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# Datasheet

## Tianma

**P1040VGF1MB00**

TI-01-xxx

# SPECIFICATION

[  ] Preliminary Specification  
[  ] Final Specification

**Description**                                    **10.4” 640xRGBx480 TFT-LCD Module**  
**Part Number**                                **P1040VGF1MB00**

|            |       |  |            |
|------------|-------|--|------------|
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\* This cover page is for your Comments and Signatures back to TIANMA.

### REVISION HISTORY

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| 1.0 | 2023/12/15 | -    | Preliminary SPEC Released. | Anna Huang |
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## 1. Summary

### 1.1 General Description

This is a 10.4 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. It is designed for medical diagnosis applications.

### 1.2 Features

- High contrast ratio
- Ultra-wide viewing angle
- Wide temperature range
- Long LED life time
- Interface: 6-bit digital signals
- This product will comply with UL62368-1/CSA C22.2 No.62368-1-03 (File number: TBD)
- This product will comply 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              |
|-----------------------------------|---------------------|--|-------------------|
| <b>Display Spec</b>               | Size                | 10.4 inches                                  | -                 |
|                                   | Resolution          | 640(RGB)x480                                 | -                 |
|                                   | Pixel Pitch         | 0.33 x 0.33                                  | mm                |
|                                   | TFT Active Area     | 211.2 x 158.4                                | mm                |
|                                   | Technology Type     | a-Si   | -                 |
|                                   | Pixel Configuration | R.G.B Vertical Stripe                        | -                 |
|                                   | Display Mode        | SFT, Normally Black                          | -                 |
|                                   | Surface Treatment   | Anti-Glare                                   | -                 |
|                                   | Viewing Direction   | All  | -                 |
| <b>Mechanical Characteristics</b> | LCM (W x H x D)     | 243.0 x 185.1 x 11.0                         | mm                |
|                                   | Weight              | (475)  | g                 |
| <b>Optical Characteristics</b>    | Luminance           | 450  | cd/m <sup>2</sup> |
|                                   | Contrast Ratio      | 1000:1                                       | -                 |
|                                   | NTSC                | 50   | %                 |
|                                   | Viewing Angle       | 88/88/88/88                                  | degree            |
| <b>Electrical Characteristics</b> | Interface           | 6-bit digital signals for data of RGB colors | -                 |
|                                   | Color Depth         | 262,144                                      | color             |
|                                   | Power Consumption   | LCD: TBD<br>Backlight: 2700                  | mW                |

Table 2.1 General TFT Specifications

### 3. Input / Output Terminals

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

| Connector Information |                                     |
|-----------------------|-------------------------------------|
| LCD Module connector  | MSAK24025P40 (STM)                  |
| Matching connector    | 20453-240T-03 (I-PEX) or equivalent |

Table 3.1.1 Connector information

| No | Symbol | I/O | Description                   | Comment                                 |
|----|--------|-----|-------------------------------|---|
| 1  | GND    | P   | Ground                        | -                                       |
| 2  | CLK    | I   | Dot clock                     | -                                       |
| 3  | Hsync  | I   | Horizontal synchronous signal | -                                       |
| 4  | Vsync  | I   | Vertical synchronous signal   | -                                       |
| 5  | GND    | P   | Ground                        | -                                       |
| 6  | R0     | I   | Red data                      | -                                       |
| 7  | R1     | I   | Red data                      | -                                       |
| 8  | R2     | I   | Red data                      | -                                       |
| 9  | R3     | I   | Red data                      | -                                       |
| 10 | R4     | I   | Red data                      | -                                       |
| 11 | R5     | I   | Red data                      | -                                       |
| 12 | GND    | P   | Ground                        | -                                       |
| 13 | G0     | I   | Green data                    | -                                       |
| 14 | G1     | I   | Green data                    | -                                       |
| 15 | G2     | I   | Green data                    | -                                       |
| 16 | G3     | I   | Green data                    | -                                       |
| 17 | G4     | I   | Green data                    | -                                       |
| 18 | G5     | I   | Green data                    | -                                       |
| 19 | GND    | P   | Ground                        | -                                       |
| 20 | B0     | I   | Blue data                     | -                                       |
| 21 | B1     | I   | Blue data                     | -                                       |
| 22 | B2     | I   | Blue data                     | -                                       |
| 23 | B3     | I   | Blue data                     | -                                       |
| 24 | B4     | I   | Blue data                     | -                                       |
| 25 | B5     | I   | Blue data                     | -                                       |
| 26 | GND    | P   | Ground                        | -                                       |
| 27 | DE     | I   | Data enable                   | -                                       |
| 28 | VCC    | P   | Power supply                  | -                                       |
| 29 | VCC    | P   | Power supply                  | -                                       |
| 30 | MODE   | -   | Select DE or SYNC mode        | High: SYNC Mode<br>Low or Open: DE Mode |



| No | Symbol | I/O | Description                 | Comment  |
|----|--------|-----|-----------------------------|--|
| 31 | DPS    | I   | Selection of scan direction | Low or Open: Normal scan<br>High: Reverse scan |
| 32 | NC     | -   | -                           | Keep this pin Open.                            |
| 33 | NC     | -   | -                           | Keep this pin Open.                            |
| 34 | NC     | -   | -                           | Keep this pin Open.                            |
| 35 | NC     | -   | -                           | Keep this pin Open.                            |
| 36 | NC     | -   | -                           | Keep this pin Open.                            |
| 37 | NC     | -   | -                           | Keep this pin Open.                            |
| 38 | NC     | -   | -                           | Keep this pin Open.                            |
| 39 | NC     | -   | -                           | Keep this pin Open.                            |
| 40 | NC     | -   | -                           | Keep this pin Open.                            |

**Table 3.1.2 Pin Assignment for LCD Interface**

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

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

**3.2 CN201 Pin assignment (Backlight Interface)**

| Connector Information |                              |
|-----------------------|------------------------------|
| LCD Module connector  | MS24011P8RA (STM)            |
| Matching connector    | P24011P8 (STM) or equivalent |

**Table 3.2.1 Connector information**

| No | Symbol | I/O | Description | Comment             |
|----|--------|-----|-------------|---------------------|
| 1  | A1     | P   | Anode1      | -                   |
| 2  | K1     | P   | Cathode1    | -                   |
| 3  | A2     | P   | Anode2      | -                   |
| 4  | K2     | P   | Cathode2    | -                   |
| 5  | A3     | P   | Anode3      | -                   |
| 6  | K3     | P   | Cathode3    | -                   |
| 7  | N. C.  | P   | -           | Keep this pin Open. |
| 8  | N. C.  | P   | -           | Keep this pin Open. |

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

Note1: I/O definition: P---Power/Ground

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

### 3.3 Positions of socket

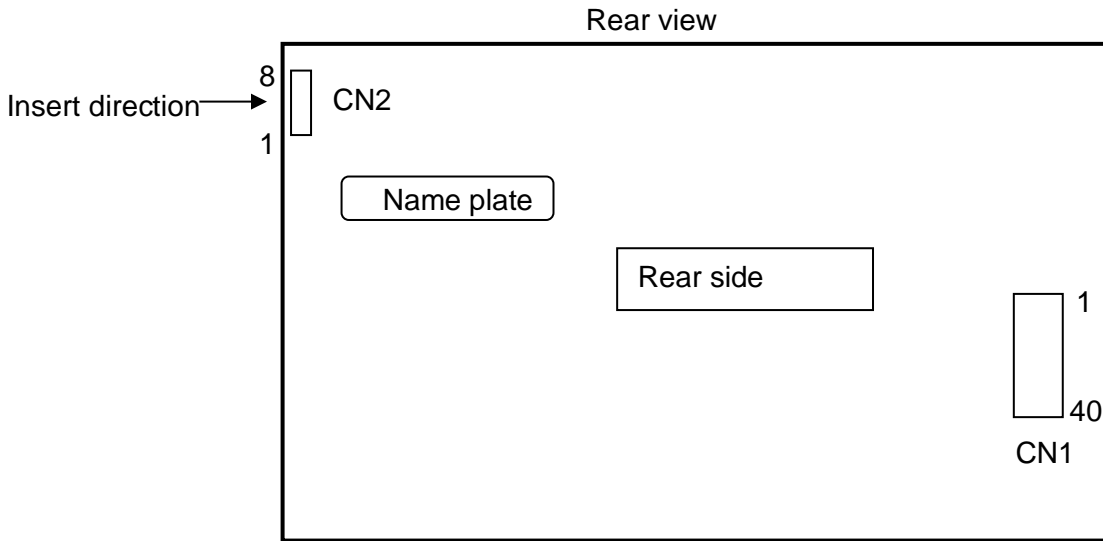


Figure 3.3 Connector pin location

## 4. Absolute Maximum Ratings

| Item                       |                                   | Symbol | Rating            | Unit | Remark           |
|----------------------------|-----------------------------------|--------|-------------------|------|------------------|
| Power supply voltage       | LCD panel signal processing board | VCC    | (-0.5 to +6.0)    | V    |                  |
| Input voltage for signals  | Display signals<br>Note1          | VD     | (-0.3 to VDD+0.3) | V    |                  |
|                            | Function signal<br>Note2          | VF     |                   | V    |                  |
| Backlight                  | Forward current                   | IL     | 55                | mA   | per one circuit  |
| Storage temperature        |                                   | Tst    | -35 to +85        | °C   | -                |
| Operating temperature      |                                   | Top    | -30 to +80        | °C   |                  |
| Relative humidity<br>Note5 |                                   | 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<br>Note5 |                                   | AH     | ≤ 70<br>Note6     | g/m3 | Ta>80°C          |

Table 4.1 Absolute Maximum Ratings

- Note1: CLK, Hsync, Vsync, DE, DATA (R0 to R5, G0 to G5, B0 to B5)
- Note2: DPS, MODE
- Note3: Measured at LCD panel surface (including self-heat)
- Note4: Measured at LCD module's rear shield surface (including self-heat)
- Note5: No condensation
- Note6: Water amount at Ta= 80°C and RH= 24%

## 5. Electrical Characteristics

### 5.1 DC Characteristics for Panel Driving

(Ta= 25°C, Note1)

| Item                                    | Symbol | MIN | TYP          | MAX          | Unit   | Remark        |
|---|--------|-----|--------------|--------------|--------|---------------|
| Power supply voltage                    | VCC    | TBD | 3.3          | TBD          | V      | at VCC = 3.3V |
| Power supply current                    | ICC    | -   | TBD<br>Note2 | TBD<br>Note3 | mA     | at VCC = 3.3V |
| Logic input voltage for display signals | High   | VDH | 0.8VCC       | -            | VCC    | CMOS level    |
|   | Low    | VDL | GND          | -            | 0.2VCC |               |
| Input voltage for DPS signal            | High   | VFH | 0.8VCC       | -            | VCC    |               |
|   | Low    | VFL | 0            | -            | 0.2VCC |               |
| Input voltage for MODE signal           | High   | VFH | 0.8VCC       | -            | VCC    |               |
|   | Low    | VFL | 0            | -            | 0.2VCC |               |

**Table 5.1.1 Panel driving 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

### 5.2 DC Characteristics for Backlight Driving

| Item            | Symbol | MIN  | TYP   | MAX  | Unit  | Remark                                   |
|-----------------|--------|------|-------|------|-------|--|
| Forward current | IL     | -    | 50.0  | 55.0 | mA    | -  |
| Forward Voltage | VL     | 16.2 | 18.0  | 19.8 | V     | Ta= +25°C<br>at IL= 50mA<br>/One circuit |
| LED life time   | Hr     | -    | 70000 | -    | hours | Ta= +25°C<br>Note 4                      |

**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 3 circuits. It is recommended that the current value difference among the circuits be less than 5%.

Note4: Operating life means brightness goes down to 50% of initial brightness.

### 5.3 Power supply voltage ripple

| Power supply voltage |       | MIN   | Remark |
|----------------------|-------|-------|--------|
| VCC                  | 3.3 V | ≤ 100 | mVp-p  |

Note1: The permissible ripple voltage includes spike noise.

### 5.4 Fuse

| Parameter | Fuse         |          | Rating | Fusing current | Remarks |
|-----------|--------------|----------|--------|----------------|---------|
|           | Type         | Supplier |        |                |         |
| VCC       | (FCC16202AB) | TBD      | 2.0A   | 4.0A           | Note1   |
|           |              |          | 36V    |                |         |

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.

### 5.5 Recommended Power ON/OFF Sequence

#### 5.5.1 LCD power on/off

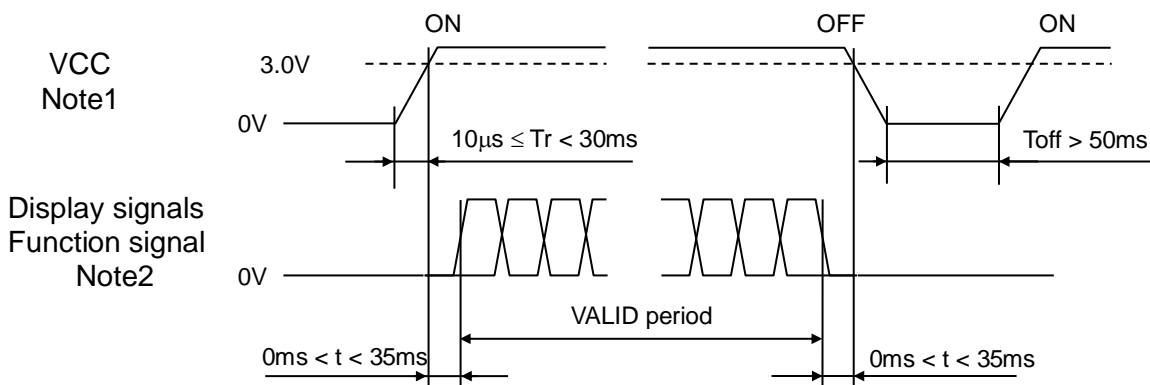


Figure 5.5.1 Backlight on/off

Note1: If there is a voltage variation (voltage drop) at the rising edge of VCC below 3.0V in "VCC = 3.3V", there is a possibility that a product does not work due to a protection circuit.

Note2: Display signals (CLK, Hsync, Vsync, DE, DATA (R0 to R5, G0 to G5, B0 to B5)) and function signal (DPS,MODE) 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.

5.5.2 Backlight on/off

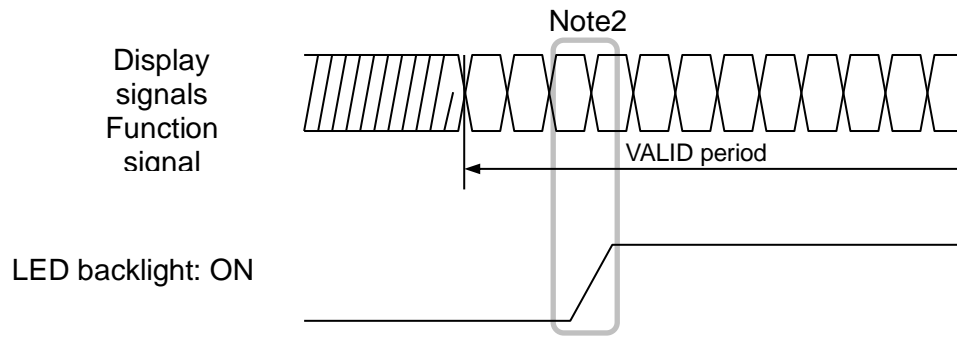


Figure 5.5.2 Backlight on/off

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.

5.6 LCD Module Block Diagram

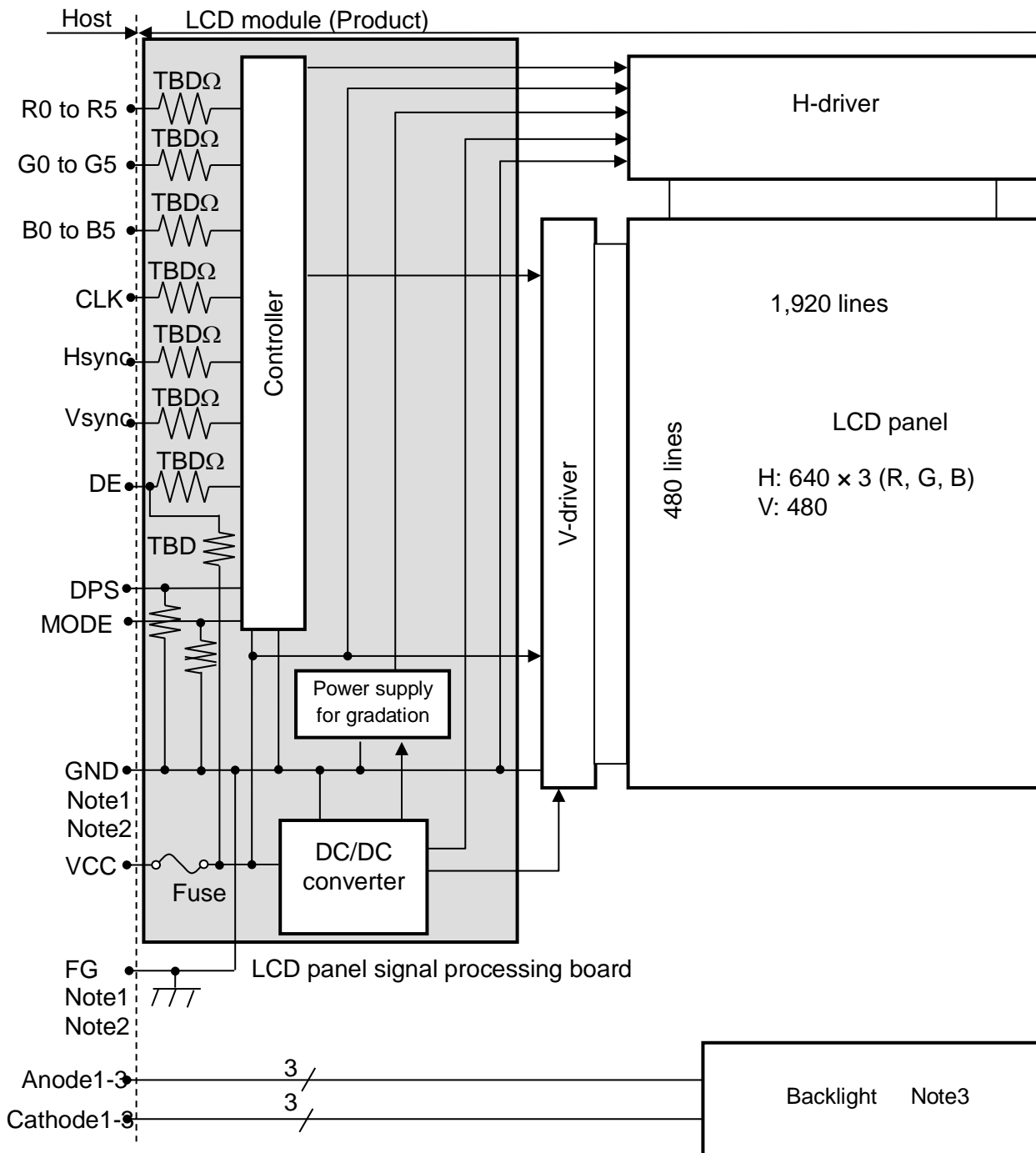


Figure 5.6.1 LCD Module Block Diagram

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 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

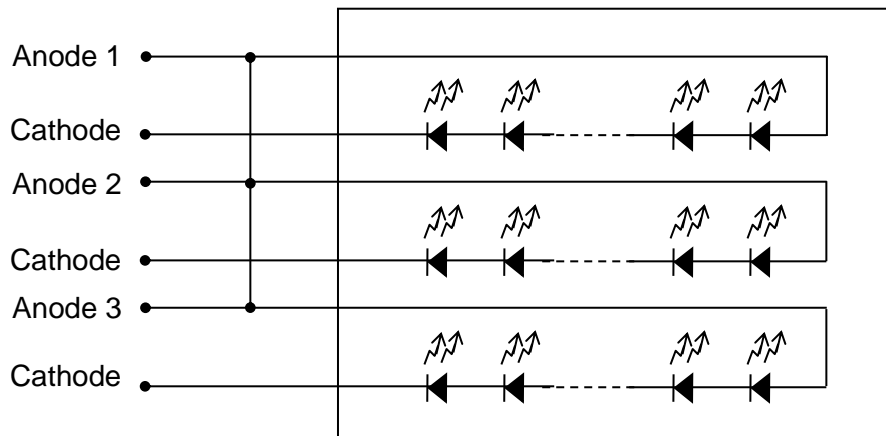


Figure 5.6.2 Backlight Block Diagram

### 5.7 Display Colors and Input Data Signals

This product can display 262,144 colors with 64 gray scales. Also the relation between display colors and input data signals is as follows.

| Display colors   |         | Data signal (0: Low level, 1: High level) |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|------------------|---------|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
|                  |         | R5  | R4 | R3 | R2 | R1 | R0 | G5 | G4 | G3 | G2 | G1 | G0 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic colors     | Black   | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                  | Blue    | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |
|                  | Red     | 1   | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                  | Magenta | 1   | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |
|                  | Green   | 0   | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
|                  | Cyan    | 0   | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                  | Yellow  | 1   | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
|                  | White   | 1   | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
| Red gray scale   | Black   | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                  | dark    | 0   | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                  | ↑       |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|                  | ↓       |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|                  | bright  | 1   | 1  | 1  | 1  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| Red              | 1       | 1   | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |
| Green gray scale | Black   | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                  | dark    | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                  | ↑       |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|                  | ↓       |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|                  | bright  | 0   | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
| Green            | 0       | 0   | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |    |
| Blue gray scale  | Black   | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                  | dark    | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  |
|                  | ↑       |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|                  | ↓       |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|                  | bright  | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 0  | 1  |
| Blue             | 0       | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 0  |    |
| Blue             | 0       | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |    |

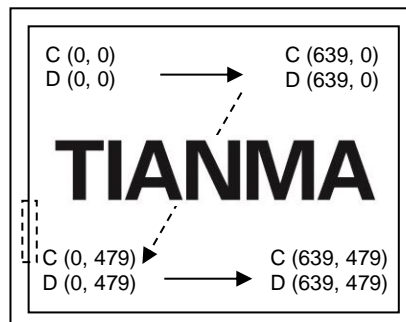
### 5.8 Display Positions

The following table is the coordinates per pixel.

|   |             |     |             |     |               |               |   |   |   |  |  |  |  |
|---|-------------|-----|-------------|-----|---------------|---------------|---|---|---|--|--|--|--|
| C (0, 0)  |             |     |             |     |               |               |   |   |   |  |  |  |  |
| <table border="1" style="margin: auto;"> <tr> <td style="padding: 2px;">R</td> <td style="padding: 2px;">G</td> <td style="padding: 2px;">B</td> <td colspan="4"></td> </tr> </table> |             |     |             |     |               |               | R | G | B |  |  |  |  |
| R   | G           | B   |             |     |               |               |   |   |   |  |  |  |  |
| $C(0, 0)$   | $C(1, 0)$   | ... | $C(X, 0)$   | ... | $C(638, 0)$   | $C(639, 0)$   |   |   |   |  |  |  |  |
| $C(0, 1)$   | $C(1, 1)$   | ... | $C(X, 1)$   | ... | $C(638, 1)$   | $C(639, 1)$   |   |   |   |  |  |  |  |
| ⋮   | ⋮           | ⋮   | ⋮           | ⋮   | ⋮             | ⋮             |   |   |   |  |  |  |  |
| $C(0, Y)$   | $C(1, Y)$   | ... | $C(X, Y)$   | ... | $C(638, Y)$   | $C(639, Y)$   |   |   |   |  |  |  |  |
| ⋮   | ⋮           | ⋮   | ⋮           | ⋮   | ⋮             | ⋮             |   |   |   |  |  |  |  |
| $C(0, 478)$   | $C(1, 478)$ | ... | $C(X, 478)$ | ... | $C(638, 478)$ | $C(639, 478)$ |   |   |   |  |  |  |  |
| $C(0, 479)$   | $C(1, 479)$ | ... | $C(X, 479)$ | ... | $C(638, 479)$ | $C(639, 479)$ |   |   |   |  |  |  |  |

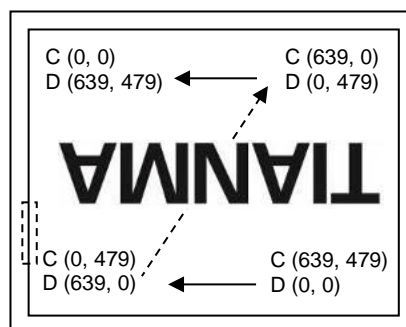
### 5.9 Scan Directions

The following figures are seen from a front view. Also the arrow shows the direction of scan.



Note1

Figure1. Normal scan (DPS: Low or Open)



Note1

Figure2. Reverse scan (DPS: High)

Note1: Meaning of C (X, Y) and D (X, Y)

C (X, Y): The coordinates of the display position

D (X, Y): The data number of input signal for LCD panel signal processing board



## 6. Timing Characteristics

### 6.1 Outline of input signal timings

#### 6.1.1 SYNC Mode Timing Diagram

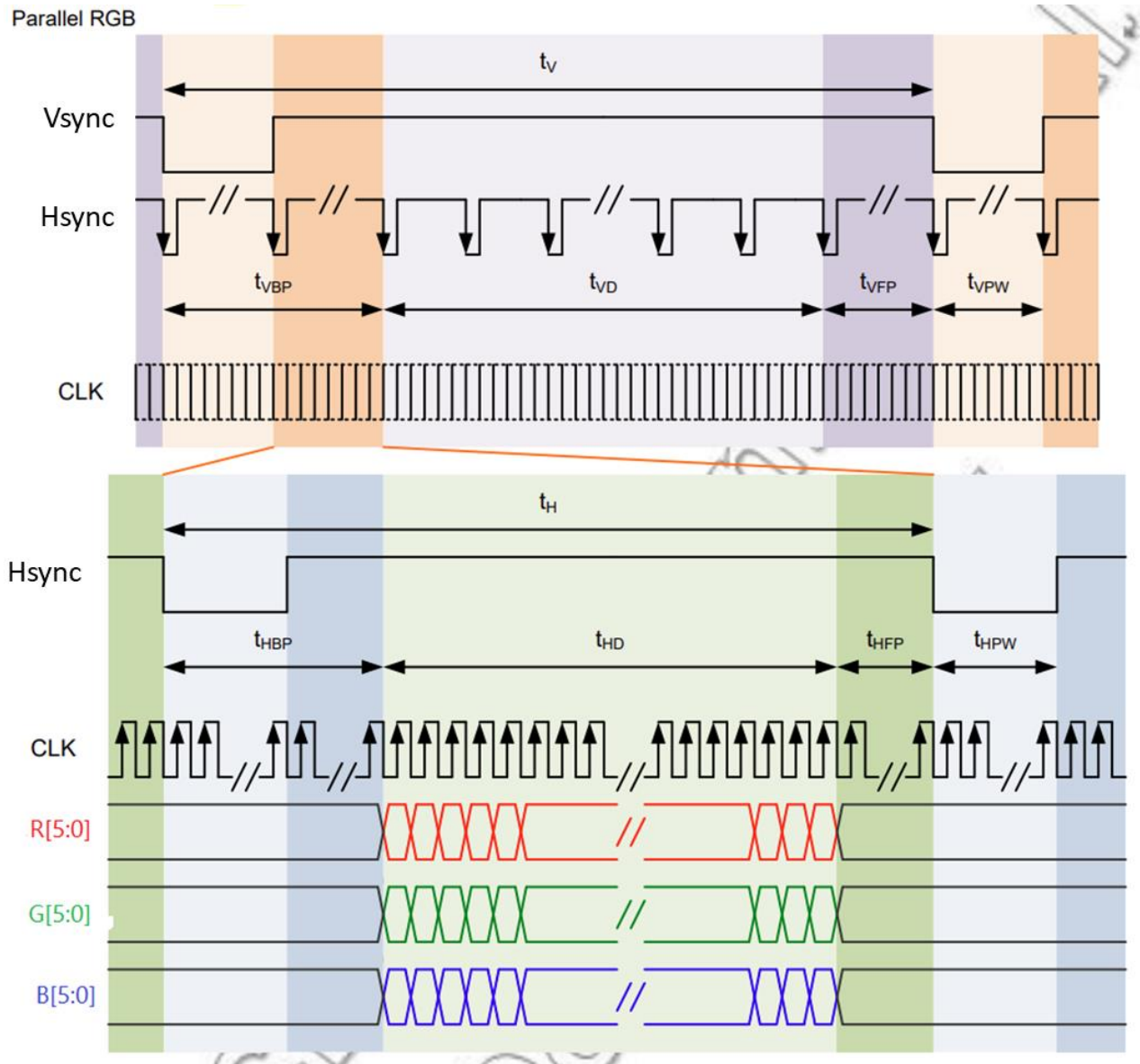


Figure 6.1.1 Data Input Timing Diagram Under SYNC Mode

6.1.2 DE Mode Timing Diagram

Parallel RGB

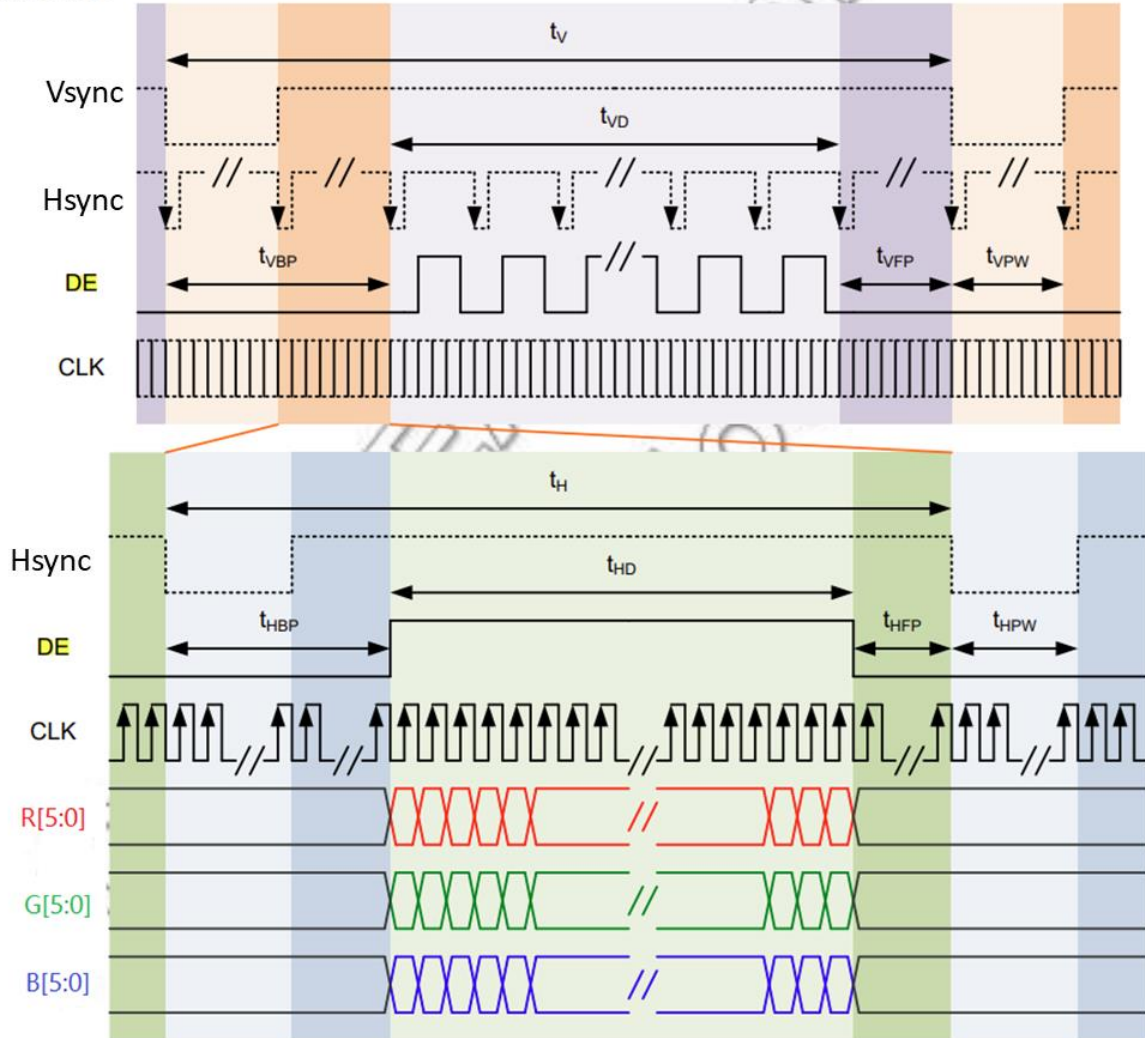


Figure 6.1.2 Data Input Timing Diagram Under DE Mode

6.2 Input Timing Parameters

(a) Sync mode

| Parameter |                                     | Symbol                              | min. | typ. | max. | Unit | Remarks               |
|-----------|-------------------------------------|-------------------------------------|------|------|------|------|-----------------------|
| CLK       | Frequency                           | 1/tc                                | 23.1 | 25.2 | 27.1 | MHz  | Note1                 |
| Hsync     | Cycle                               | t <sub>H</sub>                      | 744  | 800  | 840  | CLK  |                       |
|           | Display period                      | t <sub>HD</sub>                     | 640  |      |      | CLK  |                       |
|           | Front-porch                         | t <sub>HFP</sub>                    | 80   | 136  | 176  | CLK  |                       |
|           | Pulse width                         | t <sub>HPW</sub>                    | 2    | 2    | 5    | CLK  |                       |
|           | Back-porch                          | t <sub>HBP</sub>                    | 24   | 24   | 24   | CLK  | Note2<br>Register HBP |
|           | Total of pulse width and back-porch | t <sub>HPW</sub> + t <sub>HBP</sub> | 24   | 24   | 24   | CLK  |                       |
| Vsync     | Cycle                               | t <sub>V</sub>                      | 517  | 525  | 537  | H    |                       |
|           | Display period                      | t <sub>VD</sub>                     | 480  |      |      | H    |                       |
|           | Front-porch                         | t <sub>VFP</sub>                    | 17   | 25   | 37   | H    |                       |
|           | Pulse width                         | t <sub>VPW</sub>                    | 2    | 2    | 5    | H    |                       |
|           | Back-porch                          | t <sub>VBP</sub>                    | 20   | 20   | 20   | H    | Note2<br>Register VBP |
|           | Total of pulse width and back-porch | t <sub>VPW</sub> + t <sub>VBP</sub> | 20   | 20   | 20   |      |                       |
| FR        | Frame Rate                          | FR                                  | 60   |      |      | Hz   |                       |

Figure 6.1.1 Input Timing Parameters on Fixed Mode

Note1: Definition of parameters is as follows.

tc= 1CLK, th= 1H

Note2: Need to be consistent with the register settings.

(b) DE mode

| Parameter |                         | Symbol         | min.            | typ. | max. | Unit | Remarks |       |
|-----------|-------------------------|----------------|-----------------|------|------|------|---------|-------|
| CLK       | Frequency               | 1/tc           | 23.1            | 25.2 | 27.1 | MHz  | Note1   |       |
| DE        | Horizontal              | Cycle          | 744             | 800  | 840  | 736  |         | CLK   |
|           |                         | Display period | t <sub>HD</sub> | 640  |      |      | CLK     | Note2 |
|           | Vertical<br>(One frame) | Cycle          | t <sub>V</sub>  | 517  | 525  | 537  | H       | Note3 |
|           |                         | Display period | t <sub>VD</sub> | 480  |      |      | H       | -     |
| FR        | Frame Rate              | FR             | 60              |      |      | Hz   | -       |       |

Figure 6.1.1 Input Timing Parameters on DE Mode

Note1: Definition of parameters is as follows.

tc= 1CLK, th= 1H

Note2: Hsync signal (Pin No.3 of CN1) and Vsync signal (Pin No.4 of CN1) are not used inside the product at DE mode.

Do not keep pin open to avoid noise problem.

Note3: Vertical cycle (tv) should be specified in integral multiple of Horizontal cycle (th).

6.3 AC Characteristics

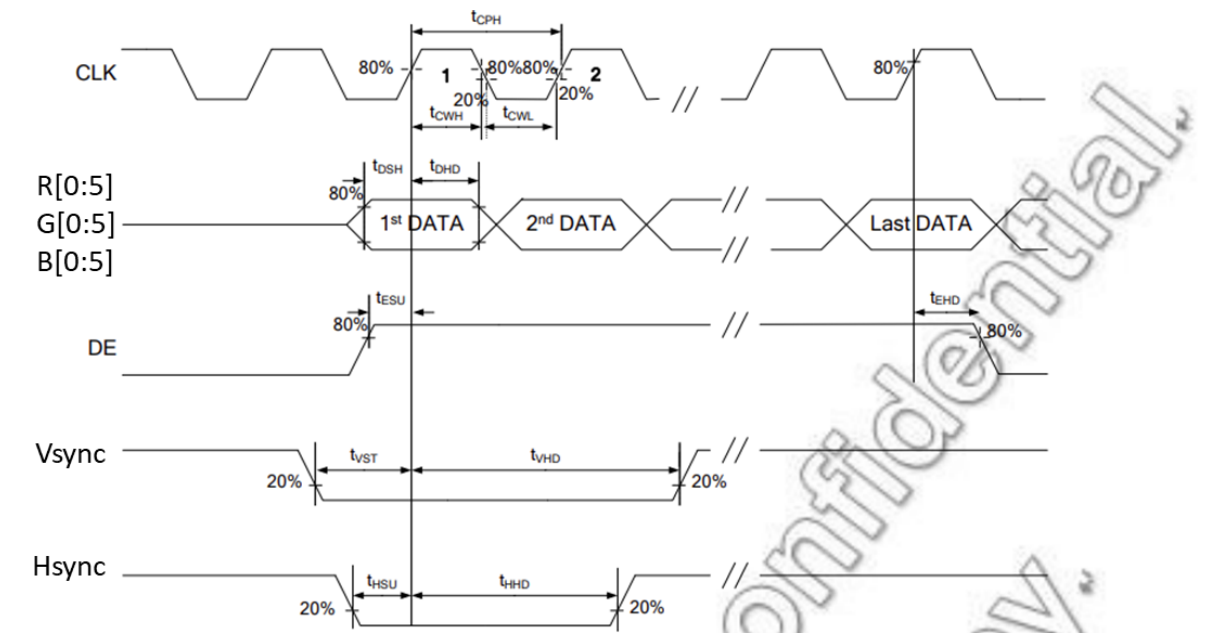


Figure 6.3.1 Input Timing Chart

| Item                | Signal                     | Symbol    | Condition | Rating |      | Unit |
|---------------------|----------------------------|-----------|-----------|--------|------|------|
|                     |                            |           |           | Min.   | Max. |      |
| CLK cycle time      | CLK                        | $t_{CPH}$ | -         | 42.3   | 46.3 | ns   |
| CLK pulse high duty |                            | $t_{CWH}$ | -         | 40     | 60   | %    |
| CLK pulse low duty  |                            | $t_{CWL}$ | -         | 40     | 60   |      |
| Vsync setup time    | Vsync                      | $t_{VST}$ | -         | 4      | -    | ns   |
| Vsync hold time     |                            | $t_{VHD}$ | -         | 2      | -    |      |
| Hsync setup time    | Hsync                      | $t_{HST}$ | -         | 4      | -    |      |
| Hsync hold time     |                            | $t_{HHD}$ | -         | 2      | -    |      |
| Data setup time     | R[0:5]<br>G[0:5]<br>B[0:5] | $t_{DSH}$ | -         | 4      | -    |      |
| Data hold time      |                            | $t_{DHD}$ | -         | 2      | -    |      |
| DE setup time       | DE                         | $t_{ESU}$ | -         | 4      | -    |      |
| DE hold time        |                            | $t_{EHD}$ | -         | 2      | -    |      |

Table 6.3.1 Input Timing Chart

## 7. Optical Characteristics

| Item           | Symbol     | Condition                | Min             | Typ   | Max   | Unit   | Remark         |                |
|----------------|------------|--------------------------|-----------------|-------|-------|--------|----------------|----------------|
| View Angles    | $\theta T$ | $CR \geq 10$             | 70              | 88    | -     | Degree | Note 2         |                |
|                | $\theta B$ |                          | 70              | 88    | -     |        |                |                |
|                | $\theta L$ |                          | 70              | 88    | -     |        |                |                |
|                | $\theta R$ |                          | 70              | 88    | -     |        |                |                |
| Contrast Ratio | CR         | $\theta=0^\circ$         | 800             | 1000  | -     | -      | Note1<br>Note3 |                |
| Response Time  | Ton+Toff   | 25°C                     | -               | 25    | 35    | ms     | Note1<br>Note4 |                |
| Chromaticity   | White      | x                        | Backlight is on | 0.263 | 0.313 | 0.363  | -              | Note5<br>Note1 |
|                |            | y                        |                 | 0.279 | 0.329 | 0.379  |                |                |
|                | Red        | x                        |                 | -     | TBD   | -      |                |                |
|                |            | y                        |                 | -     | TBD   | -      |                |                |
|                | Green      | x                        |                 | -     | TBD   | -      |                |                |
|                |            | y                        |                 | -     | TBD   | -      |                |                |
|                | Blue       | x                        |                 | -     | TBD   | -      |                |                |
|                |            | y                        |                 | -     | TBD   | -      |                |                |
| Uniformity     | LU         | White<br>( 255/255gray ) | 72              | 80    | -     | %      | Note1<br>Note6 |                |
| NTSC           | -          | -                        | 45              | 50    | -     | %      | Note 5         |                |
| Luminance      | L          | White<br>( 255/255gray ) | 280             | 450   | -     | cd/m2  | Note1<br>Note7 |                |

**Table 7.1 Optical Parameters**

Test Conditions:

1. The ambient temperature is  $25 \pm 2^\circ\text{C}$ . humidity is  $65 \pm 7\%$ .

Measurement conditions are as follows.

Ta= 25°C, VCC= 3.3V, IL= 50mA/One circuit, Display mode: VGA, DPS= Low or Open: Normal scan

2. The test systems refer to Note 1 and Note 2.
3. Contrast Ratio, Chromaticity, Uniformity, and Luminance is measured by SR-UL, SR-3AR or equivalent.
4. Response Time is measured by TRD-100, LCD-5200 or equivalent.

Note1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 20 Minutes operation, the optical characteristics are measured at the center point of the LCD screen.

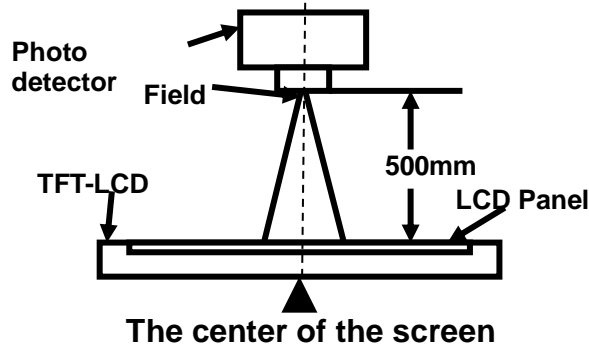


Figure 7.1 Measurement Set Up

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

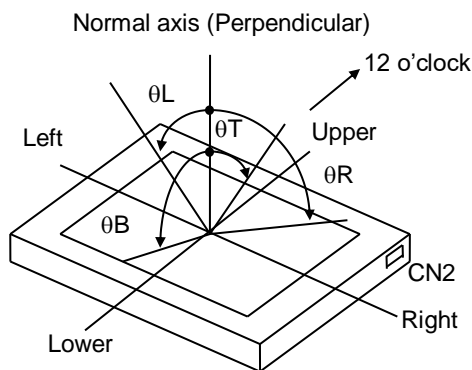


Figure 7.2 Measurement viewing angle

Note3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance of white screen}}{\text{Luminance of black screen}}$$

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%.

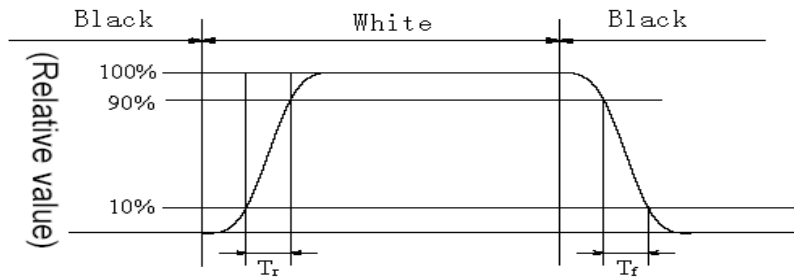


Figure 7.3 Response Time Testing( $T_a=25^{\circ}C$ )

Note5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note6: Definition of Luminance Uniformity

Active area is divided into 5 measuring area.

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

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

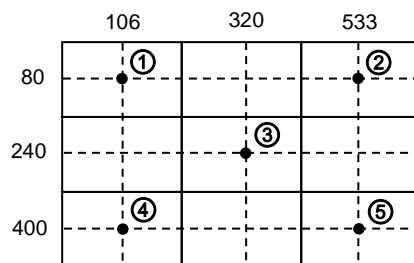


Figure 7.4 Definition of uniformity

Note7: Definition of Luminance:

Measure the luminance of white state at center point.

8. Reliability Test

| No | Test Item                                 | Condition  | Judgment                                       |
|----|---|--|--|
| 1  | High Temperature Operation                | +80°C , 240H   | No display malfunctions                        |
| 2  | High Temperature and Humidity (Operation) | +60°C , 90%RH , 240H   |  |
| 3  | Heat cycle (Operation)                    | -30°C, 1hrs ~ 80°C, 1hrs, 50cycle, 4hours/cycle  |  |
| 4  | Thermal Shock (non-operation)             | -30°C,30min ~ 80°C,30min, change time : 5min, 100cycle   |  |
| 5  | ESD Note4                                 | C=150pF , R=150Ω , 9point/panel<br>Contact : ±10kv,<br>10times each place at 1 sec interval;<br>(Environment : 15°C~35°C , 30%~60% , 86Kpa~106Kpa) |  |
| 6  | Vibration (Non-operation)                 | 5 to 100Hz, 19.6m/s <sup>2</sup><br>1 minute/cycle<br>X, Y, Z directions<br>120 times each direction   | No display malfunctions<br>No physical damages |
| 7  | Shock (Non-operation)                     | 539m/s <sup>2</sup> , 11ms<br>±X, ±Y, ±Z directions<br>5 times each direction  |  |

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 2hours 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.

Note4: See the following figure for discharge points.

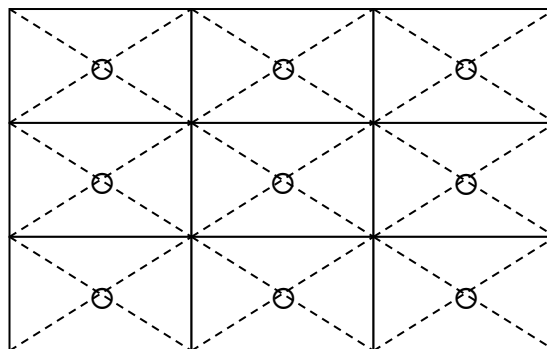
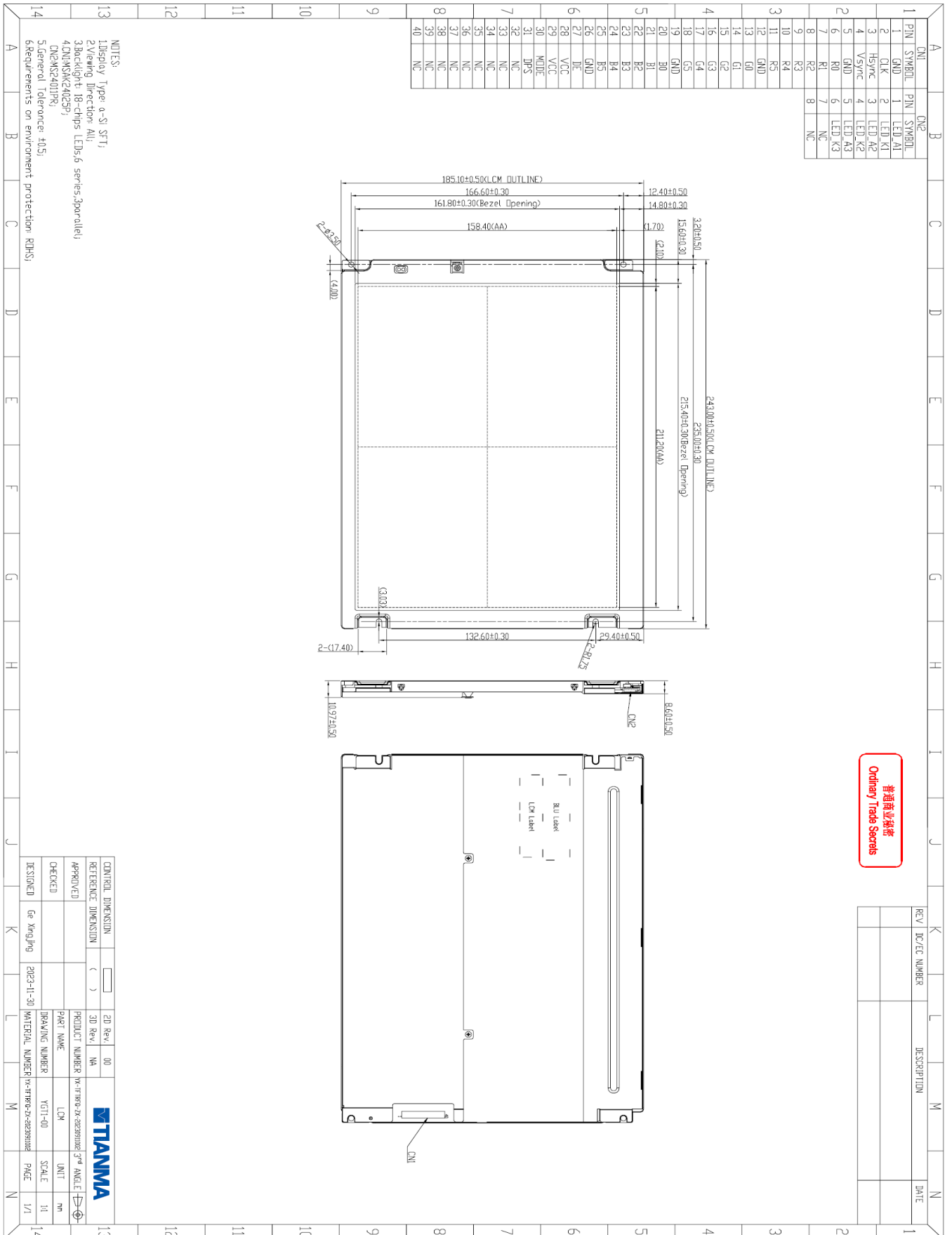


Figure 8.1 ESD position



**9. Mechanical Drawing**

**9.1 Mechanical Drawing Of LCM**



普通商业秘密  
Ordinary Trade Secrets

| REV | DEC NUMBER | DESCRIPTION | DATE |
|-----|------------|-------------|------|
|     |            |             |      |

## 9.2 Markings

The marking is attached to this product.

### 9.2.1 Nameplate label



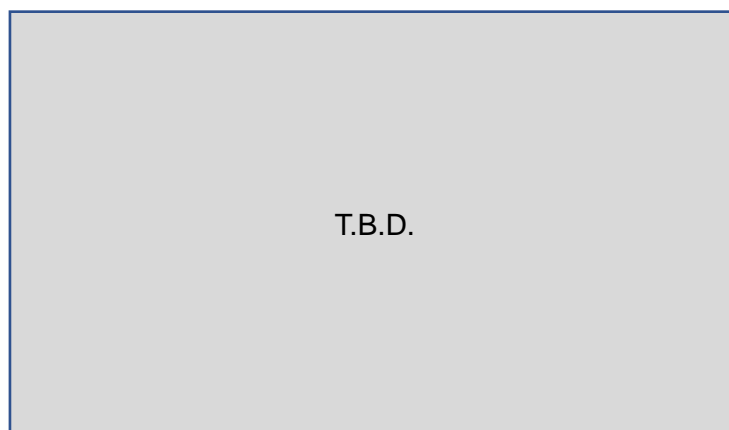
## 10. Packing Instruction

Tianma will pack products to deliver to customer in accordance with Tianma 's packing specifications, and will deliver products to customer in such a condition that products will not suffer from a damage during transportation. The delivery conditions are as follows.

| Parameter    | Packing box type                  | Unit |
|--------------|-----------------------------------|------|
| Size         | TBD(W) x TBD (H) x TBD (D) (typ.) | mm   |
| Weight       | TBD(typ.)                         | kg   |
| Total weight | TBD(typ.)<br>(with 10 products)   | kg   |

### 10.1 Packing Box

10 products are packed as the maximum in an packing box. The type name and quantity are shown on outside of the packing box, either labeling or printing. In case the packing box with products is dropped from a height of 40cm or more, there is a risk of damage to products.



**Figure 10.1 Outline Figure for Packing**

## 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 alcoholSolvents 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.

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