHARACTERISTICS" |       |      |
| Input Signal        |  |       |      |
| PWM Duty Ratio      | D  | 100   | %    |

### 7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown here and all items are measured at the center point of screen unless otherwise noted. The following items should be measured under the test conditions described above and stable conditions shown in Note (5).

| Item               | Symbol                    | Condition                            | Min.  | Typ.  | Max.  | Unit | Note     |
|--------------------|---------------------------|--------------------------------------|-------|-------|-------|------|----------|
| Color Chromaticity | Red                       | Rx                                   | 0.600 | 0.650 | 0.700 | -    | (1), (5) |
|                    |                           | Ry                                   | 0.290 | 0.340 | 0.390 |      |          |
|                    | Green                     | Gx                                   | 0.270 | 0.320 | 0.370 |      |          |
|                    |                           | Gy                                   | 0.565 | 0.615 | 0.665 |      |          |
|                    | Blue                      | Bx                                   | 0.100 | 0.150 | 0.200 |      |          |
|                    |                           | By                                   | 0.005 | 0.055 | 0.105 |      |          |
|                    | White                     | Wx                                   | 0.263 | 0.313 | 0.363 |      |          |
|                    |                           | Wy                                   | 0.279 | 0.329 | 0.379 |      |          |
|                    | Center Luminance of White | LC                                   | 300   | 350   | -     | nits | (4), (5) |
|                    | Contrast Ratio            | CR                                   | 600   | 800   | -     | -    | (2), (5) |
| Response Time      | TR                        | $\theta X=0^\circ, \theta Y=0^\circ$ | -     | 13    | 18    | -    | (3)      |
|                    | TF                        |                                      | -     | 12    | 17    | -    |          |
| White Variation    | $\delta W$                | $\theta X=0^\circ, \theta Y=0^\circ$ | 80    | -     | -     | %    | (5), (6) |
| Viewing Angle      | Horizontal                | $\theta X+$                          | 80    | 89    | -     | Deg. | (1), (5) |
|                    |                           | $\theta X-$                          | 80    | 89    | -     |      |          |
|                    | Vertical                  | $\theta Y+$                          | 80    | 89    | -     |      |          |
|                    |                           | $\theta Y-$                          | 80    | 89    | -     |      |          |

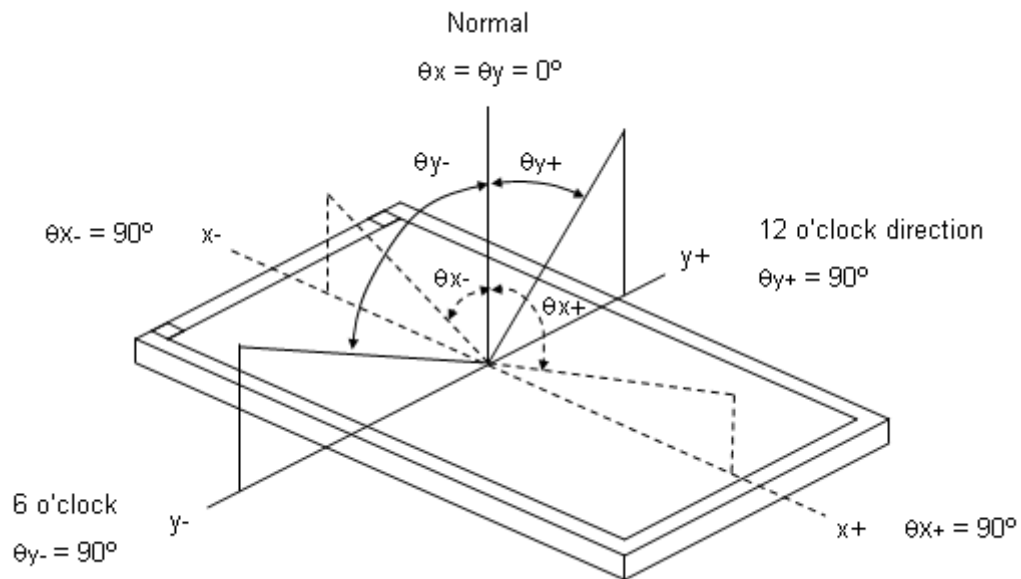
Definition :

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 ( $\theta_x$ ,  $\theta_y$ ):

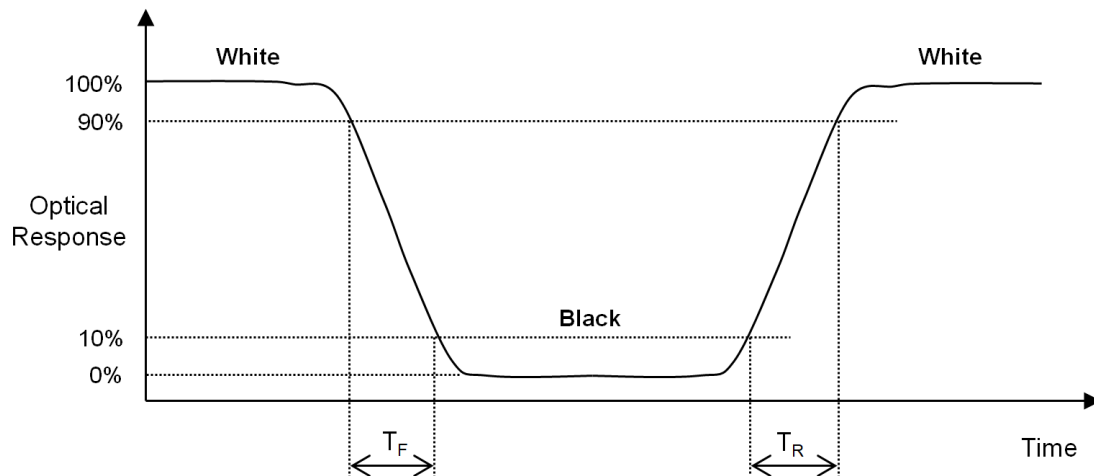


Note (2) Definition of Contrast Ratio (CR):

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

$$\text{Contrast Ratio (CR)} = \text{White} / \text{Black}$$

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



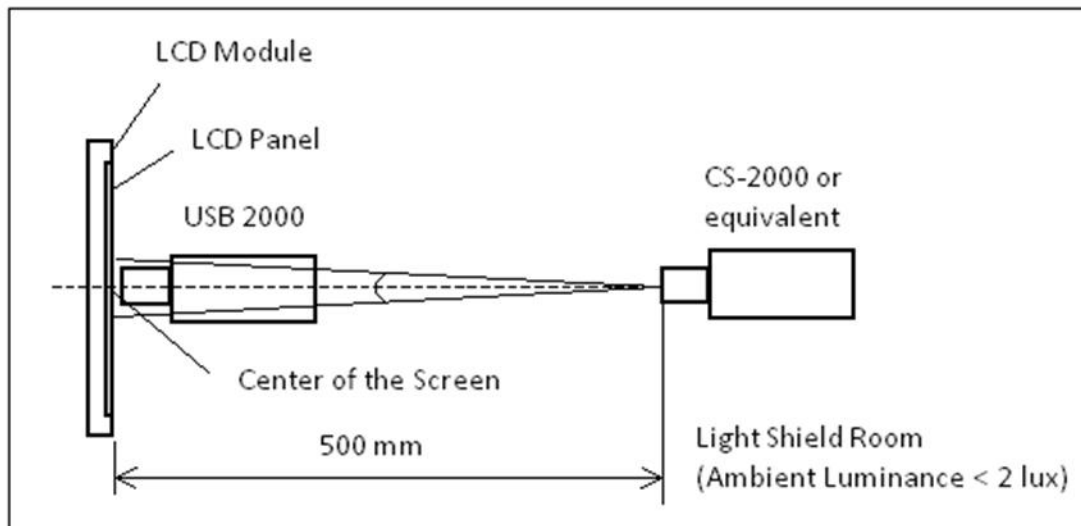
Note (4) Definition of Luminance of White ( $L_C$ ):

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 module drawing.



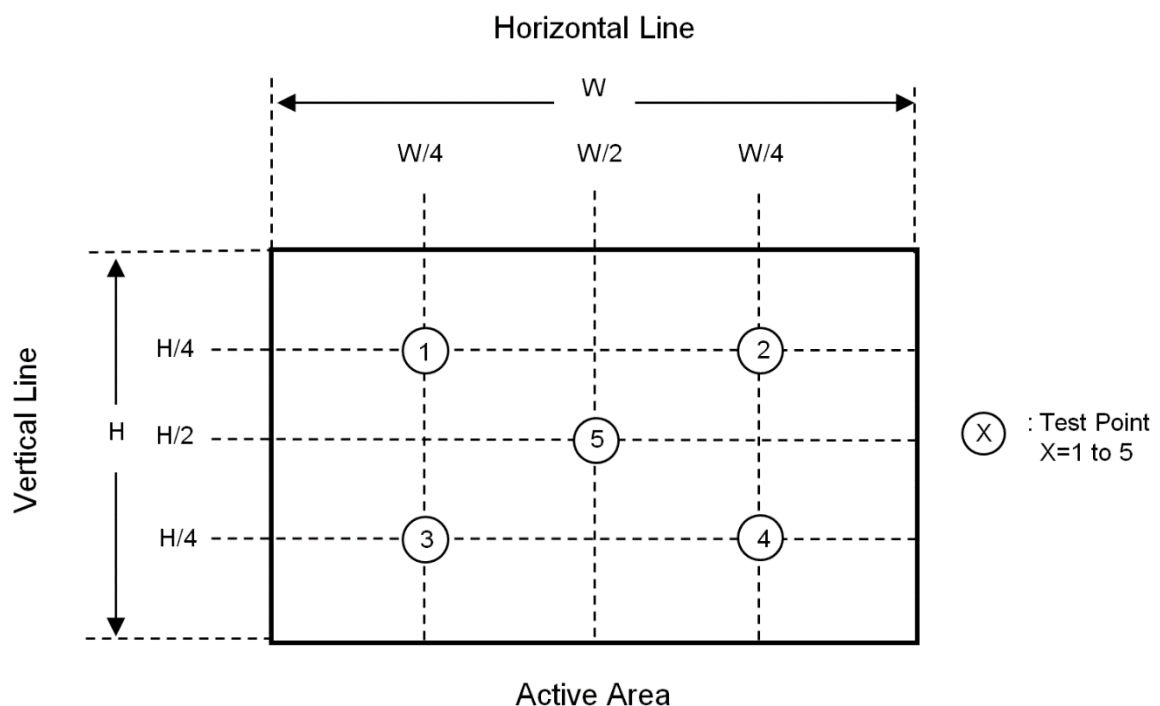


Note (6) Definition of White Variation ( $\delta W$ ):

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                   | 70°C, 240 hours   | (1),(2)<br>(4),(5) |
| Low Temperature Storage Test                    | -20°C, 240 hours  |                    |
| Thermal Shock Storage Test                      | -20°C, 0.5 hour $\longleftrightarrow$ 60°C, 0.5 hour; 100cycles, 1 hour/cycle)                          |                    |
| High Temperature Operation Test                 | 60°C, 240 hours   |                    |
| Low Temperature Operation Test                  | -10°C, 240 hours  |                    |
| High Temperature & High Humidity Operation Test | 50°C, RH 80%, 240 hours   | (1), (4)           |
| ESD Test (Operation)                            | 150pF, 330Ω, 1 sec/cycle<br>Condition 1 : Contact Discharge, ±8KV<br>Condition 2 : Air Discharge, ±15KV |                    |
| Shock (Non-Operating)                           | 50G, 11ms, half sine wave, 1 time for ± X, ± Y, ± Z direction   |                    |
| 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 60°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.

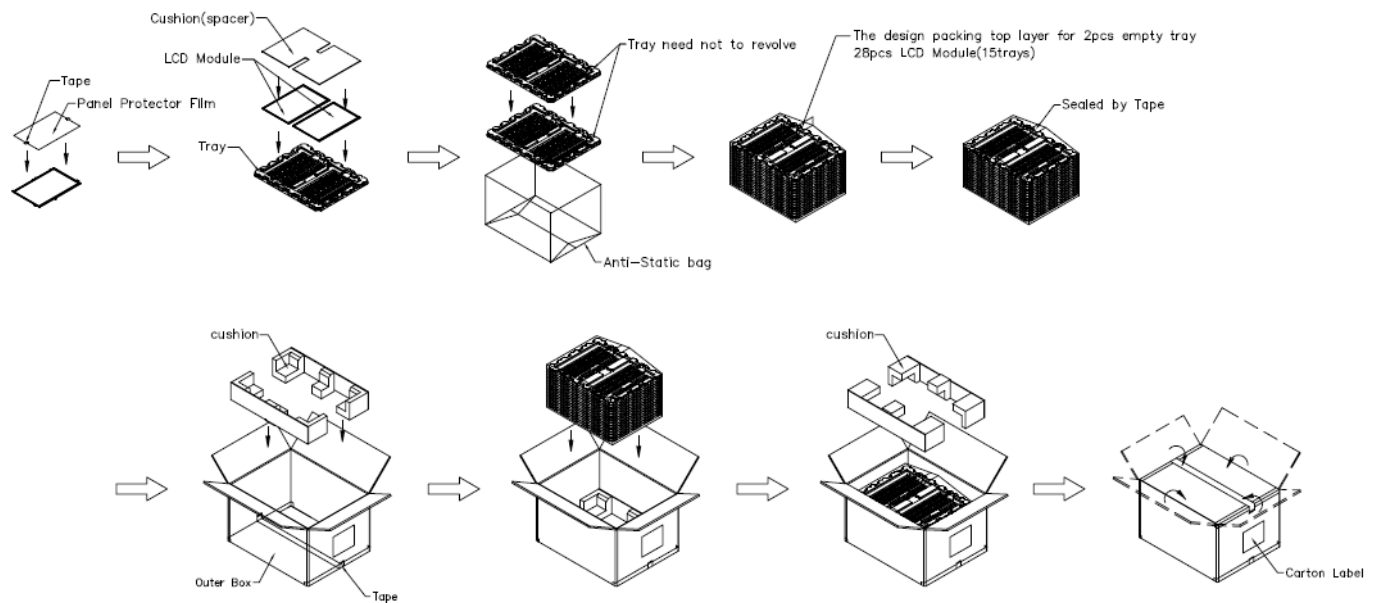
## 9. PACKAGING

### 9.1 PACKING SPECIFICATIONS

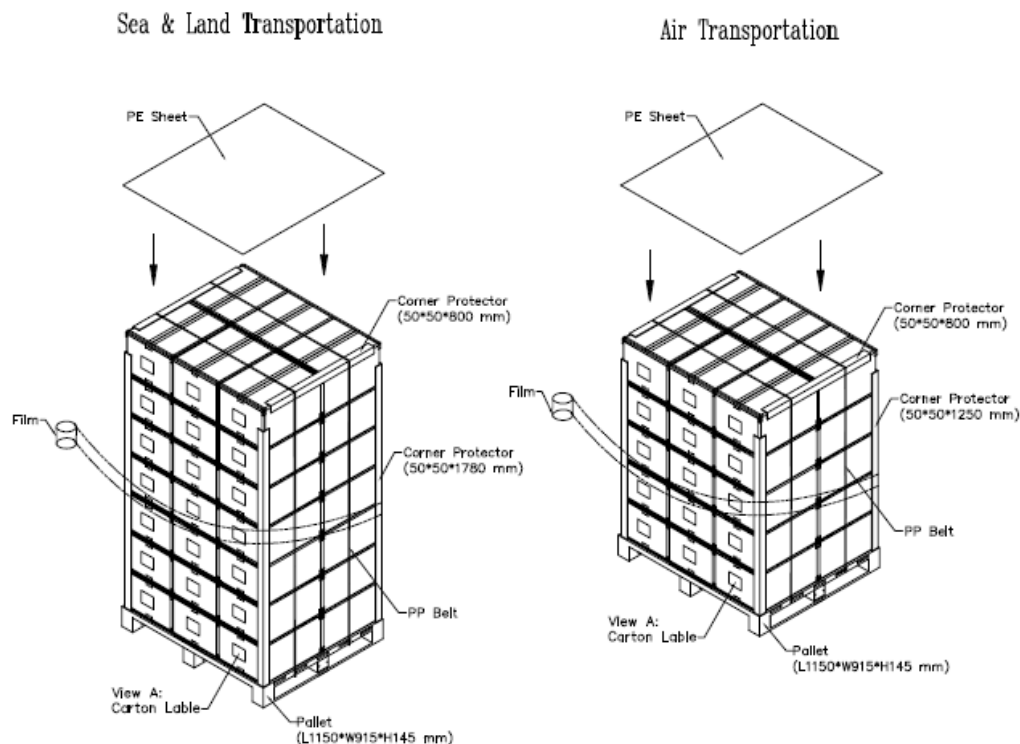
- (1) 28pcs LCD modules / 1 Box
- (2) Box dimensions: 435(L) X 350 (W) X 275 (H) mm
- (3) Weight: approximately ( 12 )Kg (28 modules per box)

### 9.2 PACKING METHOD

- (1)Box Dimensions : 435(L)\*350(W)\*275(H)
- (2)28 Modules/Carton

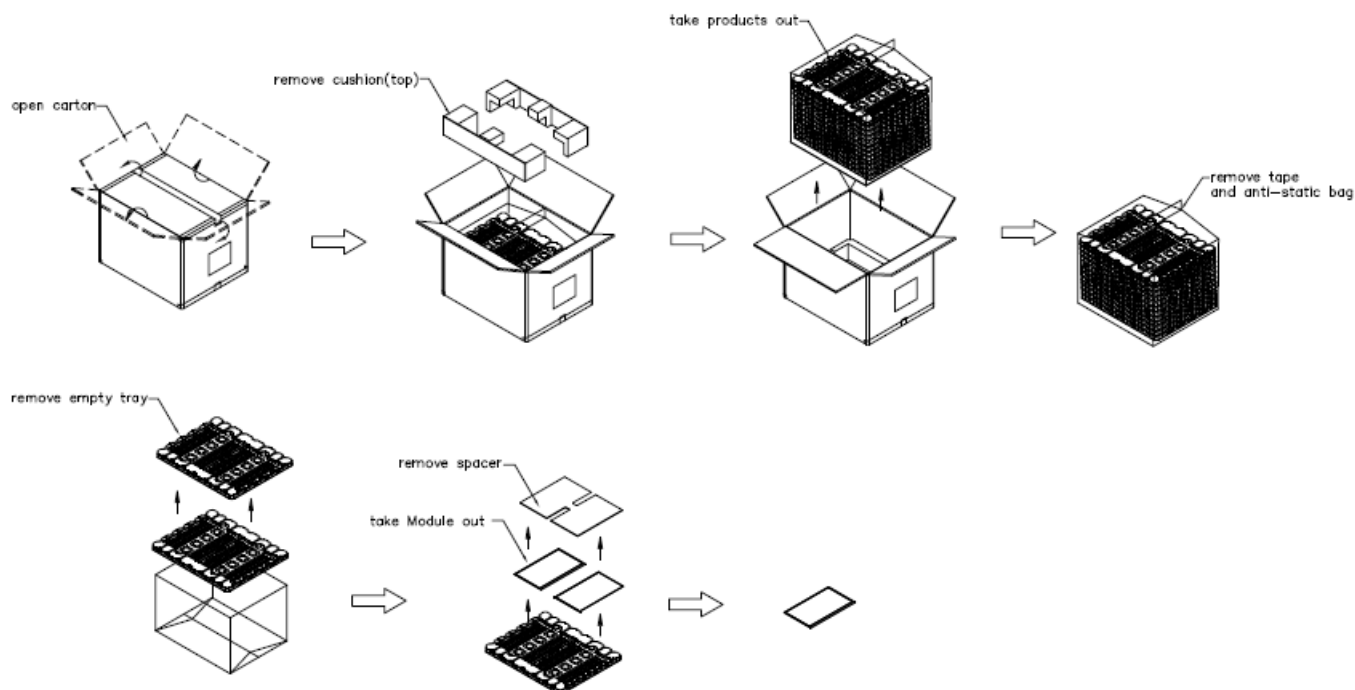


**Figure. 9-1 Packing method**



**Figure. 9-2 Packing method**

## 9.3 UN-PACKING METHOD

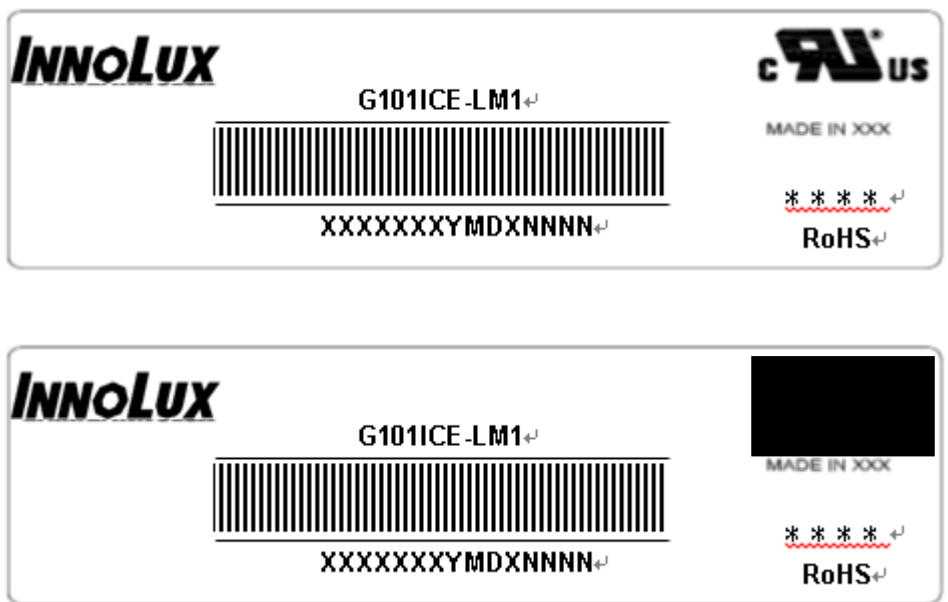


**Figure. 9-3 UN-Packing method**

## 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.

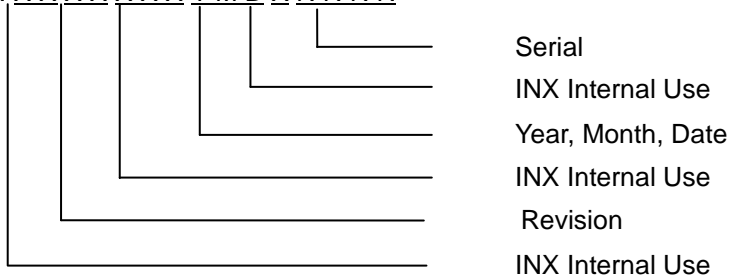


Note (1) Safety Compliance(UL logo) will open after C1 version.

(a) Model Name: G101ICE-LM1

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

(c) Serial ID: XXXXXXYMDXNNNN



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.

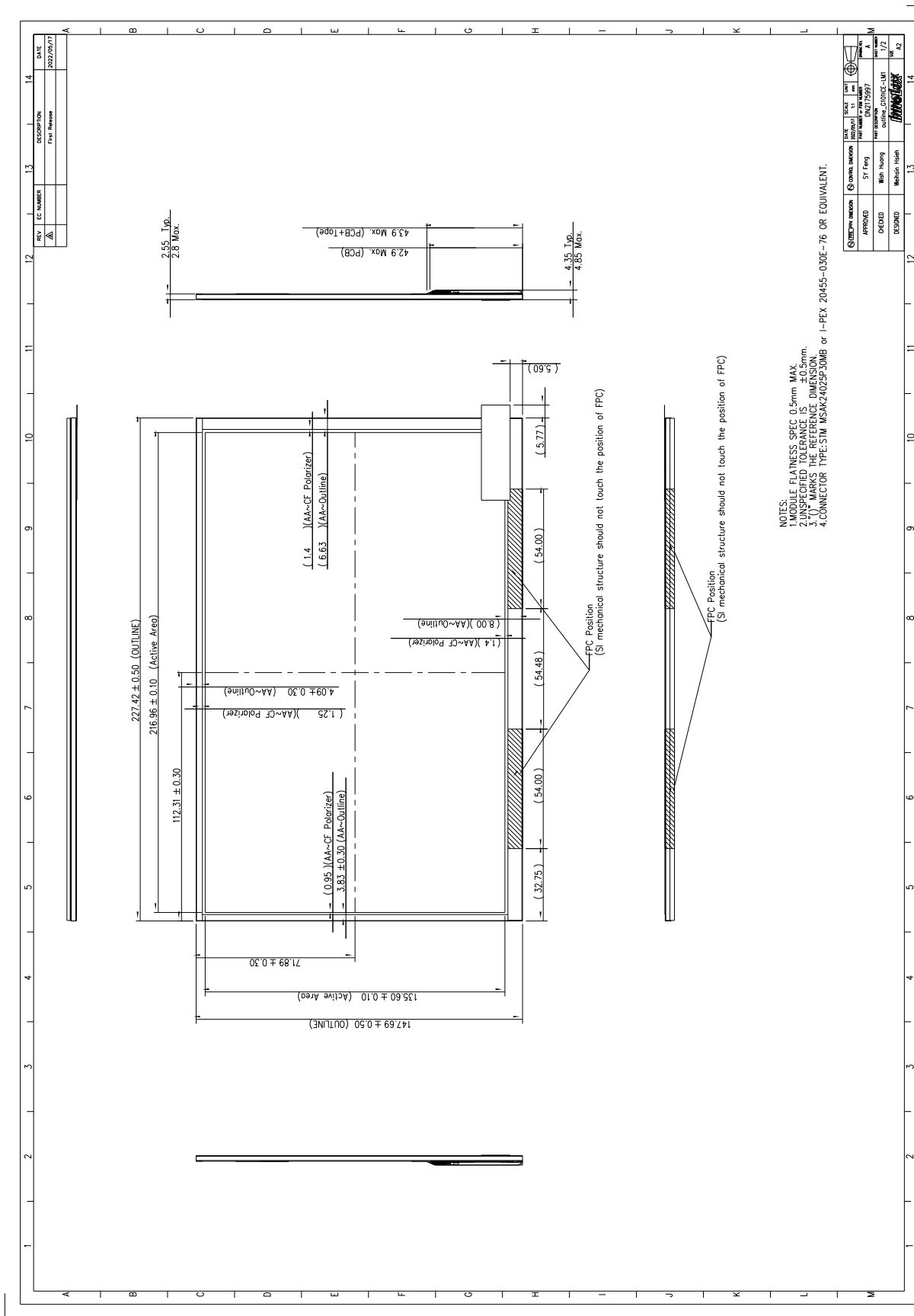
### 11.2 STORAGE PRECAUTIONS

- (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.

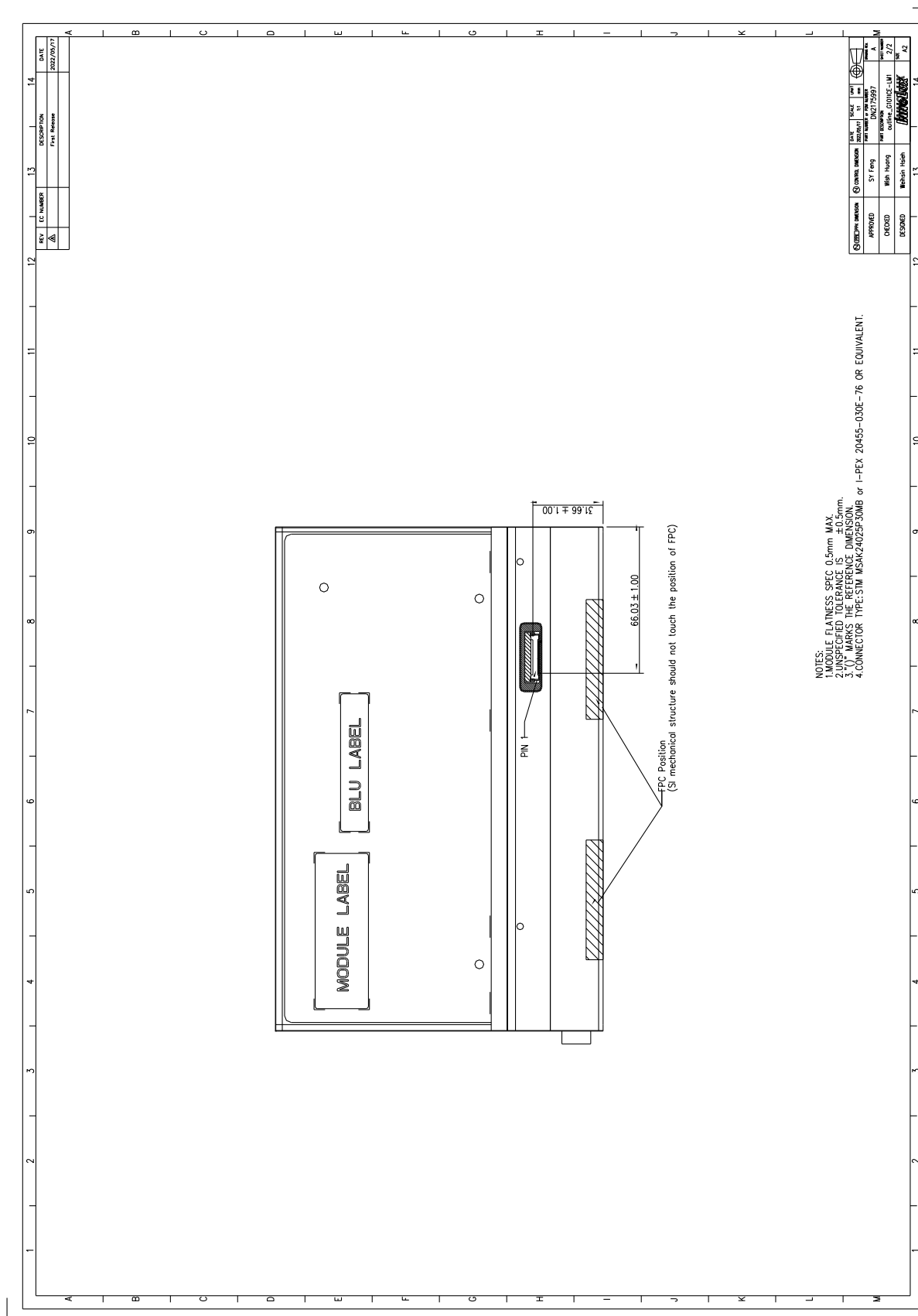
## 11.3 OTHER PRECAUTIONS

- (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.

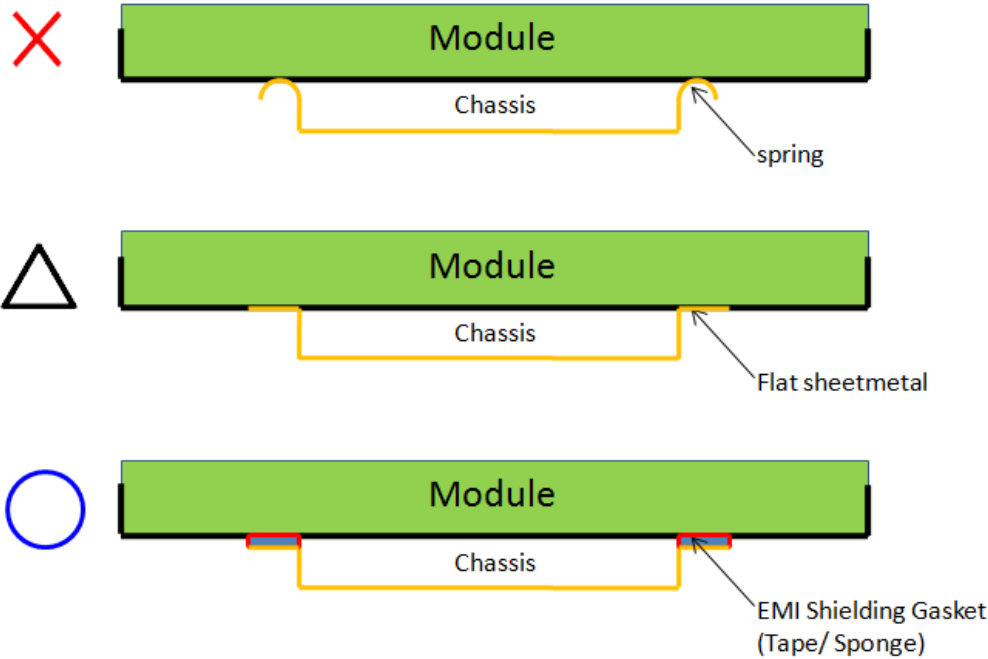
## 12. MECHANICAL CHARACTERISTICS

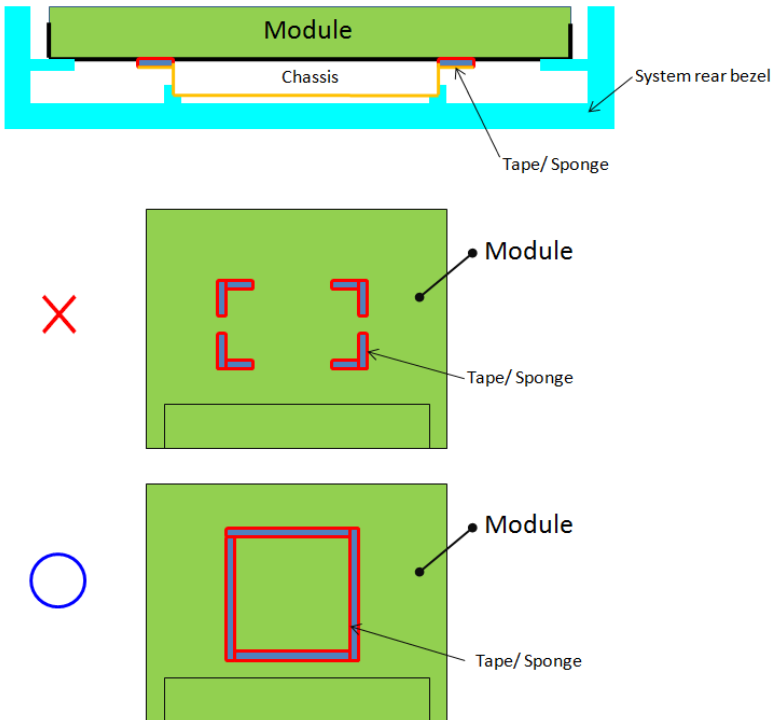


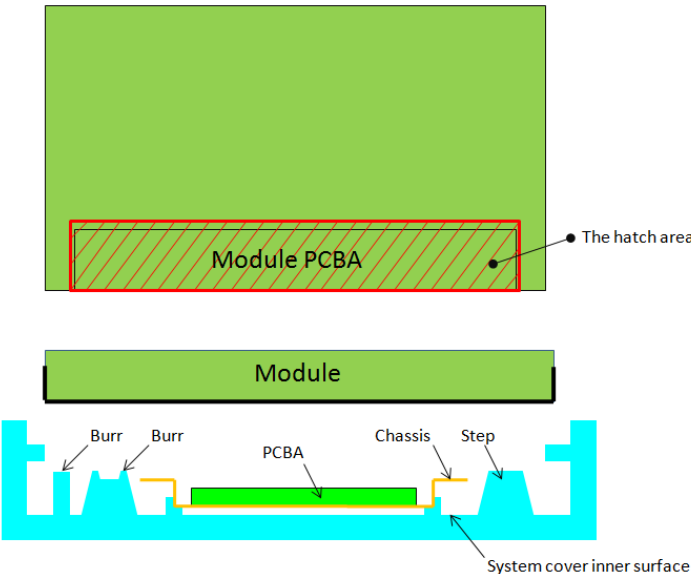




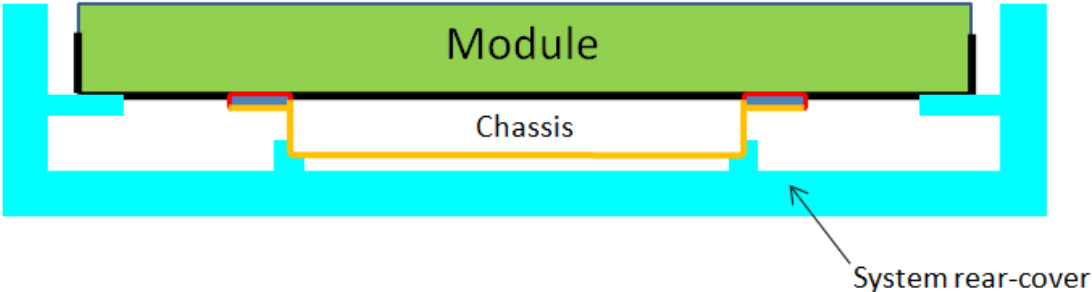
## Appendix. SYSTEM COVER DESIGN NOTICE

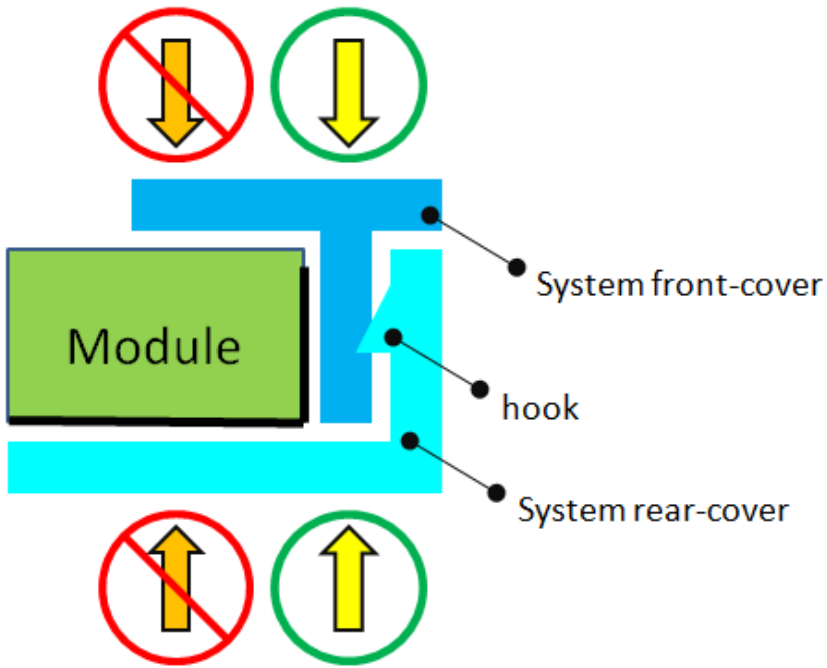
| 1          | Set Chassis and IAVM Module touching Mode  |
|------------|--|
|            |  <p>The diagrams illustrate three methods of connecting a green 'Module' to an orange 'Chassis':</p> <ul style="list-style-type: none"> <li><b>Red X:</b> A spring connects the module and chassis. This method is discouraged.</li> <li><b>Triangle:</b> A flat sheet metal piece connects the module and chassis. This is a recommended method.</li> <li><b>Blue Circle:</b> An EMI Shielding Gasket (Tape/Sponge) connects the module and chassis. This is also a recommended method.</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>  |

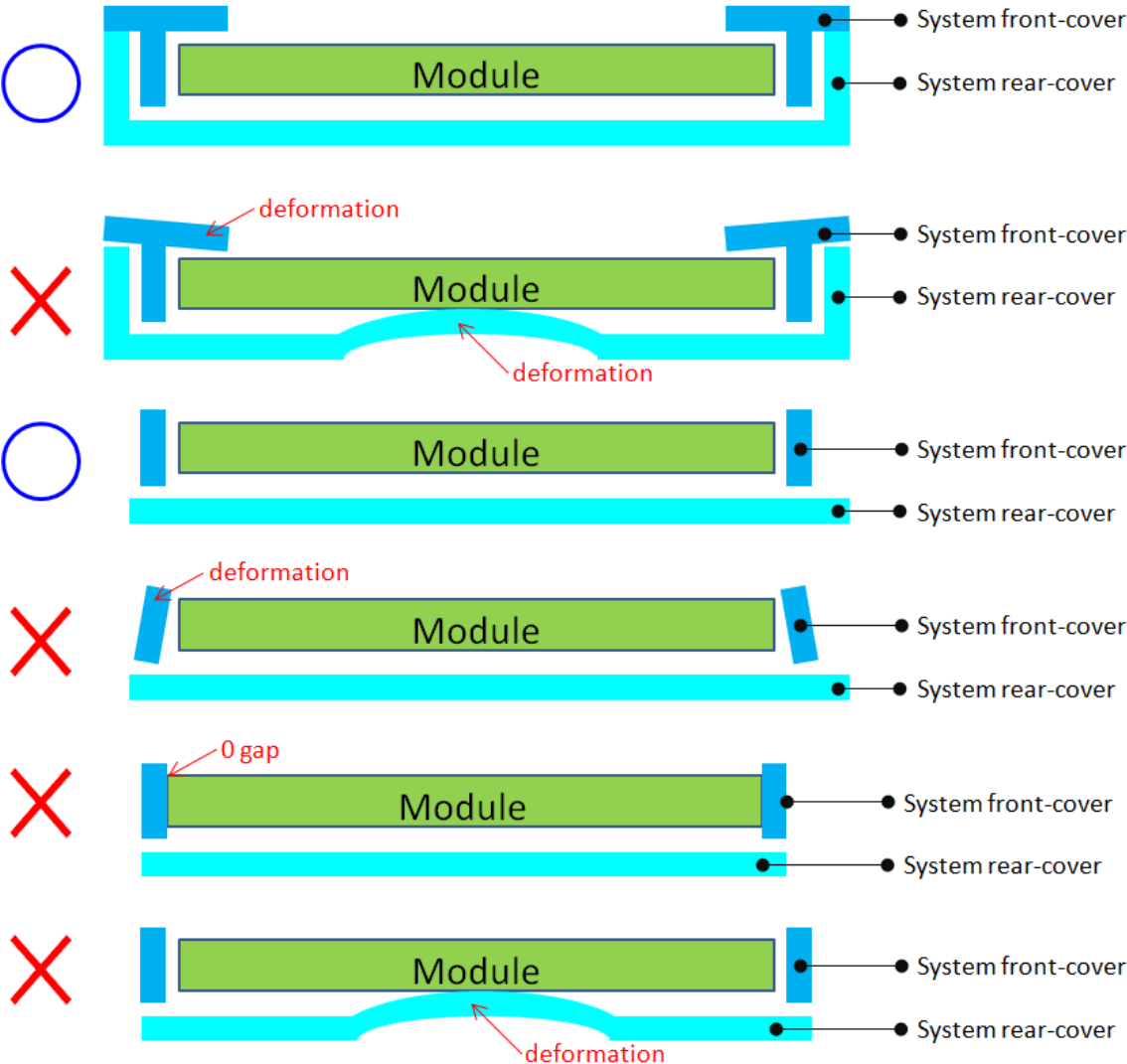
|            |  |
|------------|--|
| 2          | Tape/Sponge design on system inner surface   |
|            |  <p>The diagrams illustrate the correct and incorrect placement of Tape/Sponge on the system inner surface. The top diagram shows a cross-section of a Module (green) mounted on a Chassis (yellow) with Tape/Sponge (red) at the interface, surrounded by a System rear bezel (cyan). Below are two top-down views: the first, marked with a red 'X', shows four separate L-shaped Tape/Sponge pieces at the corners of the Module; the second, marked with a blue circle, shows a single rectangular Tape/Sponge piece covering the entire perimeter of 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          | <b>System inner surface examination</b>  |
|            |    |
| 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> |

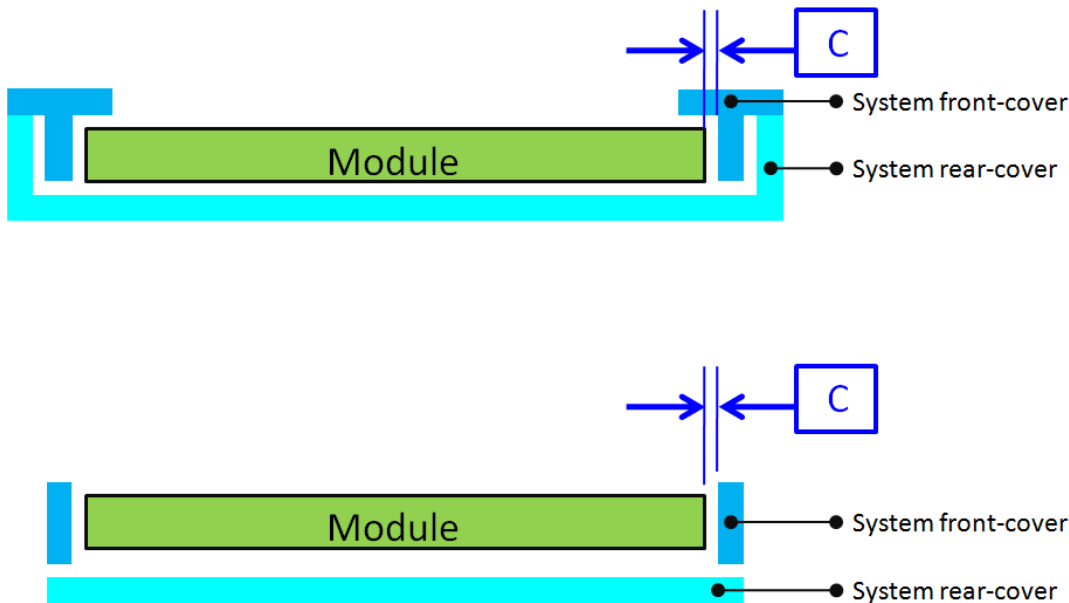
|            |  |
|------------|--|
| 4          | <b>Material used for system rear-cover</b>   |
|            |    |
| Definition | <p>System rear-cover material with high rigidity is needed to resist deformation during scuffing test, hinge test, pogo test or backpack test. Abnormal display, white spot, 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. 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   | Assembly SOP examination for system front-cover with hook structure  |
|  |  |
| Definition  | 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. |

| 6          | Permanent deformation of system cover after reliability test   |
|------------|--|
|            |  <p>The diagrams illustrate various failure modes where the system front-cover or rear-cover deforms, leading to interference with the module. Each diagram is labeled with a red 'X' for failure or a blue circle for success. Labels include 'Module', 'System front-cover', 'System rear-cover', 'deformation', and '0 gap'.</p>   |
| 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> |

|            |  |
|------------|--|
| 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> |

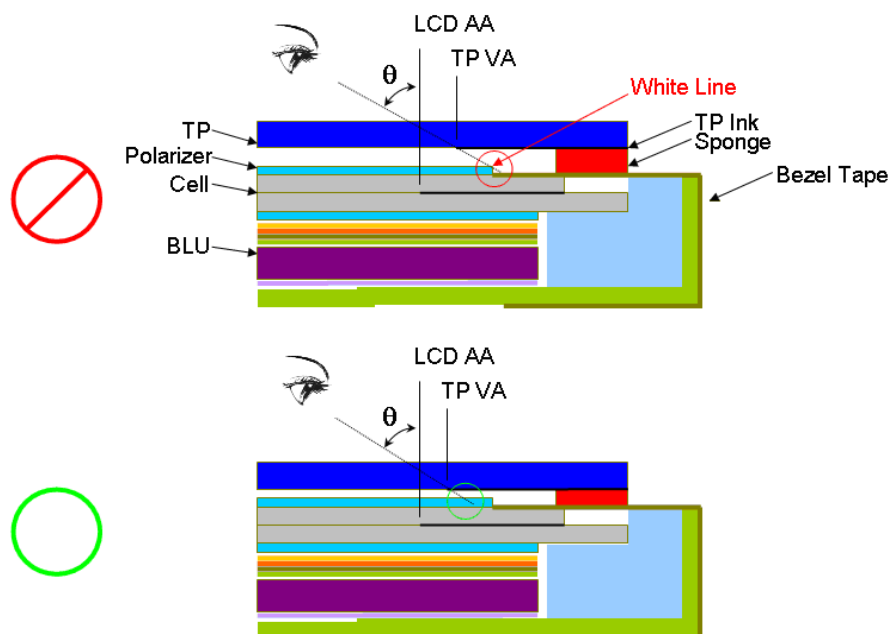
|            |  |
|------------|--|
| 8          | <b>Design gap B between system front-cover &amp; panel surface</b>   |
|            |  |
| Definition | <p>Gap between system front-cover &amp; panel surface is needed to prevent pooling or glass broken. Zero gap or interference such as burr and warpage 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. 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 design gap 'C' between the module and the system front-cover or protrusions. The top diagram shows a module (green rectangle) mounted on a system rear-cover (cyan L-shaped frame). The bottom diagram shows a module (green rectangle) mounted on a system rear-cover (cyan horizontal bar). In both cases, a gap 'C' is indicated between the module and the system front-cover (blue vertical bar). Blue arrows point to the gap, and a box labeled 'C' indicates the gap width.</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

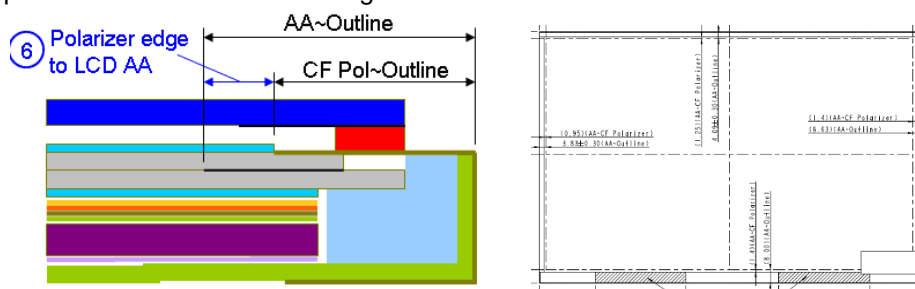
## Touch Application : TP and LCD Module Combination for White Line Prevention



### Parameter consideration for White Line Issue :

|   |   |
|---|---|
| 1 | TP VA to LCD AA distance                        |
| 2 | TP Assembly tolerance                           |
| 3 | TP Ink Printing tolerance                       |
| 4 | Sponge thickness and tolerance                  |
| 5 | Inspection/Viewing Angle specification          |
| 6 | Polarizer edge to LCD AA distance and tolerance |

Polarizer edge to LCD AA distance can be derived by "AA~Outline" – "CF Pol~Outline" with respect to INX 2D Outline Drawing on each side.



### Definition

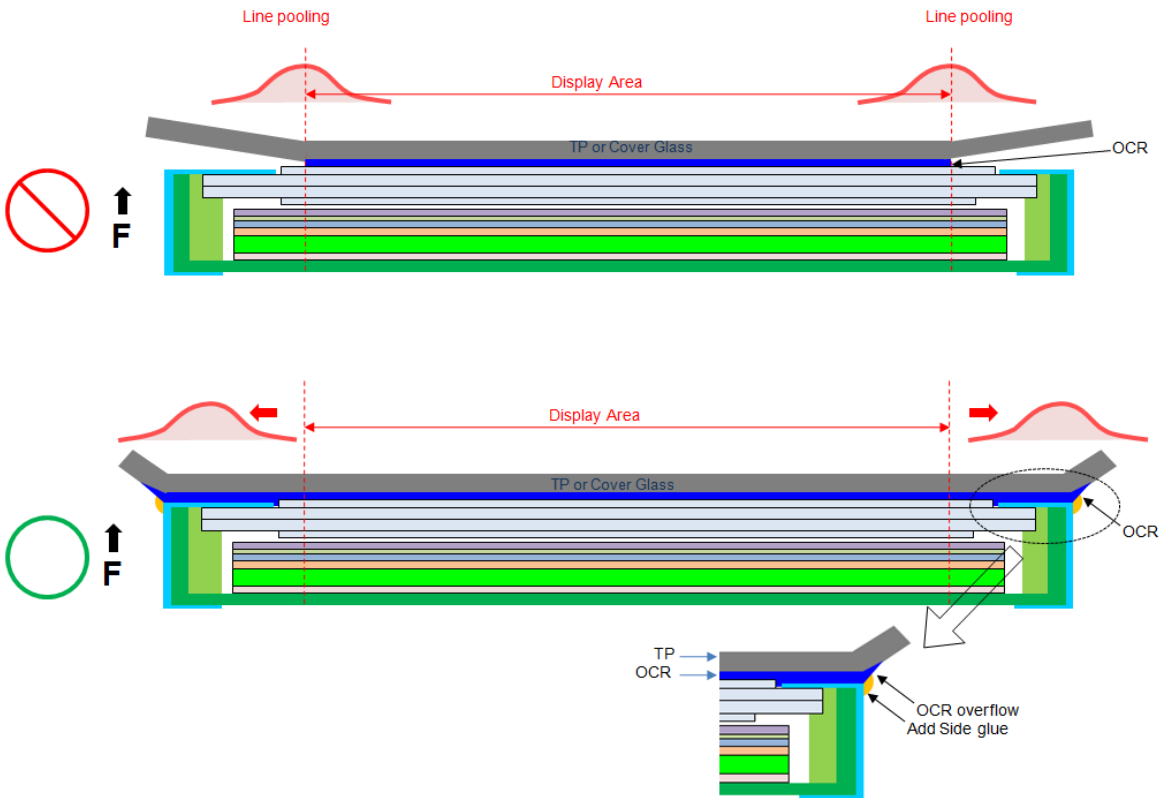
For using in Touch Application: to prevent White Line appears between TP and LCD module combination, the maximum inspection angle location must not fall onto LCD polarizer edge, otherwise light line near edge of polarizer will be appear.

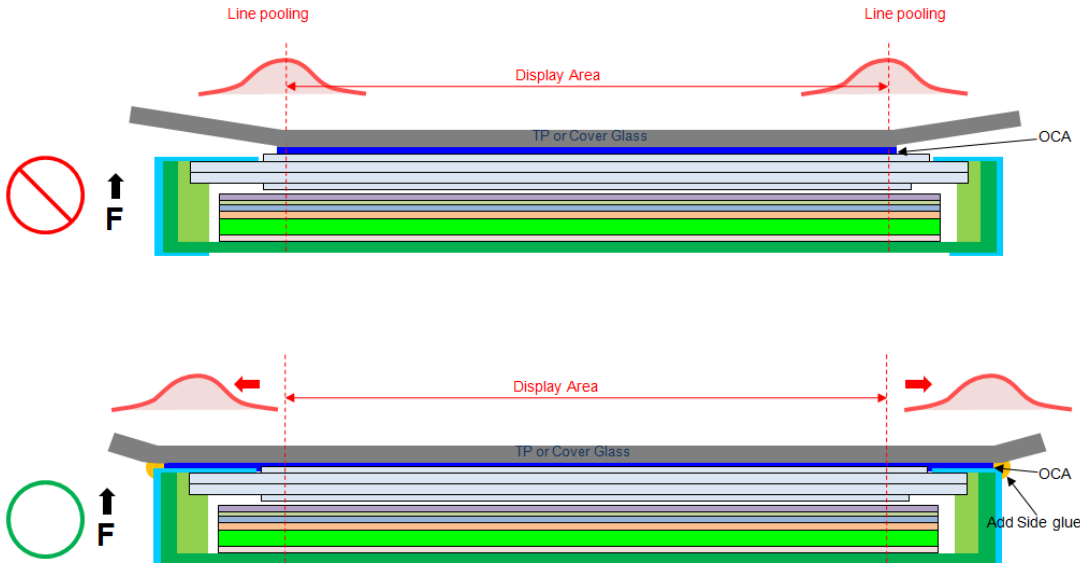
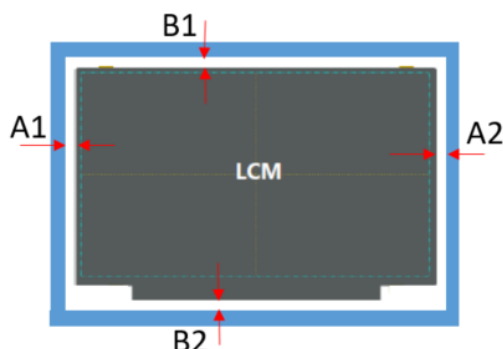
Parameters such as TP VA to LCD AA distance, TP assembly tolerance, TP Ink printing tolerance, Sponge thickness and tolerance, and Maximum Inspection/Viewing Angle, must be considered with respect to LCD module's Polarizer edge location and tolerance. This consideration must be taken at all four edges separately.

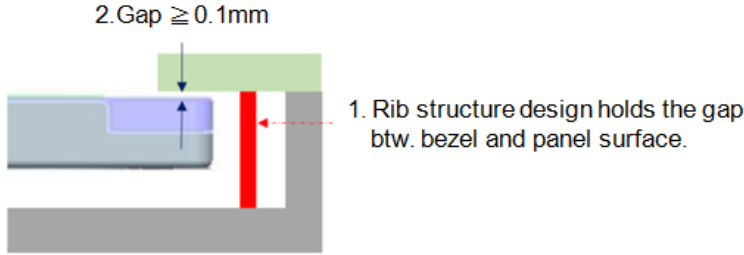
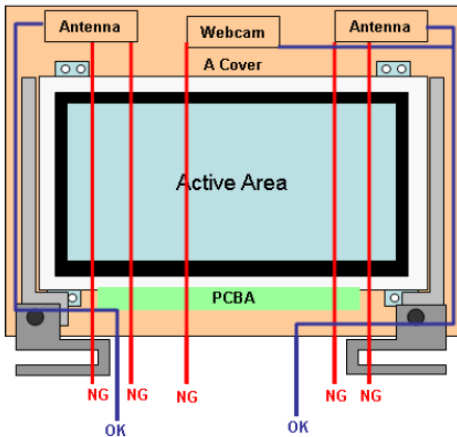
The goal is to find parameters combination that allow maximum inspection angle falls inside polarizer black margin area.

Note: Information for Polarizer edge location and its tolerance can be derived from INX 2D

|  |  |
|--|--|
|  | <p>Outline Drawing (“AA ~Outline” - “CF Pol~Outline”).</p> <p>Note: Please feel free to contact INX FAE Engineer. By providing value of parameters above on each side, we can help to verify and pass the white line risk assessment for customer reference.</p> |
|--|--|

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

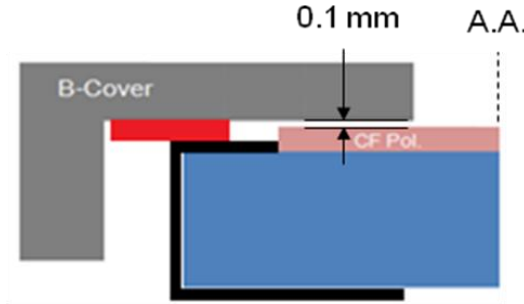
| 12   | Use OCA Lamination  |   |            |        |    |               |   |    |               |    |               |    |               |
|--|---|---|------------|--------|----|---------------|---|----|---------------|----|---------------|----|---------------|
| <div></div>  |   |   |            |        |    |               |   |    |               |    |               |    |               |
| Definition   | 1.OCA glue as possible plastered throughout the module, in order to avoid Line Pooling.<br>2.Add side glue to avoid Line Pooling  |   |            |        |    |               |   |    |               |    |               |    |               |
| 13   | Gap Design between panel & around structure   |   |            |        |    |               |   |    |               |    |               |    |               |
| <div><table><tr><th>Item</th><th>Suggestion</th><th>Remark</th></tr><tr><td>A1</td><td><math>A1 \geq 0.5</math></td><td rowspan="4">Gap <math>\geq</math> Panel outline max. tolerance + Assembly max. tolerance</td></tr><tr><td>A2</td><td><math>A2 \geq 0.5</math></td></tr><tr><td>B1</td><td><math>B1 \geq 0.5</math></td></tr><tr><td>B2</td><td><math>B2 \geq 0.8</math></td></tr></table></div> |   | Item  | Suggestion | Remark | A1 | $A1 \geq 0.5$ | Gap $\geq$ Panel outline max. tolerance + Assembly max. tolerance | A2 | $A2 \geq 0.5$ | B1 | $B1 \geq 0.5$ | B2 | $B2 \geq 0.8$ |
| Item   | Suggestion  | Remark  |            |        |    |               |   |    |               |    |               |    |               |
| A1   | $A1 \geq 0.5$   | Gap $\geq$ Panel outline max. tolerance + Assembly max. tolerance |            |        |    |               |   |    |               |    |               |    |               |
| A2   | $A2 \geq 0.5$   |   |            |        |    |               |   |    |               |    |               |    |               |
| B1   | $B1 \geq 0.5$   |   |            |        |    |               |   |    |               |    |               |    |               |
| B2   | $B2 \geq 0.8$   |   |            |        |    |               |   |    |               |    |               |    |               |
| Definition   | Gap Design between panel & around structure needs to consider the maximum tolerances of panel outline and assembly at the same time.<br>Gap Design suggestion is shown as A1/A2/B1/B2 on the chart. |   |            |        |    |               |   |    |               |    |               |    |               |

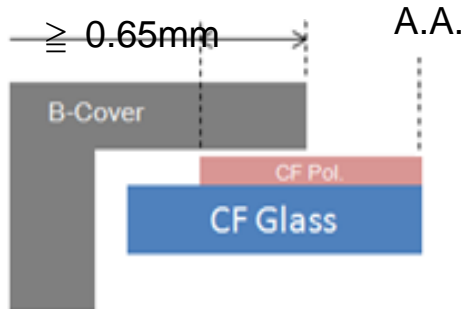
|            |   |
|------------|---|
| 14         | <b>Gap between panel &amp; bezel</b>  |
|            |  <p>2. Gap <math>\geq 0.1\text{mm}</math></p> <p>1. Rib structure design holds the gap btw. bezel and panel surface.</p>  |
| Definition | <p>The gap between system bezel &amp; panel surface is 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 the sufficient gap, design with system rib higher than maximum panel thickness is recommended.</p> <p>The sufficient gap design is greater or equal to 0.1mm.</p>  |
| 15         | <b>Cable routing behind panel</b>   |
|            |   |
| Definition | <p>It is strongly recommended that cables route around the panel outline, not overlap with the panel outline (including PCB). Because issue such as abnormal display &amp; white spot after backpack test, hinge test, twist test or pogo test may occur.</p> <p>If any routings across panel outline are needed, we suggest design as below:</p> <ul style="list-style-type: none"> <li>-Using FFC/FPC to replace cables.</li> <li>-Routing at the right or left area of panel metal rear.</li> <li>-Avoid any routings at the step of panel or A cover.</li> <li>-No interference to panel.</li> <li>-It should not overlap TCON, COF/FPC, Driver IC</li> </ul> |

|  |   |                              |                       |                     |          |        |                |                              |           |             |         |                   |        |               |            |                  |       |      |               |  |                       |
|--|---|------------------------------|-----------------------|---------------------|----------|--------|----------------|------------------------------|-----------|-------------|---------|-------------------|--------|---------------|------------|------------------|-------|------|---------------|--|-----------------------|
| 16   | Interference examination of antenna cable and Web Cam wire  |                              |                       |                     |          |        |                |                              |           |             |         |                   |        |               |            |                  |       |      |               |  |                       |
| <ul style="list-style-type: none"><li>To prevent panel damage, we suggest using CCD FPC to replace CCD cable</li><li>Using double tape to fix LCM module for no bracket design.</li></ul>  |   |                              |                       |                     |          |        |                |                              |           |             |         |                   |        |               |            |                  |       |      |               |  |                       |
| <div><div></div><div><table><tr><td>Rear-cover</td><td>Connector</td><td>Rear Cover Width(A)</td><td>A = 30mm</td></tr><tr><td>Sponge</td><td>Camera/Antenna</td><td>Cover edge to Double Tape(B)</td><td>B = 3.0mm</td></tr><tr><td>Double Tape</td><td>Stopper</td><td>CCD FPC thickness</td><td>&lt;0.1mm</td></tr><tr><td>CCD Cable/FPC</td><td>LCM Module</td><td>Sponge thickness</td><td>0.5mm</td></tr><tr><td>Hook</td><td>Panel outline</td><td></td><td>0.2~0.3mm(compressed)</td></tr></table></div></div> |   | Rear-cover                   | Connector             | Rear Cover Width(A) | A = 30mm | Sponge | Camera/Antenna | Cover edge to Double Tape(B) | B = 3.0mm | Double Tape | Stopper | CCD FPC thickness | <0.1mm | CCD Cable/FPC | LCM Module | Sponge thickness | 0.5mm | Hook | Panel outline |  | 0.2~0.3mm(compressed) |
| Rear-cover   | Connector   | Rear Cover Width(A)          | A = 30mm              |                     |          |        |                |                              |           |             |         |                   |        |               |            |                  |       |      |               |  |                       |
| Sponge   | Camera/Antenna  | Cover edge to Double Tape(B) | B = 3.0mm             |                     |          |        |                |                              |           |             |         |                   |        |               |            |                  |       |      |               |  |                       |
| Double Tape  | Stopper   | CCD FPC thickness            | <0.1mm                |                     |          |        |                |                              |           |             |         |                   |        |               |            |                  |       |      |               |  |                       |
| CCD Cable/FPC  | LCM Module  | Sponge thickness             | 0.5mm                 |                     |          |        |                |                              |           |             |         |                   |        |               |            |                  |       |      |               |  |                       |
| Hook   | Panel outline   |                              | 0.2~0.3mm(compressed) |                     |          |        |                |                              |           |             |         |                   |        |               |            |                  |       |      |               |  |                       |
| Definition   | <p>If the antenna cable or Web Cam wire must overlap with the panel outline, both sides of the antenna cable or Web Cam wire must have a sponge(Sponge material can not contain NH3) and sponge require higher antenna cable or Web Cam wire.( Antenna cable or Web Cam wire should not overlap with TCON,COF/FPC,Driver IC)</p> <p>Note: If the interference can not be avoided, please feel free to contact INX FAE Engineer for collaboration design. We can help to verify and pass risk assessment for customer reference.</p> |                              |                       |                     |          |        |                |                              |           |             |         |                   |        |               |            |                  |       |      |               |  |                       |
| Definition   | <p>To prevent peeling the bezel tape in rework process. The length of double tape is 30 – (A+B), A is bezel tape length and B is the double tape attaching tolerance.</p> <p>Ex :A :2mm, B:2mm, the length of double tape is 30-(2+2)=26mm.</p>   |                              |                       |                     |          |        |                |                              |           |             |         |                   |        |               |            |                  |       |      |               |  |                       |

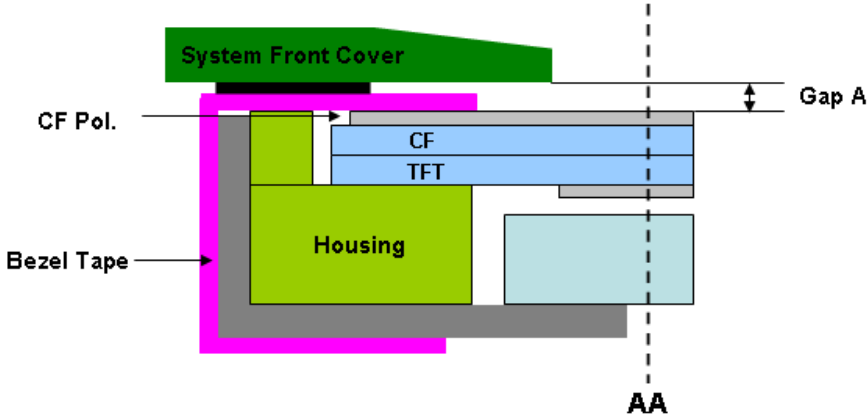
|  |   |
|--|---|
| 17   | Adhesive design between panel & bezel   |
| <div><div><p>• Risk : Bezel Tape Peeling happened in a rework or reassembly process.</p></div><div><p>• Risk : Pooling or light leakage due to stress concentration at B-cover opening</p></div></div> |   |
|  | <p>To prevent panel crack during system front-cover assembly process with double tape design. When system applied adhesive between B-Cover and LCD module, please</p> |

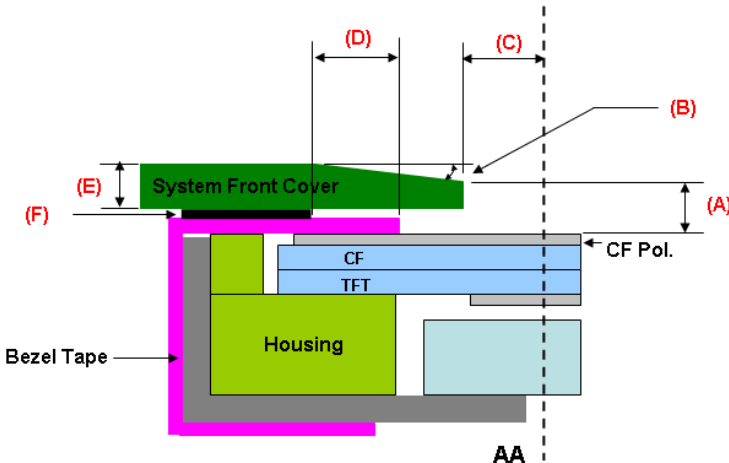
|            |  |
|------------|--|
| Definition | <p>design a distance 1.00mm between B-Cover's adhesive and CF pol. Do <b>NOT</b> put adhesive on CF pol.</p> <p>Adhesive material need be qualified to prevent from doing damage to cell tape after rework.</p> <p>Adhesive material need be qualified to prevent abnormal noise when hinge swinging test.</p> |
|------------|--|

|  |   |
|--|---|
| 18   | System front-cover assembly reference with Double tape design   |
|  |   |
| Definition   | <p>To prevent system front-cover peeling at double tape contact area, A gap between B-Cover &amp; CF-Pol. Is 0.1mm min.</p> |

|  |   |
|--|---|
| 19   | System front-cover opening area reference with TFT-LCD module   |
|  |   |
| Definition   | <p>To prevent panel the noise of B-cover &amp; CF Pol. Distance from CF Pol. edge to front-cover edge more than 0.65mm.</p> |

| 20         | Color of system front-cover material   |
|------------|--|
|            | <p>The diagrams illustrate the importance of using dark-colored material for the system front-cover to prevent light leakage. The top section shows a cross-section of the LCD and Backlight assembly. In the first case (marked with a red 'X'), the system front-cover is light-colored, allowing light to leak out, indicated by orange arrows labeled 'Light Leakage'. In the second case (marked with a green circle), the system front-cover is dark-colored, preventing light leakage. The bottom section shows a top-down view of the Panel Module. In the first case (marked with a red 'X'), the system front-cover or TP is light-colored, allowing light to leak out, indicated by yellow arrows labeled 'Light leakage'. In the second case (marked with a green circle), the system front-cover or TP is dark-colored, preventing light leakage.</p> |
| Definition | To prevent light leakage is seen at system front-cover due to material transparency, we suggest using dark color material (black) for system front-cover design.   |

|  |  |
|--|--|
| 21   | Design Gap between System Front-cover & TOD LCD module surface   |
|  <p style="text-align: center;"><math>0.15 \leq \text{Gap A} \leq 0.20 \text{ mm}</math></p> |  |
| Definition   | <p>Gap A between system front-cover &amp; TOD LCD module 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 for first graph, design value for front-cover depth is recommended higher than module wing depth.</p> |

| 22   | System Front-cover dimension suggestion  |   |                                       |                                      |                                       |                                     |                              |           |       |                                  |            |           |                                    |
|--|--|---|---------------------------------------|--------------------------------------|---------------------------------------|-------------------------------------|------------------------------|-----------|-------|----------------------------------|------------|-----------|------------------------------------|
| <div></div> <table border="1"><thead><tr><th>System Front Cover Open TOP to CF Pol.<br/>(A)</th><th>System Front Cover Chamfer<br/>(B)</th><th>System Front Cover Open to AA<br/>(C)</th><th>Bezel Tape Edge to Double Tape<br/>(D)</th><th>System Front Cover thickness<br/>(E)</th><th>Double Tape Thickness<br/>(F)</th></tr></thead><tbody><tr><td>0.8mm Max</td><td>8~20°</td><td><math>0.7 \leq (B) \leq 0.9\text{mm}</math></td><td>1.0 mm Min</td><td>1.2mm MAX</td><td><math>0.05 \leq (F) \leq 0.08\text{mm}</math></td></tr></tbody></table> <p><b>CAUTION :</b><br/>In order to avoid the risk of bezel tape peeling, INX suggest not to attach any double tape on bezel tape; if necessary, the location of double tape attach must follow INX design guidance.</p> |  | System Front Cover Open TOP to CF Pol.<br>(A) | System Front Cover Chamfer<br>(B)     | System Front Cover Open to AA<br>(C) | Bezel Tape Edge to Double Tape<br>(D) | System Front Cover thickness<br>(E) | Double Tape Thickness<br>(F) | 0.8mm Max | 8~20° | $0.7 \leq (B) \leq 0.9\text{mm}$ | 1.0 mm Min | 1.2mm MAX | $0.05 \leq (F) \leq 0.08\text{mm}$ |
| System Front Cover Open TOP to CF Pol.<br>(A)  | System Front Cover Chamfer<br>(B)  | System Front Cover Open to AA<br>(C)          | Bezel Tape Edge to Double Tape<br>(D) | System Front Cover thickness<br>(E)  | Double Tape Thickness<br>(F)          |                                     |                              |           |       |                                  |            |           |                                    |
| 0.8mm Max  | 8~20°  | $0.7 \leq (B) \leq 0.9\text{mm}$              | 1.0 mm Min                            | 1.2mm MAX                            | $0.05 \leq (F) \leq 0.08\text{mm}$    |                                     |                              |           |       |                                  |            |           |                                    |
| Definition   | To achieve better touch sensibility, INX suggests to follow design value as recommended , Recommended dimension is shown in above graph. |   |                                       |                                      |                                       |                                     |                              |           |       |                                  |            |           |                                    |