

# SPECIFICATION

☐ Preliminary Specification

☒ Final Specification

**Description**                      **12.1" 1024x768 TFT-LCD Module**  
**Part Number**                    **P1210XGF1MA00**

|            |                                                                    |               |          |
|------------|--------------------------------------------------------------------|---------------|----------|
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## REVISION HISTORY

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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, FPC, PCB, Bezel, and a LED backlight unit.

### 1.2 Features

- Ultra-wide viewing angle.
- High luminance.
- Long LED life time.
- Wide temperature range.
- Interface: LVDS 6/8 bits.
- Acquisition product for UL62368-1/CSA C22.2 No. 62368-1-14.
- 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          | 1024x768                          |        |
|                            | Pixel Pitch         | 0.240 (H) x 0.240 (V)             | mm     |
|                            | TFT Active Area     | 245.76 x 184.32                   | 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                     |        |
| Mechanical Characteristics | LCM (W x H x D)     | 260.5x203x9.5                     | mm     |
|                            | Weight              | 557                               | g      |
| Optical Characteristics    | Luminance           | Typ:1300                          | cd/m2  |
|                            | Contrast Ratio      | Typ:1000:1                        |        |
|                            | NTSC                | Typ:72                            | %      |
|                            | Viewing Angle       | 88/88/88/88(SFT)                  | degree |
| Electrical Characteristics | Interface           | LVDS 6/8 bits                     |        |
|                            | Color Depth         | 16.7 Million color/262 Kilo color | color  |
|                            | Power Consumption   | LCD:800<br>Backlight:9660         | mW     |

Table 2.1 General TFT Specifications

### 3. Input / Output Terminals

#### 3.1 CN1 Pin assignment (LCD Interface)

| Connector Information |                          |
|-----------------------|--------------------------|
| Connector type        | FI-SEB20P-HFE(JAE)       |
| Matching connector    | FI-S20S, FI-SE20-ME(JAE) |

Table 3.1.1 Connector information

| Pin No. | Symbol | I/O | Function                                                                        | Remark    |
|---------|--------|-----|---------------------------------------------------------------------------------|-----------|
| 1       | Vcc    | P   | 3.3V power supply                                                               |           |
| 2       | Vcc    | P   | 3.3V power supply                                                               |           |
| 3       | GND    | P   | Ground                                                                          |           |
| 4       | GND    | P   | Ground                                                                          |           |
| 5       | D0-    | I   | Negative LVDS differential data input                                           |           |
| 6       | D0+    | I   | Positive LVDS differential data input                                           |           |
| 7       | GND    | P   | Ground                                                                          |           |
| 8       | D1-    | I   | Negative LVDS differential data input                                           |           |
| 9       | D1+    | I   | Positive LVDS differential data input                                           |           |
| 10      | GND    | P   | Ground                                                                          |           |
| 11      | D2-    | I   | Negative LVDS differential data input                                           |           |
| 12      | D2+    | I   | Positive LVDS differential data input                                           |           |
| 13      | GND    | P   | Ground                                                                          |           |
| 14      | CLK-   | I   | Negative LVDS differential clk input                                            |           |
| 15      | CLK+   | I   | Positive LVDS differential clk input                                            |           |
| 16      | GND    | P   | Ground                                                                          |           |
| 17      | D3-    | I   | Negative LVDS differential data input                                           |           |
| 18      | D3+    | I   | Positive LVDS differential data input                                           |           |
| 19      | MODE   | I   | 6-bit / 8-bit input select for LVDS interface.<br>High or Open: 8bit Low: 6bit. | Defalut H |
| 20      | SC     | I   | Scan direction control<br>(High or Open: Normal Low: Reverse)                   | Defalut H |

Table 3.1.2 Pin Assignment for LCD Interface

Note1:I---Input, O---Output, P--- Power/Ground

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



### 3.2 CN2 Pin assignment (Back Light)

| Connector Information |                            |
|-----------------------|----------------------------|
| Connector type        | SM10B-SHLS-TF(LF)(SN)(JST) |
| Matching connector    | SHLP-10V-S-B(JST)          |

Table 3.2.1 Connector information

| Pin | Symbol | I/O | Description             | Remark |
|-----|--------|-----|-------------------------|--------|
| 1   | NC     | N   | This pin should be open |        |
| 2   | NC     | N   | This pin should be open |        |
| 3   | LEDC1  | P   | Cathode 1               |        |
| 4   | LEDA1  | P   | Anode 1                 |        |
| 5   | LEDA2  | P   | Anode 2                 |        |
| 6   | LEDC2  | P   | Cathode 2               |        |
| 7   | LEDC3  | P   | Cathode 3               |        |
| 8   | LEDA3  | P   | Anode 3                 |        |
| 9   | LEDA4  | P   | Anode 4                 |        |
| 10  | LEDC4  | P   | Cathode 4               |        |

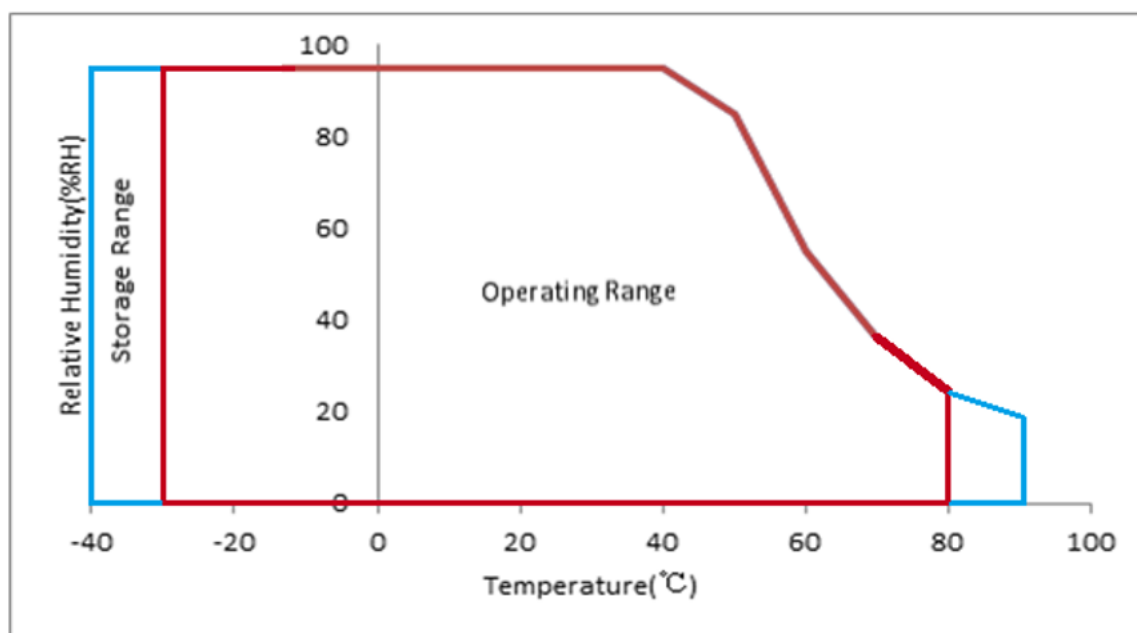
Table 3.2.2 Pin Assignment for Back Light Interface

Note1: P--- Power; NC--- Not connected.

## 4. Absolute Maximum Ratings

| Item                       | Symbol          | MIN  | MAX | Unit             | Remark       |
|----------------------------|-----------------|------|-----|------------------|--------------|
| Input voltage              | V <sub>IN</sub> | -0.3 | 5   | V                | Note1        |
|                            | VLVDS           | -0.3 | 5   | V                | Note2        |
| Operating Temperature      | Top             | -30  | 80  | °C               | -            |
| Storage Temperature        | Tst             | -40  | 90  | °C               | -            |
| Relative Humidity<br>Note2 | RH              | --   | ≤95 | %                | Ta≤40°C      |
|                            |                 | --   | ≤85 | %                | 40°C<Ta≤50°C |
|                            |                 | --   | ≤55 | %                | 50°C<Ta≤60°C |
|                            |                 | --   | ≤36 | %                | 60°C<Ta≤70°C |
|                            |                 | --   | ≤24 | %                | 70°C<Ta≤80°C |
| Absolute Humidity          | AH              | --   | ≤70 | g/m <sup>3</sup> | Ta>80°C      |

**Table 4.1 Absolute Maximum Ratings**



**Table 4.2 Absolute Maximum Ratings chart**

Note1: Input voltage include MODE,SC,VCC.

Note2: Including Link0+/-, Link1+/-, Link2+/-, Link3+/-,CLKIN+/-.

Note3: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.

Note4: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

VCC=3.3V, GND=0V, Ta=25°C

| Item                       | Symbol     | MIN | TYP    | MAX | Unit   | Remark                |
|----------------------------|------------|-----|--------|-----|--------|-----------------------|
| Power supply Voltage       | VDD        | 3.0 | 3.3    | 3.6 | V      |                       |
| Power supply ripple        | Vp-p       | -   | -      | 200 | mV     |                       |
| Power supply current       | IDD        | -   | 240    | 270 | mA     |                       |
| LCD power consumption      | P          | -   | -      | 800 | mW     |                       |
| Gate On Voltage            | VGH        | -   | 23     | -   | V      |                       |
| Gate On Voltage            | VGL        | -   | -7     | -   | V      |                       |
| Differential input voltage | Vid        | -   | -      | -   | mV     |                       |
| Power For Analog Circuit   | AVDD       | -   | 12.5   | -   | V      |                       |
| Logic Input Voltage        | Low level  | VIL | 0      | -   | 0.3VDD | mV                    |
|                            | High level | ViH | 0.7VDD | -   | VDD    | mV                    |
| Inrush current             | Irush      | -   | -      | 1   | A      | Power on $\geq$ 470us |

Table 5.1.1 Operating Voltages

### 5.2 DC Characteristics for Backlight Driving

Ta=25°C

| Item                                 | Symbol          | Min   | Typ    | Max  | Unit | Remark |
|--------------------------------------|-----------------|-------|--------|------|------|--------|
| Forward Current Voltage (per string) | V <sub>F</sub>  | 18.9  | 21     | 22.4 | V    |        |
| Forward Current(per string)          | I <sub>F</sub>  | --    | 115    | 120  | mA   |        |
| Backlight Power Consumption          | W <sub>BL</sub> | --    | 9660   | --   | mW   |        |
| LED life time                        | --              | 80000 | 100000 | --   | Hrs  |        |

Table 5.2.1 LED Backlight Characteristics

Note 1: The figure below shows the connection of backlight LED.

Note 2: Optical performance should be evaluated at Ta=25°C only.

Note 3: If LED is driven by high current, high ambient temperature & humidity condition, The life time of LED will be reduced.

Note 4: Operating life means brightness goes down to 50% of initial brightness. Typical operating life time is estimated data.

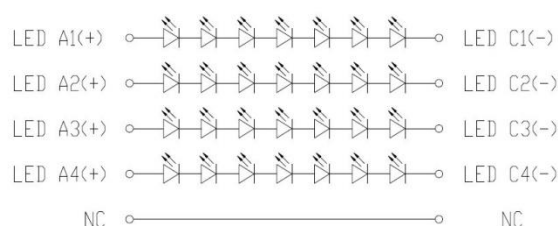
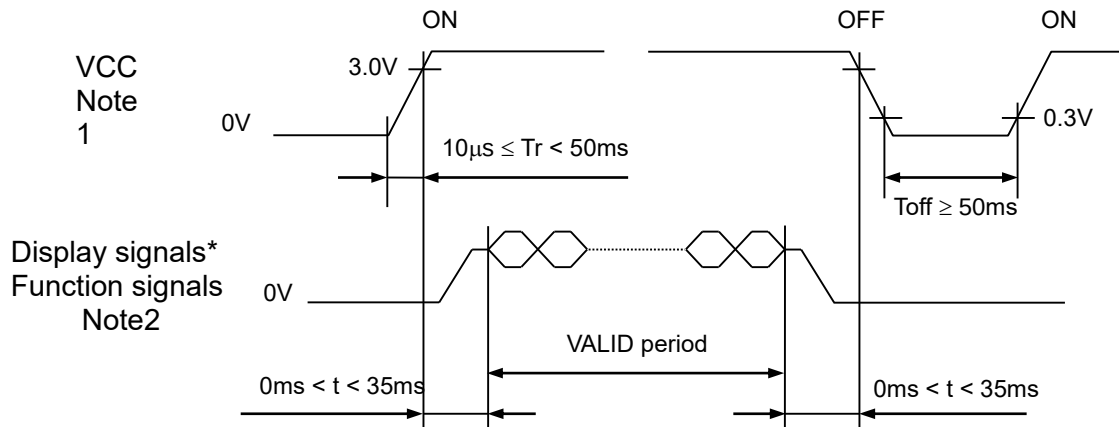


Figure 5.2.1 LED connection of backlight

### 5.3 Recommended Power ON/OFF Sequence



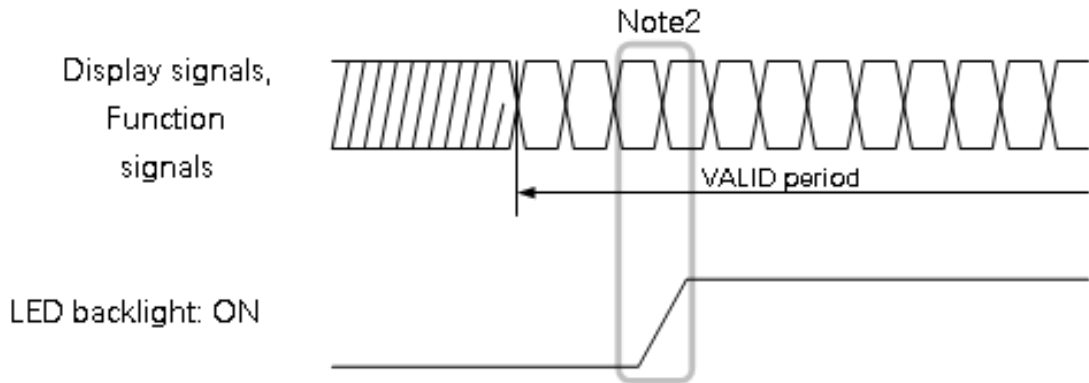
**Figure 5.3.1 Power On/off sequence**

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+/-) and function signals (DPS, FRC and MSL) 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 and function signals 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 and function signals, VCC also must be shut down.

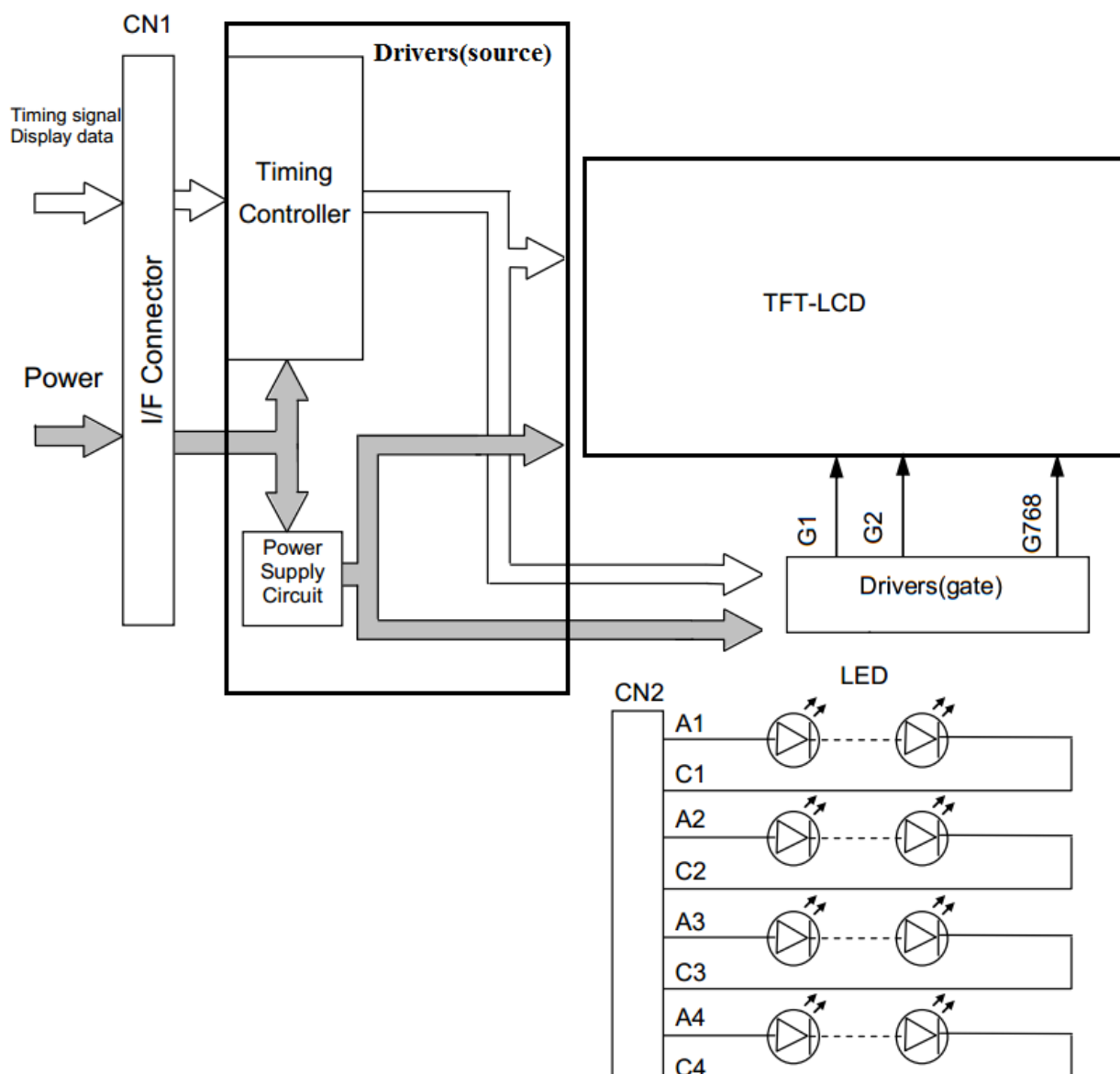
LED driver board



Note1: These are the display and function signals for LCD panel signal processing board.

Note2: The backlight should be turned on within the valid period of display and function signals, in order to avoid unstable data display.

## 5.4 LCD Module Block Diagram



**Figure 5.4.1 LCD Module Block Diagram**

Note1: Relations between GND (Signal ground and LED driver ground) and FG (Frame ground) in the LCD module are as follows.

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

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

## 6. Timing Characteristics

### 6.1 LVDS interface AC characteristics

| Parameter              | Symbol | Min.  | Typ.                        | Max. | Unit   | Condition                                                |
|------------------------|--------|-------|-----------------------------|------|--------|----------------------------------------------------------|
| Clock frequency        | FLVCLK | 25    | -                           | 85   | MHz    | Refer to input timing table for each display resolution. |
| Clock Period           | TLVCLK | 11.76 | -                           | 40   | nsec   |                                                          |
| Clock high time        | TLVCH  | -     | $4/(7 \cdot \text{RXFCLK})$ | -    | ns     |                                                          |
| Clock low time         | TLVCL  | -     | $3/(7 \cdot \text{RXFCLK})$ | -    | ns     |                                                          |
| Input data skew margin | TRSKM  | -     | -                           | 0.25 | UI     | $V_{CC\_IF}=1.8V$ w/o SSC                                |
| Strobe width           | TSW    | 0.5   | -                           | -    | UI     |                                                          |
| 1 data bit time        | UI     | -     | 1/7                         | -    | TLVCLK |                                                          |
| Position 1             | TPOS1  | -0.25 | 0                           | 0.25 | UI     |                                                          |
| Position 0             | TPOS0  | 0.75  | 1                           | 1.25 | UI     |                                                          |
| Position 6             | TPOS6  | 1.75  | 2                           | 2.25 | UI     |                                                          |
| Position 5             | TPOS5  | 2.75  | 3                           | 3.25 | UI     |                                                          |
| Position 4             | TPOS4  | 3.75  | 4                           | 4.25 | UI     |                                                          |
| Position 3             | TPOS3  | 4.75  | 5                           | 5.25 | UI     |                                                          |
| Position 2             | TPOS2  | 5.75  | 6                           | 6.25 | UI     |                                                          |

Table 6.1.1 LVDS interface AC characteristic

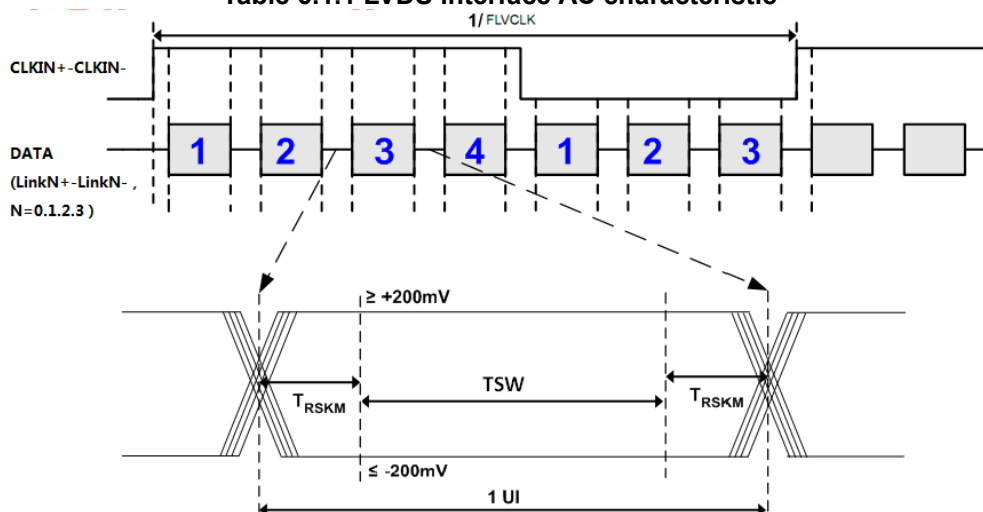


Table 6.1.2 LVDS Data Skew

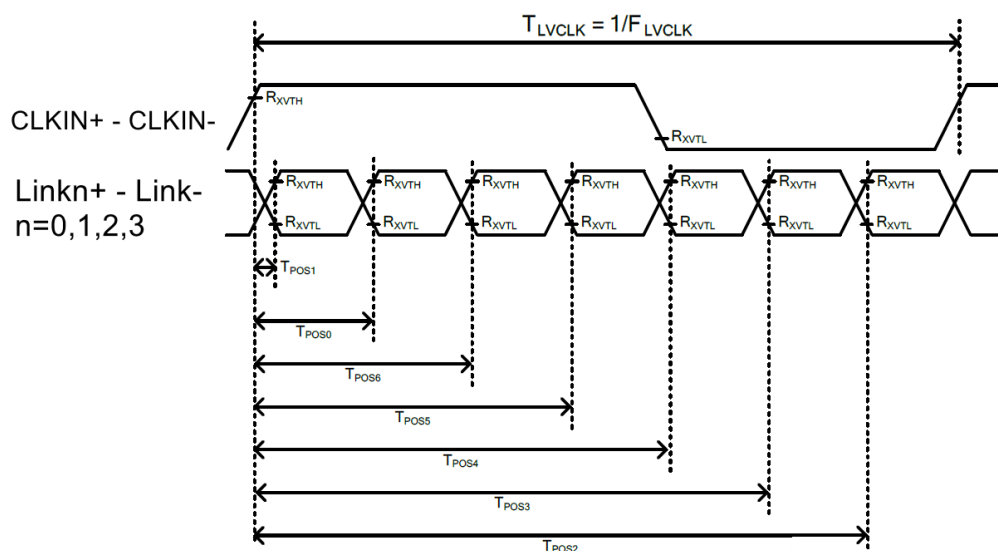


Table 6.1.3 Clock and Data Input Timing Diagram

## 6.2 Data Input Timing Parameter Setting

### DE mode for 1024RGBx768

| Parameter |                         | Symbol       | Min.  | Typ.  | Max.   | Unit | Remark        |
|-----------|-------------------------|--------------|-------|-------|--------|------|---------------|
| CLK       | Frequency               | 1/tc         | 50.34 | 50.66 | 80     | MHz  | 19.74ns(typ.) |
| DE        | Horizontal              | Display area | thd   | 1024  |        |      | CLK           |
|           |                         | Period time  | th    | -     | 21.477 | -    | μs            |
|           | Vertical<br>(One frame) | Display area | tvd   | 768   |        |      | H             |
|           |                         |              |       | -     | 16.666 | -    | ms            |
|           |                         | Period time  | tv    | 1084  | 1088   | 1332 | CLK           |
|           |                         |              |       | 774   | 776    | 1001 | H             |

Table 6.2.1 Data Input Timing Parameters

## 6.3 LVDS Interface Timing Characteristics

### 6.3.1 LVDS Input Data Format 8-bit LVDS VESA

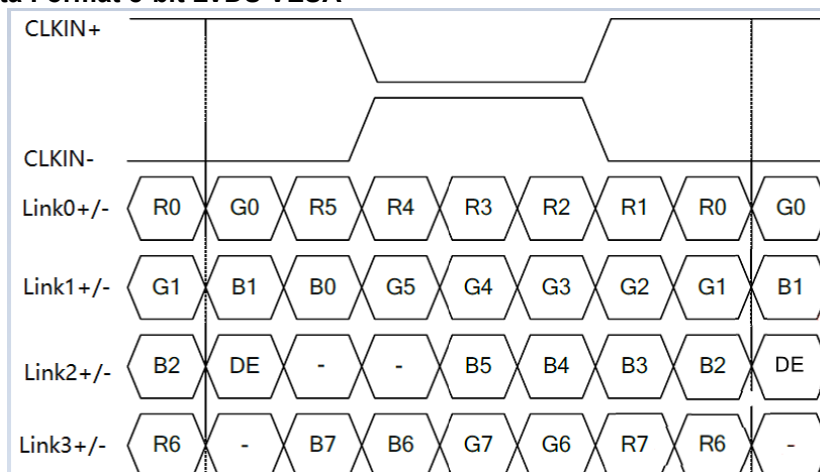


Figure 6.3.1 8-bit LVDS data map

### 6.3.2 LVDS Input Data Format 6-bit LVDS VESA

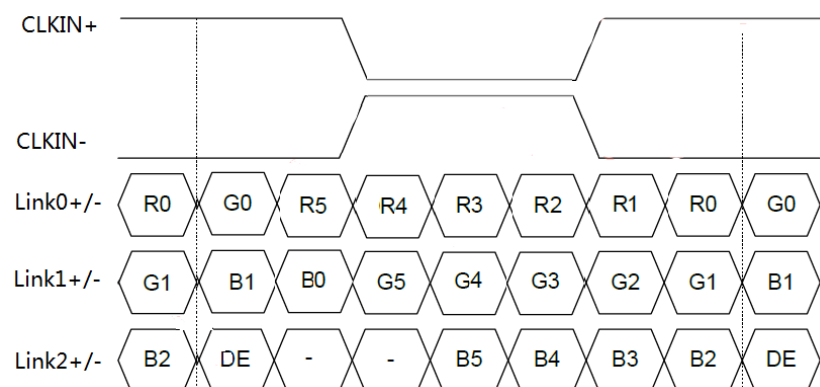


Figure 6.3.2 LVDS data map

## 6.4 LVDS Input Timing Format

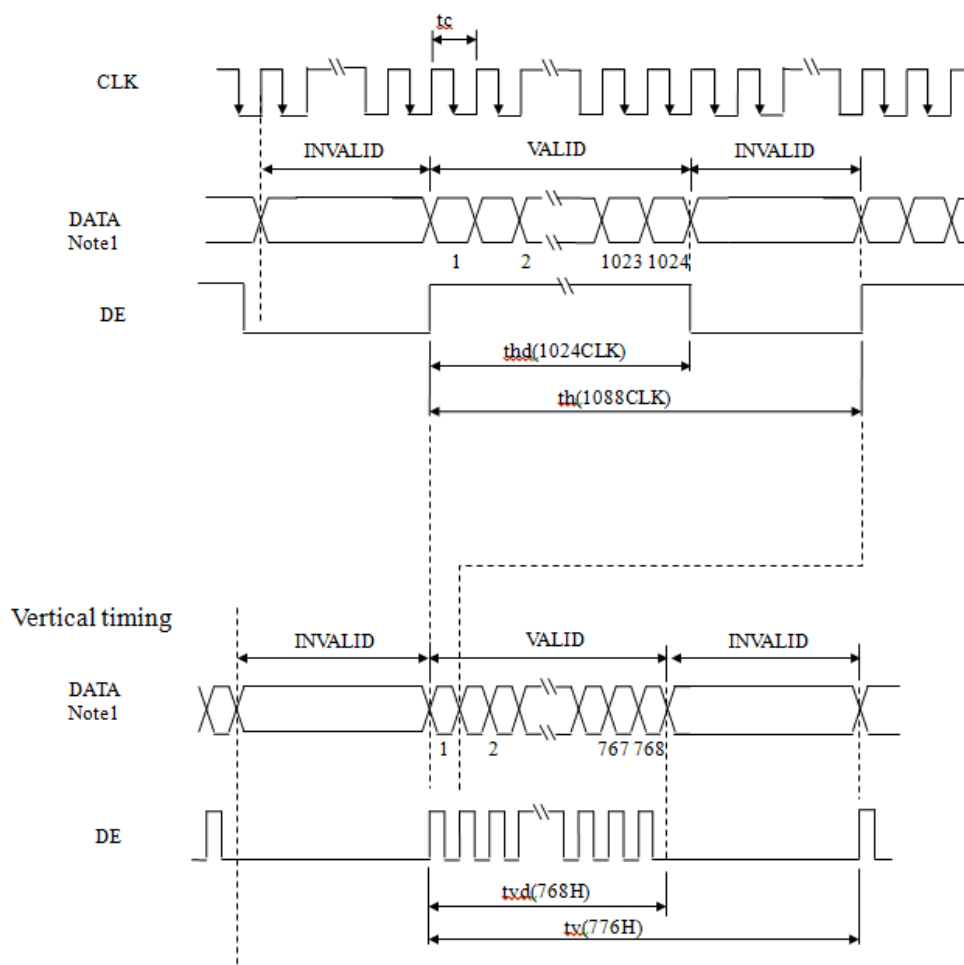


Figure 6.4.1 Recommended input timing of LVDS transmitter

Note1: DATA = R0-R7, G0-G7, B0-B7

## 7. Optical Characteristics

| Item                 |       | Symbol           | Condition       | Min   | Typ   | Max   | Unit              | Remark   |
|----------------------|-------|------------------|-----------------|-------|-------|-------|-------------------|----------|
| View Angles          |       | θT               | CR ≥ 10         | 80    | 88    | --    | Degree            | Note2,3  |
|                      |       | θB               |                 | 80    | 88    | --    |                   |          |
|                      |       | θL               |                 | 80    | 88    | --    |                   |          |
|                      |       | θR               |                 | 80    | 88    | --    |                   |          |
| Contrast Ratio       |       | CR               | θ=0°            | 800   | 1000  | --    |                   | Note 3   |
| Response Time        |       | T <sub>ON</sub>  | 25℃             | --    | 25    | 35    | ms                | Note 4   |
|                      |       | T <sub>OFF</sub> |                 |       |       |       |                   |          |
| Chromaticity         | White | x                | Backlight is on | 0.256 | 0.306 | 0.356 |                   | Note 1,5 |
|                      |       | y                |                 | 0.284 | 0.334 | 0.384 |                   |          |
|                      | Red   | x                |                 | 0.582 | 0.632 | 0.682 |                   | Note 1,5 |
|                      |       | y                |                 | 0.284 | 0.334 | 0.384 |                   |          |
|                      | Green | x                |                 | 0.248 | 0.298 | 0.348 |                   | Note 1,5 |
|                      |       | y                |                 | 0.578 | 0.628 | 0.678 |                   |          |
|                      | Blue  | x                |                 | 0.104 | 0.154 | 0.204 |                   | Note 1,5 |
|                      |       | y                |                 | 0.006 | 0.056 | 0.106 |                   |          |
| Luminance Uniformity |       | U                | -               | 75    | 80    |       | %                 | Note 6   |
| NTSC                 |       |                  |                 | 65    | 72    | --    | %                 | Note 5   |
| Luminance            |       | L                |                 | 1000  | 1300  |       | cd/m <sup>2</sup> | Note 7   |

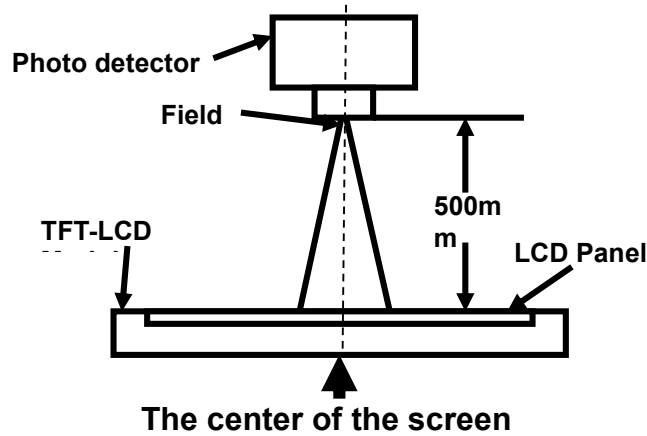
Table 7.1 Optical Parameters

Test Conditions:

1.  $I_F = 115 \text{ mA/LED}$ , and the ambient temperature is 25℃.
2. The test systems refer to Note1 and Note2.

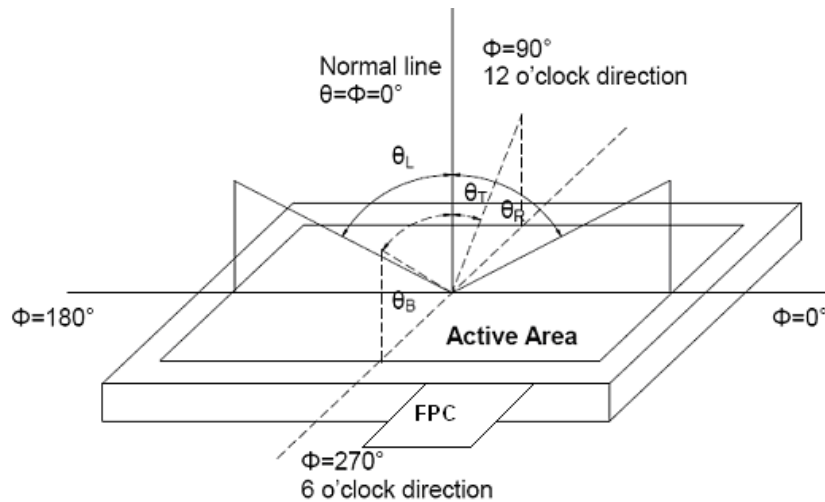
Note1: Definition of optical measurement system.

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**

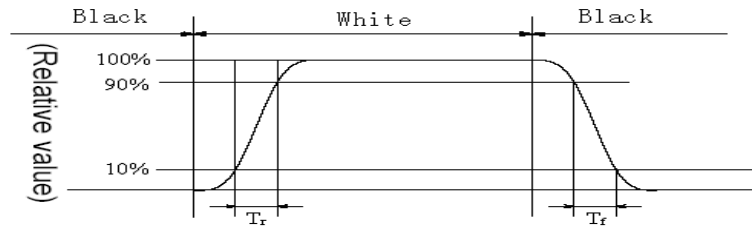
Note3: Definition of contrast ratio

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

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%.





**Fig4. Response Time Testing(SFT)**

Note5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note6: Definition of Luminance Uniformity

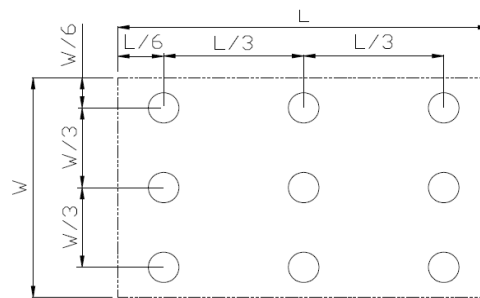
Active area is divided into 9 measuring areas (Refer Fig.5). Every measuring point is placed at the center of each measuring area.

Luminance Uniformity (U) =  $L_{min} / L_{max}$

$L_{max}$ : The measured Maximum luminance of all measurement position.

$L_{min}$ : 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               | Ta = +80℃, 240 hours                                                                                                                     | IEC60068-2-2<br>GB2423.2                                                               |
| 2  | Low Temperature Operation                | Ta = -30℃, 240 hours                                                                                                                     | IEC60068-2-1<br>GB2423.1                                                               |
| 3  | High Temperature Storage                 | Ta = +90℃, 240 hours                                                                                                                     | IEC60068-2-2<br>GB2423.2                                                               |
| 4  | Low Temperature Storage                  | Ta = -40℃, 240 hours                                                                                                                     | IEC60068-2-1<br>GB2423.1                                                               |
| 5  | Storage at High Temperature and Humidity | Ta = +60℃, 90% RH max, 240 hours                                                                                                         | IEC60068-2-78<br>GB/T2423.3                                                            |
| 6  | Thermal Shock (non-operation)            | -30℃ 30 min ~ +80℃ 30 min,<br>Change time: 5 min, 100 Cycle                                                                              | Start with cold temperature,<br>End with high temperature,<br>IEC60068-2-14, GB2423.22 |
| 7  | ESD                                      | C=150pF, R=330Ω, 9 point/panel<br>Air: ±15KV, 5 times;<br>Contact: ±8KV, 5 times<br>(Environment: 15℃~35℃,<br>30%RH~60%RH, 86Kpa~106Kpa) | IEC61000-4-2<br>GB/T17626.2                                                            |
| 8  | Vibration Test (Non Op)                  | 5~100HZ, 19.60m/s <sup>2</sup> 1min/cycle<br>120 times Per X/Y/Z                                                                         | IEC60068-2-6<br>GB/T17626.6                                                            |
| 9  | Mechanical Shock (Non Op)                | 539m/s <sup>2</sup> , 11ms<br>5 times ±X, ±Y, ±Z                                                                                         | IEC60068-2-27<br>GB/T2423.5                                                            |

**Table 8.1 RA test condition**

Note1: Ts is the temperature of panel's surface.

Note2: Ta is the ambient temperature of sample.

Note3: Before cosmetic and function test, the product must have enough recovery time, at least 24 hours at room temperature.

Note 4: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, only guarantee the operation of the product, but don't guarantee all of the cosmetic specification.

## 9. Mechanical Drawing

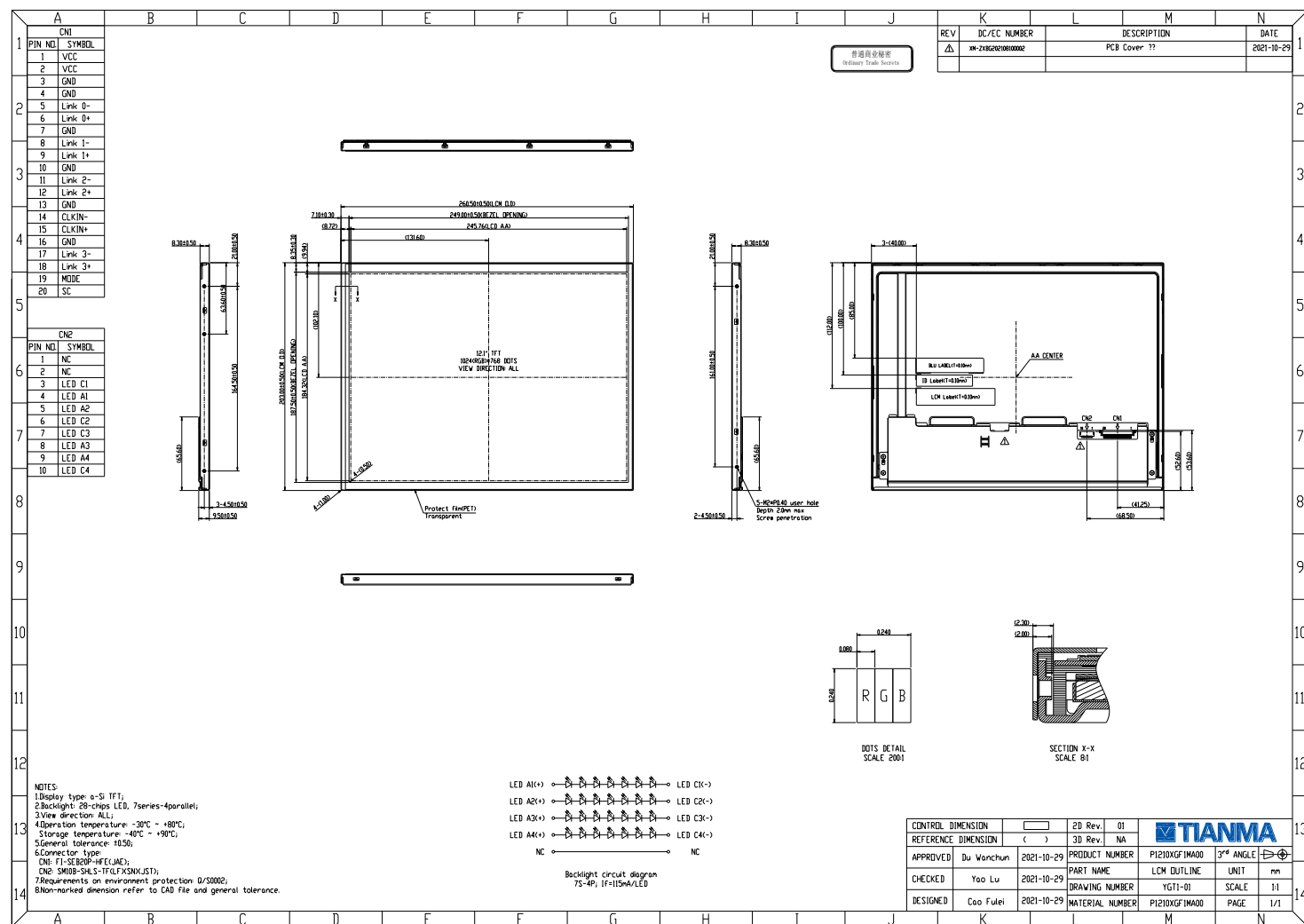
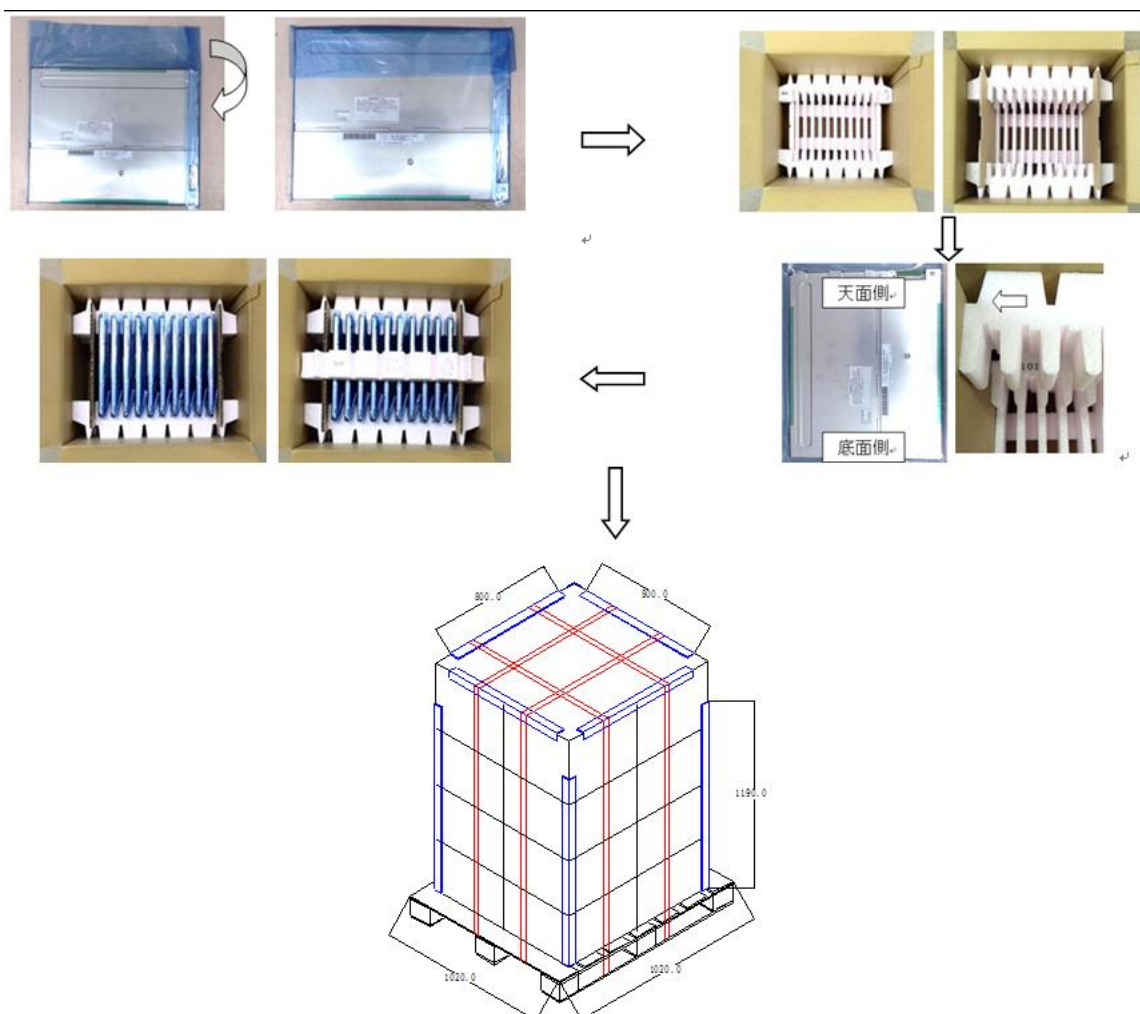


Figure 9.1 Mechanical Drawing

## 10. Packing Instruction

| No | Item            | Model (Material) | Dimensions(mm) | Weight(Kg) | Quantity | Remark |
|----|-----------------|------------------|----------------|------------|----------|--------|
| 1  | LCM module      | P1210XGF1MA00    | 260.5×203×9.5  | 0.557      | 10       |        |
| 2  | Partition board | Corrugated paper | 271×215        | 0.032      | 2        |        |
| 3  | Anti-static Bag | LD-PE            | 435×325×0.05   | 0.015      | 10       |        |
| 4  | EPP-Bottom      | EPP              | 430×390×140    | 0.116      | 1        |        |
| 5  | EPP-Top         | EPP              | 430×90×40      | 0.017      | 1        |        |
| 6  | Carton          | Corrugated paper | 433×395×310    | 1.068      | 1        |        |
| 7  | Total weight    | 6.985 Kg±5 %     |                |            |          |        |



## 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 °C 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.