

# 产 品 规 格 书

## Product Specification

|                              |                         |                                                                                                                                |                         |                       |  |                  |  |
|------------------------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----------------------|--|------------------|--|
| <b>Model Name</b><br>(产品名称)  |                         | <b>TFT-LCD Module</b>                                                                                                          |                         |                       |  |                  |  |
| <b>Part Number</b><br>(产品型号) |                         | <b>JT219FHI30RSL01</b>                                                                                                         |                         |                       |  |                  |  |
| <b>Item</b> (项目)             | <b>Prepared</b><br>(拟制) | <b>Checked</b><br>(审核)                                                                                                         | <b>Approved</b><br>(批准) |                       |  |                  |  |
| <b>Signature</b> (签名)        | 赖依                      | 林勇                                                                                                                             |                         |                       |  |                  |  |
| <b>Date</b> (日期)             | 2022-06-14              | 2022-06-14                                                                                                                     |                         |                       |  |                  |  |
| <b>Note</b> (备注)             |                         |                                                                                                                                |                         |                       |  |                  |  |
| <b>Customer:</b><br>(客户)     |                         | <table border="1"> <tr> <td><b>Signature</b> (签名)</td> <td></td> </tr> <tr> <td><b>Date</b> (日期)</td> <td></td> </tr> </table> |                         | <b>Signature</b> (签名) |  | <b>Date</b> (日期) |  |
| <b>Signature</b> (签名)        |                         |                                                                                                                                |                         |                       |  |                  |  |
| <b>Date</b> (日期)             |                         |                                                                                                                                |                         |                       |  |                  |  |

### Revision Record

| Version | Issued Date | Page | Old Description | New Description |
|---------|-------------|------|-----------------|-----------------|
| 01      | 2022-06-14  | \    | Initial release | \               |
|         |             |      |                 |                 |
|         |             |      |                 |                 |
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## 1. GENERAL DESCRIPTION

### 1.1 OVERVIEW

This is a 21.9" TFT Liquid Crystal Display MNT cell with driver ICs and a 30-pins 2ch-LVDS circuit board. The product supports 1920 x 712 Full HD mode and can display up to 16.7M colors. The backlight unit is not built in.

### 1.2 FEATURES

| Items                      | Specification                 | Unit              | Note                                                   |
|----------------------------|-------------------------------|-------------------|--------------------------------------------------------|
| Active Screen Size         | 21.9                          | inch              |                                                        |
| Number of Pixels           | 1920 X 712                    | Pixel             |                                                        |
| Display Area               | 527.04 (H) x 195.5(V)         | mm                |                                                        |
| Bezel Opening              | 530.4(H) x 199.2(V)           | mm                |                                                        |
| Outline Dimension          | 548.4(H) x 222.2(V) x 14.5(D) | mm                |                                                        |
| Luminance, White           | 1000 (Center 1 point, Typ.)   | cd/m <sup>2</sup> |                                                        |
| Power Supply Input Voltage | 12(Typ)                       | V                 | Backlight                                              |
| Power Supply Voltage       | 5.0 (Typ)                     | V                 | OC                                                     |
| Power Consumption          | Total = 28.46 (Typ.)          | W                 | LCD Open Cell = 5.46 W(Typ.)<br>Backlight = 23 W(Typ.) |
| Contrast Ratio             | 3000 : 1                      | --                |                                                        |
| Response time              | 10/6 (Typ.)(Tr/Td)            | ms                |                                                        |
| Color temperature          | 7809                          | K                 |                                                        |
| Weight                     | 2.3 (Typ)                     | Kg                |                                                        |
| Operating Temperature      | 0 ~ 50                        | °C                |                                                        |
| Storage Temperature        | -20 ~ 60                      | °C                |                                                        |

## 2. ABSOLUTE MAXIMUM RATINGS

### 2.1 ABSOLUTE RATINGS OF ENVIRONMENT

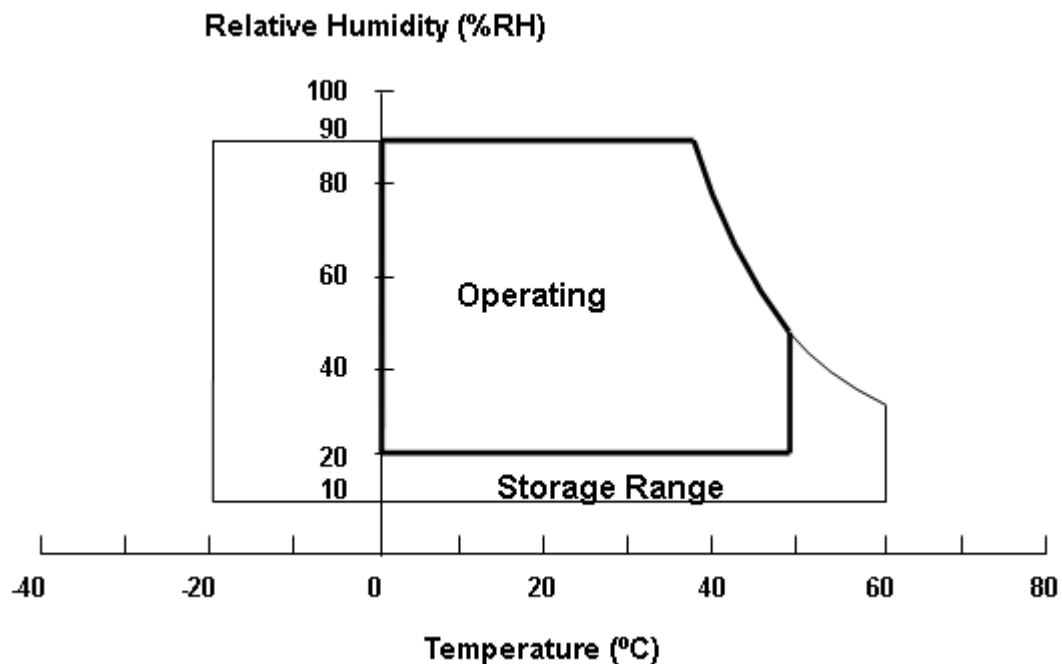
| Item                          | Symbol | Value |      | Unit | Note     |
|-------------------------------|--------|-------|------|------|----------|
|                               |        | Min.  | Max. |      |          |
| Storage Temperature           | TST    | -20   | 60   | °C   | (1)      |
| Operating Ambient Temperature | TOP    | 0     | 50   | °C   | (1), (2) |

Note (1)

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

Note (2) The temperature of panel surface should be 0 °C min. and 60 °C max.

Panel surface temperature should be 0°C min. and 60°C max under Vcc=5.0V, Input fr =60Hz, typical LED string current, 25°C ambient temperature, and no humidity control. Any condition of ambient operating temperature, the surface of active area should be keeping not higher than 60°C.



## 2.2 PACKAGE STORAGE

High temperature or humidity may reduce the performance of panel. Please store LCD panel within the specified storage conditions.

Storage Condition: With packing.

Storage temperature range:  $25\pm 5$  °C.

Storage humidity range:  $50\pm 10\%$  RH.

Shelf life: 30days

## 2.3 ELECTRICAL ABSOLUTE RATINGS

### 2.3.1 TFT LCD MODULE

| Item                 | Symbol          | Value |      | Unit | Note |
|----------------------|-----------------|-------|------|------|------|
|                      |                 | Min.  | Max. |      |      |
| Power Supply Voltage | VCCS            | -0.3  | 6.0  | V    | (1)  |
| Logic Input Voltage  | V <sub>IN</sub> | -0.3  | 3.6  | 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.

### 2.3.2 BACKLIGHT INVERTER UNIT

| Item                 | Symbol | Value |      | Unit | Note    |
|----------------------|--------|-------|------|------|---------|
|                      |        | Min.  | Max. |      |         |
| Lamp Voltage         | VW     | —     | 45   | VRMS |         |
| Power Supply Voltage | VBL    | 0     | 13.2 | V    | (1)     |
| Control Signal Level | —      | -0.3  | 5.5  | V    | (1),(3) |

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) No moisture condensation or freezing.

Note (3) The control signals include On/Off Control and Internal PWM Control.

### 3. ELECTRICAL CHARACTERISTICS

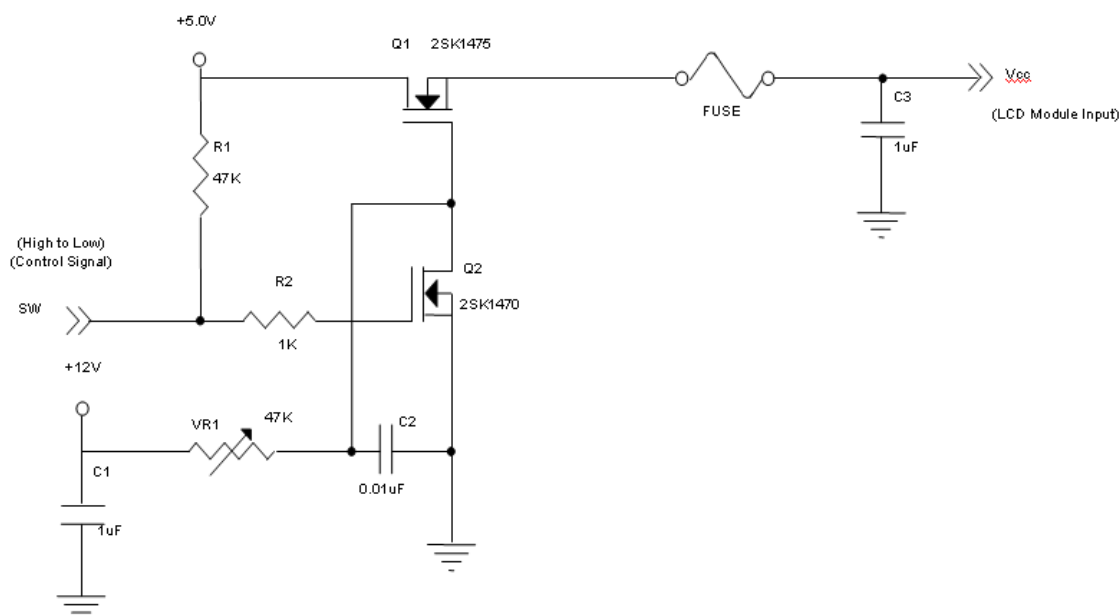
#### 3.1 Electrical Characteristics

##### TFT LCD MODULE

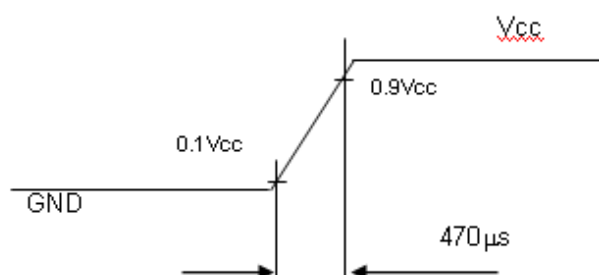
| Parameter            | Symbol                                    | Value           |       |       | Unit | Note |
|----------------------|-------------------------------------------|-----------------|-------|-------|------|------|
|                      |                                           | Min.            | Typ.  | Max.  |      |      |
| Power Supply Voltage | V <sub>CC</sub>                           | 4.5             | 5.0   | 5.5   | V    | -    |
| Ripple Voltage       | V <sub>RP</sub>                           |                 |       | 300   | mV   | -    |
| Rush Current         | I <sub>RUSH</sub>                         |                 |       | 3     | A    | (2)  |
| Power Supply Current | White                                     |                 | 1.164 | 1.352 | A    | (3)a |
|                      | Black                                     |                 | 0.71  | 0.75  | A    | (3)b |
|                      | Vertical Stripe                           |                 | 1.092 | 1.274 | A    | (3)c |
| Power Consumption    | PLCD                                      |                 | 5.46  | 6.37  | Watt | (4)  |
| LVDS interface       | Differential Input Voltage                | V <sub>ID</sub> | 100   | -     | 600  | mV   |
|                      | Common Input Voltage                      | V <sub>CM</sub> | 1.0   | 1.2   | 1.4  | V    |
|                      | Differential Input High Threshold Voltage | V <sub>TH</sub> |       | -     | 0.1  | V    |
|                      | Differential Input Low Threshold Voltage  | V <sub>TL</sub> | -0.1  | -     |      | V    |

Note (1) The ambient temperature is  $T_a = 25 \pm 2 \text{ }^\circ\text{C}$ .

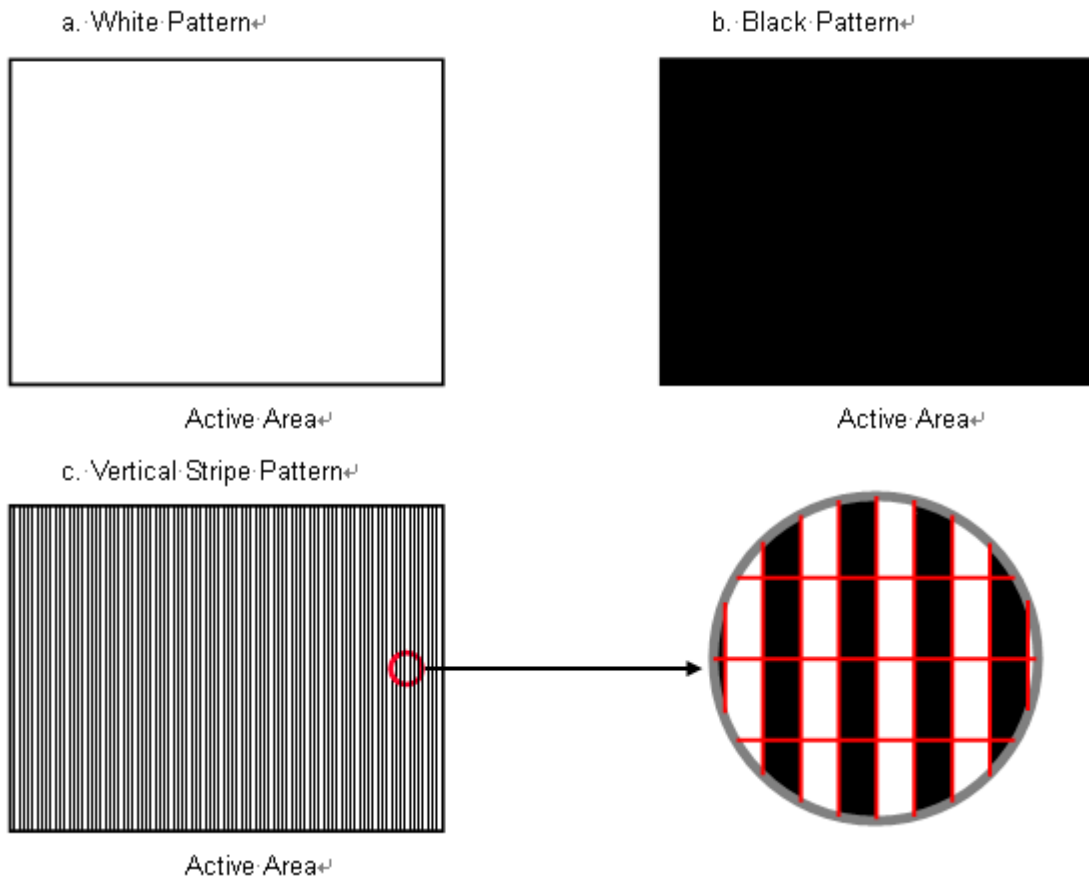
Note (2) Measurement Conditions:



**V<sub>CC</sub> rising time is 470μs**



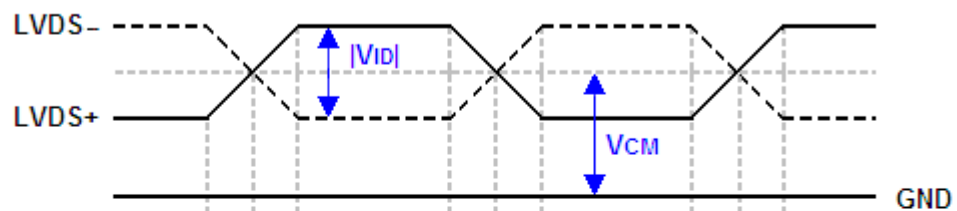
Note (3) The specified power supply current is under the conditions at  $V_{CC} = 5.0\text{ V}$ ,  $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$ ,  $F_r = 60\text{ Hz}$ , whereas a power dissipation check pattern below is displayed.



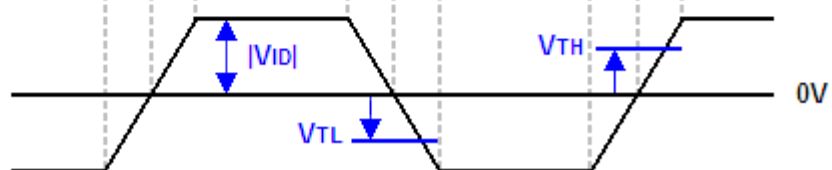
Note (4) The power consumption is specified at the pattern with the maximum current.

Note (5) The LVDS input characteristics are as follows:

## Single-end Signals



## Differential Signal



## 3.2 Interface Connections

### 3.2.1 TFT LCD Module Input

#### PIN ASSIGNMENT

| Pin | Name  | Description                                              |
|-----|-------|----------------------------------------------------------|
| 1   | RXO0- | Negative LVDS differential data input. Channel O0 (odd)  |
| 2   | RXO0+ | Positive LVDS differential data input. Channel O0 (odd)  |
| 3   | RXO1- | Negative LVDS differential data input. Channel O1 (odd)  |
| 4   | RXO1+ | Positive LVDS differential data input. Channel O1 (odd)  |
| 5   | RXO2- | Negative LVDS differential data input. Channel O2 (odd)  |
| 6   | RXO2+ | Positive LVDS differential data input. Channel O2 (odd)  |
| 7   | GND   | Ground                                                   |
| 8   | RXOC- | Negative LVDS differential clock input. (odd)            |
| 9   | RXOC+ | Positive LVDS differential clock input. (odd)            |
| 10  | RXO3- | Negative LVDS differential data input. Channel O3(odd)   |
| 11  | RXO3+ | Positive LVDS differential data input. Channel O3 (odd)  |
| 12  | RXE0- | Negative LVDS differential data input. Channel E0 (even) |
| 13  | RXE0+ | Positive LVDS differential data input. Channel E0 (even) |
| 14  | GND   | Ground                                                   |
| 15  | RXE1- | Negative LVDS differential data input. Channel E1 (even) |
| 16  | RXE1+ | Positive LVDS differential data input. Channel E1 (even) |
| 17  | GND   | Ground                                                   |
| 18  | RXE2- | Negative LVDS differential data input. Channel E2 (even) |
| 19  | RXE2+ | Positive LVDS differential data input. Channel E2 (even) |
| 20  | RXEC- | Negative LVDS differential clock input. (even)           |
| 21  | RXEC+ | Positive LVDS differential clock input. (even)           |
| 22  | RXE3- | Negative LVDS differential data input. Channel E3 (even) |
| 23  | RXE3+ | Positive LVDS differential data input. Channel E3 (even) |
| 24  | GND   | Ground                                                   |
| 25  | NC    | For LCD internal use only, Do not connect                |
| 26  | SCL   | I2C clock (for auto Vcom)                                |
| 27  | SDA   | I2C data (for auto Vcom)                                 |
| 28  | VCC   | +5.0V power supply                                       |
| 29  | VCC   | +5.0V power supply                                       |
| 30  | VCC   | +5.0V power supply                                       |

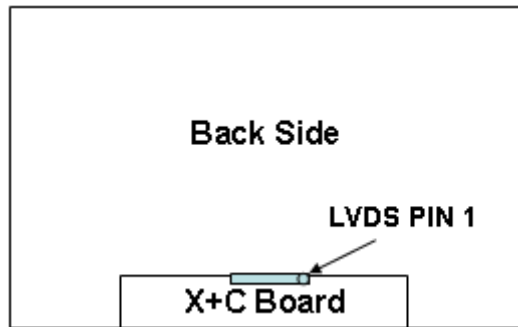
#### Connector Information

| Item                              | Description                                                               |
|-----------------------------------|---------------------------------------------------------------------------|
| Manufacturer                      | P-TWO/FCN/ Foxconn                                                        |
| Type part number                  | P-TWO : 187098-30091<br>FCN : WF13-422-3033<br>Foxconn : GS23301-0321R-7H |
| User's Mating housing part number | FI-X30HL(JAE)<br>FI-X30H(JAE)                                             |

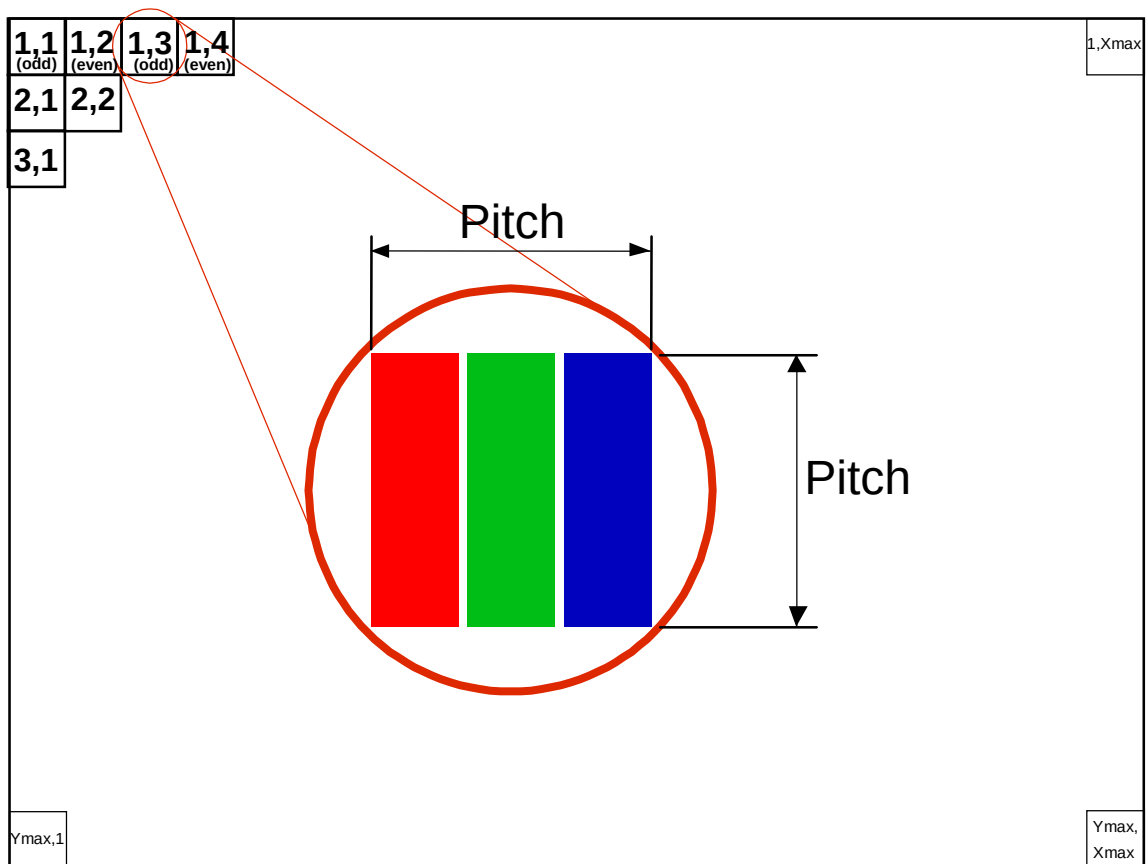
\*Notice: There would be compatible issues if not using the indicated connectors in the matching list.



Note (1) The first pixel is odd.



Note (2) Input signal of even and odd clock should be the same timing.

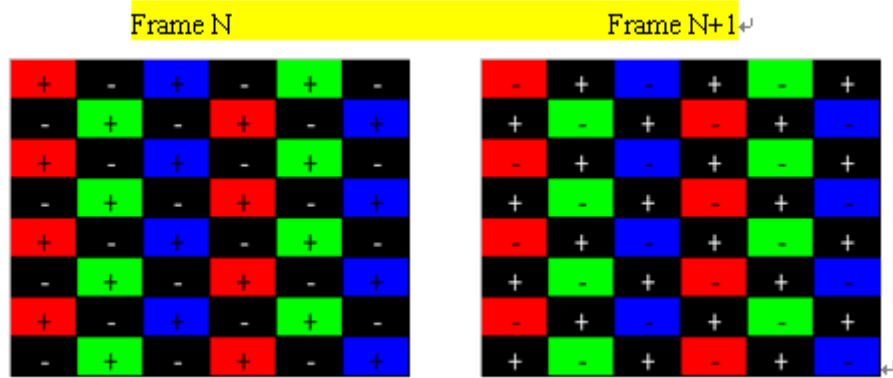


### 3.2.2 FLICKER (Vcom) ADJUSTMENT

Flicker must be finely adjusted after module assembly and aging. Please follow the instructions below.

(1) Vcom adjustment type : Auto Vcom

(2) Flicker Patt



### 3.2.3 LVDS INTERFACE

|                 |             |     |     |     |     |     |     |     |
|-----------------|-------------|-----|-----|-----|-----|-----|-----|-----|
| LVDS Channel O0 | LVDS output | D7  | D6  | D4  | D3  | D2  | D1  | D0  |
|                 | Data order  | OG0 | OR5 | OR4 | OR3 | OR2 | OR1 | OR0 |
| LVDS Channel O1 | LVDS output | D18 | D15 | D14 | D13 | D12 | D9  | D8  |
|                 | Data order  | OB1 | OB0 | OG5 | OG4 | OG3 | OG2 | OG1 |
| LVDS Channel O2 | LVDS output | D26 | D25 | D24 | D22 | D21 | D20 | D19 |
|                 | Data order  | DE  | NA  | NA  | OB5 | OB4 | OB3 | OB2 |
| LVDS Channel O3 | LVDS output | D23 | D17 | D16 | D11 | D10 | D5  | D27 |
|                 | Data order  | NA  | OB7 | OB6 | OG7 | OG6 | OR7 | OR6 |
| LVDS Channel E0 | LVDS output | D7  | D6  | D4  | D3  | D2  | D1  | D0  |
|                 | Data order  | EG0 | ER5 | ER4 | ER3 | ER2 | ER1 | ER0 |
| LVDS Channel E1 | LVDS output | D18 | D15 | D14 | D13 | D12 | D9  | D8  |
|                 | Data order  | EB1 | EB0 | EG5 | EG4 | EG3 | EG2 | EG1 |
| LVDS Channel E2 | LVDS output | D26 | D25 | D24 | D22 | D21 | D20 | D19 |
|                 | Data order  | DE  | NA  | NA  | EB5 | EB4 | EB3 | EB2 |
| LVDS Channel E3 | LVDS output | D23 | D17 | D16 | D11 | D10 | D5  | D27 |
|                 | Data order  | NA  | EB7 | EB6 | EG7 | EG6 | ER7 | ER6 |

### 3.3 Signal Timing Specification

#### INPUT SIGNAL TIMING SPECIFICATIONS

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

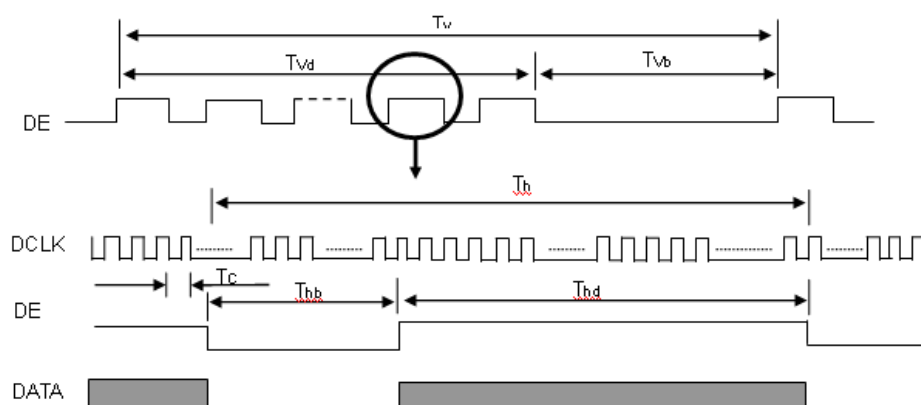
| Signal                  | Item                                 | Symbol           | Min.              | Typ.           | Max.             | Unit | Note                    |
|-------------------------|--------------------------------------|------------------|-------------------|----------------|------------------|------|-------------------------|
| LVDS Clock              | Frequency                            | $F_c$            | 58.54             | 74.25          | 97.98            | MHz  | -                       |
|                         | Period                               | $T_c$            |                   | 13.47          |                  | ns   |                         |
|                         | Input cycle to cycle jitter          | $T_{rdl}$        | $-0.02 \cdot T_c$ | -              | $0.02 \cdot T_c$ | ns   | (1)                     |
|                         | Input Clock to data skew             | TLVCCS           | $-0.02 \cdot T_c$ | -              | $0.02 \cdot T_c$ | ps   | (2)                     |
|                         | Spread spectrum modulation range     | $F_{clkin\_mod}$ | $0.97 \cdot F_c$  | -              | $1.03 \cdot F_c$ | MHz  | (3)                     |
|                         | Spread spectrum modulation frequency | $F_{SSM}$        | -                 | -              | 100              | KHz  |                         |
| Vertical Display Term   | Frame Rate                           | $F_r$            | 50                | 60             | 75               | Hz   | $T_v = T_{vd} + T_{vb}$ |
|                         | Total                                | $T_v$            | 1110              | 1125           | 1136             | Th   | -                       |
|                         | Active Display                       | $T_{vd}$         | 1080              | 1080           | 1080             | Th   | -                       |
|                         | Blank                                | $T_{vb}$         | $T_v - T_{vd}$    | $T_v - T_{vd}$ | $T_v - T_{vd}$   | Th   | -                       |
| Horizontal Display Term | Total                                | $T_h$            | 1050              | 1100           | 1150             | Tc   | $T_h = T_{hd} + T_{hb}$ |
|                         | Active Display                       | $T_{hd}$         | 960               | 960            | 960              | Tc   | -                       |
|                         | Blank                                | $T_{hb}$         | $T_h - T_{hd}$    | $T_h - T_{hd}$ | $T_h - T_{hd}$   | Tc   | -                       |

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

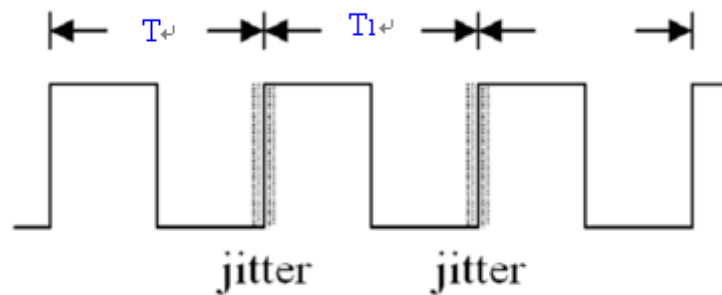
$$F_c = F_r \times T_v \times T_h$$

Please make sure the range of pixel clock has follow the below equation and  $F_c$ ,  $F_r$ ,  $T_v$ ,  $T_h$  not allowed to get beyond the min or max spec.

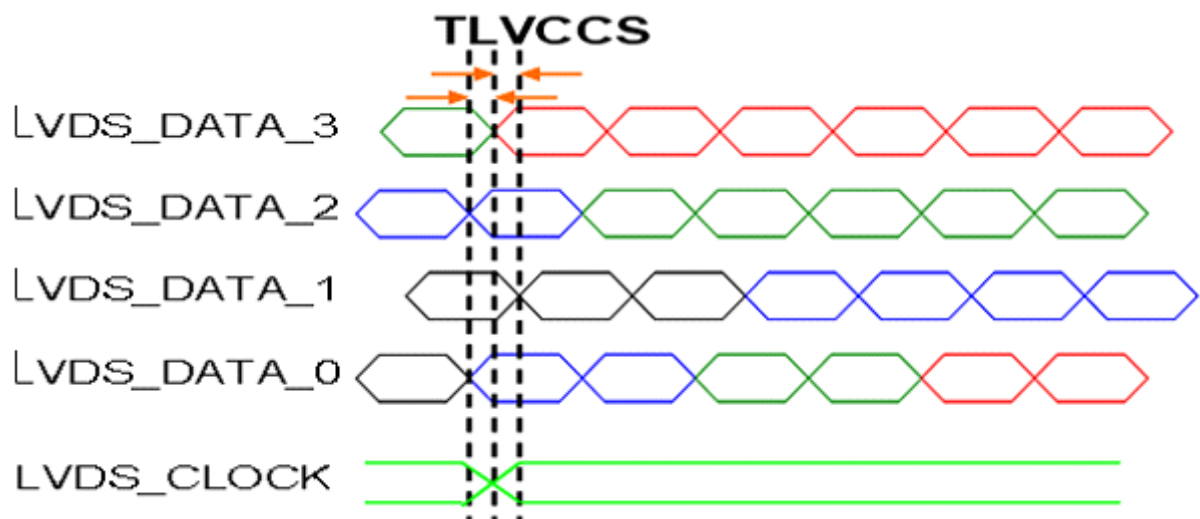
#### INPUT SIGNAL TIMING DIAGRAM



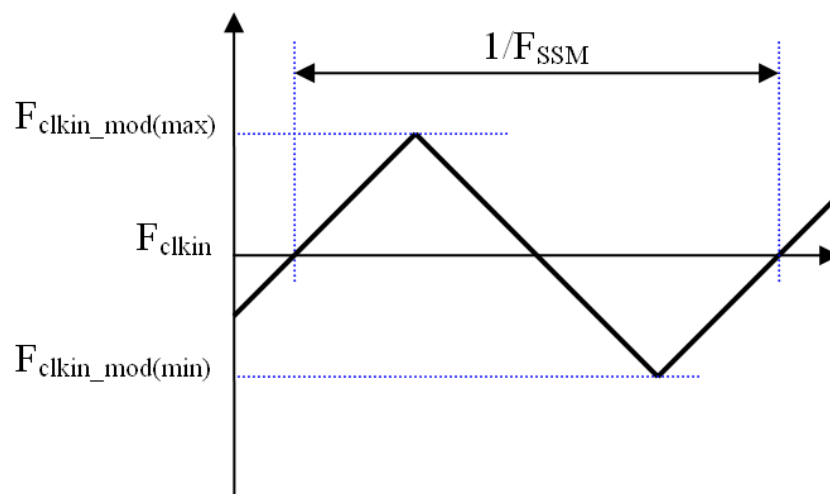
Note (1) The input clock cycle-to-cycle jitter is defined as below figures.  $Trcl = |T_1 - T_1|$



Note (2) Input Clock to data skew is defined as below figures.

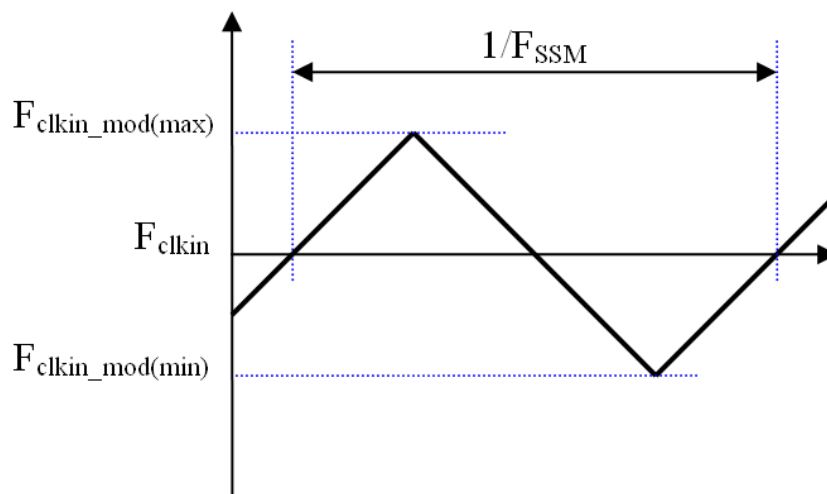
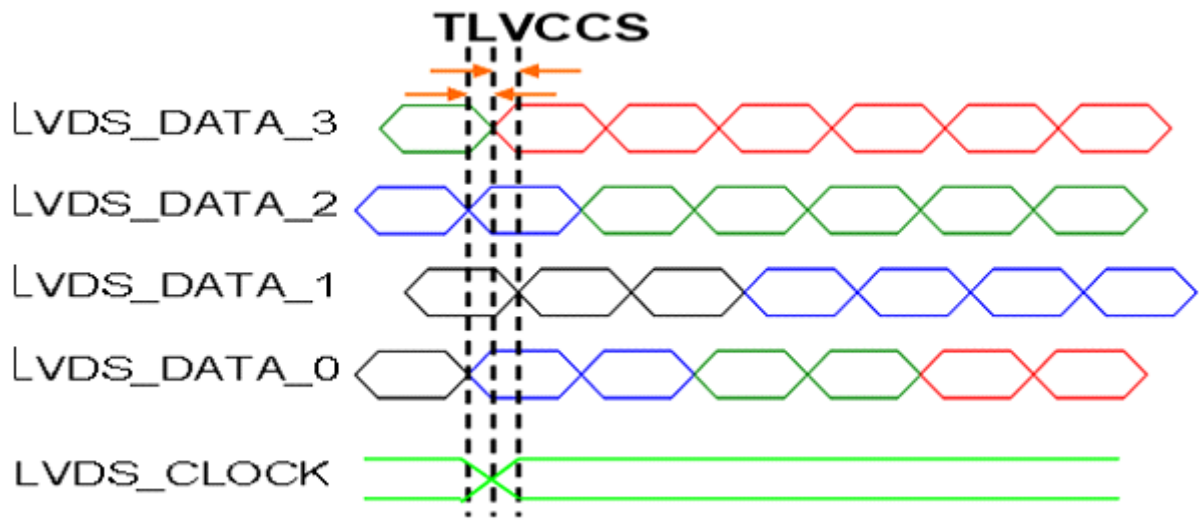


Note (3) The SSCG (Spread spectrum clock generator) is defined as below figures.



Note (4) The DCLK range at last line of V-blank should be set in 0 to Hdisplay/2

### 3.4 Signal Timing Waveforms



### 3.5 Color Input Data Reference

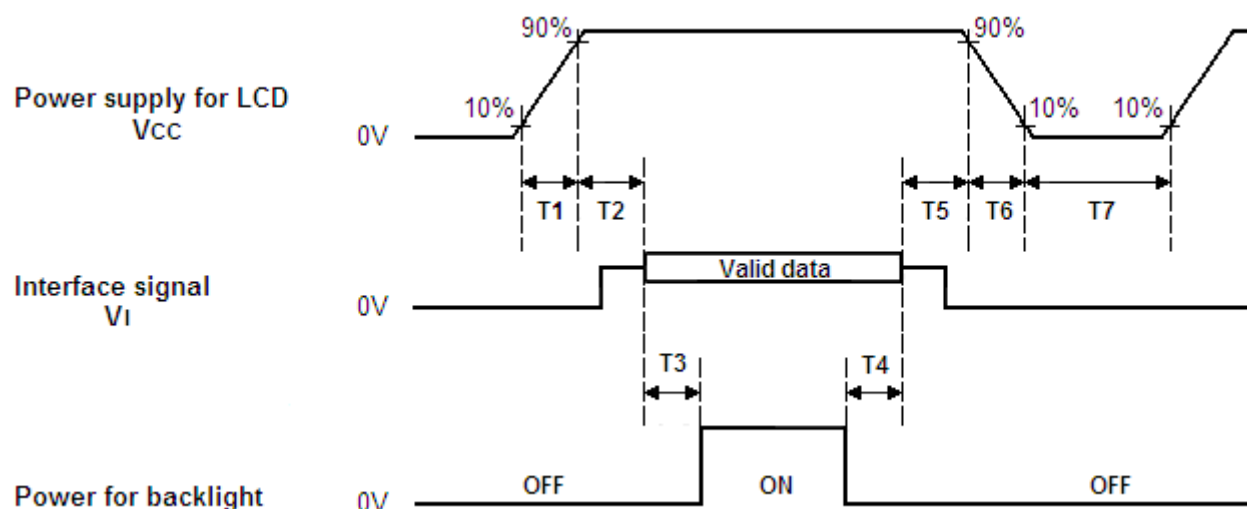
The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

| 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

### 3.6 Power Sequence for LCD

The power sequence specifications are shown as the following table and diagram.



Timing Specifications:

| Parameters | Values |      |     | Units |
|------------|--------|------|-----|-------|
|            | Min    | Typ. | Max |       |
| T1         | 0.5    | -    | 10  | ms    |
| T2         | 0      | 30   | 50  | ms    |
| T3         | 450    | --   | -   | ms    |
| T4         | 100    | 250  | -   | ms    |
| T5         | 0      | 20   | 50  | ms    |
| T6         | 0.1    | -    | 100 | ms    |
| T7         | 1000   | -    | -   | ms    |

Note (1) The supply voltage of the external system for the module input should be the same as the definition of Vcc.

Note (2) When the backlight turns on before the LCD operation of the LCD turns off, the display may momentarily become abnormal screen.

Note (3) In case of VCC = off level, please keep the level of input signals on the low or keep a high impedance.

Note (4) T7 should be measured after the module has been fully discharged between power off and on period.

Note (5) Interface signal shall not be kept at high impedance when the power is on.

Note (6) INX won't take any responsibility for the products which are damaged by the customers not following the Power Sequence.

Note (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 "t6 spec".

### 3.7 Backlight Specification

#### 3.7.1: Electrical specification

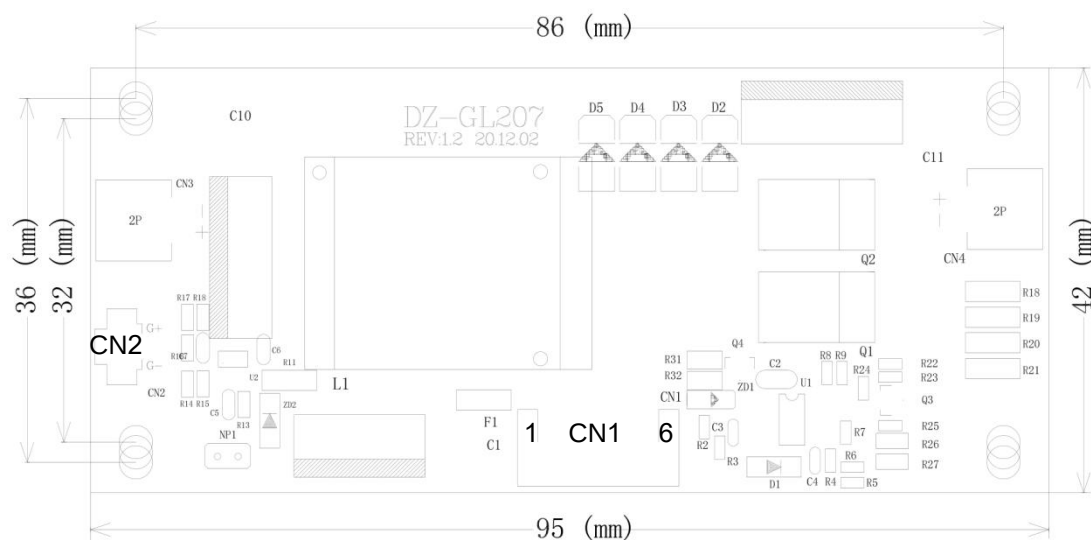
| Parameter                            | Symbol  | Values |        |       | Unit | notes                                           |
|--------------------------------------|---------|--------|--------|-------|------|-------------------------------------------------|
|                                      |         | Min    | Typ    | Max   |      |                                                 |
| LED Driver :                         |         |        |        |       |      |                                                 |
| Power Supply Input Voltage           | VBL     | 10.8   | 12.0   | 12.5  | Vdc  | 1                                               |
| Power Supply Input Current           | IBL     | -      | 1.91   | 2.08  | A    | 1                                               |
| Power Supply Input Current (In-Rush) | In-rush | -      | -      | (TBD) | A    | VBL = 12.0V<br>ExtV <sub>BR-B</sub> = 100%<br>3 |
| Power Consumption                    | PBL     | -      | 23.0   | 26.0  | W    | 1                                               |
| LED :                                |         |        |        |       |      |                                                 |
| Life Time                            |         | 30,000 | 50,000 |       | Hrs  | 2                                               |

notes :

1. Electrical characteristics are determined after the unit has been 'ON' and stable for approximately 60 minutes at  $25\pm 2^{\circ}\text{C}$ . The specified current and power consumption are under the typical supply Input voltage 24V and VBR (ExtV<sub>BR-B</sub> : 100%), it is total power consumption.
2. The life time (MTTF) is determined as the time which luminance of the LED is 50% compared to that of initial value at the typical LED current (ExtV<sub>BR-B</sub> : 100%) on condition of continuous operating in LCM state at  $25\pm 2^{\circ}\text{C}$ .
3. The duration of rush current is about 200ms. This duration is applied to LED on time.



L×W×H 95mm×42mm×10mm Tolerance: ±0.5mm



|                                    |         |                   |                       |
|------------------------------------|---------|-------------------|-----------------------|
| Input connector: CN1 (6pins PH2.0) |         |                   |                       |
| Pin No.                            | Symbol  | Description       | Parameter             |
| 1、2                                | VCC     | Supply voltage    | 12V (10.8~12.5V)      |
| 3                                  | ENA     | Standby/Operation | On =2-5.0V Off=0-0.8V |
| 4                                  | PWM/DIM | Dimming Control   | Note                  |
| 5、6                                | GND     | Ground            | 0V                    |

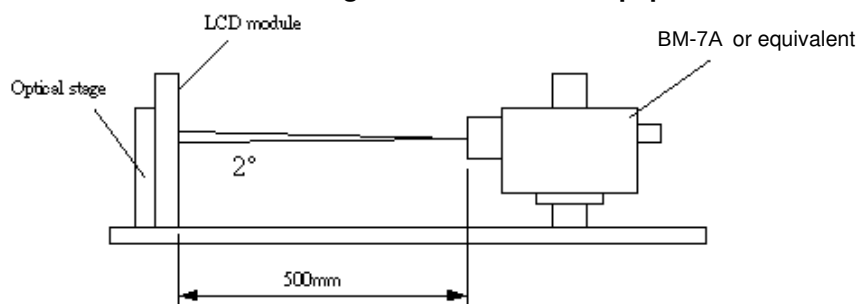
- \* Dimming control by PWM, Pin 4, 100% = Brightness Max, 0% = Brightness Min
- \* Dimming control by DC, Pin 4, 0V = Brightness Max, 5V = Brightness Min
- \* Dimming control by Light Sensor, CN2

We suggest customer to inform us the right control way suitable with the final application.

## 4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 45 minutes in a dark environment at 25°C. The values specified are at an approximate distance 50cm from the LCD surface at a viewing angle of  $\varphi$  and  $\theta$  equal to 0°.

Fig.1 presents additional information concerning the measurement equipment and method.



| Parameter                 |                                      | Symbol               | Values    |        |           | Unit     | Notes |
|---------------------------|--------------------------------------|----------------------|-----------|--------|-----------|----------|-------|
|                           |                                      |                      | Min.      | Typ.   | Max       |          |       |
| Contrast Ratio            |                                      | CR                   | 700       | 1000   | --        |          | 1,2   |
| Surface Luminance (White) |                                      | $L_{WH}(2D)$         | 900       | 1000   | --        | $cd/m^2$ | 1,3   |
|                           |                                      | $L_{WH}(3D)$         |           |        | -         |          |       |
| Luminance Variation       |                                      | $\delta_{WHITE(9P)}$ | --        | --     | 1.3       |          | 1,4   |
| Response Time (G to G)    |                                      | $T_{\gamma}$         | --        | 6.5    | --        | ms       | 5     |
| Color Gamut               |                                      | NTSC                 |           | 78     |           | %        | 1,6   |
| Color Coordinates         |                                      |                      |           |        |           |          | 6     |
|                           | Red                                  | $R_x$                | Typ.-0.05 | 0.6514 | Typ.+0.05 |          |       |
|                           |                                      | $R_y$                |           | 0.3307 |           |          |       |
|                           | Green                                | $G_x$                |           | 0.3236 |           |          |       |
|                           |                                      | $G_y$                |           | 0.6162 |           |          |       |
|                           | Blue                                 | $B_x$                |           | 0.1462 |           |          |       |
|                           |                                      | $B_y$                |           | 0.0792 |           |          |       |
|                           | White                                | $W_x$                |           | 0.2907 |           |          |       |
|                           |                                      | $W_y$                |           | 0.3281 |           |          |       |
| Viewing Angle             |                                      |                      |           |        |           |          | 5     |
| 2D                        | x axis, right( $\varphi=0^\circ$ )   | $\theta_r$           | --        | 89     | --        | degree   |       |
|                           | x axis, left( $\varphi=180^\circ$ )  | $\theta_l$           | --        | 89     | --        | degree   |       |
|                           | y axis, up( $\varphi=90^\circ$ )     | $\theta_u$           | --        | 89     | --        | degree   |       |
|                           | y axis, down ( $\varphi=270^\circ$ ) | $\theta_d$           | --        | 89     | --        | degree   |       |
| 3D                        | y axis, up                           | $\theta_u$           |           |        |           | degree   |       |
|                           | y axis, down                         | $\theta_d$           |           |        |           | degree   |       |
| 3D cross talk (middle)    |                                      | --                   |           |        |           |          |       |

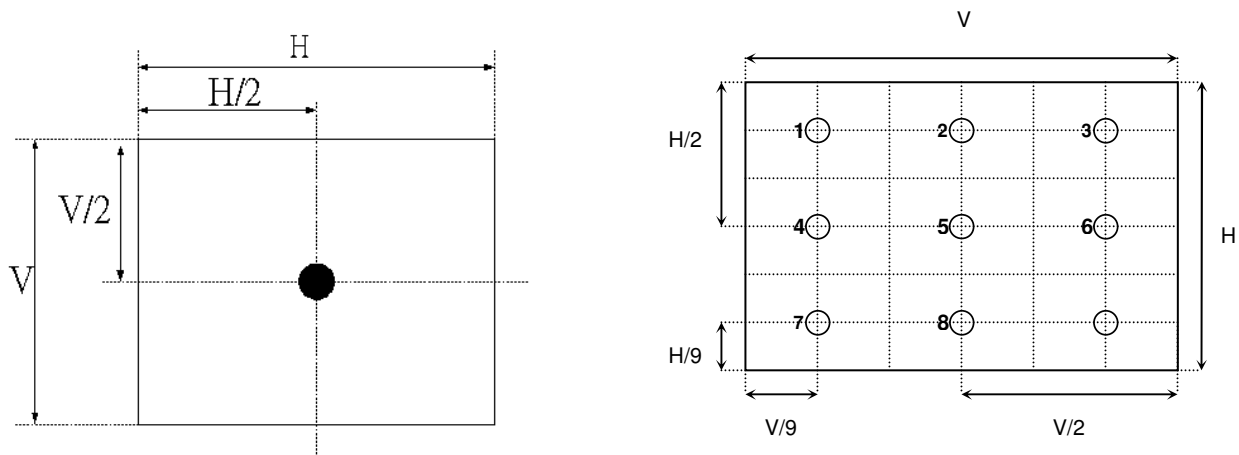
Note:

- Contrast Ratio (CR) is defined mathematically as:

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance of } L_{on5}}{\text{Surface Luminance of } L_{off5}}$$

- Surface luminance is luminance value at point 5 across the LCD surface 50cm from the surface with all pixels displaying white. From more information see FIG 2. When LED input  $V_{DDB} = 24V$ ,  $I_{DDB} = 3.00$ ,  $L_{WH} = L_{on5}$  where  $L_{on5}$  is the luminance with all pixels displaying white at center 5 location.

FIG. 2 Luminance



- The variation in surface luminance,  $\delta_{WHITE}$  is defined (center of Screen) as:

$$\delta_{WHITE(9P)} = \frac{\text{Maximum}(L_{on1}, L_{on2}, \dots, L_{on9})}{\text{Minimum}(L_{on1}, L_{on2}, \dots, L_{on9})}$$

- Response time  $T_{\gamma}$  is the average time required for display transition by switching the input signal for five luminance ratio (0%,25%,50%,75%,100% brightness matrix) and is based on  $F_v = 60\text{Hz}$  to optimize.

| Measured Response Time |      | Target     |             |             |             |             |
|------------------------|------|------------|-------------|-------------|-------------|-------------|
|                        |      | 0%         | 25%         | 50%         | 75%         | 100%        |
| Start                  | 0%   |            | 0% to 25%   | 0% to 50%   | 0% to 75%   | 0% to 100%  |
|                        | 25%  | 25% to 0%  |             | 25% to 50%  | 25% to 75%  | 25% to 100% |
|                        | 50%  | 50% to 0%  | 50% to 25%  |             | 50% to 75%  | 50% to 100% |
|                        | 75%  | 75% to 0%  | 75% to 25%  | 75% to 50%  |             | 75% to 100% |
|                        | 100% | 100% to 0% | 100% to 25% | 100% to 50% | 100% to 75% |             |

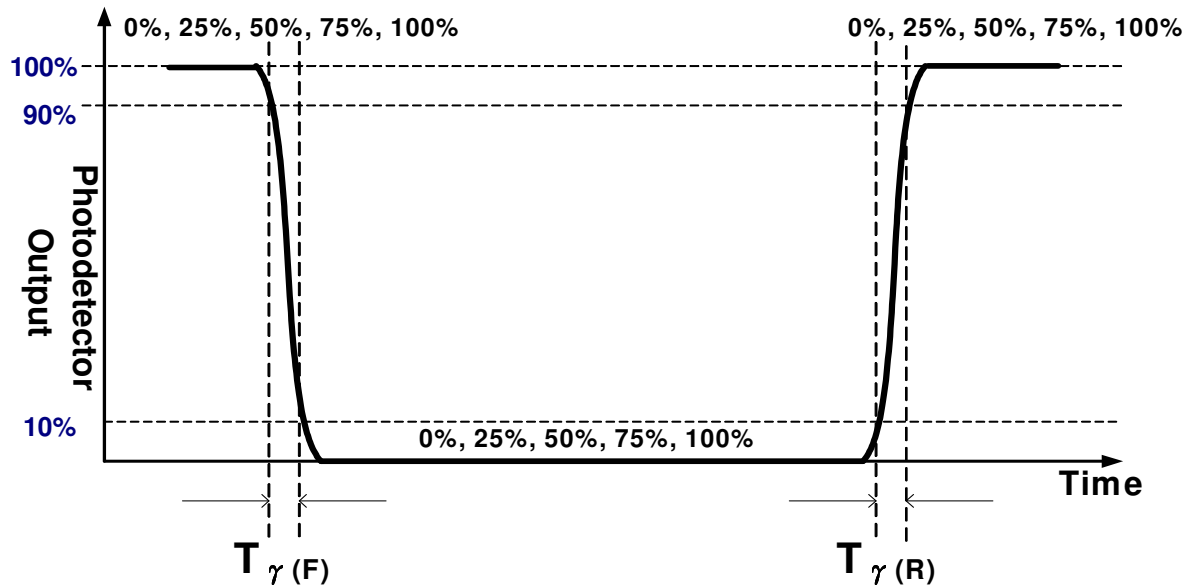
$T_{\gamma}$  is determined by 10% to 90% brightness difference of rising or falling period. (As illustrated)

The response time is defined as the following figure and shall be measured by switching the input signal for “any level of grey(bright)” and “any level of grey(dark)”.

Any level of gray (Bright)

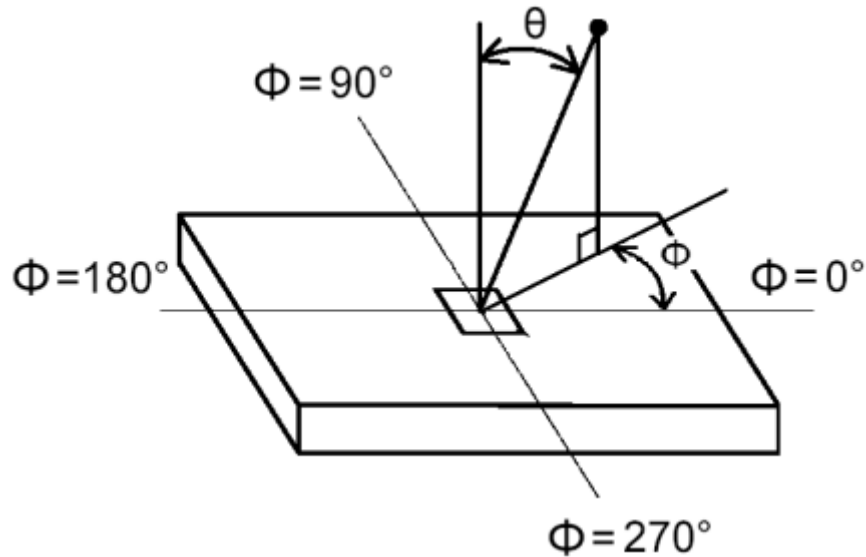
Any level of gray (Dark)

Any level of gray (Bright)



5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG3.

**FIG.3 Viewing Angle**



6. Definition of Transmittance (T%):

$$\text{Transmittance} = \frac{\text{Luminance of LCD module}}{\text{Luminance of backlight}} * 100\%$$

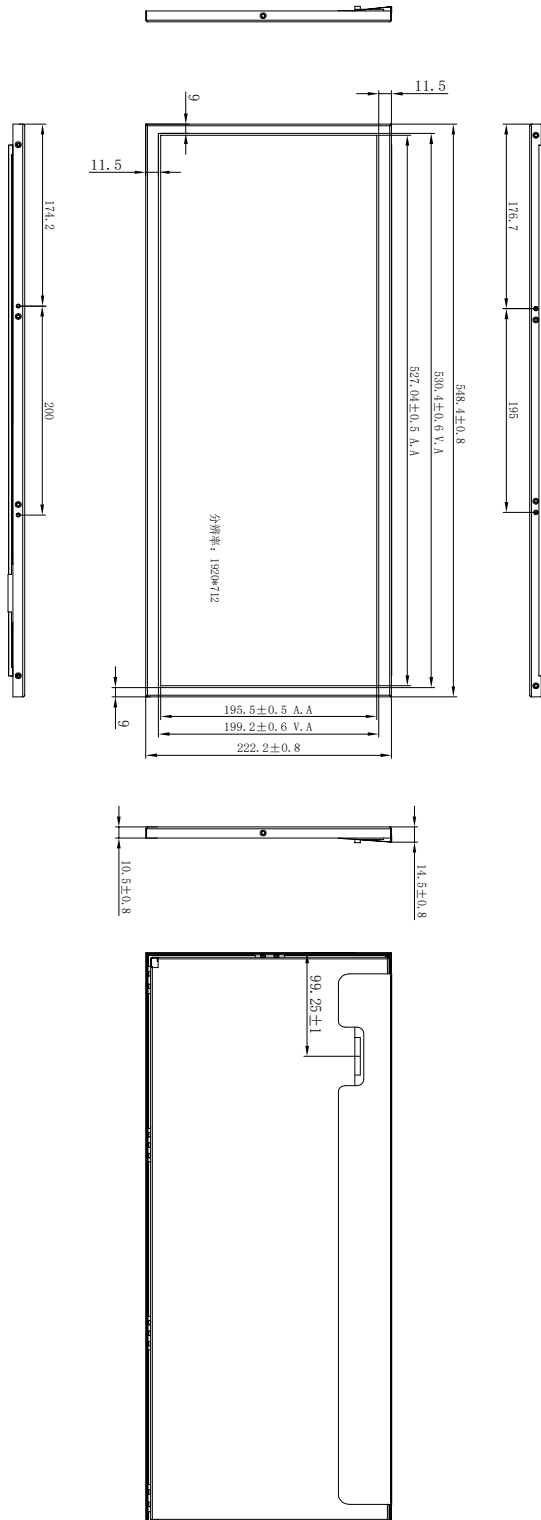
During transmittance measurement, the backlight of LCD module contains no brightness enhancement film. Two diffuser sheets which diffuse the light source uniformly are suggested to use for transmittance measurement.

## 5. Mechanical Characteristics

| Item                | Value                      |           |
|---------------------|----------------------------|-----------|
| Outline Dimension   | Horizontal                 | 548.4 mm  |
|                     | Vertical                   | 222.2 mm  |
|                     | Depth                      | 14.5 mm   |
| Bezel Area          | Horizontal                 | 530.4 mm  |
|                     | Vertical                   | 199.2 mm  |
| Active Display Area | Horizontal                 | 527.04 mm |
|                     | Vertical                   | 195.5 mm  |
| Weight              | 2.3 Kg(Typ.), 2.4 Kg(Max.) |           |

Note : Please refer to a mechanical drawing in terms of tolerance at the next page.

## Mechanical



产品平面图

| ELECTRICAL-OPTICAL CHARACTERISTICS              |                             |                  |            |      |      |      |                   |
|-------------------------------------------------|-----------------------------|------------------|------------|------|------|------|-------------------|
| THE MAXIMUM TEMPERATURE T <sub>max</sub> = 55°C |                             |                  |            |      |      |      |                   |
| 項目                                              | 規格                          | Symbol           | Condition  | min. | typ. | max. | unit.             |
| 輸入電圧                                            | DC INPUT VOLTAGE            | V <sub>i</sub>   | 12 ± 5     | 6V   | —    | —    | V                 |
| 出力電圧                                            | DC OUTPUT VOLTAGE           | V <sub>o</sub>   | 12 ± 5     | —    | —    | —    | V                 |
| 消費電力                                            | POWER CONSUMPTION           | P                | 12 ± 5     | 6W   | —    | —    | W                 |
| 色温度                                             | COLOR TEMPERATURE           |                  | 21 ± 5     | —    | —    | —    | K                 |
| 全光束                                             | TOTAL LUMINOUS FLUX         | Φ <sub>v</sub>   | 21 ± 5     | 6W   | 75   | —    | lm                |
| 光束中心照度                                          | BEAM CENTER ILLUMINANCE     | E <sub>c</sub>   | 12 ± 5     | 6W   | —    | 100  | cd/m <sup>2</sup> |
| 光束直径                                            | BEAM DIAMETER               | φ                | —          | —    | —    | —    | mm                |
| 工作温度                                            | OPERATING TEMPERATURE RANGE | T <sub>op</sub>  | normal use | —    | —    | 400  | °C                |
| 保存温度                                            | STORAGE TEMPERATURE RANGE   | T <sub>stg</sub> | normal use | -50  | —    | 400  | °C                |

| 图 纸 编 号 |                                                                                     | 1       | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10  |
|---------|-------------------------------------------------------------------------------------|---------|---|---|---|---|---|---|---|---|-----|
| 序号      | 标记                                                                                  | 更 改 内 容 |   |   |   |   |   |   |   |   |     |
| 1       |  |         |   |   |   |   |   |   |   |   |     |
|         |                                                                                     |         |   |   |   |   |   |   |   |   | 日期  |
|         |                                                                                     |         |   |   |   |   |   |   |   |   | 签 名 |

## 6. Reliability Test Items

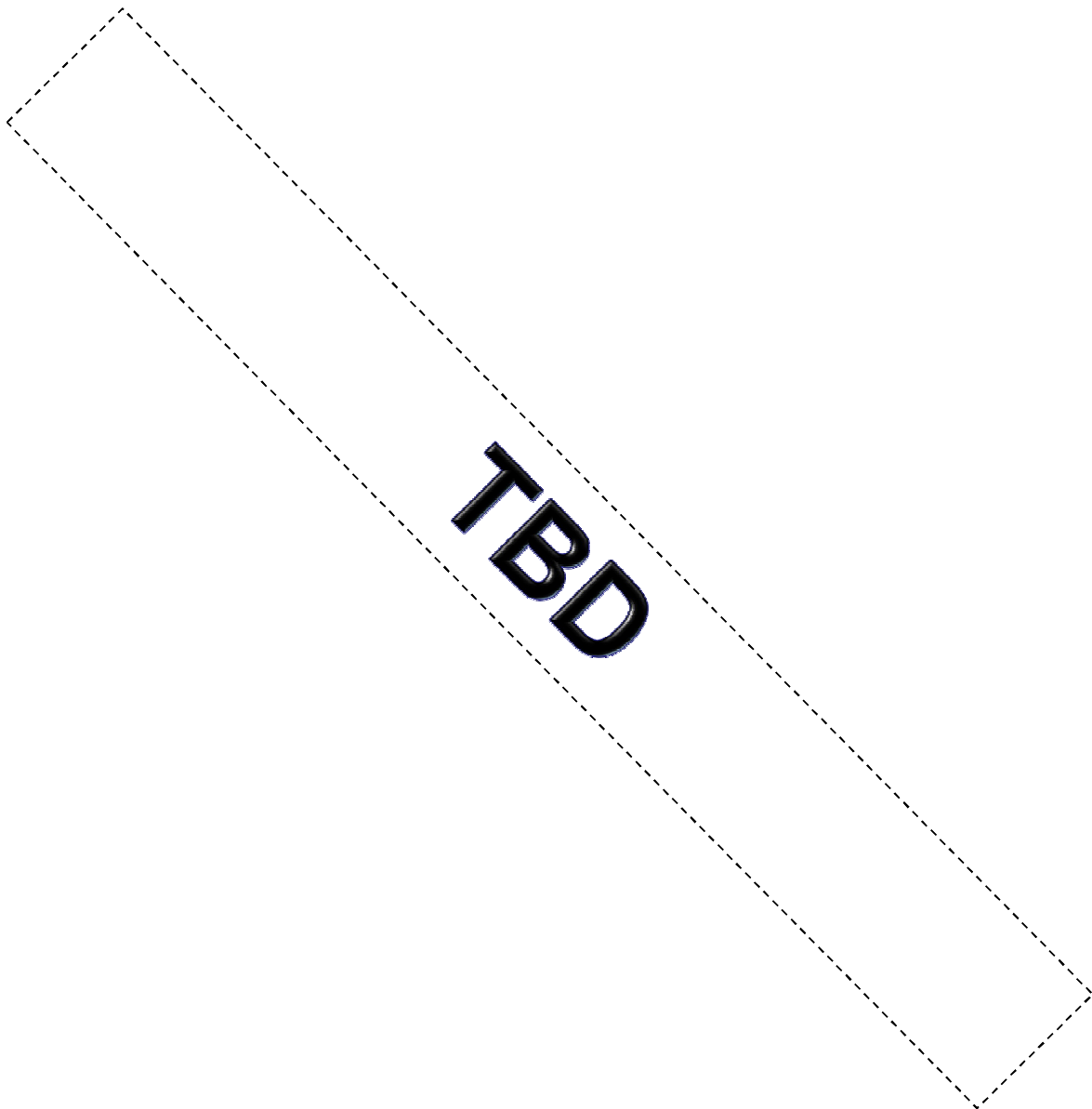
| Items                            | Required Condition                                                                                                                                                             | Note |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Temperature Humidity Bias (THB)  | Ta= 50°C , 80%RH, 240hours                                                                                                                                                     | (1)  |
| High Temperature Operation (HTO) | Ta= 50°C , 240hours                                                                                                                                                            |      |
| Low Temperature Operation (LTO)  | Ta= 0°C , 240hours                                                                                                                                                             |      |
| High Temperature Storage (HTS)   | Ta= 60°C , 240hours                                                                                                                                                            |      |
| Low Temperature Storage (LTS)    | Ta= -20°C , 240hours                                                                                                                                                           |      |
| Package Vibration Test           | ISTA STANDARD<br>1.14Grms<br>Random, Frequency Range: 1 ~ 200 Hz<br>Top & Bottom: 30 minutes (+Z), 10 min (-Z),<br>Right & Left: 10 minutes (X)<br>Back & Forth 10 minutes (Y) | (2)  |
| Thermal Shock Test (TST)         | -20°C/30min, 60°C / 30min, 100 cycles                                                                                                                                          | (1)  |
| On/Off Test                      | 25°C , On/10sec, Off /10sec, 30000 cycles                                                                                                                                      |      |
| Altitude Test                    | Operation: 10000 ft / 24hours<br>Non-Operation: 30000 ft / 24hours                                                                                                             |      |

Note (1) The tests are done with LCD modules .

Note (2) The test is done with a package shown in Section 8

## 7. Packing

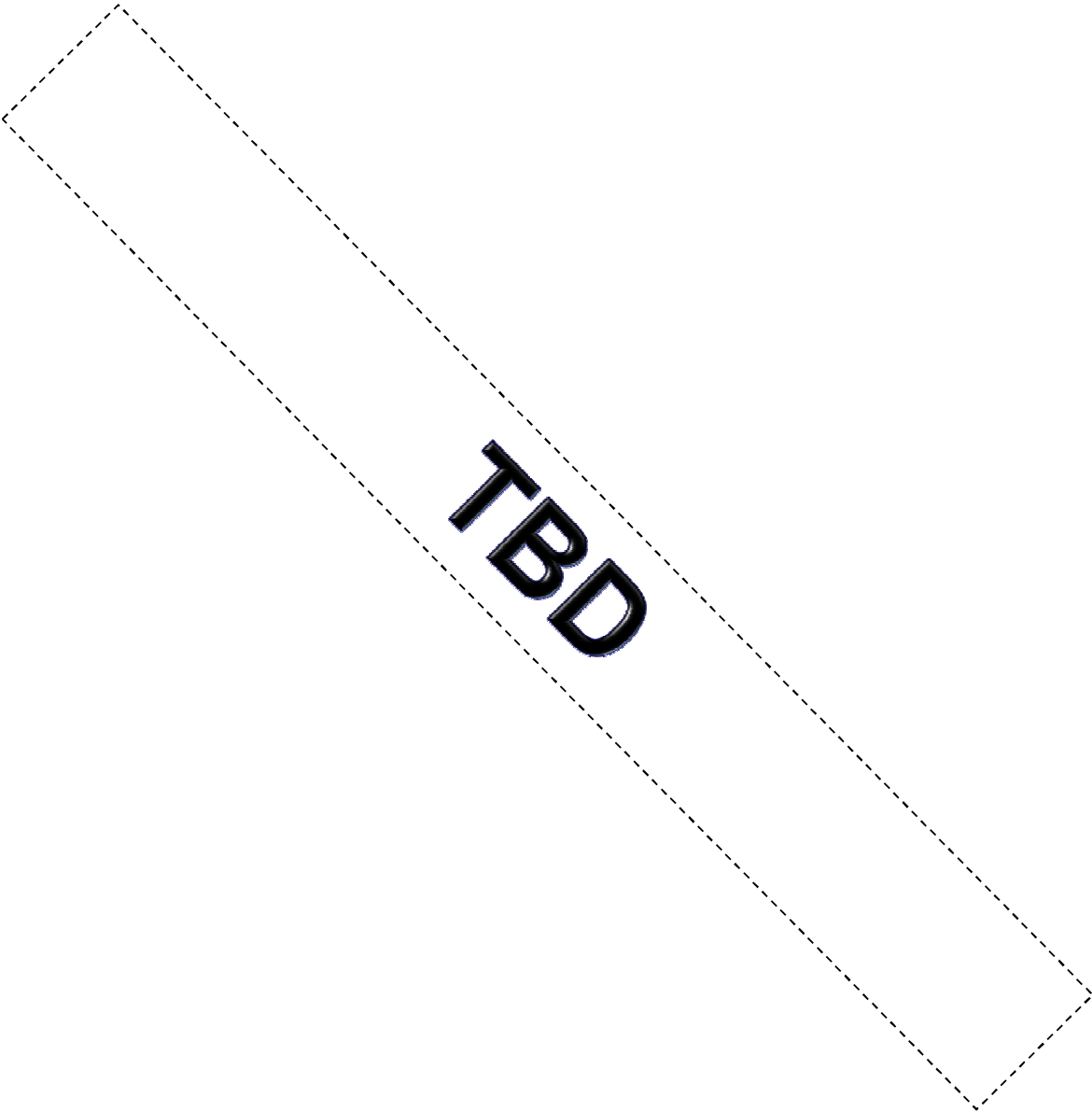
### 7.1 MODULE LABEL





**7.2 PACKING SPECIFICATIONS**

- (1) 5 LCD TV Panels / 1 Box
- (2) Box dimensions : -- (L) X -- (W) X -- (H) (TBD)
- (3) Weight : approximately (TBD)Kg ( 5 panels per box)

**7.3 PACKING METHOD**

**TBD**

## 8. PRECAUTIONS

Please pay attention to the followings when you use this TFT LCD Open Cell unit.

### 8-1 MOUNTING PRECAUTIONS

- (1) You should consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the cell. And the frame on which a cell is mounted should have sufficient strength so that external force is not transmitted directly to the cell.
- (2) Please attach the surface transparent protective plate to the surface in order to protect the polarizer. Transparent protective plate should have sufficient strength in order to resist external force.
- (3) You should adopt radiation structure to satisfy the temperature specification.
- (3) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- (4) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment. Do not touch the surface of polarizer for bare hand or greasy cloth. (Some cosmetics are detrimental to the polarizer.)
- (5) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front/ rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- (6) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (7) Do not open the case because inside circuits do not have sufficient strength.

### 8-2 OPERATING PRECAUTIONS

- (1) The open cell unit listed in the product specification sheets was designed and manufactured for TV application
- (2) The spike noise causes the mis-operation of circuits. It should be lower than following voltage:  
 $V = \pm 200\text{mV}$  (Over and under shoot voltage)
- (3) Response time depends on the temperature. (In lower temperature, it becomes longer.)
- (4) Brightness/transmittance depends on the temperature. (In lower temperature, it becomes lower.) And in lower temperature, response time (required time that brightness is stable after turned on) becomes longer.
- (5) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- (6) When fixed patterns are displayed for a long time, remnant image is likely to occur.
- (7) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interface.

### 8-3 ELECTROSTATIC DISCHARGE CONTROL

Since a open cell unit is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

## **8-4 PRECAUTIONS FOR STRONG LIGHT EXPOSURE**

Strong light exposure causes degradation of polarizer and color filter.

## **8-5 STORAGE**

When storing open cell units as spares for a long time, the following precautions are necessary.

- (1) Store them in a dark place. Do not expose the open cell unit to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
- (2) The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.

## **8-6 HANDLING PRECAUTIONS FOR PROTECTION FILM OF POLARIZER**

The protection film of polarizer is still attached on the surface as you receive open cell units. When the protection film is peeled off, static electricity is easily generated on the polarizer surface. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.