

**深圳市拓普微科技开发有限公司****SHENZHEN TOPWAY TECHNOLOGY CO.,LTD.****MODEL NO. : LMT150DNGFWD-1****ISSUED DATE : 2017-06-07****VERSION : V2.0**

- ☒ **Preliminary Specification**  
☐ **Final Product Specification**

**Customer :**

| Approved by | Notes |
|-------------|-------|
|             |       |

**TOPWAY Confirmed :**

| Prepared by | Checked by | Approved by |
|-------------|------------|-------------|
| Liu Tihou   |            |             |

This technical specification is subjected to change without notice

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## Record of Revision

[illegible]

# 1 General Specifications

| Feature                           |                                | Spec  |
|-----------------------------------|--------------------------------|---|
| <b>Display Spec.</b>              | Size                           | 15 inch   |
|                                   | Resolution                     | 1024xRGBx768  |
|                                   | Technology Type                | a-Si  |
|                                   | Pixel Configuration            | RGB vertical stripe   |
|                                   | Pixel pitch(mm)                | 0.297(H) × 0.297(V)   |
|                                   | Display Mode                   | TM with Normally White                                      |
|                                   | Surface Treatment              | Anti Glare  |
|                                   | Viewing Direction              | 12:00   |
|                                   | Gray Scale Inversion Direction | 6:00  |
| <b>Mechanical Characteristics</b> | LCM (W x H x D) (mm)           | 326.5(H)×253.5 (V) ×11.8 (D) (typ.)                         |
|                                   | Active Area(mm)                | 304.128(W) x 228.096 (V) (typ.)                             |
|                                   | With /Without TSP              | Without TSP   |
|                                   | Connection Type                | Socket  |
|                                   | Weight (g)                     | TBD   |
|                                   | Backlight                      | LED backlight type<br>Replaceable lamp holder for backlight |
| <b>Electrical Characteristics</b> | Interface                      | LVDS 1 port   |
|                                   | Color Depth                    | 16.2M/262K  |

Note 1: Viewing direction for best image quality is different from TFT definition. There is a 180 degree shift.

Note 2: Requirements on Environmental Protection: RoHS

Note 3: LCM weight tolerance: ± 5%

## 2 Input/Output Terminals

### 2.1 LCD PINS

CN1 socket(Module side): 185083-20121 ( P-TWO ELECTRIC TECHNOLOGY CO., LTD.)

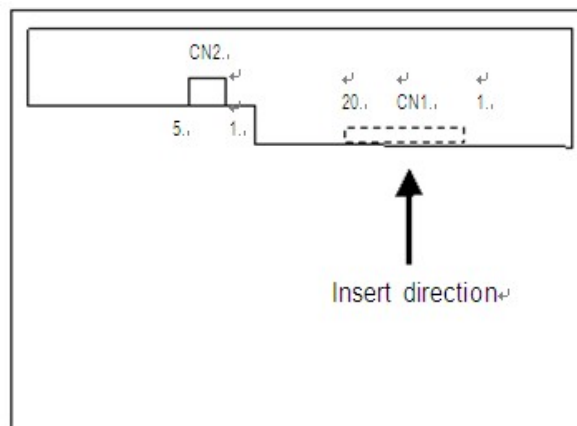
| Pin No. | Symbol | Signal                            | Input data signal: 8bit                        | Input data signal:6bit | Remarks |
|---------|--------|-----------------------------------|--|------------------------|---------|
| 1       | VCC    | Power supply                      | Power supply                                   |                        |         |
| 2       | VCC    |                                   |  |                        |         |
| 3       | GND    | Ground                            | Ground   |                        |         |
| 4       | REV    | Selection of scan direction       | High: Reverse scan<br>Low or Open: Normal scan |                        |         |
| 5       | D0-    | Pixel data                        | R0-R5,G0                                       |                        |         |
| 6       | D0+    |                                   |  |                        |         |
| 7       | GND    | Ground                            | Ground   |                        |         |
| 8       | D1-    | Pixel data                        | G1-G5,B0-B1                                    |                        |         |
| 9       | D1+    |                                   |  |                        |         |
| 10      | GND    | Ground                            | Ground   |                        |         |
| 11      | D2-    | Pixel data                        | B2-B5,DE                                       |                        |         |
| 12      | D2+    |                                   |  |                        |         |
| 13      | GND    | Ground                            | Ground   |                        |         |
| 14      | CLK-   | Pixel clock                       | Pixel clock                                    |                        |         |
| 15      | CLK+   |                                   |  |                        |         |
| 16      | GND    | Ground                            | Ground   |                        |         |
| 17      | D3-    | Pixel data                        | R6-R7,<br>G6-G7,<br>B6-B7                      | Ground                 |         |
| 18      | D3+    |                                   |  |                        |         |
| 19      | NC     | Non connection                    | -  |                        |         |
| 20      | SEL6/8 | Selection of the number of colors | Low  | High or Open           |         |

## 2.2 BACKLIGHT PINS

CN2: MSB24038P5 (Produced by STM) or equivalent.

| Pin | Symbol | Description  |
|-----|--------|--|
| 5   | VDD    | 12V  |
| 4   | GND    | Ground   |
| 3   | BRTC   | Back light ON/OFF control:<br>5V-On / 0V-Off                                 |
| 2   | PWM    | PWM Luminance control(Active high)<br>PWM= Hi,100% Drive<br>PWM= Lo,0% Drive |
| 1   | NC     | NC   |

## 2.3 POSITIONS OF PLUG AND SOCKET



### 3 Absolute Maximum Ratings

AGND=GND=0V, Ta = 25°C

| Parameter                 | Symbol | Rating     | Unit             | Remarks   |
|---------------------------|--------|------------|------------------|-----------|
| Power Supply Voltage      | VCC    | -0.3~+3.96 | V                | Ta = 25°C |
| Input voltage for signals | Vi     | -0.5~+3.96 | V                | Ta = 25°C |
| Storage temperature       | Tst    | -30 ~ +80  | °C               | Note 1    |
| Operating temperature     | Top    | -20 ~ +70  | °C               | Note 1, 2 |
| Absolute humidity         | AH     | ≤ 70       | g/m <sup>3</sup> | Ta > 50°C |

Note1: Temperature and relative humidity range is shown in the figure below.

(a) 90%RH Max. (Ta ≤ 40°C)

(b) Wet-bulb temperature should be 39°C Max. (Ta > 40°C)

(c) No condensation.

Note2: The temperature of panel display surface area should be -20°C Min and 70°C Max.

## 4 Electrical Characteristics

### 4.1 Driving For LCD

AGND=GND=0V, Ta = 25°C

| Parameter  |      | Symbol            | min.   | typ. | max.   | Unit | Remarks               |
|--|------|-------------------|--------|------|--------|------|-----------------------|
| Power supply voltage                                   |      | VCC               | 3.0    | 3.3  | 3.6    | V    | -                     |
| Power supply ripple                                    |      | Vp-p              |        |      | 200    | mV   | Including spike noise |
| Power supply current                                   |      | ICC               | -      | 550  | -      | mA   | Note 1                |
| Permissible ripple voltage                             |      | VRP               | -      | -    | 100    | mV   |                       |
| Differential input voltage                             |      | Vid               | 250    |      | 450    | mV   |                       |
| Differential input threshold voltage for LVDS receiver | High | VTH               | -      | -    | 100    | mV   | VCM = 1.25V<br>Note2  |
|  | Low  | VTL               | -100   | -    |        | mV   |                       |
| Input voltage width for LVDS receiver                  |      | Vi                | 0      | -    | 1.90   | V    | -                     |
| Terminating resistor                                   |      | RT                | -      | 100  | -      | Ω    | -                     |
| Rush current   |      | I <sub>rush</sub> | -      | -    | 1.5    | A    | Note3                 |
| Input voltage for MSL signals                          | High | VFH               | 0.7VCC |      | VCC    | V    |                       |
|  | Low  | VFL               | 0      |      | 0.3VCC | V    |                       |

Note 1: Black mode, 65MHz, at VCC = 3.3V.

Note 2: Common mode voltage for LVDS receiver.

Note 3: Measurement Conditions:

### 4.2 Driving For Backlight

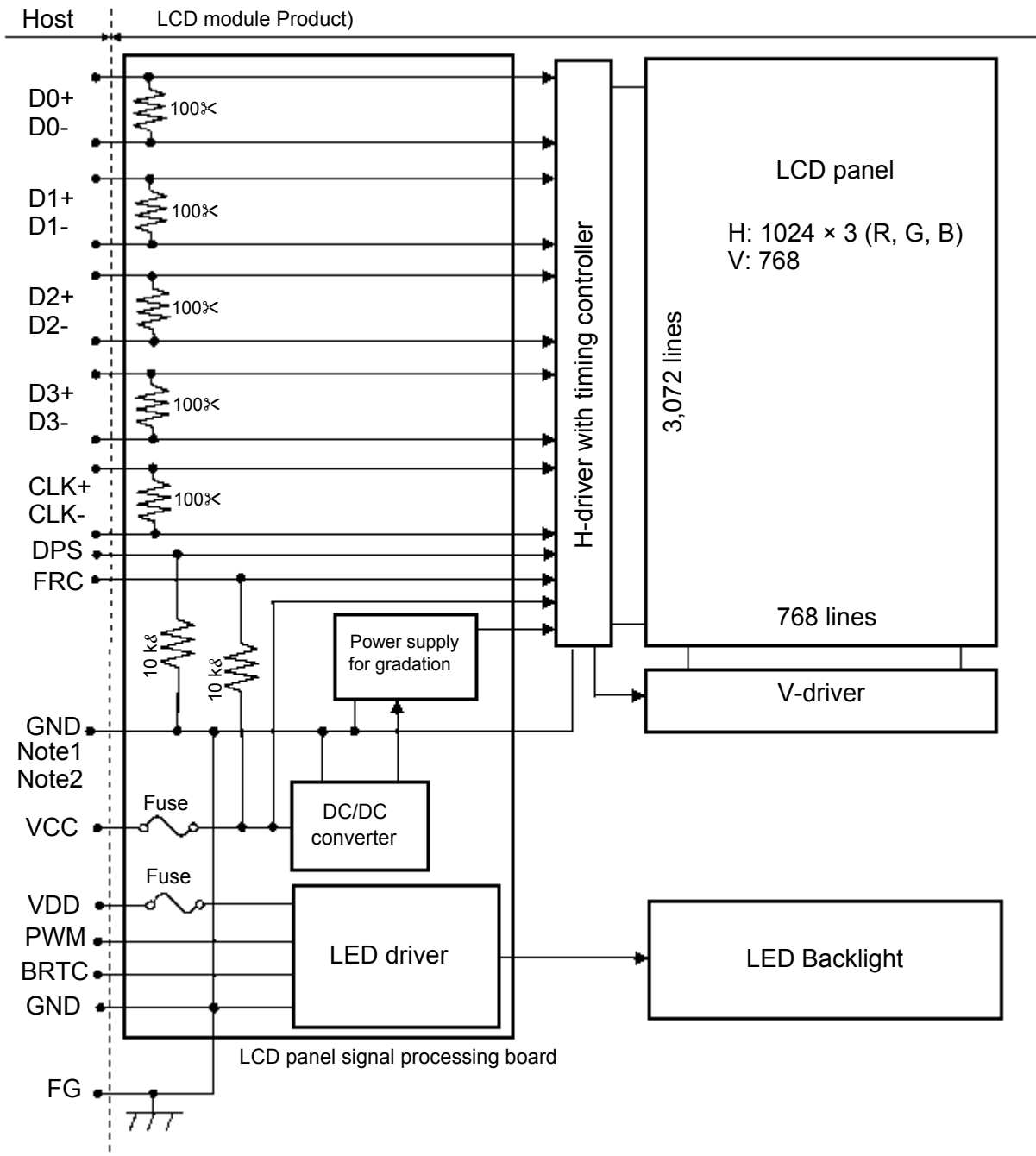
(Ta=25°C) Note1

| Parameter                     |      | Symbol | min.  | typ.  | max.  | Unit | Remarks |
|-------------------------------|------|--------|-------|-------|-------|------|---------|
| Power supply voltage          |      | VDD    | 10.8  | 12.0  | 12.6  | V    |         |
| Power supply current          |      | IDD    | -     | TBD   | -     | mA   |         |
| Light bar life time           |      | Hr     | 30000 | 50000 | -     | Hour | Note1   |
| Input voltage for PWM signal  | High | VDFH1  | 2.0   |       | 5.0   | V    |         |
|                               | Low  | VDFL1  | 0     |       | 0.4   | V    |         |
| Input voltage for BRTC signal | High | VDFH2  | 2.0   |       | 5.0   | V    |         |
|                               | Low  | VDFL2  | 0     |       | 0.4   | V    |         |
| PWM frequency                 |      | fpwm   | 200   |       | (20K) | Hz   |         |
| PWM pulse width               |      | tPWH   | 10    |       |       | us   |         |

Note1: Optical performance should be evaluated at Ta=25°C. Only If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% of initial brightness. Typical operating life time is an estimated data.



### 4.3 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.

## 5 DISPLAY COLORS AND INPUT DATA INFORMATION

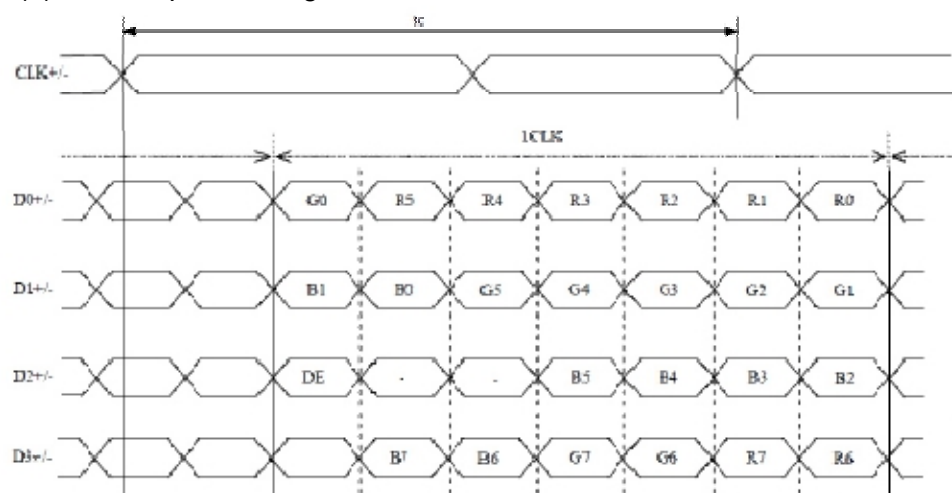
### 5.1 DISPLAY COLORS AND DATA SIGNAL

This product can display in equivalent to 16,194,277 colors in 253 scales. Also the relation between display colors and input data signals is as the following table. And it can display in equivalent to 262,144 colors in 64 scales, without data signals R7, R6, G7, G6, B7, B6 in the following table.

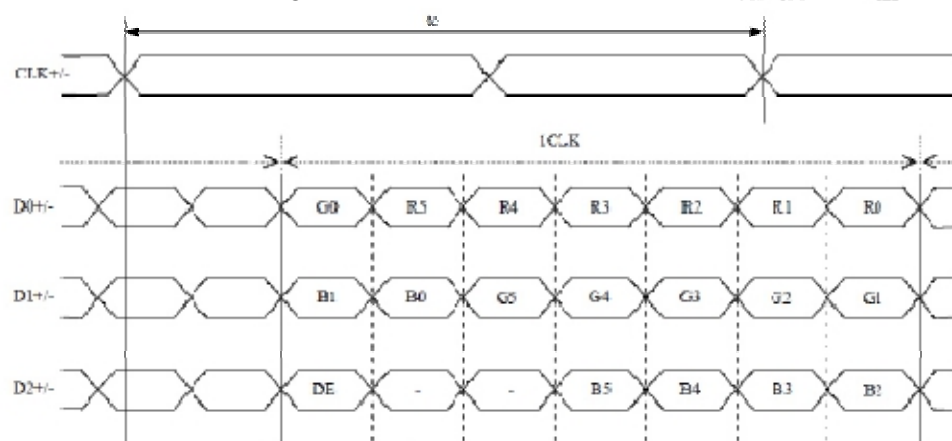
| Display colors |                 | Data signal （0:Low level , 1:High Level） |                         |                         |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------|-----------------|--|-------------------------|-------------------------|-----------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
|                |                 | R7 R6 R5 R4 R3 R2 R1 R0                  | G7 G6 G5 G4 G3 G2 G1 G0 | B7 B6 B5 B4 B3 B2 B1 B0 |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Basic Color    | Black           | 0 0 0 0 0 0 0 0                          | 0 0 0 0 0 0 0 0         | 0 0 0 0 0 0 0 0         |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                | Blue            | 0 0 0 0 0 0 0 0                          | 0 0 0 0 0 0 0 0         | 1 1 1 1 1 1 1 1         |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                | Red             | 1 1 1 1 1 1 1 1                          | 0 0 0 0 0 0 0 0         | 0 0 0 0 0 0 0 0         |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                | Magenta         | 1 1 1 1 1 1 1 1                          | 0 0 0 0 0 0 0 0         | 1 1 1 1 1 1 1 1         |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                | Green           | 0 0 0 0 0 0 0 0                          | 1 1 1 1 1 1 1 1         | 0 0 0 0 0 0 0 0         |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                | Cyan            | 0 0 0 0 0 0 0 0                          | 1 1 1 1 1 1 1 1         | 1 1 1 1 1 1 1 1         |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                | Yellow          | 1 1 1 1 1 1 1 1                          | 1 1 1 1 1 1 1 1         | 0 0 0 0 0 0 0 0         |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                | White           | 1 1 1 1 1 1 1 1                          | 1 1 1 1 1 1 1 1         | 1 1 1 1 1 1 1 1         |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Red grayscale  | Black           | 0 0 0 0 0 0 0 0                          | 0 0 0 0 0 0 0 0         | 0 0 0 0 0 0 0 0         |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                | Dark            | 0 0 0 0 0 0 0 1                          | 0 0 0 0 0 0 0 0         | 0 0 0 0 0 0 0 0         |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                |                 | 0 0 0 0 0 0 1 0                          | 0 0 0 0 0 0 0 0         | 0 0 0 0 0 0 0 0         |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                |                 | :  | :                       | :                       |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                | Bright          | 1 1 1 1 1 1 0 1                          | 0 0 0 0 0 0 0 0         | 0 0 0 0 0 0 0 0         |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                |                 | 1 1 1 1 1 1 1 0                          | 0 0 0 0 0 0 0 0         | 0 0 0 0 0 0 0 0         |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                |                 | 1 1 1 1 1 1 1 1                          | 0 0 0 0 0 0 0 0         | 0 0 0 0 0 0 0 0         |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                | Green grayscale | Black                                    | 0 0 0 0 0 0 0 0         | 0 0 0 0 0 0 0 0         | 0 0 0 0 0 0 0 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Dark           |                 | 0 0 0 0 0 0 0 0                          | 0 0 0 0 0 0 0 1         | 0 0 0 0 0 0 0 0         |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                |                 | 0 0 0 0 0 0 0 0                          | 0 0 0 0 0 0 1 0         | 0 0 0 0 0 0 0 0         |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                |                 | :  | :                       | :                       |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Bright         |                 | 0 0 0 0 0 0 0 0                          | 1 1 1 1 1 1 0 1         | 0 0 0 0 0 0 0 0         |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                |                 | 0 0 0 0 0 0 0 0                          | 1 1 1 1 1 1 1 0         | 0 0 0 0 0 0 0 0         |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                |                 | 0 0 0 0 0 0 0 0                          | 1 1 1 1 1 1 1 1         | 0 0 0 0 0 0 0 0         |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Blue grayscale |                 | Black                                    | 0 0 0 0 0 0 0 0         | 0 0 0 0 0 0 0 0         | 0 0 0 0 0 0 0 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                | Dark            | 0 0 0 0 0 0 0 0                          | 0 0 0 0 0 0 0 0         | 0 0 0 0 0 0 0 1         |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                |                 | 0 0 0 0 0 0 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 0 0 0 0         | 1 1 1 1 1 1 0 1         |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                |                 | 0 0 0 0 0 0 0 0                          | 0 0 0 0 0 0 0 0         | 1 1 1 1 1 1 1 0         |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                |                 | 0 0 0 0 0 0 0 0                          | 0 0 0 0 0 0 0 0         | 1 1 1 1 1 1 1 1         |                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

## 5.2 DATA MAP

(1) LVDS Input data signal: 8bit



(2) LVDS Input data signal: 6bit



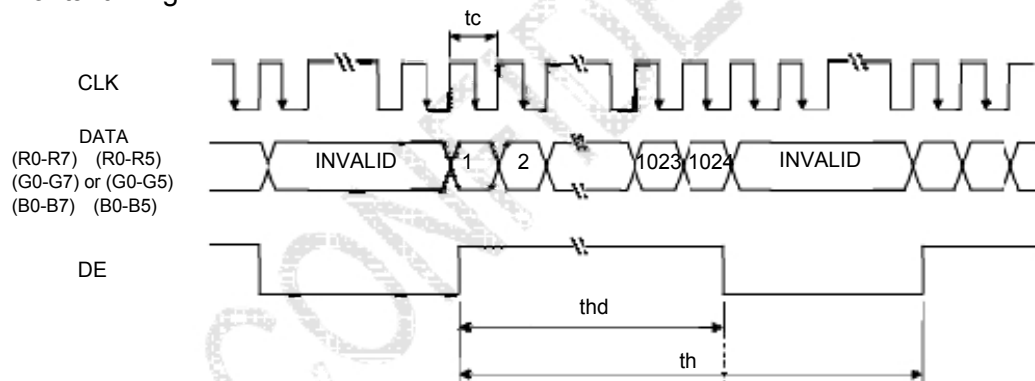
## 6 Timing Chart

### 6.1 TIMING CHARACTERISTICS

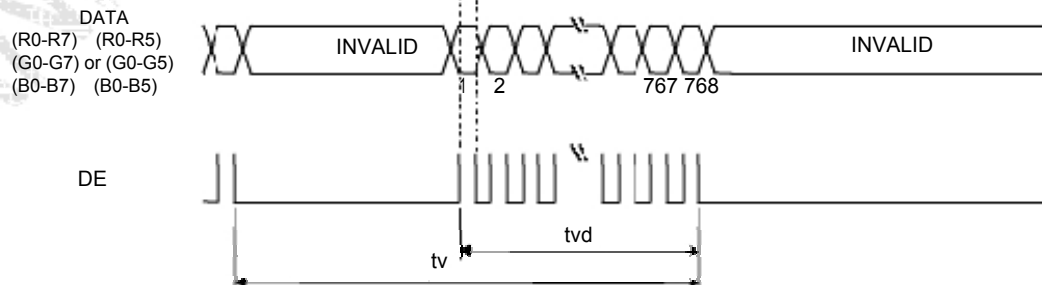
| Parameter          |                | Symbol | min.  | typ.  | max.  | Unit | Remarks           |
|--------------------|----------------|--------|-------|-------|-------|------|-------------------|
| Clock              | Frequency      | 1/tc   | 52    | 56.88 | 71    | MHz  | 17.58ns<br>(typ.) |
|                    |                | tc     | 19.23 | 17.58 | 14.08 | ns   |                   |
| Horizontal signals | Cycle          | th     | 1114  | 1200  | 1400  | CLK  |                   |
|                    | Display period | thd    | 1024  |       |       |      | -                 |
| Vertical signals   | Cycle          | tv     | 778   | 790   | 845   | H    | 60.0Hz(typ.)      |
|                    | Display period | tvd    | 768   |       |       |      | -                 |

### 6.2 INPUT SIGNAL TIMING CHART

#### Horizontal timing



#### Vertical timing



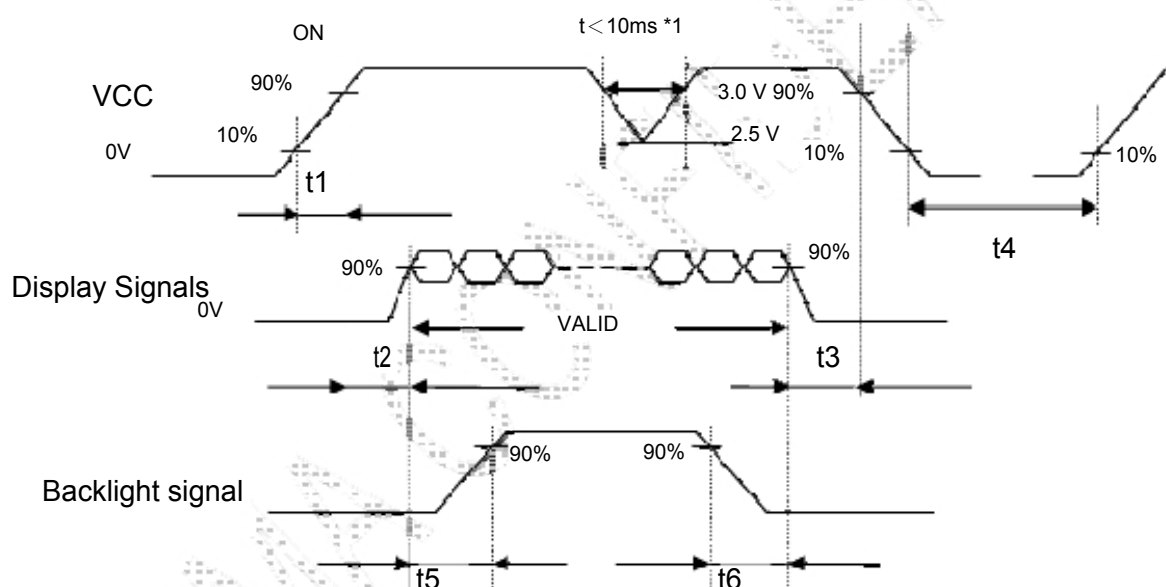
## 6.3 PIXEL DATA ALIGNMENT OF DISPLAY IMAGE

The following chart is the coordinates of per pixel

|  |   |   |          |          |          |        |             |        |     |           |
|--|---|---|----------|----------|----------|--------|-------------|--------|-----|-----------|
| <div>D(1,1)</div> <table><tr><td>B</td><td>G</td><td>R</td></tr></table> |   |   | B        | G        | R        | D(1,1) | D(2,1)      | D(3,1) | ... | D(1024,1) |
|  |   |   | B        | G        | R        |        |             |        |     |           |
|  |   |   | D(1,2)   | D(2,2)   | D(3,2)   | ...    | D(1024,2)   |        |     |           |
|  |   |   | D(1,3)   | D(2,3)   | D(3,3)   | ...    | D(1024,3)   |        |     |           |
|  |   |   | .        | .        | .        | ...    | .           |        |     |           |
| .  | . | . | ...      | .        |          |        |             |        |     |           |
|  |   |   | D(1,768) | D(2,768) | D(3,768) | ...    | D(1024,768) |        |     |           |

## 6.4 POWER SUPPLY VOLTAGE SEQUENCE

## 6.4.1 The sequence of backlight and power



## Timing Specifications:

- t1 : 0.5ms < t1 < 10ms;
- t2 : 0.5 ms < t2 < 50ms;
- t3 : 0ms < t3 < 50ms;
- t4 : t4 > 1000ms;
- t5 : t5 > 200ms;
- t6 : t6 > 200ms;

## 7 Optical Characteristics

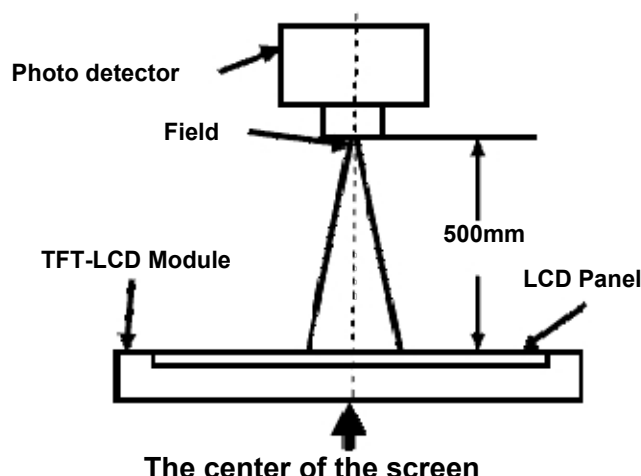
| Item                 |       | Symbol     | Condition          | Min   | Typ.  | Max   | Unit              | Remark             |
|----------------------|-------|------------|--------------------|-------|-------|-------|-------------------|--------------------|
| View Angles          |       | $\theta_T$ | $CR \geq 10$       | 70    | 80    | -     | Degree            | Note 2             |
|                      |       | $\theta_B$ |                    | 70    | 80    | -     |                   |                    |
|                      |       | $\theta_L$ |                    | 70    | 80    | -     |                   |                    |
|                      |       | $\theta_R$ |                    | 70    | 80    | -     |                   |                    |
| Contrast Ratio       |       | CR         | $\theta=0^\circ$   | 600   | 800   | -     | -                 | Note1<br>Note3     |
| Luminance uniformity |       | U          |                    | -     | 1.25  | 1.33  | -                 | Note6              |
| Response Time        |       | $T_{ON}$   | $25^\circ C$       | -     | 8     | 12    | ms                | Note1<br>Note4     |
|                      |       | $T_{OFF}$  |                    |       |       |       |                   |                    |
| Chromaticity         | White | x          | Backlight is<br>on | 0.263 | 0.313 | 0.363 | -                 | Note5<br><br>Note1 |
|                      |       | y          |                    | 0.279 | 0.329 | 0.379 |                   |                    |
|                      | Red   | x          |                    | 0.582 | 0.632 | 0.682 |                   |                    |
|                      |       | y          |                    | 0.305 | 0.355 | 0.405 |                   |                    |
|                      | Green | x          |                    | 0.294 | 0.344 | 0.394 |                   |                    |
|                      |       | y          |                    | 0.558 | 0.608 | 0.658 |                   |                    |
|                      | Blue  | x          |                    | 0.107 | 0.157 | 0.207 |                   |                    |
|                      |       | y          |                    | 0.037 | 0.087 | 0.137 |                   |                    |
| NTSC                 |       |            |                    | 50    | 60    | -     | %                 | Note5              |
| Luminance            |       | L          |                    | 400   | 450   | -     | cd/m <sup>2</sup> | Note7              |

Test Conditions:

1. The ambient temperature is 25℃. VDD= 3.3V, VCC=12V, 100% brightness,
2. The test systems refer to Note 1 and Note2.

Note 1: Definition of optical measurement system.

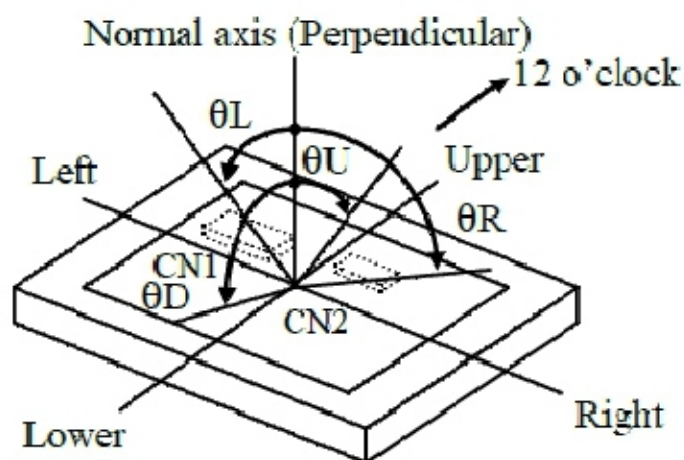
The optical characteristics should be measured in dark room. After 5 Minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



| Item           | Photo detector | Field |
|----------------|----------------|-------|
| Contrast Ratio | SR-3A          | 1°    |
| Luminance      |                |       |
| Chromaticity   |                |       |
| Lum Uniformity |                |       |
| Response Time  | BM-7A          | 2°    |

Note 2: Definition of viewing angle range and measurement system.

viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80).



Note 3: Definition of contrast ratio

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

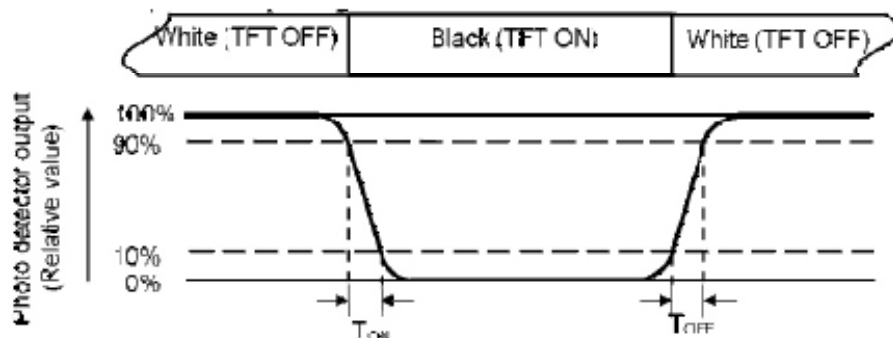
"White state ": The state is that the LCD should drive by V<sub>white</sub>.

"Black state": The state is that the LCD should drive by V<sub>black</sub>.

V<sub>white</sub>: To be determined      V<sub>black</sub>: To be determined.

## Note 4: Definition of Response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time ( $T_{ON}$ ) is the time between photo detector output intensity changed from 90% to 10%. And fall time ( $T_{OFF}$ ) is the time between photo detector output intensity changed from 10% to 90%.



## Note 5: Definition of color chromaticity (CIE1931)

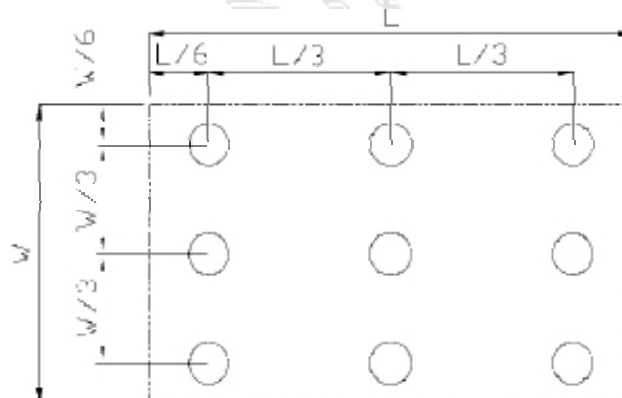
Color coordinates measured at center point of LCD.

## Note 6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

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

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



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

$L_{\min}$ : The measured Minimum luminance of all measurement position.

## Note 7: Definition of Luminance:

Measure the luminance of white state at center point.



## 8 Environmental / Reliability Test

| No | Test Item                                | Condition  | Remarks   |
|----|--|--|---|
| 1  | High Temperature Operation               | Ts = +70℃, 240 hours (Note1)   | IEC60068-2-1:2007<br>GB2423.2-2008  |
| 2  | Low Temperature Operation                | Ta = -20℃, 240 hours (Note1)   | IEC60068-2-1:2007<br>GB2423.1-2008  |
| 3  | High Temperature Storage                 | Ta = +80℃, 240 hours   | IEC60068-2-1:2007<br>GB2423.2-2008  |
| 4  | Low Temperature Storage                  | Ta = -30℃, 240 hours   | IEC60068-2-1:2007<br>GB2423.1-2008  |
| 5  | Storage at High Temperature and Humidity | Ta = +50℃, 80% RH max, 240hours  | IEC60068-2-78 :2001<br>GB/T2423.3—2006  |
| 6  | Thermal Shock (non-operation)            | -20℃ 30 min ~ +60℃ 30 min,<br>Change time:5min, 20 Cycle   | Start with cold temperature,<br>End with high temperature,<br>IEC60068-2-14:1984,<br>GB2423.22-2002 |
| 7  | ESD(Operation)                           | C=150pF, R=330 $\Omega$ 5point/panel<br>Air: $\pm 15$ Kv, 9points,25times/point;<br>Contact: $\pm 8$ Kv, 9points,25times/point<br>(Environment: 15℃~35℃, 30%~60%.<br>86Kpa~106Kpa) | IEC61000-4-2:2001<br>GB/T17626.2-2006   |
| 8  | Package Drop Test                        | Height: 60cm,<br>1corner, 3edges, 6surfaces  | IEC60068-2-32:1990<br>GB/T2423.8—1995   |
| 9  | Vibration (Non-operation)                | Frequency range:5~100Hz,11.76m/s <sup>2</sup><br>1minute/cycle<br>X,Y,Z directions<br>50times each directions  | IEC60068-2-6:1982<br>GB2423.10-1995   |
| 10 | Shock (Non-operation)                    | 30G,11ms, $\pm$ X,Y,Z directions,3times<br>For each direction  | IEC60068-2-27:1987<br>GB/T2423.5—1995   |

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 2 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, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

## 9 Precautions for Use of LCD Modules

### 9.1 Handling Precautions

9.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

9.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

9.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

9.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

9.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

- Isopropyl alcohol
- Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

- Water
- Ketone
- Aromatic solvents

9.1.6 Do not attempt to disassemble the LCD Module.

9.1.7 If the logic circuit power is off, do not apply the input signals.

9.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

9.1.8.1 Be sure to ground the body when handling the LCD Modules.

9.1.8.2 Tools required for assembly, such as soldering irons, must be properly ground.

9.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

9.1.8.4 The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

### 12.2 Storage precautions

9.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

9.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : 0℃ ~ 40℃ Relatively humidity: ≤80%

9.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

### 12.3 Transportation Precautions

9.3.1 The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.