# SPECIFICATION

[ ◉ ] Preliminary Specification
[ ] Final Specification

**Description** **12.1” 1280xRGBx800 TFT-LCD Module**

**Part Number** **P1210WXF2MA01**

| Customer | | | Product Dept, PDBU<br>Tianma Microelectronics Co., Ltd. | |
|---|---|---|---|---|
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* This cover page is for your Comments and Signatures back to TIANMA.

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# 1. Summary

## 1.1 General Description

This is a 12.1 inch a-Si TFT-LCD module with Normal- Black technology. It is composed of a TFT-LCD panel, a driver circuit, PCB, and a LED backlight unit.

## 1.2 Features

- Ultra-wide viewing angle
- High luminance
- Wide temperature range
- Interface: LVDS 1port

- Acquisition product for UL62368-1/CSA C22.2 No.62368-1-03
- Compliant with the European RoHS Directive (2011/65/EU) and Delegated Directive (2015/863/EU, Amending Annex II of 2011/65/EU)

## 2. General Specifications

| Feature | | Spec | Unit |
|---|---|---|---|
| **Display Spec** | Size | 12.1 inches | |
| | Resolution | 1280(RGB)x800 | |
| | Pixel Pitch | 0.204x0.204 | mm |
| | TFT Active Area | 261.12 x163.2 | mm |
| | Technology Type | a-Si | |
| | Pixel Configuration | R.G.B Vertical Stripe | |
| | Display Mode | SFT, Normally Black | |
| | Surface Treatment | Anti-Glare | |
| | Viewing Direction | All direction | |
| | Gray Scale Inversion Direction | NA | |
| **Mechanical Characteristics** | LCM (W x H x D) | 277.7x 180.6x8.7 | mm |
| | Weight | TBD | g |
| **Optical Characteristics** | Luminance | 1100 | $cd/m^2$ |
| | Contrast Ratio | 1000:1 | |
| | NTSC | 40 | % |
| | Viewing Angle | 88/88/88/88 | degree |
| **Electrical Characteristics** | Interface | LVDS 1port | |
| | Color Depth | 16.7 Million | color |
| | Power Consumption | LCD:TBD<br>Backlight:TBD | mW |

**Table 2.1 General TFT Specifications**

# 3. Input / Output Terminals

## 3.1 CN1 Pin assignment (LCD Interface)

| Connector Information | |
|---|---|
| LCD Module connector | FI-SE20P-HFE |
| Matching connector | FI-S20S |

**Table 3.1.1 Connector information**

| No | Symbol | I/O | Description | Comment |
|---|---|---|---|---|
| 1 | D3+ | I | Positive(+) LVDS differential data input | |
| 2 | D3- | I | Negative(-) LVDS differential data input | |
| 3 | N.C. | N | No connection | |
| 4 | N.C. | N | No connection | |
| 5 | GND | P | Power ground | |
| 6 | CLK+ | I | Clock Signal(+) | |
| 7 | CLK- | I | Clock Signal(-) | |
| 8 | GND | P | Ground | |
| 9 | D2+ | I | Positive(+) LVDS differential data input | |
| 10 | D2- | I | Negative(-) LVDS differential data input | |
| 11 | GND | P | Power ground | |
| 12 | D1+ | I | Positive(+) LVDS differential data input | |
| 13 | D1- | I | Negative(-) LVDS differential data input | |
| 14 | GND | P | Power ground | |
| 15 | D0+ | I | Positive(+) LVDS differential data input | |
| 16 | D0- | I | Negative(-) LVDS differential data input | |
| 17 | GND | P | Power ground | |
| 18 | N.C. | N | No connection | |
| 19 | VCC | P | Power supply +3.3V | |
| 20 | VCC | P | Power supply +3.3V | |

**Table 3.1.2 Pin Assignment for LCD Interface**

Note1: I/O definition: I---Input, O---Output, P---Power/Ground, N---No connection

Note2: All of the GND pins should be connected to the system ground.

Note3: Twist pair wires with 100Ω (Characteristic impedance) should be used between LCD panel signal processing board and LVDS transmitter.

## 3.2 CN2 Pin assignment (Back Light)

| Connector Information | |
|---|---|
| LCD Module connector | SM10B-SHLS-TF (LF) (SN) |

| | |
|---|---|
| Matching connector | : SHLP-10V-S-B |

**Table 3.2.1 Connector information**

| No | Symbol | I/O | Description | Wire Color |
|---|---|---|---|---|
| 1 | A1 | P | LED driving anode (+) | 1 |
| 2 | A2 | P | LED driving anode (+) | 2 |
| 3 | A3 | P | LED driving anode (+) | 3 |
| 4 | A4 | P | LED driving anode (+) | 4 |
| 5 | NC | NC | keep this pin open | 5 |
| 6 | NC | NC | keep this pin open | 6 |
| 7 | K1 | P | LED driving cathode (-) | 7 |
| 8 | K2 | P | LED driving cathode (-) | 8 |
| 9 | K3 | P | LED driving cathode (-) | 9 |
| 10 | K4 | P | LED driving cathode (-) | 10 |

**Table 3.2.2 Pin Assignment for Back Light Interface**

Note1: I/O definition: I---Input, O---Output, P---Power/Ground, N---No connection

## 4. Absolute Maximum Ratings

| Item | Symbol | MIN | MAX | Unit | Remark |
|---|---|---|---|---|---|
| Power Voltage | VCC | -0.3 | 4.0 | V | Note1 |
| Input voltage | $V_{IN}$ | -0.3 | 4.0 | V | |
| Operating Temperature | Top | -30 | 80 | ℃ | |
| Storage Temperature | Tst | -30 | 80 | ℃ | |
| Relative Humidity Note2 | RH | -- | ≤95 | % | Ta≤40℃ |
| | | -- | ≤85 | % | 40℃＜Ta≤50℃ |
| | | -- | ≤55 | % | 50℃＜Ta≤60℃ |
| | | -- | ≤36 | % | 60℃＜Ta≤70℃ |
| | | -- | ≤24 | % | 70℃＜Ta≤80℃ |
| Absolute Humidity | AH | -- | ≤70 | g/m³ | Ta＞70℃ |

**Table 4.1 Absolute Maximum Ratings**

Note1: Input voltage include all in put data.
Note2: Ta means the ambient temperature. It is necessary to limit the relative humidity to the specified temperature range. Condensation on the module is not allowed.
Note3: The absolute maximum rating values of this product are not allowed to be exceeded at any times. A module should be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme condition, the module may be permanently destroyed

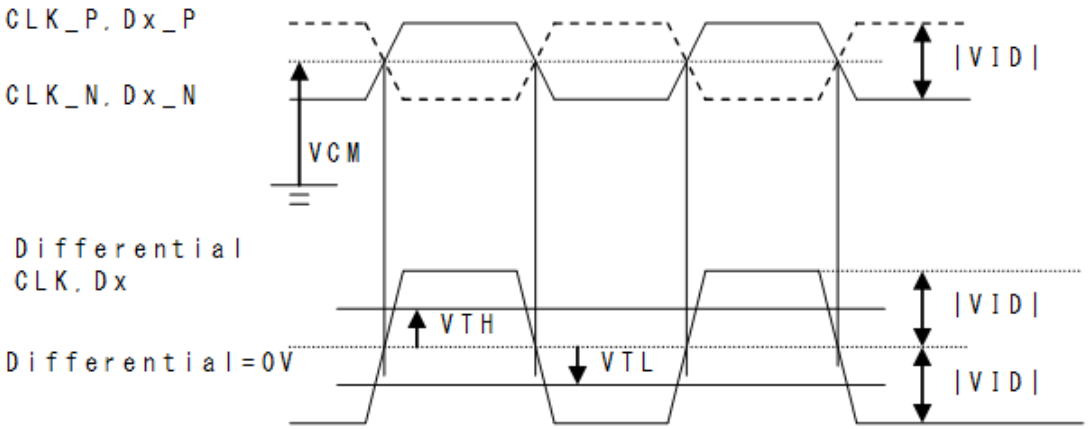
# 5. Electrical Characteristics

## 5.1 DC Characteristics for Panel Driving

| Parameter | | Symbol | min. | typ. | max. | Unit | Remarks |
|---|---|---|---|---|---|---|---|
| Power supply voltage | | VCC | 3.2 | 3.3 | 3.4 | V | - |
| Power supply current | | ICC | 125 | 250 | 375 | mA | at VCC= 3.3V |
| Permissible ripple voltage | | VRP | - | - | 100 | mVp-p | for VCC Note4,Note5,Note6 |
| Differential input threshold voltage | High | VTH | 0.8*VCC | - | VCC | V | at VCM= 1.2V Note7, Note8 |
| | Low | VTL | 0 | - | 0.2*VCC | V | |
| Input Differential Voltage | | \|VID\| | 0.1 | - | VCC-0.1 | V | - |
| Differential Input Common Mode Voltage | | VCM | 0.6 | 1.2 | 2.4-VID/2 | V | - |
| Terminating resistance | | RT | - | 100 | - | Ω | - |

**Table 5.1.1 Operating Voltages**

Note1: When designing of the power supply, take the measures for the prevention of surge voltage.
Note2: Checkered flag pattern [by IEC 61747-6]
Note3: Pattern for maximum current
Note4: This product works even if the ripple voltage levels are over the permissible values, but there might be noise on the display image.
Note5: The permissible ripple voltage includes spike noise.
Note6: The load variation influence does not include.
Note7: Common mode voltage for LVDS receiver
Note8: DC characteristics (LVDS receiver part)




CLK_P, CLK_N
Dx_P, Dx_N: x=0,1,2,3
|VID|=|**_P-**_N|
VCM=(**_P+**_N)/2
P: +, N: -
**: CLK or Dx

## 5.2 DC Characteristics for Backlight Driving

| Parameter | Symbol | min. | typ. | max. | Unit | Remarks |
|---|---|---|---|---|---|---|
| Forward current | IL | - | ( 426 ) | | mA | - |

| | | | | | | |
|---|---|---|---|---|---|---|
| Forward Voltage | VL | | 12 | | V | Ta= +25°C , at IL= (60) mA/One circuit |
| LED lifetime | - | | 50000 | | Hours | The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. |

**Table 5.2.1 LED Backlight Characteristics**

Note1: Please drive with constant current.
Note2: The above specifications are for one LED circuit of the backlight.
Note3: The Luminance uniformity may be changed depending on the current variation between 4 circuits.
It is recommended that the current value difference among the circuits be less than 5%.

## 5.3 Fuse

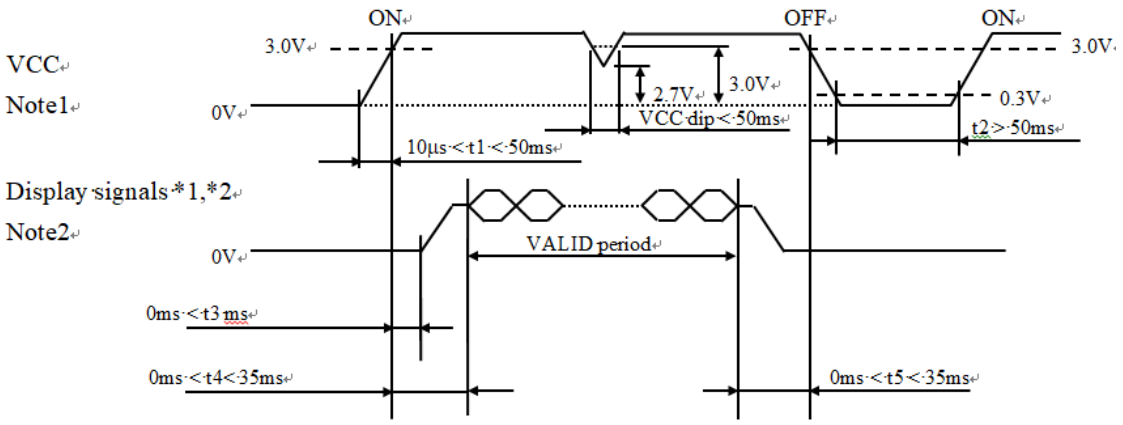
| Parameter | Fuse | | Rating | Fusing current | Remarks |
|---|---|---|---|---|---|
| | Type | Supplier | | | |
| VCC | FCC16202AB | KAMAYA ELECTRIC CO.,LTD | 2.0A<br>36V | 4.0A<br>5 seconds maximum | Note1 |

**Table 5.3.1 Fuse**

Note1: The power supply's rated current must be more than the fusing current. If it is less than the fusing current, the fuse may not blow in a short time, and then nasty smell, smoke and so on may occur.

## 5.4 POWER SUPPLY VOLTAGE SEQUENCE

### 5.4.1 LCD panel signal processing board



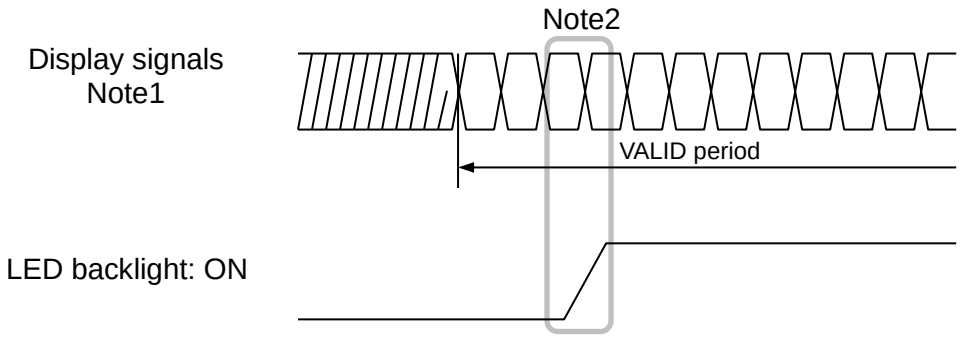

*1 D0+/-, D1+/-, D2+/-, D3+/-, CLK+/-
*2 These signals should be measured at the terminal of 100Ω resistance.

Note1: If there is a voltage variation (voltage drop) at the rising edge of VCC below 3.0V, there is a

possibility that a product does not work due to a protection circuit.

Note2: Display signals (D0+/-, D1+/-, D2+/-, D3+/- and CLK+/-) must be set to Low or High-impedance, except the VALID period (See above sequence diagram), in order to avoid the circuitry damage.
If some of display signal of this product are cut while this product is working, even if the signal input to it once again, it might not work normally. If a customer stops the display signals, VCC also must be shut down.

### 5.4.2 LED driver




Note1: These are the display signals for LCD panel signal processing board.
Note2: The backlight should be turned on within the VALID period of display signals, in order to avoid unstable data display.

## 5.5 LCD Module Block Diagram

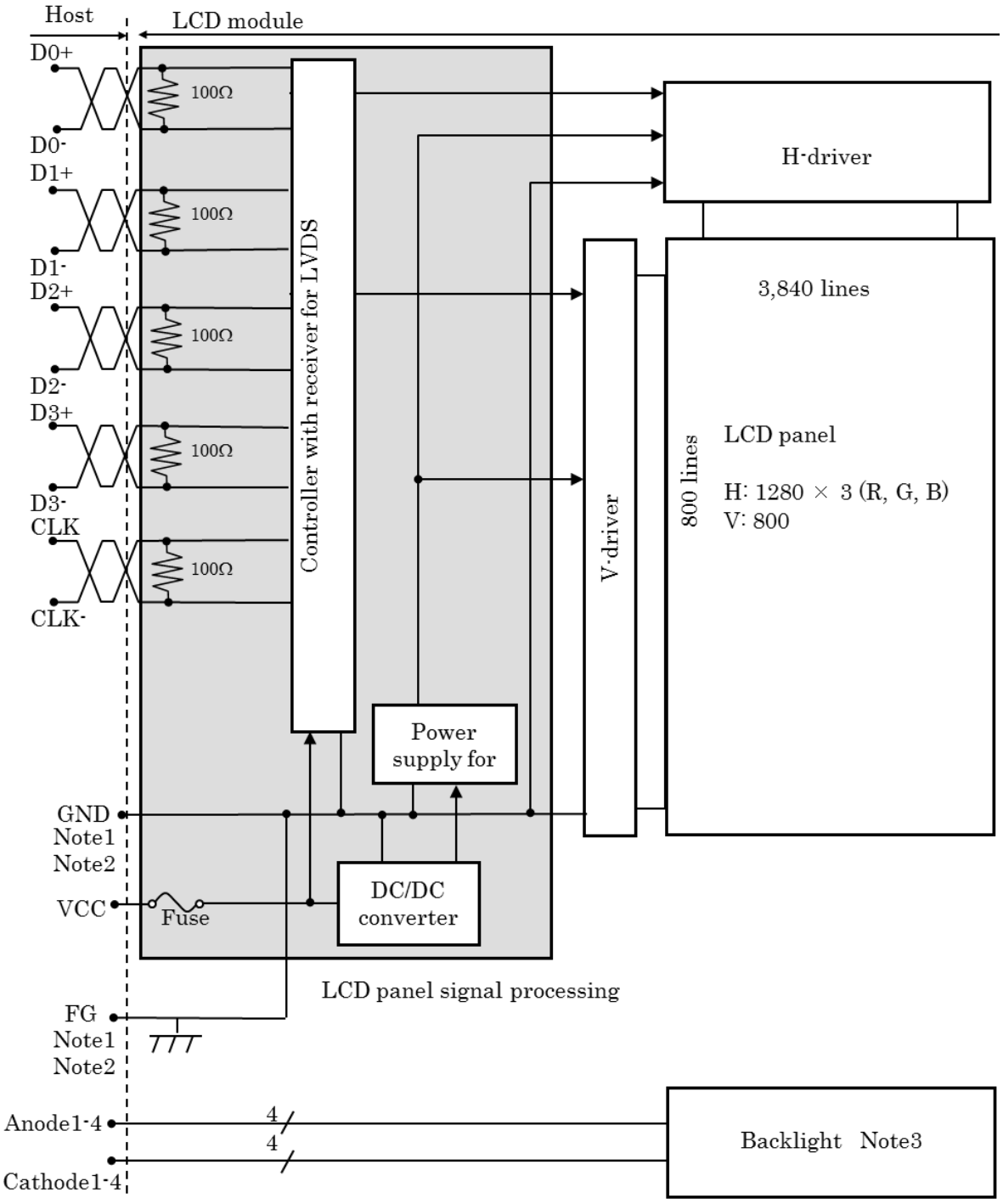


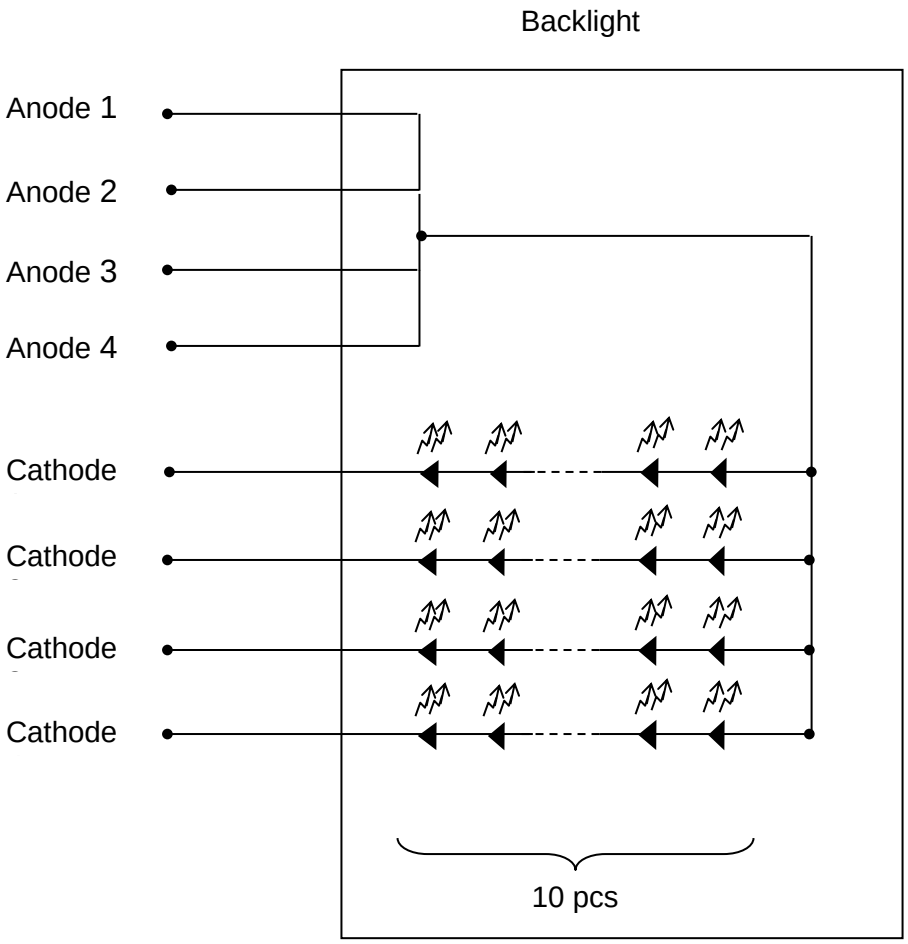

**Figure 5.5.1 LCD Module Block Diagram**

Note1: Relation between GND (Signal ground) and FG (Frame ground) in the LCD module is as follows.

| | |
|---|---|
| GND- FG | Connected |

Note2: GND and FG must to be connected to customer equipment's ground, and it is recommended that these grounds to be connected together in customer equipment.

Note3: Backlight in detail


Backlight
Anode 1
Anode 2
Anode 3
Anode 4
Cathode
Cathode
Cathode
Cathode
10 pcs

# 6. Timing Characteristics

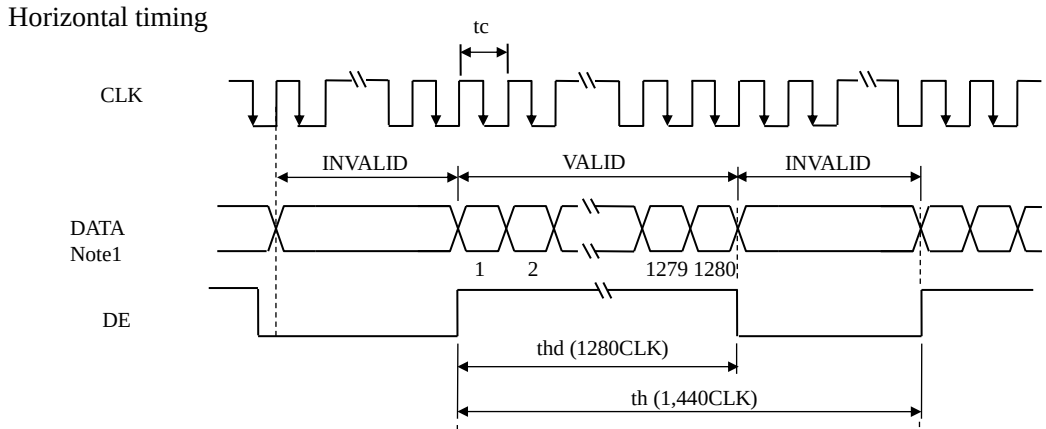
## 6.1 Timing characteristics

7 (Note1, Note2, Note3)

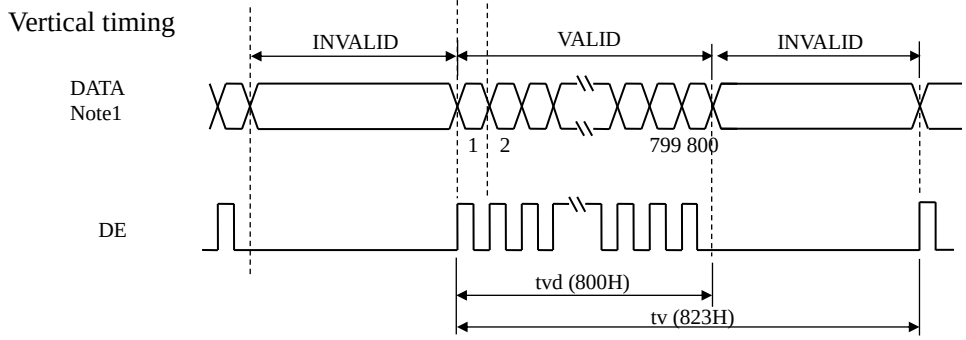
| Parameter | | | Symbol | min. | typ. | max. | Unit | Remarks |
|---|---|---|---|---|---|---|---|---|
| CLK | Frequency | | 1/tc | 67.0 | 71.0 | 75.0 | MHz | 14.085 ns (typ.) |
| DATA | CLK-DATA | Setup time | - | - | | | ns | - |
| | | Hold time | - | | | | ns | |
| | Rise time, Fall time | | - | | | | ns | |
| DE | Horizontal | Cycle | th | 17.20 | 20.28 | 21.49 | μs | 49.306 kHz (typ.) |
| | | | | 1,290 | 1,440 | - | CLK | |
| | | Display period | thd | 1,280 | | | CLK | - |
| | Vertical (One frame) | Cycle | tv | 14.16 | 16.69 | 17.69 | ms | 59.91 Hz (typ.) |
| | | | | - | 823 | - | H | |
| | | Display period | tvd | 800 | | | H | - |
| | | Hold time | - | | | | ns | |

## 6.2 Input signal timing chart

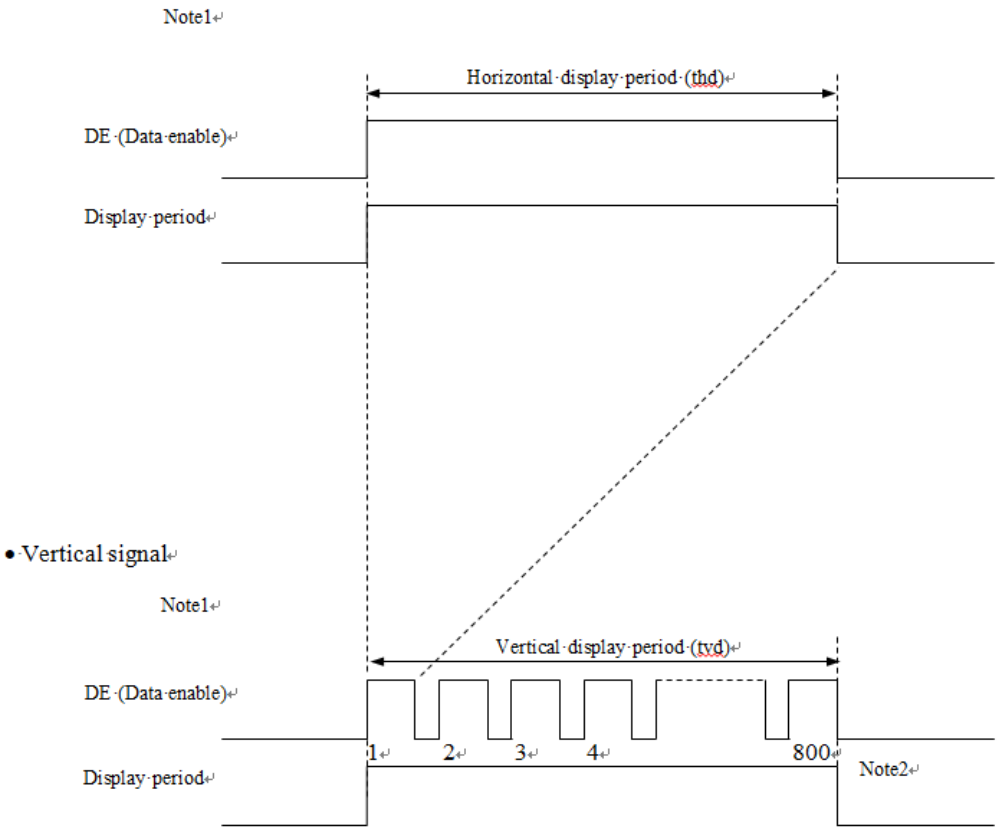
Horizontal timing




Vertical timing

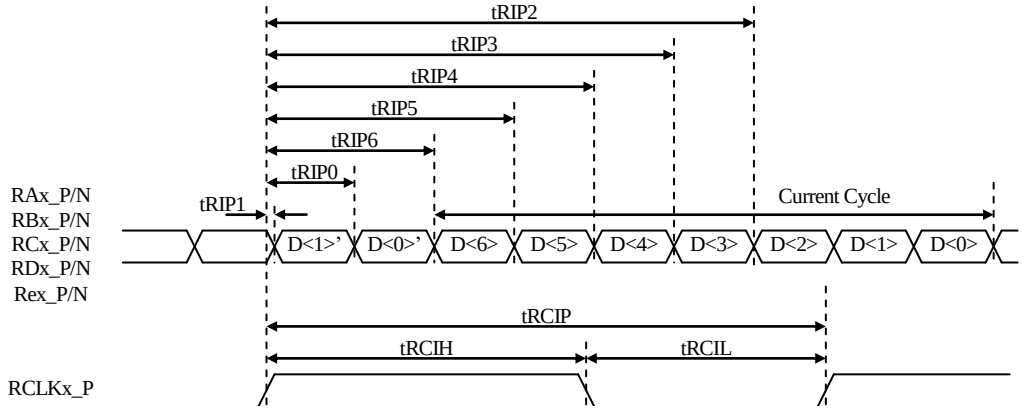


• Horizontal signal



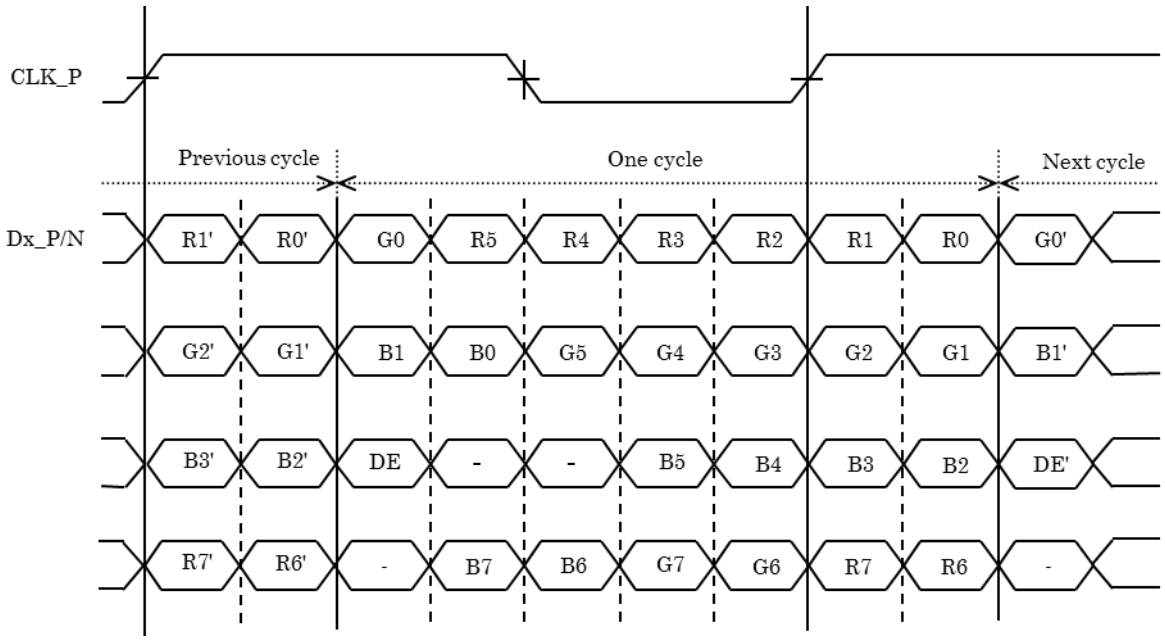

## 6.3 LVDS Rx AC SPEC

| Symbol | Parameter | min. | typ. | max. | Units |
|---|---|---|---|---|---|
| $t_{RCIP}$ | CKy_+ Period | 13.34 | - | 14.92 | ns |
| $t_{RCIH}$ | CKy_+ High pulse width | - | $\frac{4}{7}t_{RCIP}$ | - | ns |
| $t_{RCIL}$ | CKy_+ Low pulse width | - | $\frac{3}{7}t_{RCIP}$ | - | ns |
| $t_{RMG}$ | Receiver Data Input Margin | (-0.4) | - | (0.4) | ns |
| $t_{RIP1}$ | Input Data Position0 | -\| $t_{RMG}$\| | 0.0 | +\| $t_{RMG}$\| | ns |
| $t_{RIP0}$ | Input Data Position1 | $\frac{t_{RCIP}}{7}-\lvert t_{RMG}\rvert$ | $\frac{t_{RCIP}}{7}$ | $\frac{t_{RCIP}}{7}+\lvert t_{RMG}\rvert$ | ns |
| $t_{RIP6}$ | Input Data Position2 | $2\frac{t_{RCIP}}{7}-\lvert t_{RMG}\rvert$ | $2\frac{t_{RCIP}}{7}$ | $2\frac{t_{RCIP}}{7}+\lvert t_{RMG}\rvert$ | ns |
| $t_{RIP5}$ | Input Data Position3 | $3\frac{t_{RCIP}}{7}-\lvert t_{RMG}\rvert$ | $3\frac{t_{RCIP}}{7}$ | $3\frac{t_{RCIP}}{7}+\lvert t_{RMG}\rvert$ | ns |
| $t_{RIP4}$ | Input Data Position4 | $4\frac{t_{RCIP}}{7}-\lvert t_{RMG}\rvert$ | $4\frac{t_{RCIP}}{7}$ | $4\frac{t_{RCIP}}{7}+\lvert t_{RMG}\rvert$ | ns |
| $t_{RIP3}$ | Input Data Position5 | $5\frac{t_{RCIP}}{7}-\lvert t_{RMG}\rvert$ | $5\frac{t_{RCIP}}{7}$ | $5\frac{t_{RCIP}}{7}+\lvert t_{RMG}\rvert$ | ns |
| $t_{RIP2}$ | Input Data Position6 | $6\frac{t_{RCIP}}{7}-\lvert t_{RMG}\rvert$ | $6\frac{t_{RCIP}}{7}$ | $6\frac{t_{RCIP}}{7}+\lvert t_{RMG}\rvert$ | ns |




## 6.4 Input data mapping

Input data signal: 8-bit




Note1: LSB (Least Significant Bit) – R0, G0, B0 MSB (Most Significant Bit) – R7, G7, B7

Note2: Twist pair wires with 100Ω(Characteristic impedance) should be used between LCD panel signal processing board and LVDS transmitter.

Note3: Dx_P/N: x = 0,1,2,3 (P: +, N: - )

## 7. Optical Characteristics

| Item | | Symbol | Condition | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| **View Angles** | | θT | CR≧10 | 70 | 88 | | degree | Note2,3 |
| | | θB | | 70 | 88 | | | |
| | | θL | | 70 | 88 | | | |
| | | θR | | 70 | 88 | | | |
| **Contrast Ratio** | | CR | θ=0° | 700 | 1000 | | | Note 3 |
| **Response Time** | | $T_{ON}$ | 25℃ | | 25 | 40 | ms | Note 4 |
| | | $T_{OFF}$ | | | | | | |
| **Chromaticity** | **White** | x | Backlight is on | 0.263 | 0.313 | 0.363 | | Note 1,5 |
| | | y | | 0.279 | 0.329 | 0.379 | | |
| | **Red** | x | | - | (0.572) | - | | Note 1,5 |
| | | y | | - | (0.339) | - | | |
| | **Green** | x | | - | (0.350) | - | | Note 1,5 |
| | | y | | - | (0.556) | - | | |
| | **Blue** | x | | - | (0.163) | - | | Note 1,5 |
| | | y | | - | (0.139) | - | | |
| **Uniformity** | | U | | 70 | 75 | | % | Note 6 |
| **NTSC** | | - | | 35 | 40 | | % | Note 5 |
| **Luminance** | | L | | 800 | 1100 | | $cd/m^2$ | Note 7 |

**Table 7.1 Optical Parameters**

Test Conditions:

1. $I_F$= **160** mA, and the ambient temperature is 25℃.
2. The test systems refer to Note1 and Note2.

Note1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 Minutes operation, the optical characteristics are measured at the center point of the LCD screen.

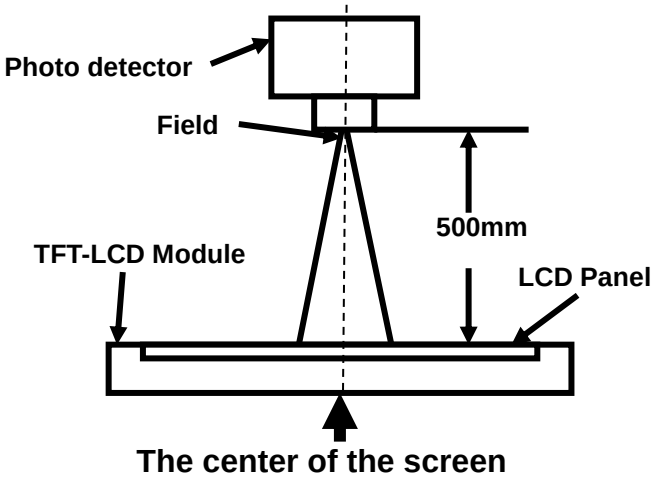



**Fig1. Measurement Set Up**

Note2: Definition of viewing angle range and measurement system. Viewing angle is measured at the center point of the LCD 。

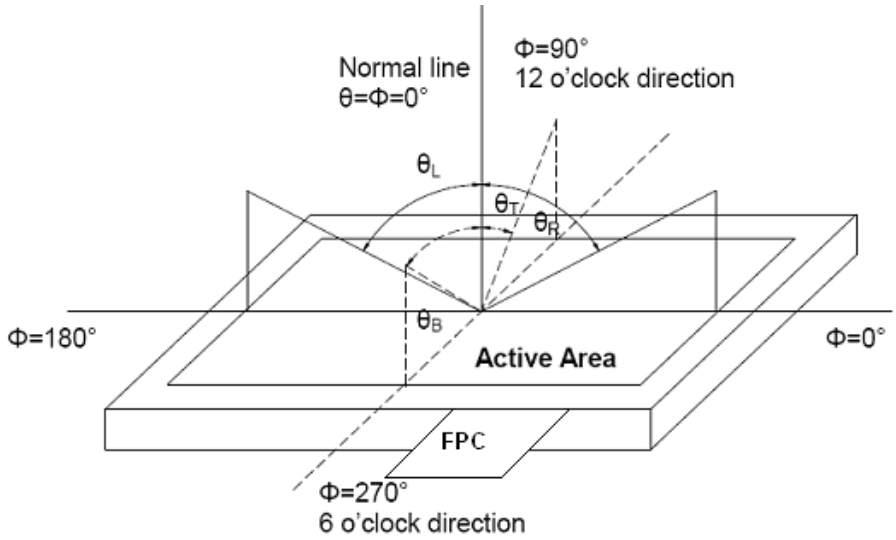



**Fig2. Measurement viewing angle**

Note3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

Note4: Definition of Response time

For SFT LCM, the response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time ($T_r$) is the time between photo detector output intensity changed from 10% to 90%. And fall time ($T_f$) is the time between photo detector output intensity changed from 90% to 10%.

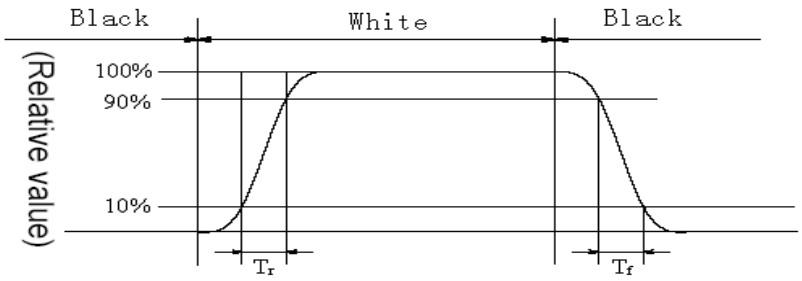



**Fig3. Response Time Testing(SFT)**

Note5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig.5). Every measuring point is placed at the center of each measuring area.

Luminance Uniformity (U) = Lmin/ Lmax

Lmax: The measured Maximum luminance of all measurement position.

Lmin: The measured Minimum luminance of all measurement position.

L-------Active area length; W----- Active area width

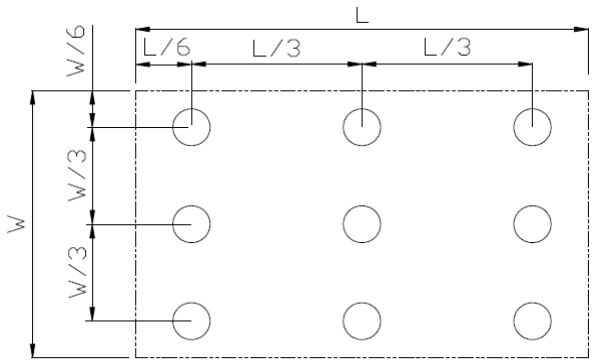



**Fig5. Luminance Uniformity Measurement Locations(9 points)**

Note7: Definition of Luminance:

Measure the luminance of white state at center point.

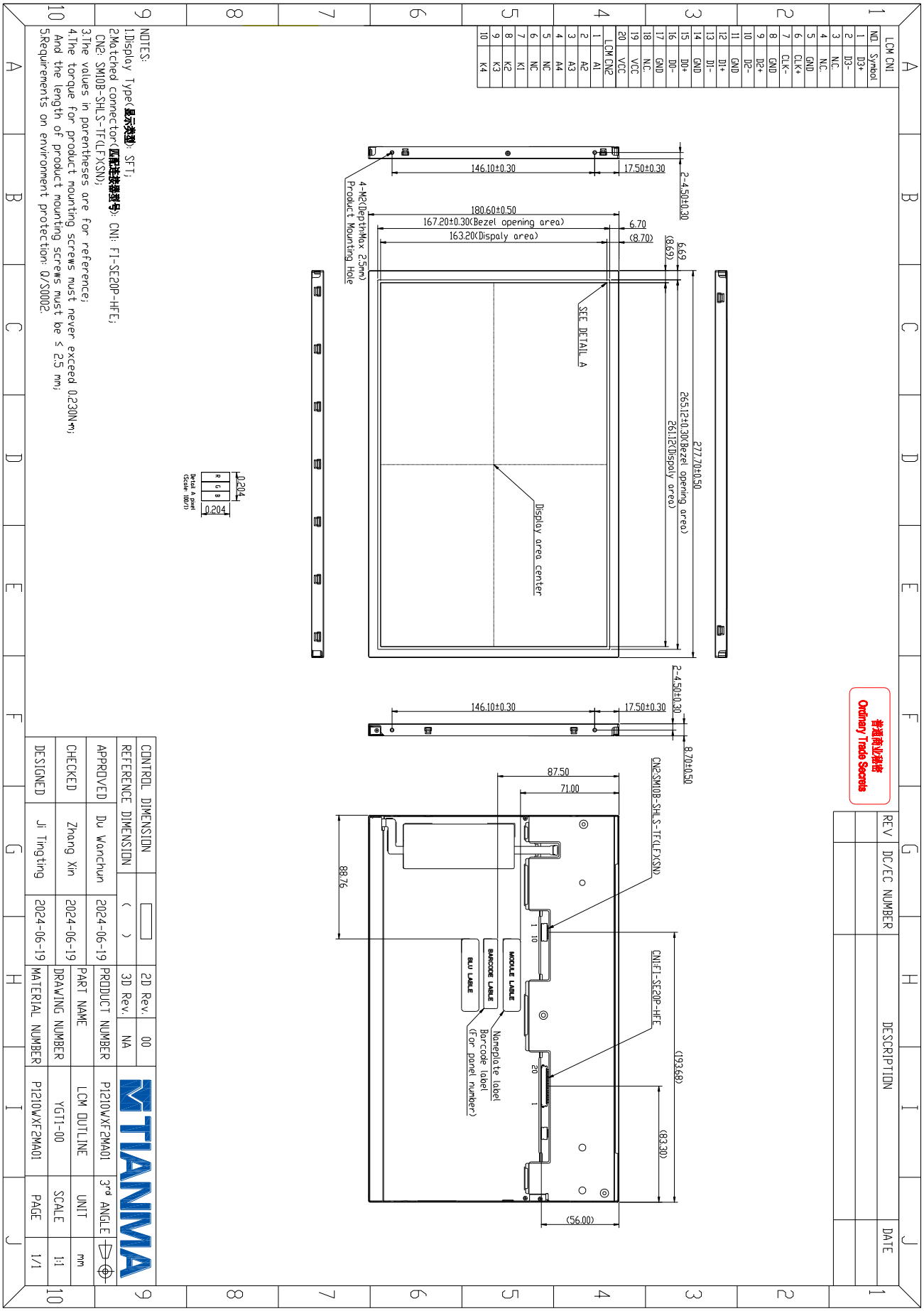
## 8. Reliability Test

| No | Test Item | Condition | Remarks |
|---|---|---|---|
| 1 | High Temperature Operation | +80℃，240H | IEC60068-2-1:2007<br>GB2423.2-2008 |
| 2 | Low Temperature Operation | -30℃，240H | IEC60068-2-1:2007<br>GB2423.1-2008 |
| 3 | High Temperature Storage | +80℃，240H | IEC60068-2-1:2007<br>GB2423.2-2008 |
| 4 | Low Temperature Storage | -30℃，240H | IEC60068-2-1:2007<br>GB2423.1-2008 |
| 5 | Storage at High Temperature and Humidity(Operation) | +60℃，90%RH，240H | IEC60068-2-78 :2001<br>GB/T2423.3—2006 |
| 6 | Thermal Shock (non-operation) | -30℃，30min~80℃，30min，change time：5min，100cycle | Start with cold temperature,<br>End with high temperature,<br>IEC60068-2-14:1984,GB2423.22-2002 |
| 7 | ESD | (1)150pF, 150Ω, ± 15kV<br>(2)9 places on a panel surface<br>(3)10 times each place at 1 sec interval；<br>（Environment：15℃~35℃，30%~60%，86Kpa~106Kpa） | IEC61000-4-2:2001<br>GB/T17626.2-2006 |
| 8 | Package Vibration | 5-20-200HZ，PSD：0.01-0.01-0.001<br>Total:0.781g2/HZ,x/y/z 30min） | |
| 9 | Vibration 1<br>(Non operation) | (1) Perform the test in accordance with IEC 60068-2-64, random vibration.<br>(2) 32 h for each plane of the DUT.<br>(3)The angle between the DUT and platform is 45°<br>Note3,Note4 | |
| 10 | Vibration 2<br>(Non operation) | (1)5 to 100Hz, 19.6m/s2<br>(2)1 minute/cycle<br>(3)X, Y, Z directions<br>(4)120 times each direction | |
| 11 | Mechanical shock<br>(Non operation) | (1)539m/s2, 11ms<br>(2)± X, ± Y, ± Z directions<br>(3)5 times each direction | |
| 12 | Package Drop Test | Height: X cm,1 corner, 3edges, 6 surfaces<br>Note：X > 10Kg:60cm；≤10Kg:80cm | IEC60068-2-32:1990<br>GB/T2423.8—1995 |

**Table 8.1 RA test condition**

Note1: Temperature is the ambient temperature of sample
Note2: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.
Note3: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product's function only be guaranteed, but not for all of the cosmetic specification.

# 9. Mechanical Drawing



## 10. Packing Instruction

| No | Item | Model (Material) | Dimensions(mm) | Unit Weight(Kg) | Q'ty | Remark |
|---|---|---|---|---|---|---|
| 1 | LCM module | | | | | |
| 2 | Tray | | | | | |
| 3 | Dust Proof Bag | | | | | |
| 4 | BOX | | | | | |
| 5 | Carton | | | | | |
| 6 | Total weight | | | | | |

TBD

# 11. Precautions for Use of LCD Modules

## 11.1 Handling Precautions

(1) The display panel is made of glass. Do not subject it to mechanical shock by dropping it, etc.
(2) If the display panel is damaged and the liquid crystal fluid inside it leaks out be sure not to get any in your mouth. If the fluid comes into contact with your skin or clothes promptly wash it off using soap and water.
(3) Do not apply excessive force to the display surface or the bezel since this may cause the color tone to vary.
(4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle the polarizer carefully.
(5) If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is still not completely clear use a moist cloth with one of the following solvents:
- Isopropyl alcohol
- Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Specifically, do not use the following:
- Water
- Ketone
- Aromatic solvents

(6) Do not disassemble the LCD Module.
(7) If powered off, do not apply the input signals.
(8) To prevent destruction of the module by static electricity, be careful to maintain an optimum work environment.
(9) Be sure to ground your body when handling the LCD Modules.
(10) Tools used for assembly, must be properly grounded.
(11) To reduce the amount of static electricity generated, do not conduct assembly or other work under very low humidity conditions.
(12) The LCD Module is covered with a film to protect the display surface, remove film slowly under the ionizer.

## 11.2 Storage precautions

(1) When storing the LCD modules avoid exposure to direct sunlight or to the light of fluorescent lamps.
(2) The LCD modules should be stored within the rated storage temperature range. The recommend condition is: Temperature: 0 ~ 35 ℃ at normal humidity.
(3) The LCD modules should be stored in a room without acid, alkali or other harmful gas.

## 11.3 Transportation Precautions

The LCD modules should not be dropped or subject to violent mechanical shock during transportation. Also they should avoid excessive pressure, water, high humidity and direct sunlight.

## 11.4 Screen saver Precautions

Not display the fixed pattern for a long time. Use a screen saver, if the fixed pattern is displayed on the screen

## 11.5 Safety Precautions

(1) When you waste damaged or unnecessary LCDs, it is recommended to crush LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned
(2) Be sure to turn off the power supply when inserting or disconnecting the LED backlight cable.
(3) LED driver should be designed to limit or stop its function when over current is detected on the LED.