

# Datasheet

## **InnoLux** **G104V1-T03**

CH-01-026 (Rev. C1, until Version 2.2)

CH-01-026R1.1 (Rev. C2)

CH-01-026R1.2 (Rev. C3)

CH-01-026R1.3 (Rev. C4)

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Doc. Number: DN0625097

Tentative Specification  
Preliminary Specification  
Approval Specification

**MODEL NO.: G104V1**  
**SUFFIX: T03**

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

|  |  |                                      |
|--|--|--------------------------------------|
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| 2016-07-28<br>10:55:00 CST                       | 2016-07-22<br>14:55:04 CST                     | 2016-07-22<br>13:57:11 CST           |

**CONTENTS**

|   |       |           |
|---|-------|-----------|
| <b>1. GENERAL DESCRIPTION</b>           | ----- | <b>5</b>  |
| 1.1 OVERVIEW                            |       |           |
| 1.2 FEATURES                            |       |           |
| 1.3 APPLICATION                         |       |           |
| 1.4 GENERAL SPECIFICATIONS              |       |           |
| 1.5 MECHANICAL SPECIFICATIONS           |       |           |
| <b>2. ABSOLUTE MAXIMUM RATINGS</b>      | ----- | <b>7</b>  |
| 2.1 ABSOLUTE RATINGS OF ENVIRONMENT     |       |           |
| 2.2 ELECTRICAL ABSOLUTE RATINGS         |       |           |
| 2.2.1 TFT LCD MODULE                    |       |           |
| 2.2.2 LED CONVERTER                     |       |           |
| <b>3. ELECTRICAL CHARACTERISTICS</b>    | ----- | <b>8</b>  |
| 3.1 TFT LCD MODULE                      |       |           |
| 3.2 LED CONVERTER                       |       |           |
| <b>4. BLOCK DIAGRAM</b>                 | ----- | <b>12</b> |
| 4.1 TFT LCD MODULE                      |       |           |
| <b>5. INPUT TERMINAL PIN ASSIGNMENT</b> | ----- | <b>13</b> |
| 5.1 TFT LCD MODULE                      |       |           |
| 5.2 BACKLIGHT UNIT                      |       |           |
| 5.3 COLOR DATA INPUT ASSIGNMENT         |       |           |
| <b>6. INTERFACE TIMING</b>              | ----- | <b>15</b> |
| 6.1 INPUT SIGNAL TIMING SPECIFICATIONS  |       |           |
| 6.2 POWER ON/OFF SEQUENCE               |       |           |
| 6.3 SCANNING DIRECTION                  |       |           |
| <b>7. OPTICAL CHARACTERISTICS</b>       | ----- | <b>18</b> |
| 7.1 TEST CONDITIONS                     |       |           |
| 7.2 OPTICAL SPECIFICATIONS              |       |           |
| <b>8. RELIABILITY TEST CRITERIA</b>     | ----- | <b>21</b> |
| <b>9. PACKAGING</b>                     | ----- | <b>22</b> |
| 9.1 PACKING SPECIFICATIONS              |       |           |
| 9.2 PACKING METHOD                      |       |           |
| 9.3 UN-PACKING METHOD                   |       |           |
| <b>10. DEFINITION OF LABELS</b>         | ----- | <b>24</b> |
| <b>11. PRECAUTIONS</b>                  | ----- | <b>25</b> |
| 11.1 ASSEMBLY AND HANDLING PRECAUTIONS  |       |           |
| 11.2 SAFETY PRECAUTIONS                 |       |           |
| <b>12. MECHANICAL CHARACTERISTICS</b>   | ----- | <b>26</b> |

## REVISION HISTORY

| Version | Date          | Section  | Description   |
|---------|---------------|--|---|
| 0.0     | July 29,2009  | All  | G104V1-T03 Tentative Spec was first issued.   |
| 1.0     | Mar 12,2010   | 1.4<br>1.5<br>2.1<br>3.1<br>3.2<br>4.1<br>5.1<br>6.1<br>6.2<br>7.2<br>9.1<br>9.2<br>10.1<br>12 | G104V1-T03 Preliminary Spec was first issued.<br>Add the Module Power Consumption value.<br>Add note(1) with module depth typical value 7.8mm without TTL connector and 9.34 mm with TTL connector.<br>Add plot of temperature v.s relative humidity.<br>Add Max Power Supply Current under white/black pattern.<br>Add Power Consumption value of TFT-LCD<br>Modify Converter Power Supply Current to 0.6A.<br>Modify Converter Power Consumption to 7.2W.<br>Remove HS/VS symbol and add converter ADJ/EN symbol.<br>Pin3/4 change to NC.<br>Add Horizontal/Vertical Active Display Term parameter.<br>Note(1):remove Hsync/Vsync description.<br>Modify power on/off sequence and delay time request(T6/T7/T10).<br>Modify optical specification value.<br>Modify note(4) : gray level L255 to L63.<br>Modify Q'ty per carton and weight.<br>Modify Q'ty per carton and weight.<br>Modify Manufactured Date : Year:1~9, for 2010~2019<br>Update module drawing to Ver1.0 |
| 2.0     | Mar 17,2010   | 1.4<br>1.5<br>3.1<br>3.2   | G104V1-T03 Approval Spec was first issued.<br>Modify the module power consumption<br>Modify module thickness and weight<br>Modify Power supply current of white/black pattern and power consumption<br>Modify LED converter power supply current and power consumption  |
| 2.1     | Jul 13,2010   | 3.1  | Modify power supply current(min)<br>450mA -> 390mA, at VCC=3.3V 60Hz white pattern.<br>360mA -> 290mA, at VCC=5.0V 60Hz white pattern.<br>420mA -> 370mA, at VCC=3.3V 60Hz black pattern.<br>330mA -> 280mA, at VCC=5.0V 60Hz black pattern.  |
| 2.2     | Aug 23,2010   | 3.2<br>4.1   | Add cautionary statement to Note(2) about life time vs. operating conditions.<br>Modify LED power input connector description. From ACES to Entery  |
| 2.3     | Apr 10,2013   | 3.2<br>6.1<br>9.2<br>9.3   | Modify LED PWM frequency max value from 200Hz to 20KHz.<br>Correct the Tv/Tvd/Tvb and Th/Thd/Thb symbol<br>Modify Figure. 9-1 packing method<br>Add un-packing method   |
| 2.4     | July 20, 2016 | 1.1  | Updated 1.1 General Overview  |

|  |  |     |  |
|--|--|-----|--|
|  |  | 1.4 | Modified Module Power Consumption  |
|  |  | 3.2 | Modified Converter Power Supply Current & Converter Power Consumption<br>Modified Note (2) |
|  |  | 6.1 | Added Note (3)   |
|  |  | 7.1 | Modified Test Conditions   |
|  |  | 7.2 | Modified Note (2) & (4)  |
|  |  | 8   | Added Note (5), (6)  |

## 1. GENERAL DESCRIPTION

### 1.1 OVERVIEW

The G104V1-T03 model is a IAV 10.4" TFT-LCD module with white LED Backlight Unit and a 31-pin and 1ch TTL interface. This module supports 640 x 480 VGA mode and display 262,144 colors. The converter for the LED Backlight Unit is built in.

### 1.2 FEATURES

- Wide viewing angle
- High contrast ratio
- VGA (640 x 480 pixels) resolution
- Wide operating temperature
- DE (Data Enable) mode
- CMOS/TTL (Transistor-Transistor Logic) interface
- Reversible-scan direction
- RoHS Compliance
- LED Light Bar Replaceable

### 1.3 APPLICATION

- TFT LCD Monitor
- Industrial Application
- Amusement

### 1.4 GENERAL SPECIFICATIONS

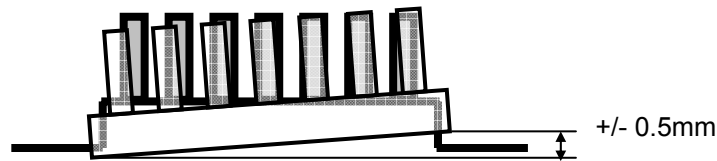
| Item                     | Specification                            | Unit  | Note |
|--------------------------|--|-------|------|
| Diagonal Size            | 10.4                                     | inch  | (1)  |
| Active Area              | 211.2(H) x 158.4(V)                      | mm    |      |
| Bezel Opening Area       | 215.4(H) x 161.8(V)                      | mm    |      |
| Driver Element           | a-si TFT active matrix                   | -     | -    |
| Pixel Number             | 640 x R.G.B. x 480                       | pixel | -    |
| Pixel Pitch              | 0.33(H) x 0.33(V)                        | mm    | -    |
| Pixel Arrangement        | RGB vertical stripe                      | -     | -    |
| Display Colors           | 262,144                                  | color | -    |
| Transmissive Mode        | Normally black                           | -     | -    |
| Surface Treatment        | Hard coating (3H), Anti-glare (Haze 25%) | -     | -    |
| Module Power Consumption | 7.38                                     | W     | Typ. |

**1.5 MECHANICAL SPECIFICATIONS**

| Item                            | Min.   | Typ.       | Max.       | Unit       | Note |     |
|---------------------------------|--|------------|------------|------------|------|-----|
| Module Size                     | Horizontal (H)   | 225        | 225.5      | 226        | mm   | (1) |
|                                 | Vertical (V)   | 175.8      | 176.3      | 176.8      | mm   |     |
|                                 | Depth (D)  | 8.84(7.31) | 9.34(7.81) | 9.84(8.31) | mm   |     |
| Weight                          | 345  | 395        | 445        | 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. Module depth 7.8mm does not include TTL connector, with TTL connector is 9.34mm (typical).

(2) Connector mounting position



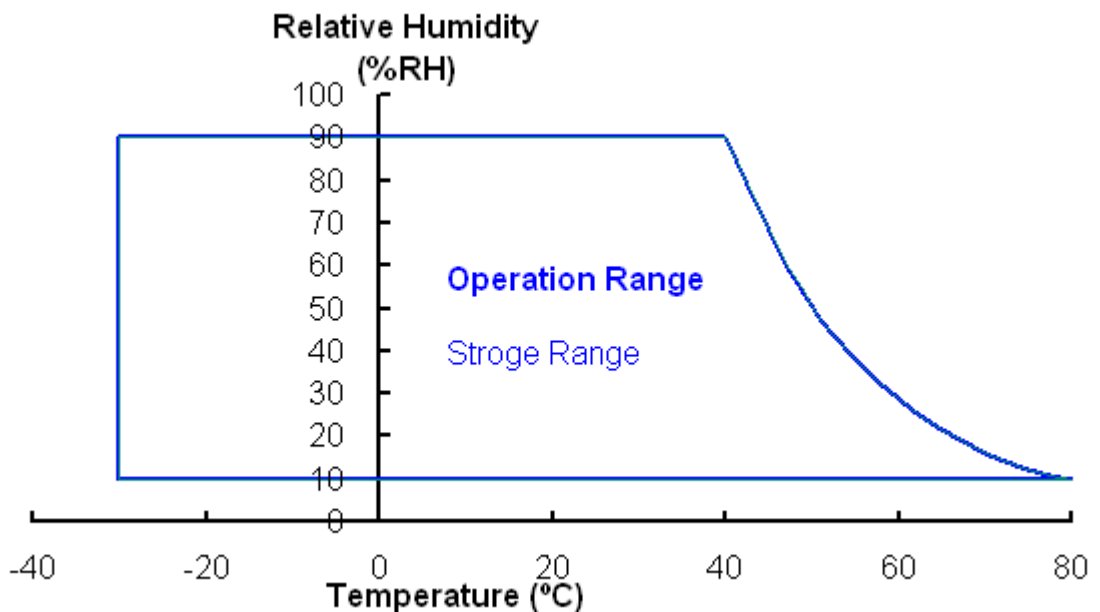
**2. ABSOLUTE MAXIMUM RATINGS**

**2.1 ABSOLUTE RATINGS OF ENVIRONMENT**

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

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

- (a) 90 %RH Max. (Ta ≤ 40 °C).
- (b) Wet-bulb temperature should be 39 °C Max. (Ta > 40 °C).
- (c) No condensation.



**2.2 ELECTRICAL ABSOLUTE RATINGS**

**2.2.1 TFT LCD MODULE**

| Item                 | Symbol | Value |      | Unit | Note |
|----------------------|--------|-------|------|------|------|
|                      |        | Min.  | Max. |      |      |
| Power Supply Voltage | VCC    | -0.3  | 7    | V    | (1)  |

**2.2.2 LED CONVERTER**

| Item              | Symbol         | Value |      | Unit | Note     |
|-------------------|----------------|-------|------|------|----------|
|                   |                | Min.  | Max. |      |          |
| Converter Voltage | V <sub>i</sub> | -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 LED (Refer to 3.2 for further information).



**3. ELECTRICAL SPECIFICATIONS**

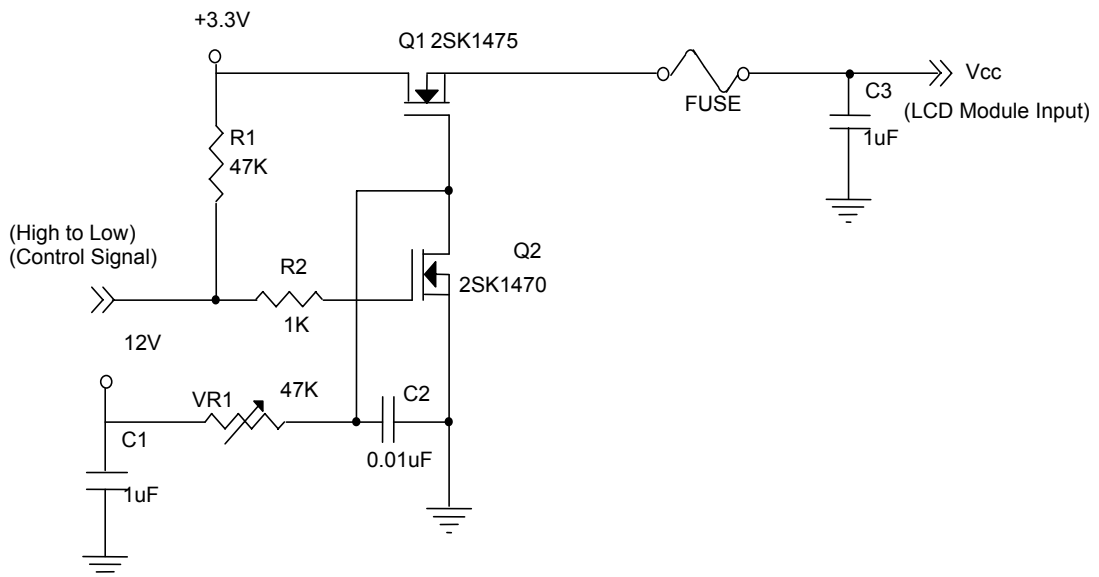
**3.1 TFT LCD MODULE**

Ta = 25 ± 2 °C

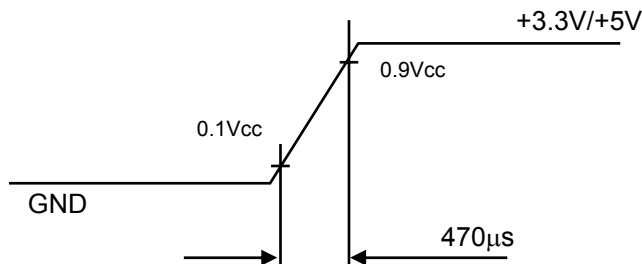
| Parameter            | Symbol          | Value              |       |                    | Unit                    | Note                    |
|----------------------|-----------------|--------------------|-------|--------------------|-------------------------|-------------------------|
|                      |                 | Min.               | Typ.  | Max.               |                         |                         |
| Power Supply Voltage | VCC             | 3.0                | 3.3   | 3.6                | V                       | at VCC=3.3V             |
|                      |                 | 4.75               | 5.0   | 5.25               | V                       | at VCC=5.0V             |
| Power Supply Current | White           | 390                | 490   | 540                | mA                      | (3)a, at VCC=3.3V, 60Hz |
|                      | Black           | 290                | 390   | 440                | mA                      | (3)a, at VCC=5.0V, 60Hz |
|                      |                 | 370                | 470   | 520                | mA                      | (3)b, at VCC=3.3V, 60Hz |
|                      | 280             | 380                | 430   | mA                 | (3)b, at VCC=5.0V, 60Hz |                         |
| Power Consumption    | P <sub>L</sub>  | ---                | 1.617 | ---                | W                       | VCC=3.3V, 60Hz          |
| Logic input voltage  | V <sub>IH</sub> | 0.7V <sub>CC</sub> | -     | V <sub>CC</sub>    | V                       |                         |
|                      | V <sub>IL</sub> | 0                  | -     | 0.3V <sub>CC</sub> | V                       |                         |

Note (1) The module is recommended to operate within specification ranges listed above for normal function.

Note (2) Measurement Conditions:

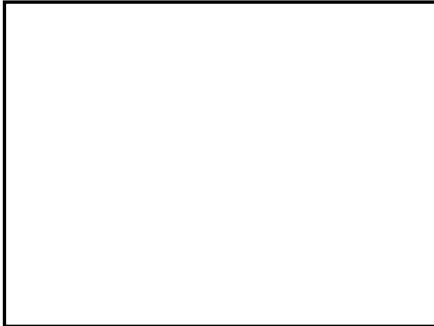


**Vcc rising time is 470μs**



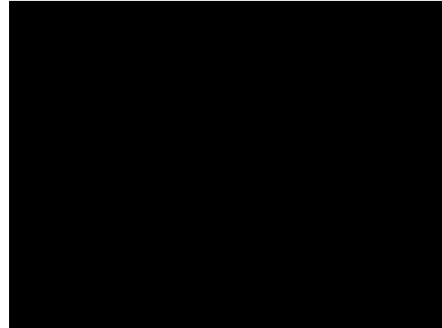
Note (3) The specified power supply current is under the conditions at  $T_a = 25 \pm 2 \text{ }^\circ\text{C}$ ,  $f_v = 60 \text{ Hz}$ , where as a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

b. Black Pattern



Active Area

**3.2 LED CONVERTER**

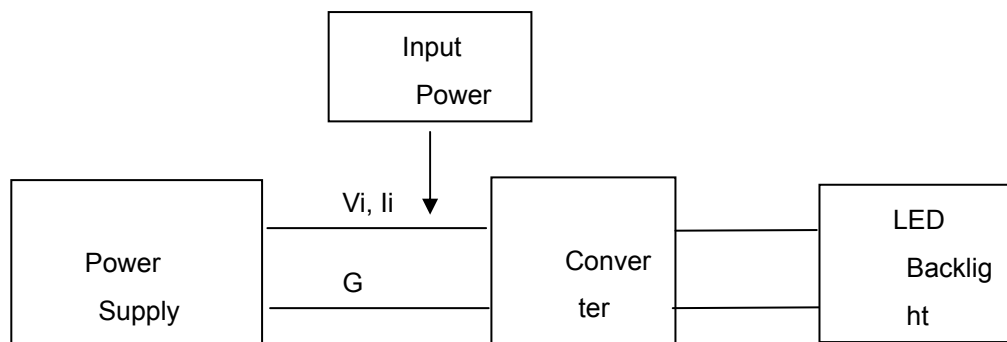
Ta = 25 ± 2 °C

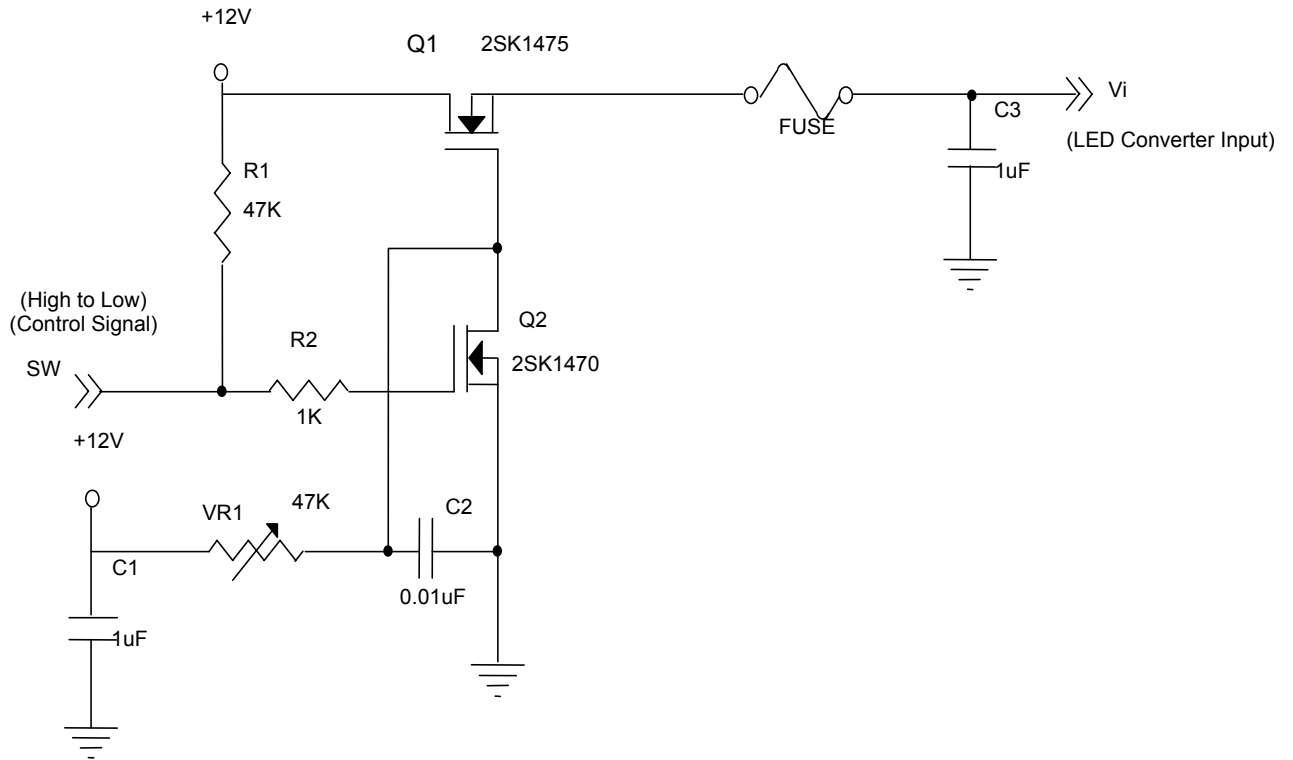
| Parameter                      | Symbol         | Value  |      |      | Unit | Note                           |
|--------------------------------|----------------|--------|------|------|------|--------------------------------|
|                                |                | Min.   | Typ. | Max. |      |                                |
| Converter Power Supply Voltage | $V_i$          | 10.8   | 12.0 | 12.6 | V    | (Duty 100%)                    |
| Converter Power Supply Current | $I_i$          | ---    | 0.48 | ---  | A    | (1) $V_i = 12V$<br>(Duty 100%) |
| Converter Power Consumption    | $P_i$          | ---    | 5.76 | ---  | W    | (1) $V_i = 12V$<br>(Duty 100%) |
| EN Control Level               | Backlight on   | 2.0    | 3.3  | 5.0  | V    |                                |
|                                | Backlight off  | 0      | ---  | 0.8  | V    |                                |
| PWM Control Level              | PWM High Level | 2.0    | 3.3  | 5.0  | V    |                                |
|                                | PWM Low Level  | 0      | ---  | 0.8  | V    |                                |
| PWM Control Duty Ratio         |                | 20     |      | 100  | %    |                                |
| PWM Control Frequency          | $f_{PWM}$      | 190    | 200  | 20K  | Hz   |                                |
| LED Life Time                  | $L_L$          | 50,000 |      |      | Hrs  | (2)                            |

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

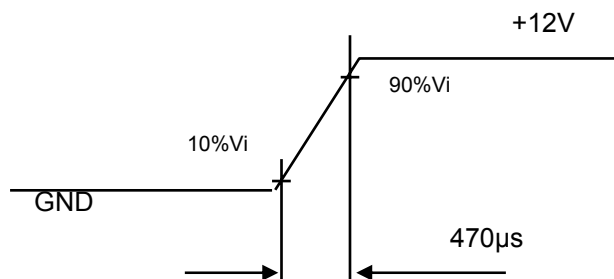
Note (2) The lifetime of LED is defined as the time when it continues to operate under the conditions at  $T_a = 25 \pm 2$  and  $I_{LED} = 70mA_{DC}$  (LED forward current) until the brightness becomes 50% of its original value. And minimum LED lifetime is estimated and provided by Nichia in Japan.

**Operating LED under high temperature environment will reduce life time and lead to color shift.**



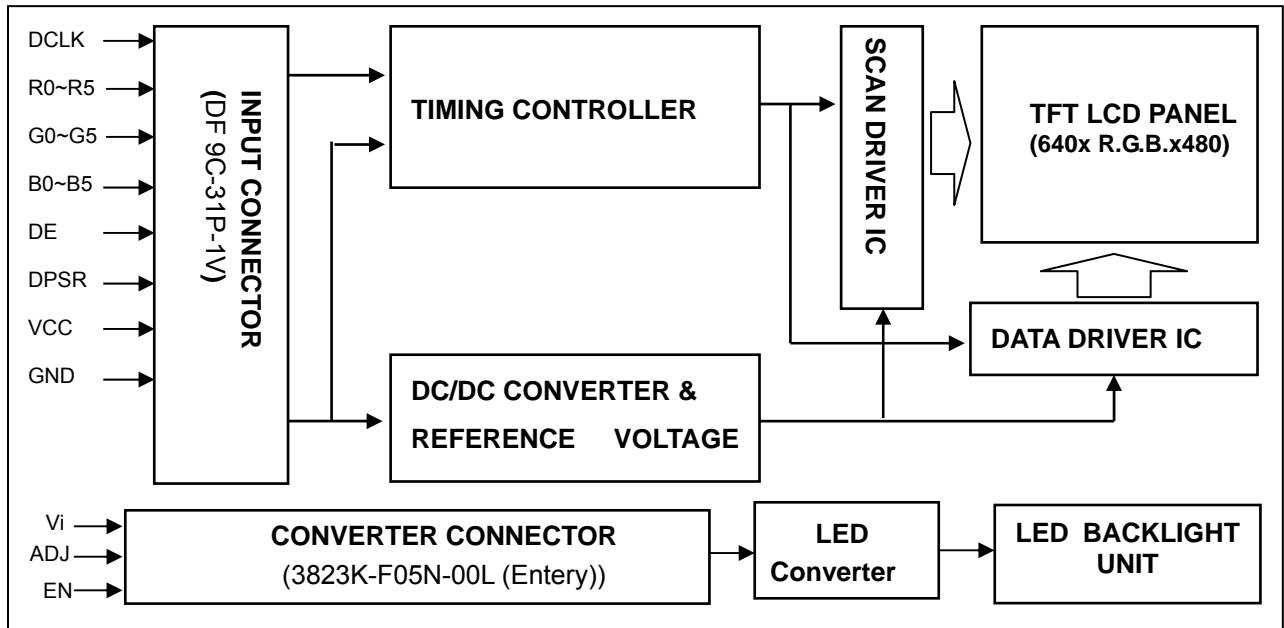


**Vi rising time is 470us**



**4. BLOCK DIAGRAM**

**4.1 TFT LCD MODULE**



## 5. INPUT TERMINAL PIN ASSIGNMENT

### 5.1 TFT LCD MODULE

| Pin | Name | Description                        |
|-----|------|------------------------------------|
| 1   | GND  | Ground                             |
| 2   | DCLK | Dot clock                          |
| 3   | N.C. | N.C.                               |
| 4   | N.C. | N.C.                               |
| 5   | GND  | Ground                             |
| 6   | R0   | Red data (LSB)                     |
| 7   | R1   | Red data                           |
| 8   | R2   | Red data                           |
| 9   | R3   | Red data                           |
| 10  | R4   | Red data                           |
| 11  | R5   | Red data (MSB)                     |
| 12  | GND  | Ground                             |
| 13  | G0   | Green data (LSB)                   |
| 14  | G1   | Green data                         |
| 15  | G2   | Green data                         |
| 16  | G3   | Green data                         |
| 17  | G4   | Green data                         |
| 18  | G5   | Green data (MSB)                   |
| 19  | GND  | Ground                             |
| 20  | B0   | Blue data (LSB)                    |
| 21  | B1   | Blue data                          |
| 22  | B2   | Blue data                          |
| 23  | B3   | Blue data                          |
| 24  | B4   | Blue data                          |
| 25  | B5   | Blue data (MSB)                    |
| 26  | GND  | Ground                             |
| 27  | DE   | Data enable signal                 |
| 28  | VCC  | Power supply                       |
| 29  | VCC  | Power supply                       |
| 30  | N.C. | Reserved, please keep it floating. |
| 31  | DPSR | Selection of scan direction        |

Note (1) Connector Part No.: DF 9C-31P-1V or equivalent.

## 5.2 BACKLIGHT UNIT (Converter connector pin)

| Pin | Symbol           | Description             | Remark      |
|-----|------------------|-------------------------|-------------|
| 1   | V <sub>i</sub>   | Converter input voltage | 12V         |
| 2   | V <sub>GND</sub> | Converter ground        | Ground      |
| 3   | EN               | Enable pin              |             |
| 4   | ADJ              | Backlight Adjust        | PWM Dimming |
| 5   | NC               | Not Connect             |             |

Note (1) Connector Part No.: 3823K-F05N-00L (Entry) or equivalent

Note (2) User's connector Part No.: H208K-P05N-02B (Entry) or equivalent

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

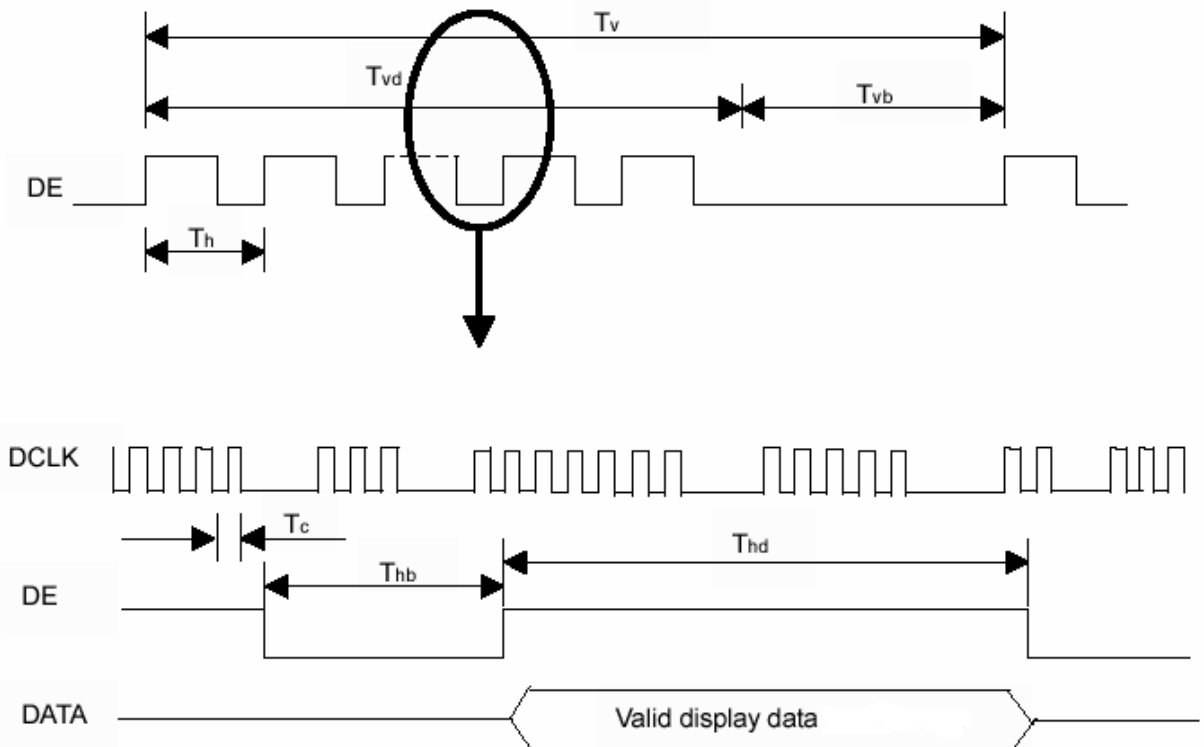
| Signal                         | Item       | Symbol | Min. | Typ.   | Max. | Unit | Note       |
|--------------------------------|------------|--------|------|--------|------|------|------------|
| Dot Clock                      | Frequency  | Fc     | 21   | 25.175 | 29   | MHz  | -          |
|                                | Duty       |        | 0.4  | 0.5    | 0.6  |      |            |
| Dot Data                       | Setup Time | Tlvs   | 8    | -      | -    | ns   | -          |
|                                | Hold Time  | Tlvh   | 12   | -      | -    | ns   | -          |
| Horizontal Active Display Term | Frame Rate | Fr     | -    | 60     | -    | Hz   |            |
|                                | Total      | Th     | 730  | 800    | 900  | Th   | Th=Thd+Thb |
|                                | Display    | Thd    |      | 640    |      | Th   | -          |
|                                | Blank      | Thb    | 90   | 160    | 260  | Th   | -          |
| Vertical Active Display Term   | Total      | Tv     | 485  | 525    | 800  | Tc   | Tv=Tvd+Tvb |
|                                | Display    | Tvd    |      | 480    |      | Tc   | -          |
|                                | Blank      | Tvb    | 5    | 45     | 320  | Tc   | -          |

Note : (1) This module is operated by DE only mode

(2) Frame rate is 60Hz

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

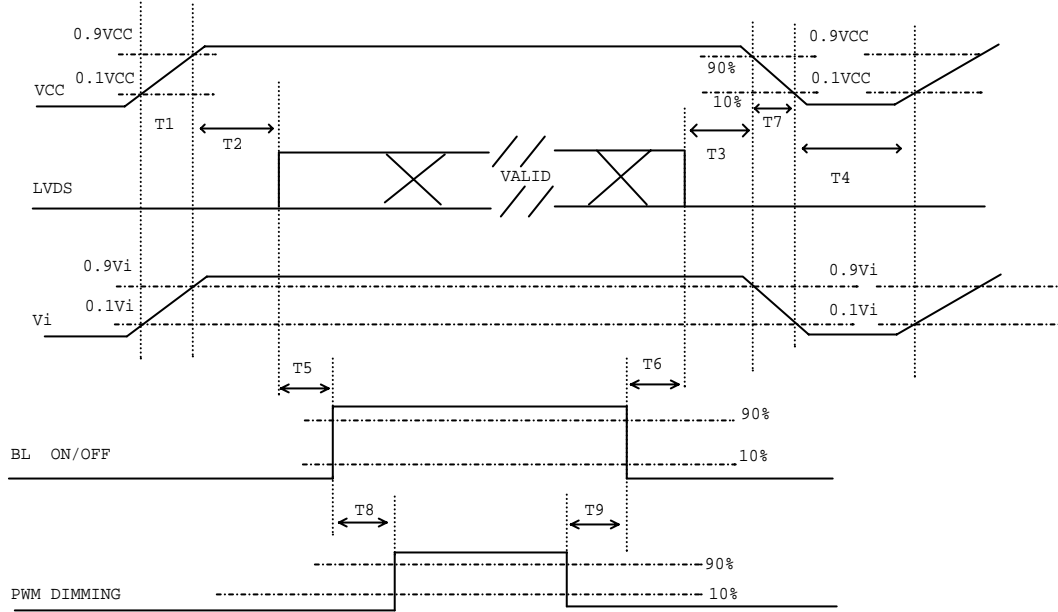
**INPUT SIGNAL TIMING DIAGRAM**





**6.2 POWER ON/OFF SEQUENCE**

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should follow the conditions shown in the following diagram.



**Power ON/OFF sequence**

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

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

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

| Parameter | Value |     |     | Units |
|-----------|-------|-----|-----|-------|
|           | Min   | Typ | Max |       |
| T1        | 0.5   | -   | 10  | ms    |
| T2        | 0     | -   | 50  | ms    |
| T3        | 0     | -   | 50  | ms    |
| T4        | 500   | -   | -   | ms    |
| T5        | 200   | -   | -   | ms    |
| T6        | 20    | -   | -   | ms    |
| T7        | 5     | -   | 300 | ms    |
| T8        | 10    | -   | -   | ms    |
| T9        | 10    | -   | -   | ms    |

### 6.3 SCANNING DIRECTION

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

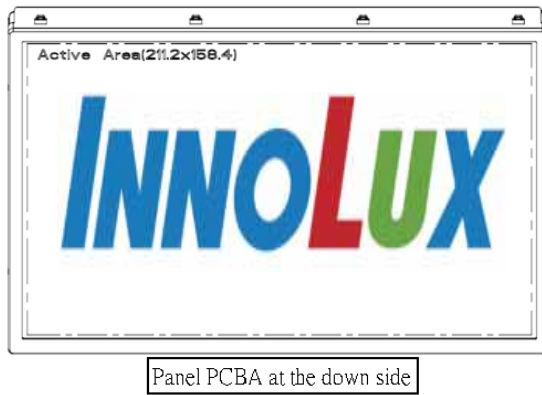


Figure1.Normal scan (DPSR : Low or Open )



Figure 2. Reverse scan (DPSR : High )

## 7. OPTICAL CHARACTERISTICS

### 7.1 TEST CONDITION

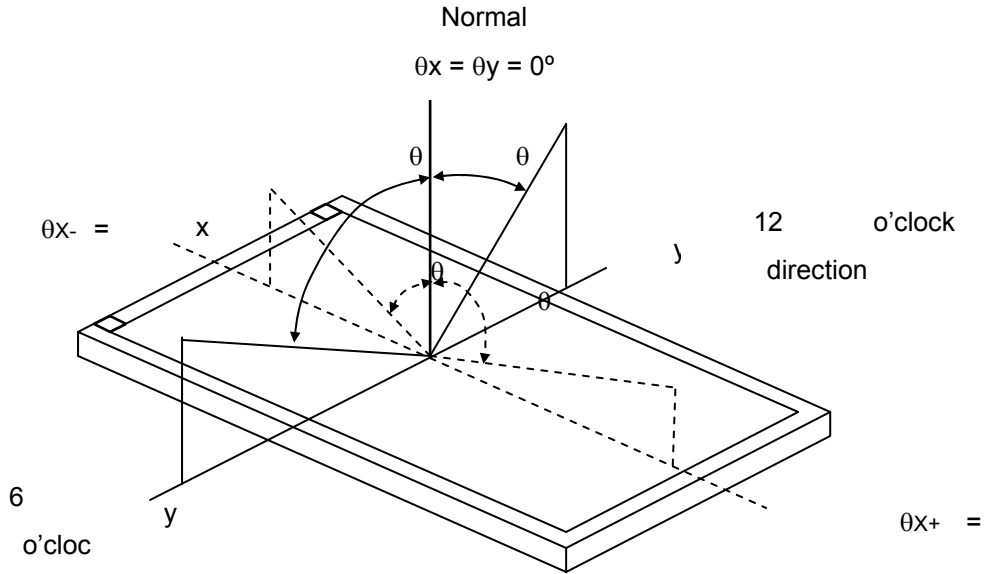
| Item                                      | Value  | Unit |
|---|--|------|
| Ambient Temperature (Ta)                  | 25±2   | °C   |
| Ambient Humidity (Ha)                     | 50±10  | %RH  |
| Supply Voltage                            | According to typical value in "ELECTRICAL CHARACTERISTICS"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

### 7.2 OPTICAL SPECIFICATION

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (5).

| Item                      | Symbol         | Condition                              | Min.       | Typ.  | Max.       | Unit | Note     |          |
|---------------------------|----------------|--|------------|-------|------------|------|----------|----------|
| Color Chromaticity        | Red            | Rx                                     | Typ - 0.05 | 0.619 | Typ + 0.05 | -    | (1), (5) |          |
|                           |                | Ry                                     |            | 0.357 |            | -    |          |          |
|                           | Green          | Gx                                     |            | 0.333 |            | -    |          |          |
|                           |                | Gy                                     |            | 0.562 |            | -    |          |          |
|                           | Blue           | Bx                                     |            | 0.145 |            | -    |          |          |
|                           |                | By                                     |            | 0.092 |            | -    |          |          |
|                           | White          | Wx                                     |            | 0.313 |            | -    |          |          |
|                           |                | Wy                                     |            | 0.329 |            | -    |          |          |
| Center Luminance of White | L <sub>C</sub> |  | 450        | 500   | -          | -    | (4), (5) |          |
| Contrast Ratio            | CR             |  | 1000       | 1500  | -          | -    | (2), (5) |          |
| Response Time             | T <sub>R</sub> | θ <sub>x</sub> =0°, θ <sub>y</sub> =0° | -          | 14    | 19         | ms   | (3)      |          |
|                           | T <sub>F</sub> |  | -          | 9     | 14         | ms   |          |          |
| White Variation           | δW             | θ <sub>x</sub> =0°, θ <sub>y</sub> =0° | -          | -     | 1.4        | -    | (5), (6) |          |
| Viewing Angle             | Horizontal     | θ <sub>x+</sub>                        | CR≥10      | 80    | 88         | -    | Deg.     | (1), (5) |
|                           |                | θ <sub>x-</sub>                        |            | 80    | 88         | -    |          |          |
|                           | Vertical       | θ <sub>y+</sub>                        |            | 80    | 88         | -    |          |          |
|                           |                | θ <sub>y-</sub>                        |            | 80    | 88         | -    |          |          |

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



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

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio, CR} = L_{63} / L_0$$

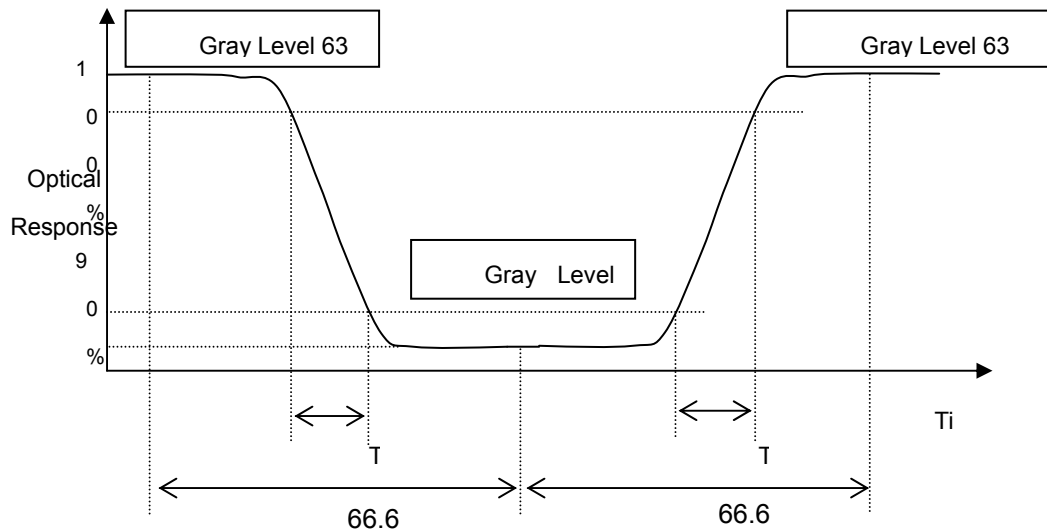
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

$$\text{CR} = \text{CR} (5)$$

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

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



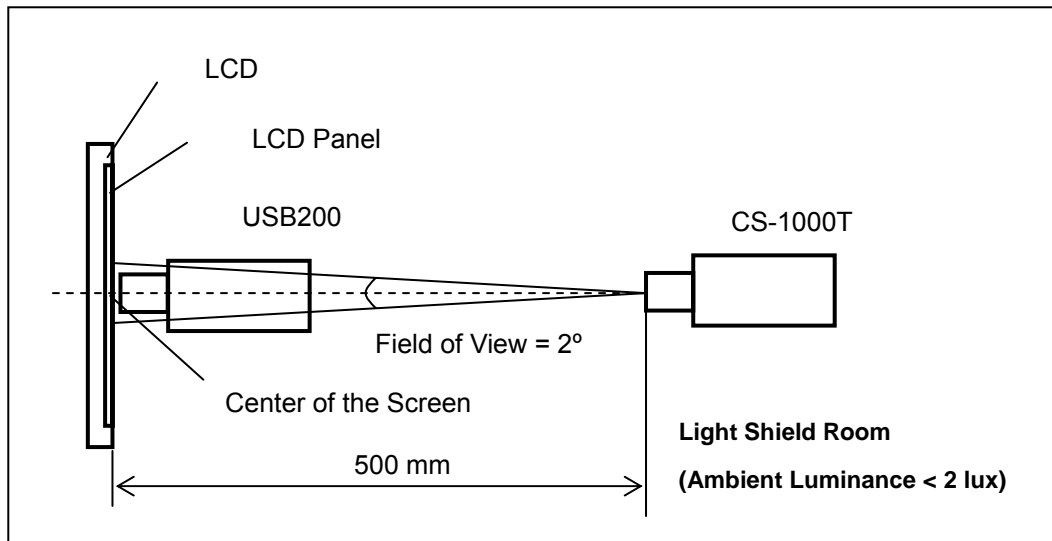
Note (4) Definition of Luminance of White ( $L_C$ ):

Measure the luminance of gray level 63 at center point and 5 points

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

Note (5) Measurement Setup:

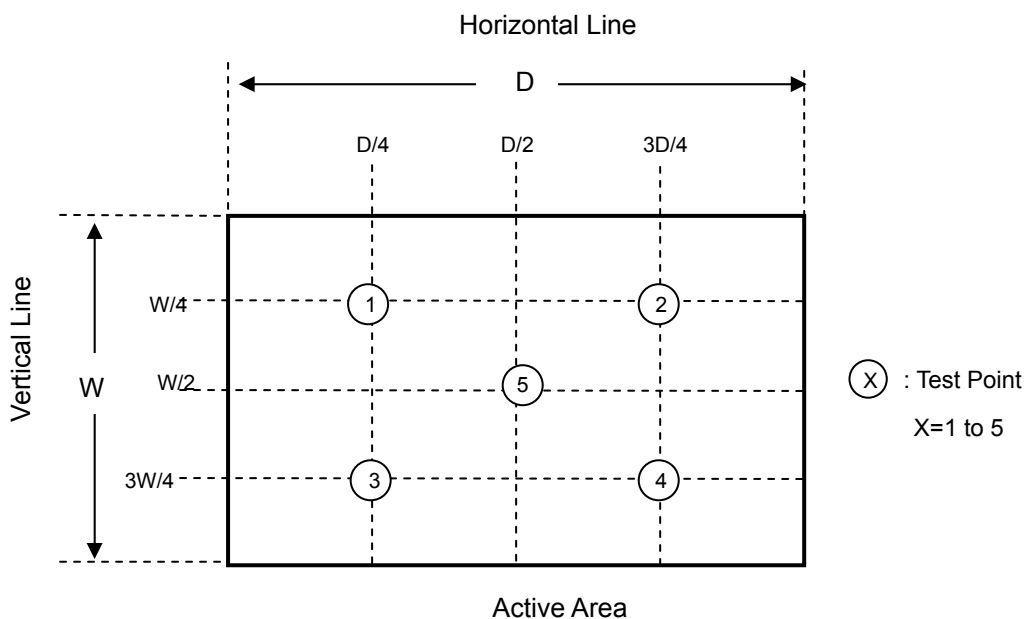
The LCD assembly should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a windless room.



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

Measure the luminance of gray level 63 at 5 points

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



## 8. RELIABILITY TEST CRITERION

| Test Item                                       | Test Condition  | Note              |
|---|---|-------------------|
| High Temperature Storage Test                   | 80°C, 240 hours                                       | (1)               |
| Low Temperature Storage Test                    | -30°C, 240 hours                                      | (2)               |
| Thermal Shock Storage Test                      | -30°C, 0.5hour←→80 , 0.5hour; 100cycles, 1hour/cycle  | (4)               |
| High Temperature Operation Test                 | 80°C, 240 hours                                       | (5)               |
| Low Temperature Operation Test                  | -30°C, 240 hours                                      | (1)               |
| High Temperature & High Humidity Operation Test | 60°C, 90%RH, 240hours                                 | (2)<br>(4)<br>(6) |
| Shock (Non-Operating)                           | 200G, 2ms, half sine wave, 1 time for ± X, ± Y, ± Z.  | (3) (4)           |
| Vibration (Non-Operating)                       | 1.5G, 10 ~ 300 Hz, 10min/cycle, 3 cycles each X, Y, Z | (3) (4)           |

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

Note (2) Temperature of panel display surface area should be 85 °C Max.

Note (3) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

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

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

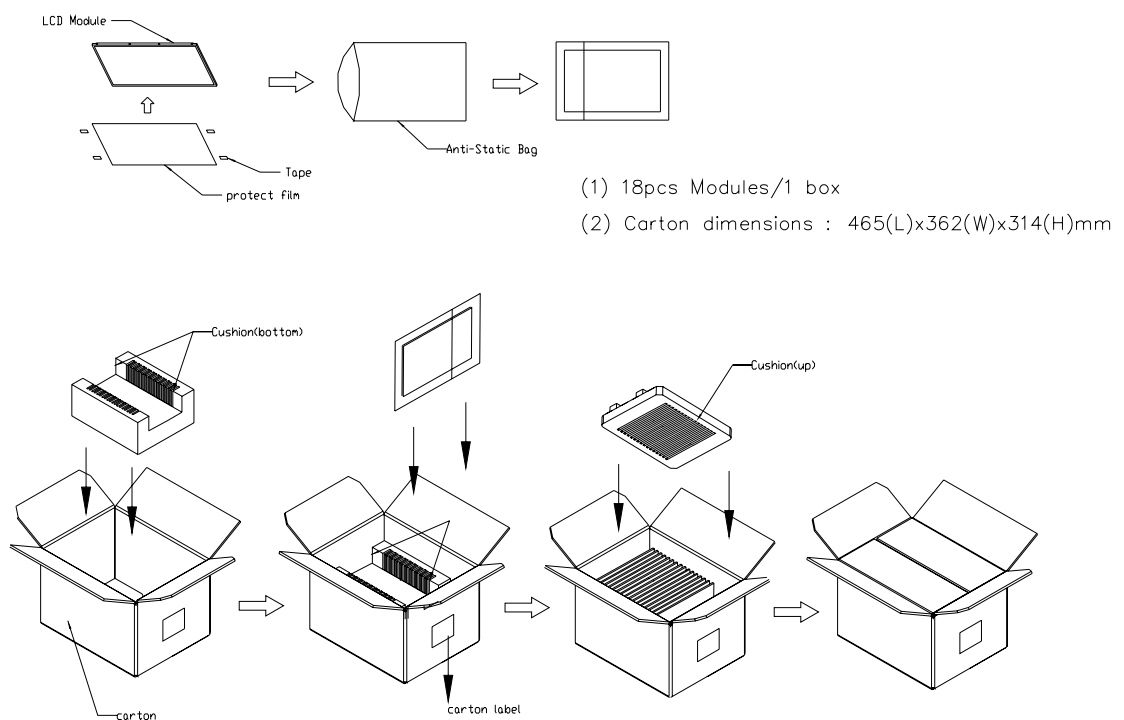
Note (6) Before cosmetic and function test, the product must have enough recovery time, at least 24 hours at room temperature.

**9. PACKING**

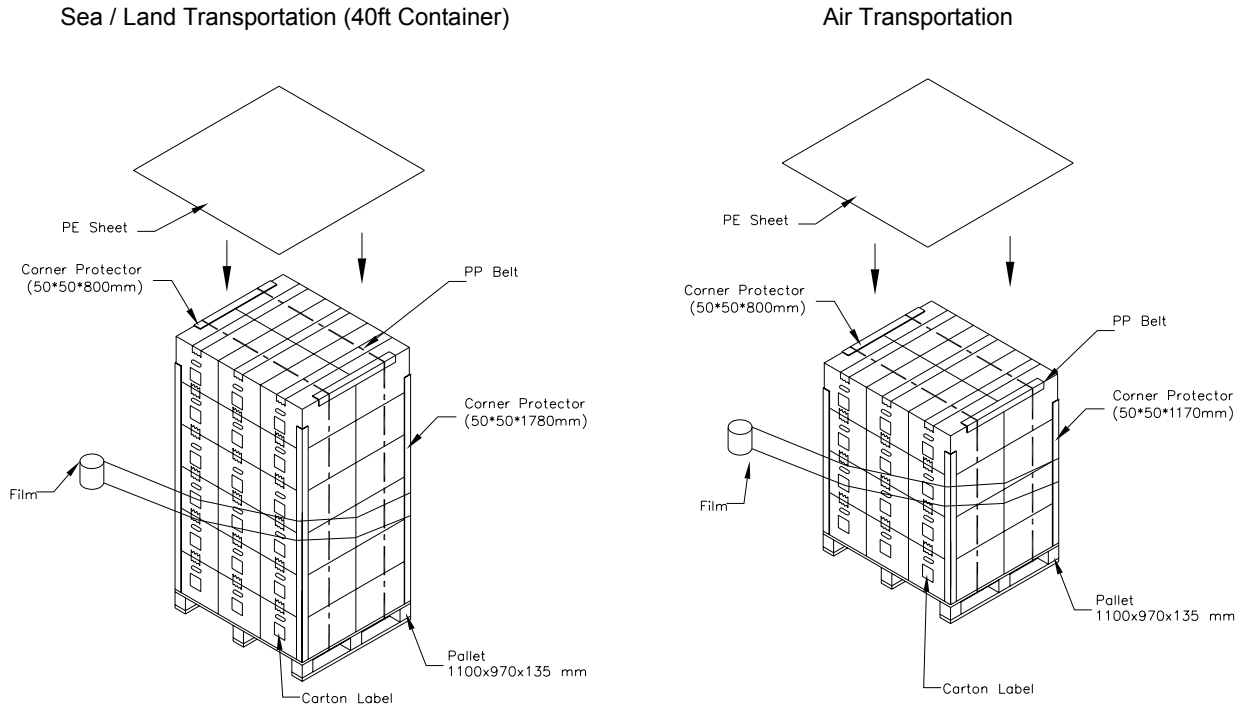
**9.1 PACKING SPECIFICATIONS**

- (1) 18pcs LCD modules / 1 Box
- (2) Box dimensions: 465 (L) X 362 (W) X 314 (H) mm
- (3) Weight: approximately 11.23Kg (18 modules per box)

**9.2 PACKING METHOD**

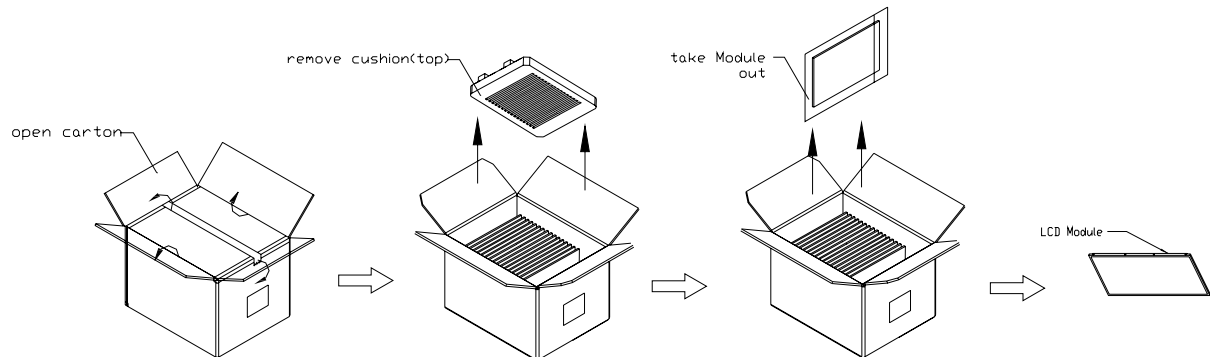


**Figure. 9-1 Packing method**



**Figure. 9-2 Packing method**

**9.3 UN-PACKING METHOD**



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



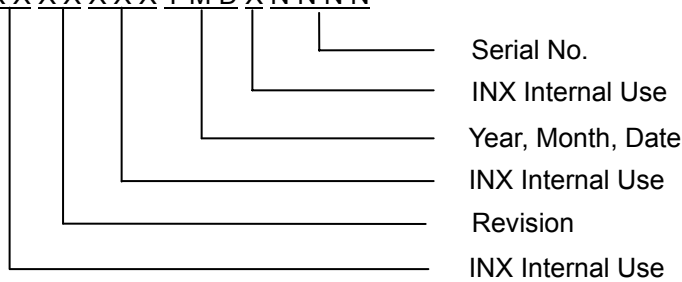
**10. DEFINITION OF LABEL**

**10.1 INX MODULE LABEL**

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



- (a) Model Name: G104V1 –T03
- (b) Revision: Rev. XX, for example: A1, ...C1, C2 ...etc.
- (c) Serial ID: XXXXXXYMDXNNNN



Serial ID includes the information as below:

- (a) Manufactured Date: Year: 0~9, for 2010~2019  
 Month: 1~9, A~C, for Jan. ~ Dec.  
 Day: 1~9, A~Y, for 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

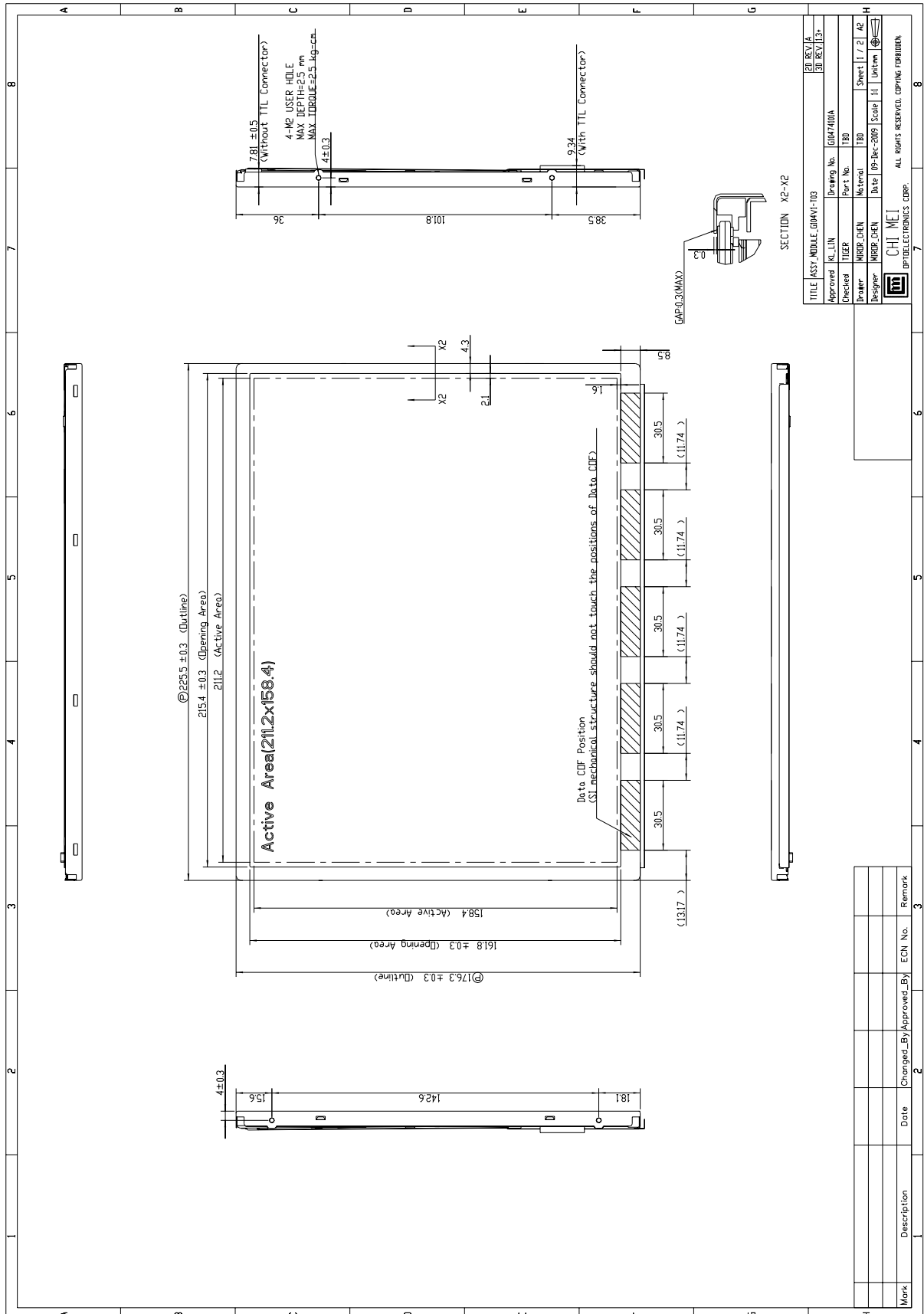
**11. PRECAUTIONS****11.1 ASSEMBLY AND HANDLING PRECAUTIONS**

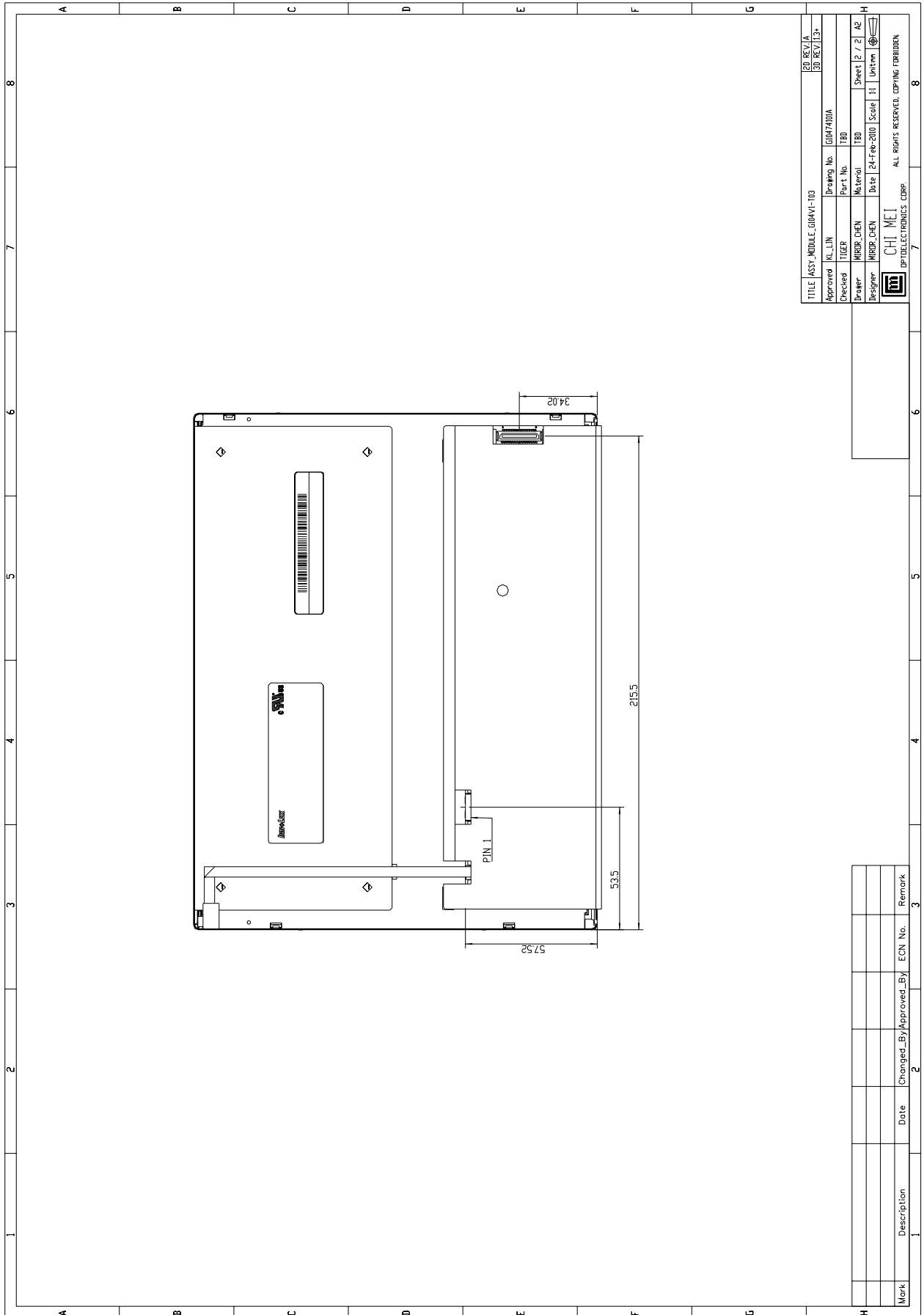
- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) To assemble or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- (3) It's not permitted to have pressure or impulse on the module because the LCD panel and Backlight will be damaged.
- (4) Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.
- (5) Do not pull the I/F connector in or out while the module is operating.
- (6) Do not disassemble the module.
- (7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (8) It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.
- (9) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (10) When ambient temperature is lower than 10°C may reduce the display quality, the response time will become slowly.
- (11) Do not keep same pattern in a long period of time. It may cause image sticking on LCD.

**11.2 SAFETY PRECAUTIONS**

- (1) Do not disassemble the module or insert anything into the Backlight unit.
- (2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- (3) After the module's end of life, it is not harmful in case of normal operation and storage.

12. MECHANICAL CHARACTERISTICS





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