

MODEL NO. : TM043NDH02ISSUED DATE: 2010-10-08VERSION : Ver 2.0

- ☐ Preliminary Specification  
☒ Final Product Specification

Customer :

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

SHANGHAI TIANMA Confirmed :

| Prepared by | Checked by | Approved by |
|-------------|------------|-------------|
|             |            |             |

This technical specification is subjected to change without notice



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[illegible]



## 1. General Specifications

| Feature                    |                                 | Spec                   |
|----------------------------|---------------------------------|------------------------|
| Display Spec.              | Size                            | 4.3 inch               |
|                            | Resolution                      | 480(RGB) x 272         |
|                            | Interface                       | RGB 24 bits            |
|                            | Color Depth                     | 16.7M                  |
|                            | Technology Type                 | a-Si                   |
|                            | Pixel Pitch (mm)                | 0.198x0.198            |
|                            | Pixel Configuration             | R.G.B. Vertical Stripe |
|                            | Display Mode                    | TM with Normally White |
|                            | Surface Treatment(Up Polarizer) | Anti-Glare(3H)         |
|                            | Viewing Direction               | 6 o'clock              |
|                            | Gray Scale Inversion Direction  | 12 o'clock             |
|                            | LCM (W x H x D) (mm)            | 105.50x67.20x2.90      |
| Mechanical Characteristics | Active Area(mm)                 | 95.04x53.86            |
|                            | With /Without TSP               | Without TSP            |
|                            | Weight (g)                      | 44.065                 |
|                            | LED Numbers                     | 10 LEDs                |

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: Q/S0002

Note 3: LCM weight tolerance:  $\pm 5\%$

**2. Input/Output Terminals**

| No | Symbol | I/O | Description                                                                      | Remark |
|----|--------|-----|----------------------------------------------------------------------------------|--------|
| 1  | VLED-  | P   | Back light cathode                                                               |        |
| 2  | VLED+  | P   | Back light anode                                                                 |        |
| 3  | GND    | P   | Ground                                                                           |        |
| 4  | VDD    | P   | Power supply                                                                     |        |
| 5  | R0     | I   | Data input                                                                       |        |
| 6  | R1     | I   | Data input                                                                       |        |
| 7  | R2     | I   | Data input                                                                       |        |
| 8  | R3     | I   | Data input                                                                       |        |
| 9  | R4     | I   | Data input                                                                       |        |
| 10 | R5     | I   | Data input                                                                       |        |
| 11 | R6     | I   | Data input                                                                       |        |
| 12 | R7     | I   | Data input                                                                       |        |
| 13 | G0     | I   | Data input                                                                       |        |
| 14 | G1     | I   | Data input                                                                       |        |
| 15 | G2     | I   | Data input                                                                       |        |
| 16 | G3     | I   | Data input                                                                       |        |
| 17 | G4     | I   | Data input                                                                       |        |
| 18 | G5     | I   | Data input                                                                       |        |
| 19 | G6     | I   | Data input                                                                       |        |
| 20 | G7     | I   | Data input                                                                       |        |
| 21 | B0     | I   | Data input                                                                       |        |
| 22 | B1     | I   | Data input                                                                       |        |
| 23 | B2     | I   | Data input                                                                       |        |
| 24 | B3     | I   | Data input                                                                       |        |
| 25 | B4     | I   | Data input                                                                       |        |
| 26 | B5     | I   | Data input                                                                       |        |
| 27 | B6     | I   | Data input                                                                       |        |
| 28 | B7     | I   | Data input                                                                       |        |
| 29 | GND    | P   | Ground                                                                           |        |
| 30 | DCLK   | I   | Clock for input data. Data latched at rising edge of this signal.                |        |
| 31 | DISP   | I   | Standby mode.<br>DISP = "1": Normally operation.<br>DISP = "0": Standby mode.    |        |
| 32 | HSYNC  | I   | Horizontal sync input with negative polarity. If unused, please pull high level. |        |
| 33 | VSYNC  | I   | Vertical sync input with negative polarity. If unused, please pull high level.   |        |
| 34 | DE     | I   | Data input enable. If unused, please pull low level.                             |        |
| 35 | NC     | --  | No connection                                                                    |        |
| 36 | GND    | P   | Ground.                                                                          |        |
| 37 | X_R    | --  | No connection                                                                    |        |
| 38 | Y_B    | --  | No connection                                                                    |        |
| 39 | X_L    | --  | No connection                                                                    |        |
| 40 | Y_T    | --  | No connection                                                                    |        |

**Note:** I--Input, O--Output, P--Power/Ground

**Table 2.1 Input Terminal Pin Assignment**

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### 3 Absolute Maximum Ratings

#### 3.1 Driving TFT LCD Panel

GND=0V, Ta=25°C

| Item                       | Symbol           | Min  | Max | Unit | Remark       |
|----------------------------|------------------|------|-----|------|--------------|
| Supply Voltage             | VDD              | -0.3 | 4.0 | V    |              |
| Back Light Forward Current | I <sub>LED</sub> |      | 25  | mA   | For each LED |
| Operating Temperature      | T <sub>OPR</sub> | -20  | 70  | °C   |              |
| Storage Temperature        | T <sub>STG</sub> | -30  | 80  | °C   |              |

Note1: The parameter is for driver IC (gate driver, source driver) only.

Note2: Signals include R0~R5, G0~G5, B0~B5, DCLK, DISP, HSYNC, VSYNC, DE

Table 3.1 absolute maximum rating

### 4 Electrical Characteristics

#### 4.1 Driving TFT LCD Panel

GND=0V, Ta=25°C

| Item                          | Symbol            | Min             | Typ     | Max | Unit    | Remark                                            |
|-------------------------------|-------------------|-----------------|---------|-----|---------|---------------------------------------------------|
| Supply Voltage                | VDD               | 3.0             | 3.3     | 3.6 | V       |                                                   |
| Input Signal Voltage          | Low Level         | V <sub>IL</sub> | 0       | --  | 0.3xVDD | R0~R5, G0~G5, B0~B5, DCLK, DISP, HSYNC, VSYNC, DE |
|                               | High Level        | V <sub>IH</sub> | 0.7xVDD | --  | VDD     |                                                   |
| Output Signal Voltage         | Low Level         | V <sub>OL</sub> | --      | --  | 0.2xVDD |                                                   |
|                               | High Level        | V <sub>OH</sub> | 0.8xVDD | --  | VDD     |                                                   |
| (Panel+LSI) Power Consumption | Black Mode (60Hz) |                 | 74.0    |     | mW      |                                                   |
|                               | Standby Mode      |                 | 50      |     | uW      | Note1                                             |

Note1: To test the current dissipation, use "all Black Pattern".

Table 4.1 LCD module electrical characteristics

#### 4.2 Driving Backlight

| Item                        | Symbol               | Min    | Typ      | Max  | Unit | Remark |
|-----------------------------|----------------------|--------|----------|------|------|--------|
| Channel                     | I <sub>channel</sub> | --     | 20.0     | 25.0 | mA   | Note 1 |
| Forward Voltage             | V <sub>BL</sub>      | --     | 3.2      | --   | V    |        |
| Backlight Power Consumption | W <sub>BL</sub>      | --     | 640      | --   | mW   |        |
| Life Time                   | --                   | 10,000 | (20,000) | --   | Hrs  | Note 3 |

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Note 1:  $I_F$  is defined for one channel LED. There are total two LED channels in back light unit

Note 2: Optical performance should be evaluated at  $T_a=25^{\circ}\text{C}$  only.

Note 3: 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% initial brightness. Typical operating life time is estimated data.

Table 4.2 LED backlight characteristics

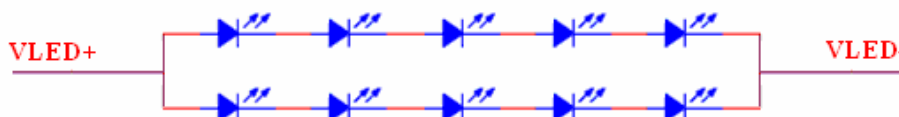


Figure 4.2 LED connection of backlight

### 4.3 Block Diagram

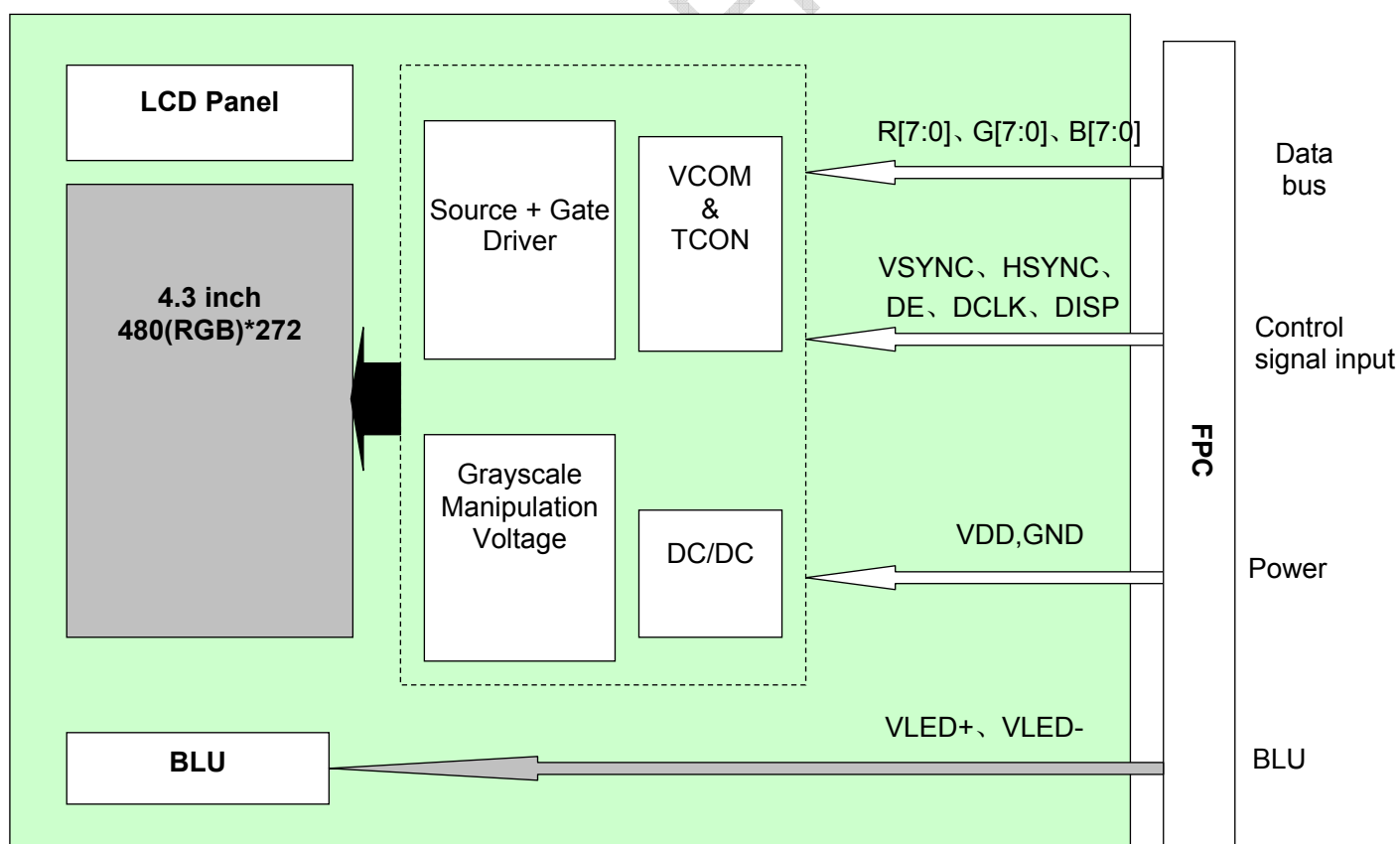


Figure 4.3 LCD Module Diagram



## 5. Interface timing

### 5.1 Input Setup Timing Setting

#### 5.1.1 Input Setup Timing Parameter Setting

VDD=3.3V Ta=25°C

Normal Write Mode

| Parameter             | Symbol     | Min  | Typ | Max | Unit | Remark |
|-----------------------|------------|------|-----|-----|------|--------|
| DCLK Cycle Time       | $T_{pw}$   | 66.7 | -   | -   | ns   |        |
| DCLK Pulse High Width | $T_{pwh}$  | 26.7 | -   | -   | ns   |        |
| DCLK Pulse Low Width  | $T_{pwl}$  | 26.7 | -   | -   | ns   |        |
| DE Setup Time         | $T_{des}$  | 10   | -   | -   | ns   |        |
| DE Hold Time          | $T_{deh}$  | 10   | -   | -   | ns   |        |
| HSYNC Setup Time      | $T_{hs}$   | 10   | -   | -   | ns   |        |
| HSYNC Hold Time       | $T_{hh}$   | 10   | -   | -   | ns   |        |
| VSYNC Setup Time      | $T_{vhs}$  | 10   | -   | -   | ns   |        |
| VSYNC Hold Time       | $T_{vhh}$  | 10   | -   | -   | ns   |        |
| Data Setup Time       | $T_{ds}$   | 10   | -   | -   | ns   |        |
| Data Hold Time        | $T_{dh}$   | 10   | -   | -   | ns   |        |
| DISP Setup Time       | $T_{diss}$ | 10   | -   | -   | us   |        |
| DISP Hold Time        | $T_{dish}$ | 10   | -   | -   | ms   |        |

**Note 1:**  $t_r=t_f=2ns$ ,  $t_r$  is defined 10% to 90% of signal amplitude.

**Note 2:** For parallel interface, maximum clock frequency is 15MHz.

**Table 5.1 Input Setup Timing Parameters Requirement**





## 5.1.2 Input Setup Timing Diagram

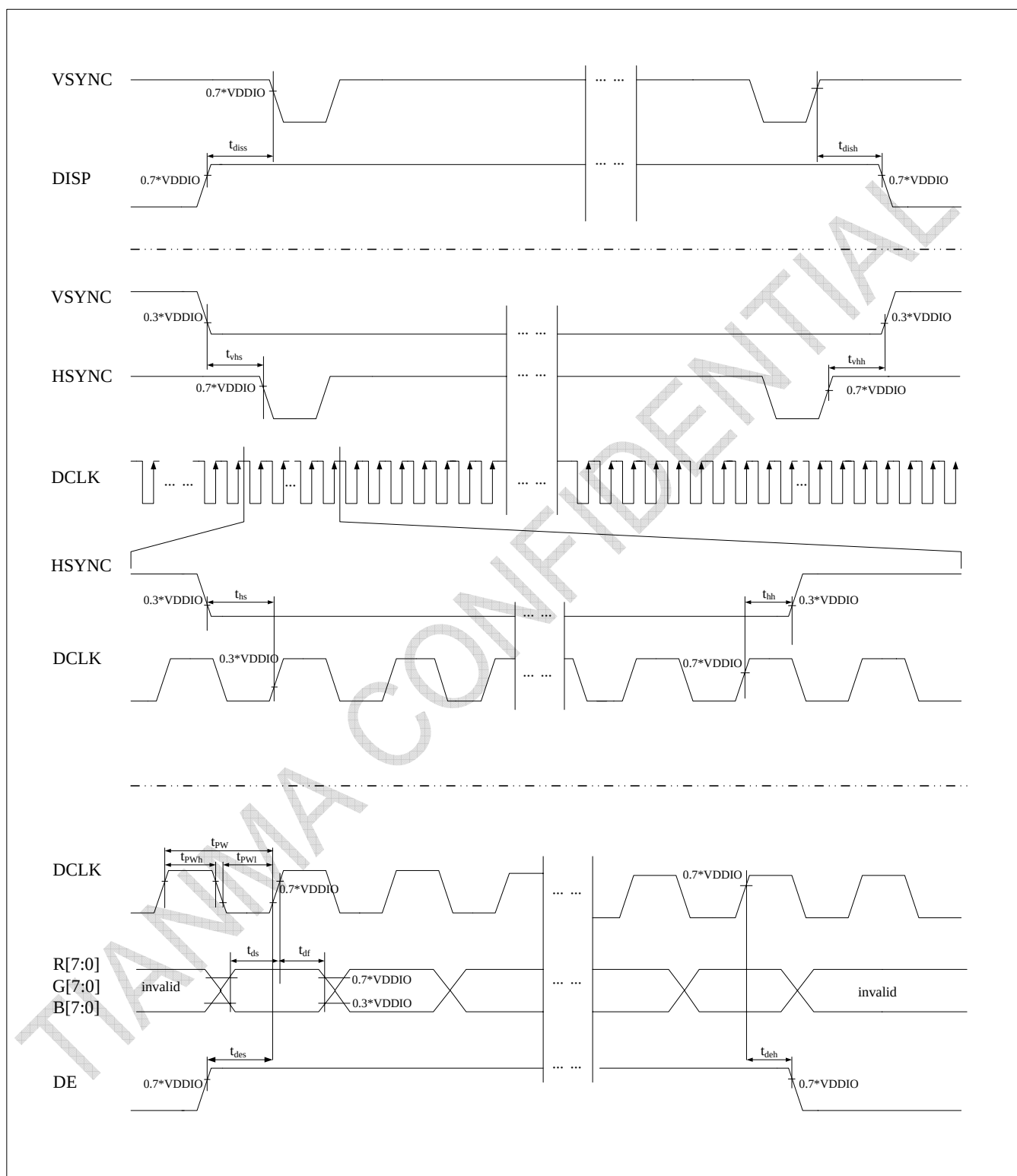


Figure 5.1.2 Input Setup Timing Diagram



## 5.2 Data Input Format

### 5.2.1 Data Input Timing Parameter Setting

| Parameter                 | Symbol    | Min | Typ   | Max | Unit  | Remark |
|---------------------------|-----------|-----|-------|-----|-------|--------|
| DCLK frequency            | $f_{clk}$ | --  | 9     | 15  | MHZ   |        |
| HSYNC frequency           | $1/t_h$   | --  | 17.14 | --  | KHz   |        |
| VSYNC frequency           | $1/t_v$   | --  | 59.94 | --  | Hz    |        |
| Horizontal cycle          | $t_h$     | 525 | 525   | 605 | DCLK  |        |
| Horizontal display period | $t_{hd}$  | 480 |       |     | DCLK  |        |
| Horizontal pulse width    | $t_{hp}$  | 2   | 41    | 41  | DCLK  |        |
| Horizontal back porch     | $t_{hb}$  | 2   | 2     | 41  | DCLK  |        |
| Horizontal front porch    | $t_{hf}$  | 2   | 2     | 82  | DCLK  |        |
| Vertical cycle            | $t_v$     | 285 | 286   | 399 | HSYNC |        |
| Vertical display period   | $t_{vd}$  | 272 |       |     | HSYNC |        |
| Vertical pulse width      | $t_{vp}$  | 1   | 10    | 11  | HSYNC |        |
| Vertical back porch       | $t_{vb}$  | 1   | 2     | 11  | HSYNC |        |
| Vertical front porch      | $t_{vf}$  | 1   | 2     | 227 | HSYNC |        |

**Note 1:** Unit: CLK=1/  $f_{CLK}$  , H=  $t_h$ ,

**Note 2:** It is necessary to keep  $t_{vp}+t_{vb}=12$  and  $t_{hp}+t_{hb}=43$  in sync mode. DE mode is unnecessary to keep it.

**Table 5.2.2 Data Input Timing Parameters Requirement**



## 5.2.2 Data Input Timing Diagram

### 5.2.2.1 Data Input Timing Diagram under SYNC Mode

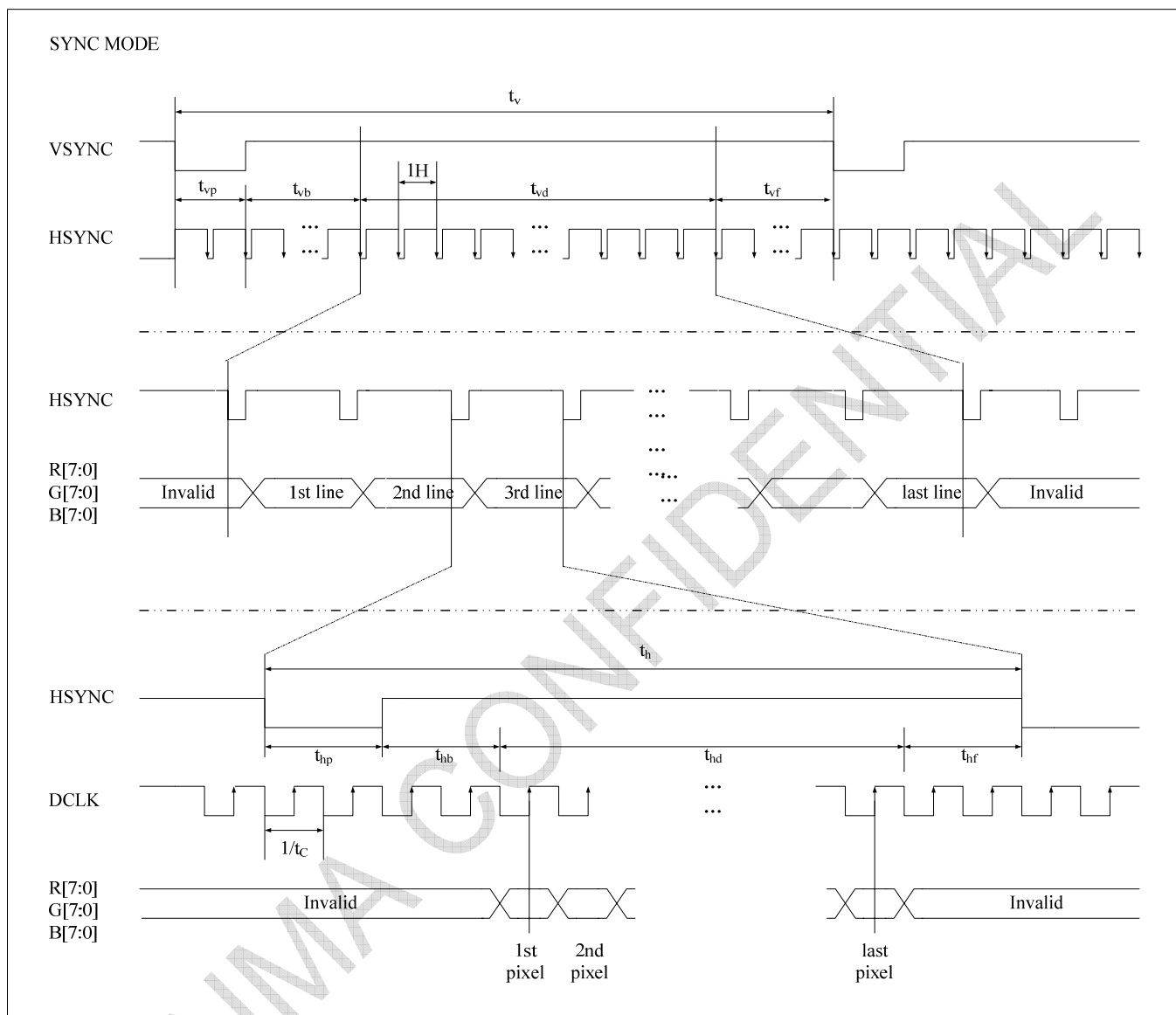


Figure 5.2.1 Data Input Timing Diagram Under SYNC Mode(DE="L")



## 5.2.2.2 Data Input Timing Diagram under DE Mode

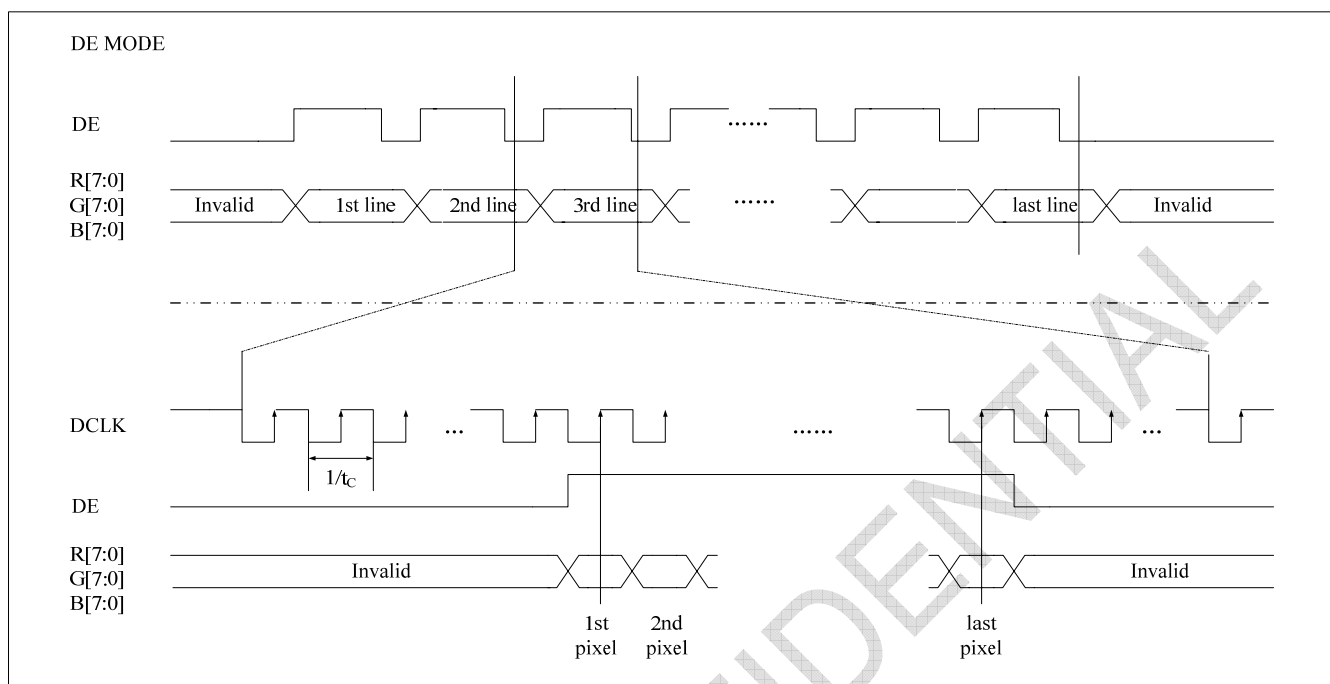


Figure 5.2.2 Data Input Timing Diagram Under DE Mode(VSYNC/HSYNC="H")



## 5.3 Power ON/OFF Sequence

### 5.3.1 Power ON Sequence

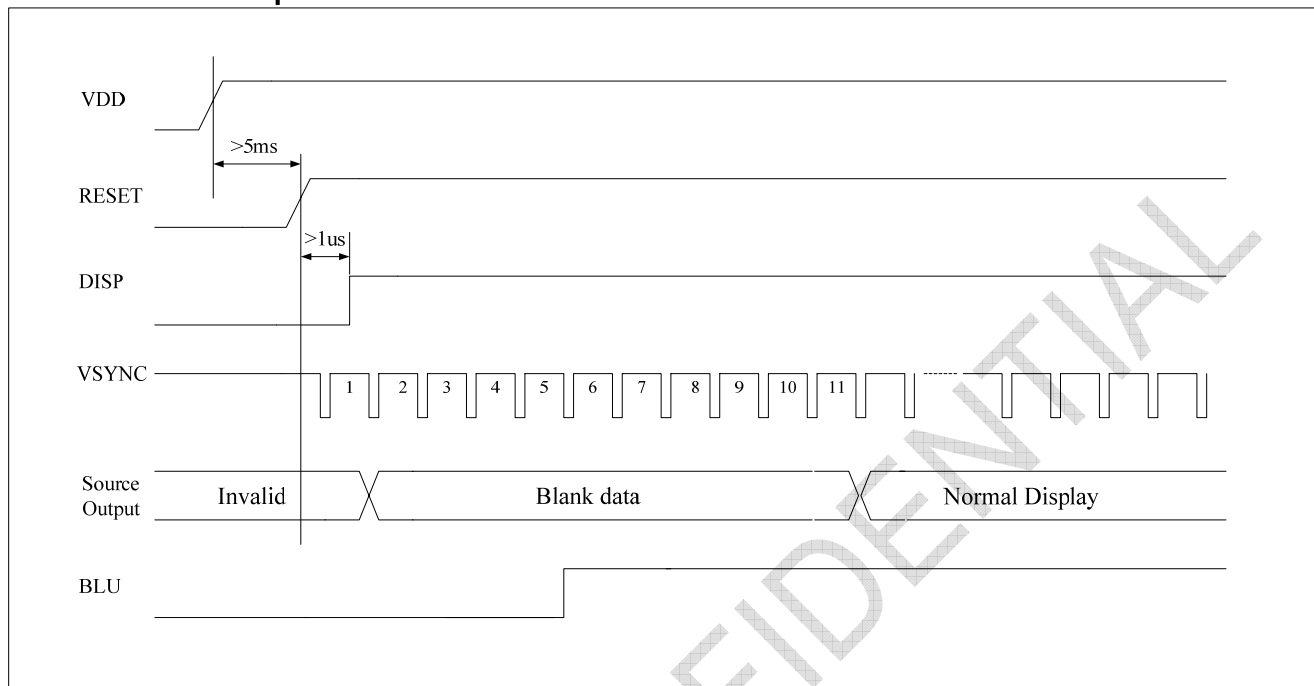


Figure 5.3.1 Power on sequence

### 5.3.2 Power OFF Sequence

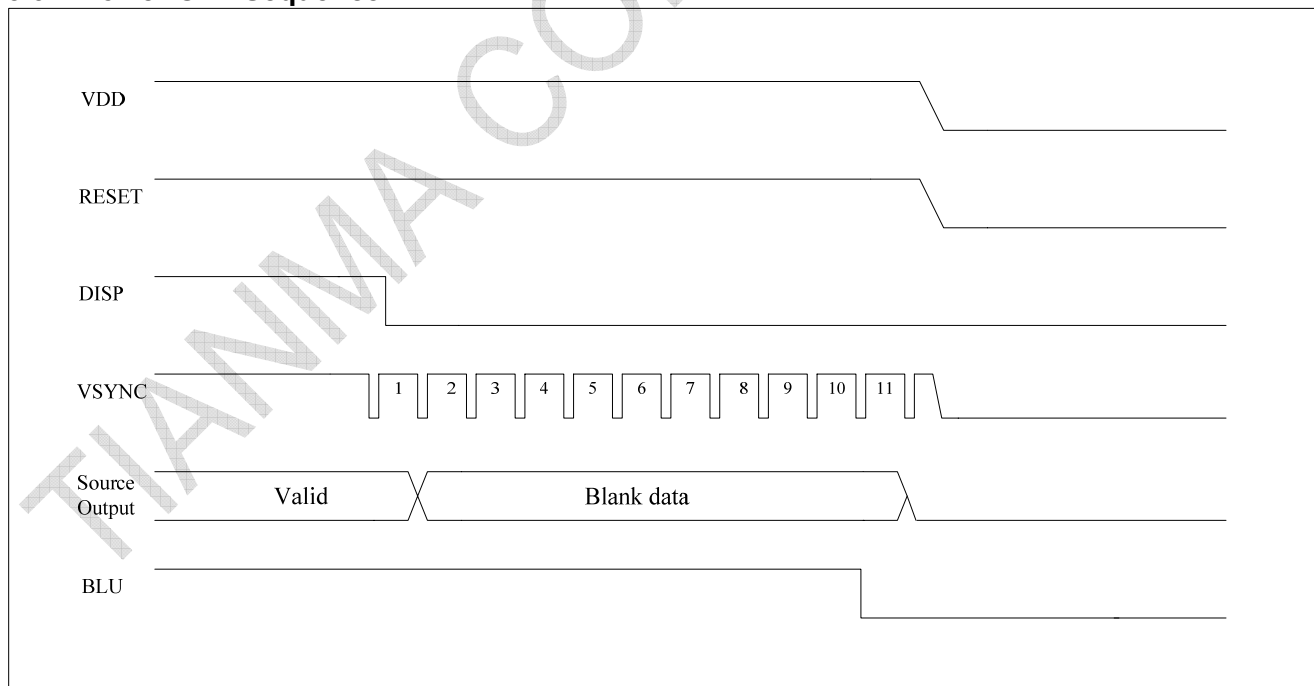


Figure 5.3.2 Power off sequence



## 6. Optical Characteristics

| Item           |       | Symbol           | Condition          | Min   | Typ   | Max   | Unit              | Remark         |
|----------------|-------|------------------|--------------------|-------|-------|-------|-------------------|----------------|
| View Angles    |       | θT               | CR ≥ 10            | 60    | 70    | --    | Degree            | Note 2         |
|                |       | θB               |                    | 40    | 50    | --    |                   |                |
|                |       | θL               |                    | 60    | 70    | --    |                   |                |
|                |       | θR               |                    | 60    | 70    | --    |                   |                |
| Contrast Ratio |       | CR               | θ=0°               | 400   | 500   | --    |                   | Note1、Note3    |
| Response Time  |       | T <sub>ON</sub>  | 25℃                | --    | 20    | 30    | ms                | Note1          |
|                |       | T <sub>OFF</sub> |                    |       |       |       |                   | Note4          |
| Chromaticity   | White | x                | Backlight<br>is on | 0.265 | 0.315 | 0.365 |                   | Note5<br>Note1 |
|                |       | y                |                    | 0.285 | 0.335 | 0.385 |                   |                |
|                | Red   | x                |                    | 0.531 | 0.581 | 0.631 |                   |                |
|                |       | y                |                    | 0.295 | 0.345 | 0.395 |                   |                |
|                | Green | x                |                    | 0.298 | 0.348 | 0.395 |                   |                |
|                |       | y                |                    | 0.531 | 0.581 | 0.631 |                   |                |
|                | Blue  | x                |                    | 0.103 | 0.153 | 0.203 |                   |                |
|                |       | y                |                    | 0.045 | 0.095 | 0.145 |                   |                |
| Uniformity     |       | U                |                    | 75    | 80    | --    | %                 | Note1、Note6    |
| NTSC           |       |                  |                    | --    | 50    | --    | %                 | Note 5         |
| Luminance      |       | L                |                    | 250   | 300   | --    | cd/m <sup>2</sup> | Note1、Note7    |

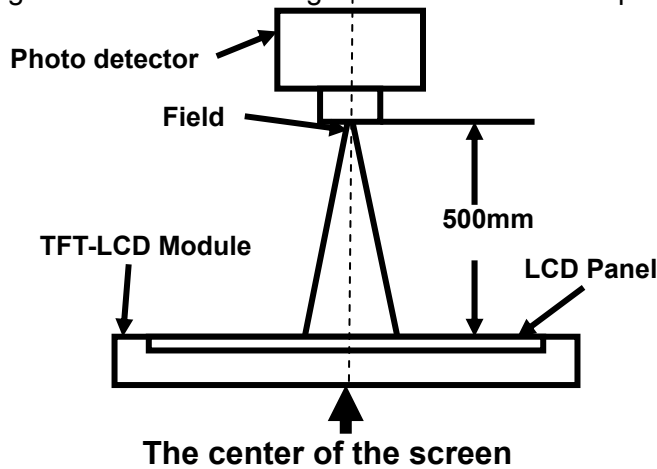
Test Conditions:

1.  $I_F = 20mA$ (one channel),the ambient temperature is  $25^\circ C$ .
2. The test systems refer to Note 1 and Note 2.



Note 1: Definition of optical measurement system.

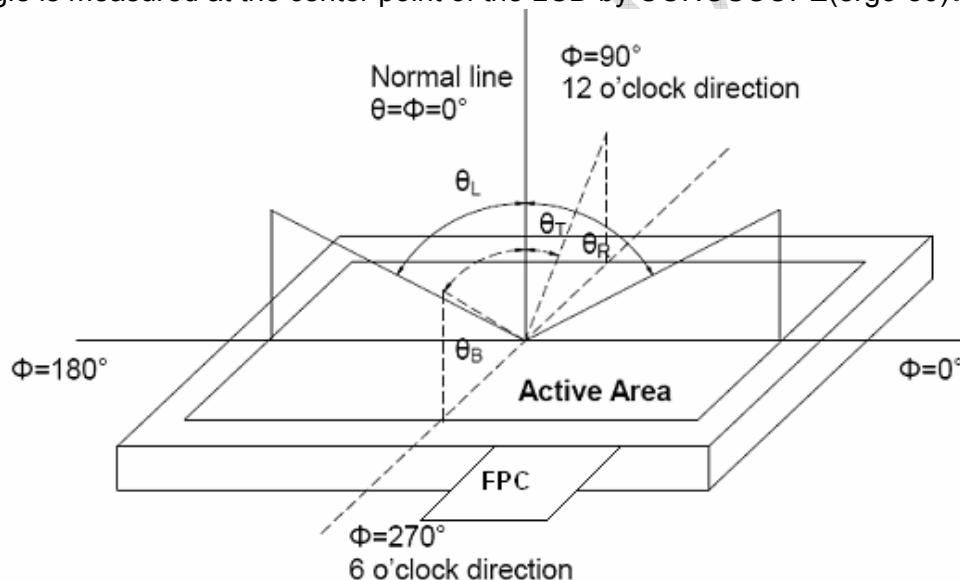
The optical characteristics should be measured in dark room. After 5 Minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



| 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

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

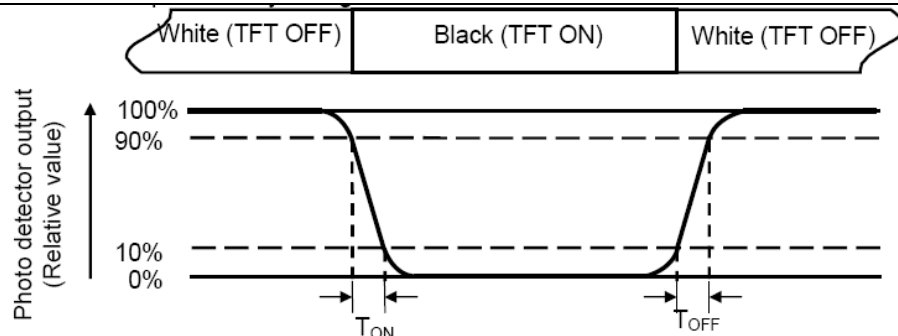
"White state": The state is that the LCD should drive by  $V_{\text{white}}$ .

"Black state": The state is that the LCD should drive by  $V_{\text{black}}$ .

$V_{\text{white}}$ : To be determined     $V_{\text{black}}$ : 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 ( $T_{\text{ON}}$ ) is the time between photo detector output intensity changed from 90% to 10%. And fall time ( $T_{\text{OFF}}$ ) is the time between photo detector output intensity changed from 10% to 90%.



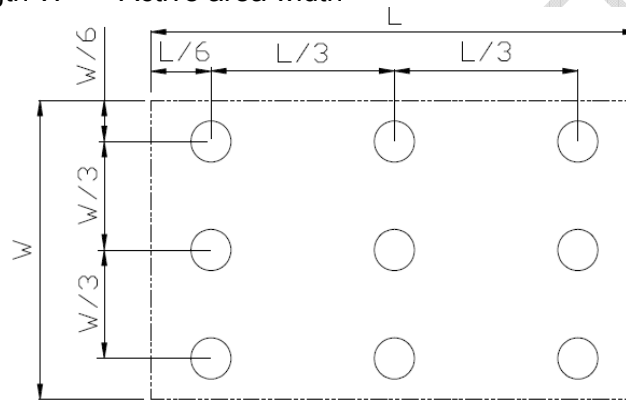
Note 5: Definition of color chromaticity (CIE1931)  
Color coordinates measured at center point of LCD.

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.

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.





## 7. Environmental / Reliability Test

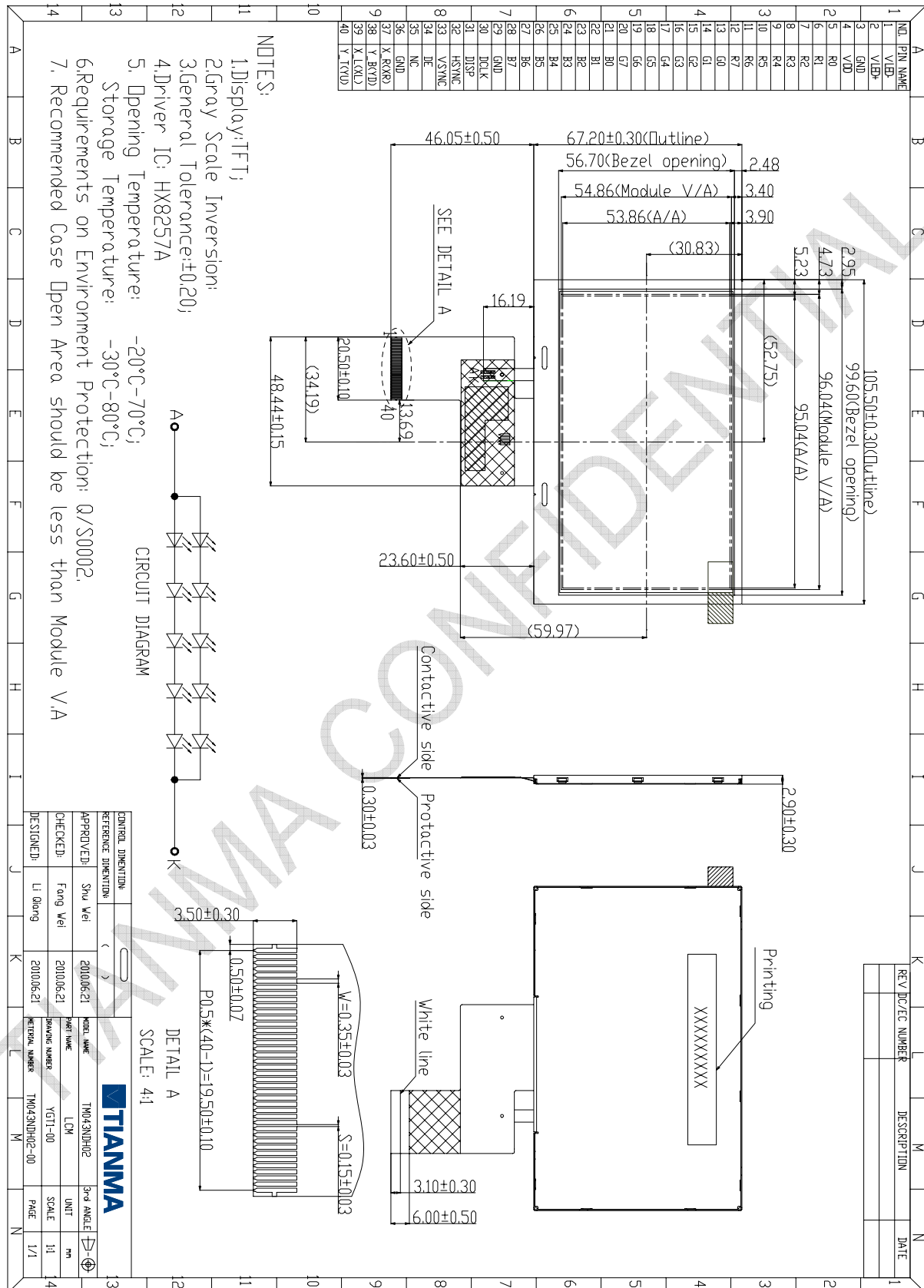
| No | Test Item                                | Condition                                                                                                                                 | Remarks                                                                               |
|----|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1  | High Temperature Operation               | Ts = +70℃, 240 hours                                                                                                                      | Note1<br>IEC60068-2-1,GB2423.2                                                        |
| 2  | Low Temperature Operation                | Ta = -20℃, 240 hours                                                                                                                      | IEC60068-2-1<br>GB2423.1                                                              |
| 3  | High Temperature Storage                 | Ta = +80℃, 240 hours                                                                                                                      | IEC60068-2-1<br>GB2423.2                                                              |
| 4  | Low Temperature Storage                  | Ta = -30℃, 240 hours                                                                                                                      | IEC60068-2-1<br>GB2423.1                                                              |
| 5  | Storage at High Temperature and Humidity | Ta = +60℃, 90% RH max,240hours                                                                                                            | Note2<br>IEC60068-2-78<br>GB/T2423.3                                                  |
| 6  | Thermal Shock (non-operation)            | -20℃ 30 min~+80℃ 30 min,<br>Change time:5min, 100 Cycle                                                                                   | Start with cold temperature,<br>End with high temperature,<br>IEC60068-2-14,GB2423.22 |
| 7  | ESD                                      | C=150pF,R=330Ω,5point/panel<br>Air:±8Kv,5times;<br>Contact:±4Kv,5times<br>(Environment:15℃~35℃,<br>30%~60%.86Kpa~106Kpa)                  | IEC61000-4-2<br>GB/T17626.2                                                           |
| 8  | Vibration Test                           | Frequency range:10~55Hz<br>Stroke:1.5mm<br>Sweep:10Hz~55Hz~10Hz<br>2 hours for each direction of X.Y.Z.<br>(6 hours for total)            | IEC60068-2-6<br>GB/T2423.10                                                           |
| 9  | Mechanical Shock (Non Op)                | Half Sine Wave<br>60G 6ms, ±X,±Y,±Z<br>3times for each direction                                                                          | IEC60068-2-27<br>GB/T2423.5                                                           |
| 10 | Package Drop Test                        | Height:60cm,<br>1corner,3edges,6surfaces                                                                                                  | IEC60068-2-32<br>GB/T2423.8                                                           |
| 11 | Package Vibration Test                   | Random Vibration:<br>0.015G*G/Hz for 5-200Hz,<br>-6dB/Octave from 200-500Hz<br>2 hours for each direction of X,Y,Z<br>(6 hours for total) | IEC60068-2-34<br>GB/T2423.11                                                          |

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

Note2: Ta is the ambient temperature of samples.



## 8. Mechanical Drawing





## 9. Packing Drawing

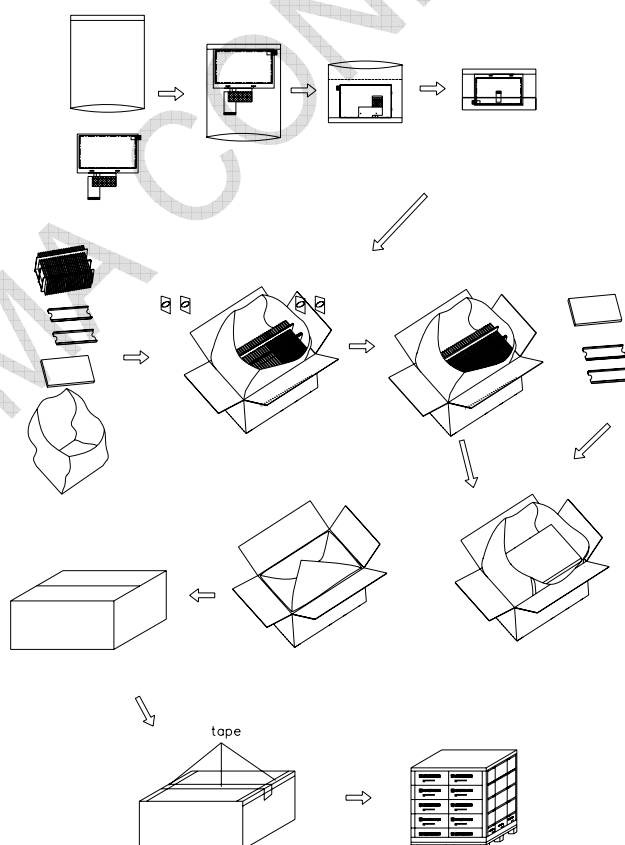
### 9.1 Packaging Material

| No | Item            | Model(Material)  | Dimensions (mm) | Unit Weigt (Kg) | Quantity | Remark      |
|----|-----------------|------------------|-----------------|-----------------|----------|-------------|
| 1  | LCM module      | TM043NDH02       | 105.5x67.2x2.9  | 0.044           | 112      |             |
| 2  | Partition_1     | Corrugated Paper | 513x333x106     | 0.7             | 2        |             |
| 3. | Anti-Static Bag | PE               | 175.8x125x0.05  | 0.0007          | 112      | Anti-static |
| 4  | Dust-Proof Bag  | PE               | 700x530         | 0.0600          | 1        |             |
| 5  | Partition_2     | Corrugated Paper | 505x332x4.00    | 0.09            | 3        |             |
| 6  | Corrugated Bar  | Corrugated Paper | 513x117x3       | 0.04            | 8        |             |
| 7  | Carton          | Corrugated Paper | 530x350x250     | 1.1000          | 1        |             |
| 8  | Total weight    | TBD Kg           |                 |                 |          |             |

Note: Packaging Specification and Quantity

Module quantity in a carton: 28pcs(per row)x2(per column)x2= 112pcs

### 9.2 Packing Instruction





## 10. Precautions for Use of LCD Modules

### 10.1 Handling Precautions

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

10.1.2 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.

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

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

10.1.5 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

10.1.6 Do not attempt to disassemble the LCD Module.

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

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

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

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

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

10.1.8.4 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.

### 10.2 Storage precautions

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

10.2.2 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%

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

### 10.3 Transportation Precautions

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