**MODEL NO. : TM047NDH03**

**ISSUED DATE: 2009-12-16**

**VERSION : Ver 2.2**

□**Preliminary Specification**
■**Final Product Specification**



Customer :_____

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

SHANGHAI TIANMA Confirmed :

| Prepared by | Checked by | Approved by |
|---|---|---|
| 2010.1.12 | 2010-01-13 | 劉慶全 |

This technical specification is subjected to change without notice

# Table of Contents

# Record of Revision

| Rev | Issued Date | Description | Editor |
|---|---|---|---|
| 1.0 | 2009-1-9 | Rev 1.0 was issued | Haijun He |
| 2.0 | 2009-2-5 | Update to final product spec | Haijun He |
| 2.1 | 2009-11-30 | Modify luminance typ from 350 to 320<br>Modify luminance min from 300 to280 | Xing Nie |
| 2.2 | 2009-12-16 | Revise Interface to RGB 24 bits with TCON in page 4<br>Update Operating Life Time in page 7<br>Revise View Angles ΘT in page 14<br>Update Reliability Test Remarks in page 18 | Xing Nie |
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# 1 General Specifications

| Feature | | Spec |
|---|---|---|
| **Display Spec.** | Size | 4.7 inch |
| | Resolution | 480(RGB) x 272 |
| | Interface | RGB 24 bits with TCON |
| | Color Depth | 16.7M |
| | Technology type | a-Si |
| | Pixel pitch (mm) | 0.216 x 0.216 |
| | Pixel Configuration | R.G.B. Vertical Stripe |
| | Display Mode | TM with Normally White |
| | Surface Treatment(Up Polarizer) | Clear type (3H) |
| | Viewing Direction | 12 o'clock |
| | Gray Scale Inversion Direction | 6 o'clock |
| **Mechanical Characteristics** | LCM (W x H x D) (mm) | 114.3x72.5x3.80 |
| | Active Area(mm) | 103.680 x 58.752 |
| | With /Without TSP | Without TSP |
| | Weight(g) | 60 |
| | 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: The weight tolerance:±5%

# 2 Input/Output Terminals

## 2.1 TFT LCD Panel

**Recommended connector: HIROSE FH12A-40S-0.5SH**

| No | Symbol | I/O | Description | Remark |
|---|---|---|---|---|
| 1 | VLED- | P | Power for LED | |
| 2 | VLED+ | P | Power for LED | |
| 3 | GND | P | Power Ground | |
| 4 | VDD | P | Power Supply (+3.3V) | |
| 5 | R0 | I | Red data | |
| 6 | R1 | I | Red data | |
| 7 | R2 | I | Red data | |
| 8 | R3 | I | Red data | |
| 9 | R4 | I | Red data | |
| 10 | R5 | I | Red data | |
| 11 | R6 | I | Red data | |
| 12 | R7 | I | Red data | |
| 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 | G6 | I | Green data | |
| 20 | G7 | I | Green data | |
| 21 | B0 | I | Blue data | |
| 22 | B1 | I | Blue data | |
| 23 | B2 | I | Blue data | |
| 24 | B3 | I | Blue data | |
| 25 | B4 | I | Blue data | |
| 26 | B5 | I | Blue data | |
| 27 | B6 | I | Blue data | |
| 28 | B7 | I | Blue data | |
| 29 | GND | P | Power Ground | |
| 30 | PCLK | I | Pixel clock | |
| 31 | DISP | I | Display on/off | |
| 32 | HSYNC | I | Horizontal sync signal | |
| 33 | VSYNC | I | Vertical sync signal | |
| 34 | DE | I | Date enable | |
| 35 | NC | - | No connection | |
| 36 | GND | P | Power Ground | |
| 37 | X1 | - | No connection | |
| 38 | Y1 | - | No connection | |
| 39 | X2 | - | No connection | |
| 40 | Y2 | - | No connection | |

Note2-1: I/O definition：

I-----Input O---Output P----Power/Ground

# 3 Absolute Maximum Ratings

## 3.1 Driving TFT LCD Panel

Ta = 25°C

| Item | Symbol | Min | Max | Unit | Remark |
|---|---|---|---|---|---|
| Power Supply Voltage | VDD | -0.3 | 4.6 | V | |
| Input Signal Voltage | R0-R7,G0-G7,B0-B7,PCLK,DISP, HSYNC, VSYNC, DE | -0.3 | VDD +0.3 | V | |
| Back Light Forward Current | $I_{LED}$ | -- | 25 | mA | For each LED |
| Operating Temperature | $T_{OPR}$ | -20 | 60 | ℃ | |
| Storage Temperature | $T_{STG}$ | -30 | 70 | ℃ | |

# 4 Electrical Characteristics

## 4.1 Driving TFT LCD Panel

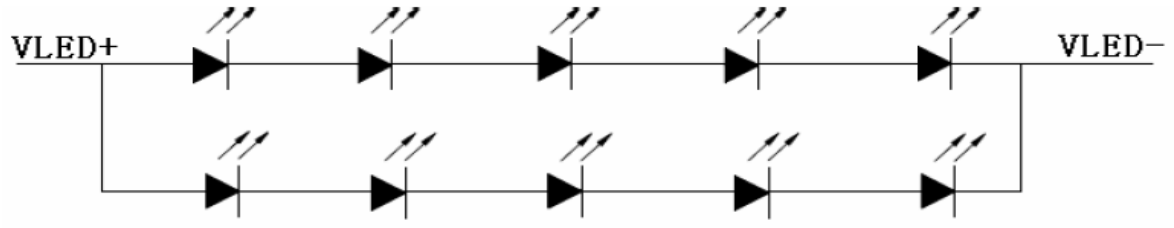
GND=0V, Ta=25℃

| Item | | Symbol | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|---|
| Power Supply Voltage | | VDD | 3.0 | 3.3 | 3.6 | V | |
| Input Signal Voltage | Low Level | $V_{IL}$ | -0.3 | -- | 0.2xVDD | V | R0-R7,G0-G7,B0-B7 PCLK, DISP, HSYNC, VSYNC, DE |
| | High Level | $V_{IH}$ | 0.8xVDD | -- | VDD | V | |
| Output Signal Voltage | Low Level | $V_{OL}$ | 0 | -- | 0.2xVDD | V | |
| | High Level | $V_{OH}$ | 0.8xVDD | -- | VDD- | V | |
| (Panel+ LSI) Power Consumption | | Black Mode (60Hz) | -- | 85 | 90 | mW | |
| | | Standby Mode | -- | 0.8 | 1.0 | uW | |

4.2 Driving Backlight Ta=25℃

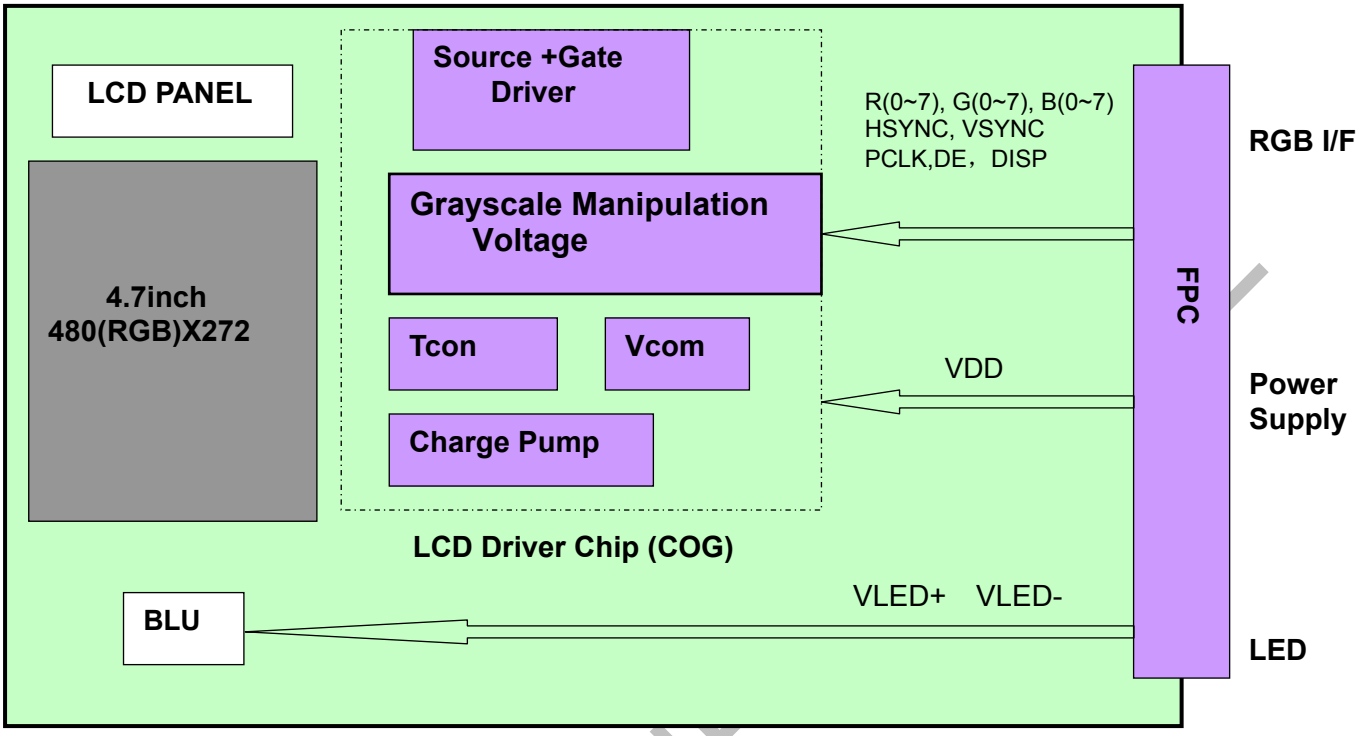
| Item | Symbol | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|
| Forward Current | $I_F$ | -- | 40 | 50 | mA | 5LEDs serial x 2 |
| Forward Voltage | $V_F$ | -- | 16 | -- | V | |
| Power Consumption | $W_{BL}$ | -- | 640 | -- | mW | |
| Operating Life Time | -- | 10000 | （20000） | -- | hrs | Note 2 |

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




Note 2: $I_F$ is defined for one channel LED.
Optical performance should be evaluated at Ta=25℃ 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% initial brightness.
Typical operating life time is estimated data.

### 4.3 Block Diagram



# 5 Timing Chart

## 5.1 RGB Timing Parameter

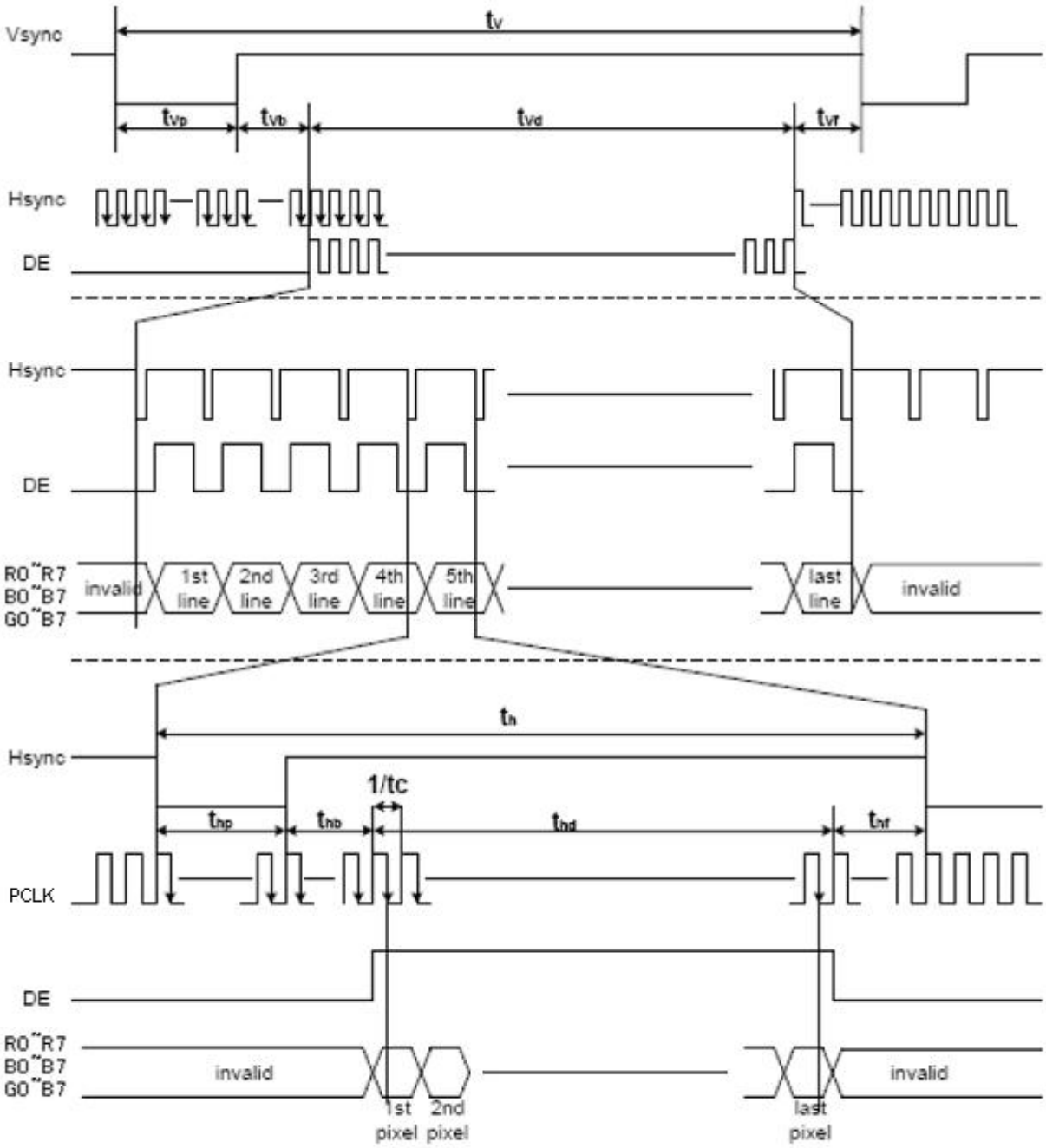
| Item | Symbol | Values | | | Unit | Remark |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| **Clock cycle** | 1/tc | - | 9.00 | 15 | MHz | |
| **Hsync cycle** | 1/fH | - | 17.14 | - | KHz | |
| **Vsync cycle** | 1/fV | - | 59.94 | - | Hz | |
| **Horizontal signal** | Th | 525 | 525 | 605 | CLK | |
| **Horizontal display period** | Thd | 480 | 480 | 480- | CLK | |
| **Horizontal Front porch** | Thf | 2 | 2 | 82 | CLK | |
| **Horizontal Pulse width** | Thp | 2 | 41 | 41 | CLK | |
| **Horizontal Back porch** | Thb | 2 | 2 | 41 | CLK | |
| **Vertical cycle** | Tv | 285- | 286 | 511 | H | |
| **Vertical display period** | Tvd | 272 | 272 | 272 | H | |
| **Vertical Front porch** | Tvf | 1 | 2 | 227 | H | |
| **Vertical Pulse width** | Tvp | 1 | 10 | 11 | H | |
| **Vertical Back porch** | Tvb | 1 | 2 | 11 | H | |
| **DISP Setup Time** | Tdiss | 10 | - | - | ns | |
| **DISP Hold Time** | Tdish | 10 | - | - | ns | |
| **Clock Period** | PW CLK | 66.7 | - | - | ns | |
| **Clock Pulse High Period** | PWH | 26.7 | - | - | ns | |
| **Clock Pulse Low Period** | PWL | 26.7 | - | - | ns | |
| **Hsync Setup Time** | Ths | 10 | - | - | ns | |
| **Hsync Hold Time** | Thh | 10 | - | - | ns | |
| **Data Setup Time** | Tds | 10 | - | - | ns | |
| **Data Hold Time** | Tdh | 10 | - | - | ns | |
| **DE Setup Time** | Tdes | 10 | - | - | ns | |
| **DE Hold Time** | Tdeh | 10 | - | - | ns | |
| **Vsync Setup Time** | Tvhs | 10 | - | - | ns | |
| **Vsync Hold Time** | Tvhh | 10 | - | - | ns | |

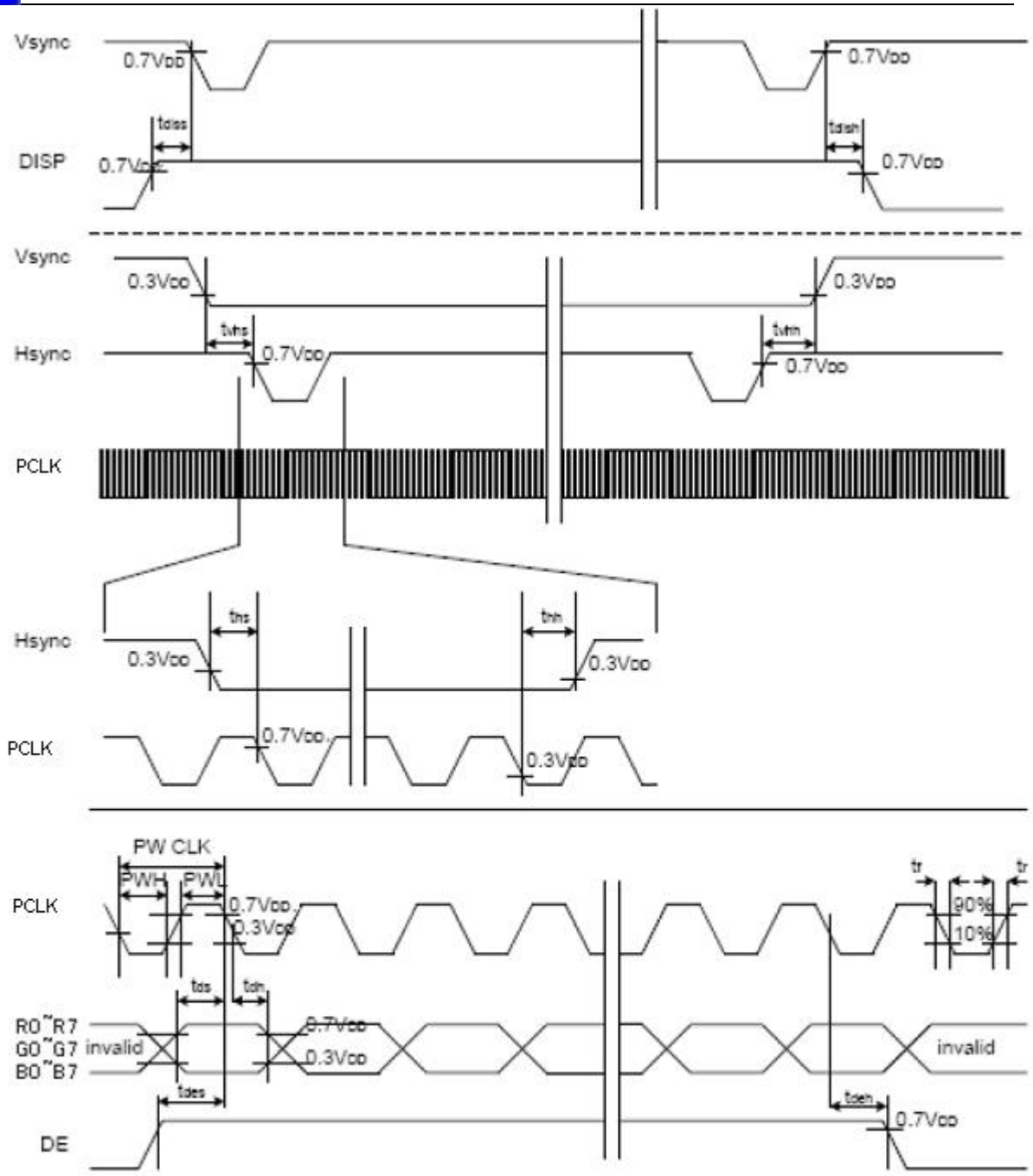
Note 1: Thd=480CLK, Thf= 2CLK, Thp= 41CLK, Thb= 2CLK

525CLK=480CLK + 2CLK + 41CLK + 2CLK

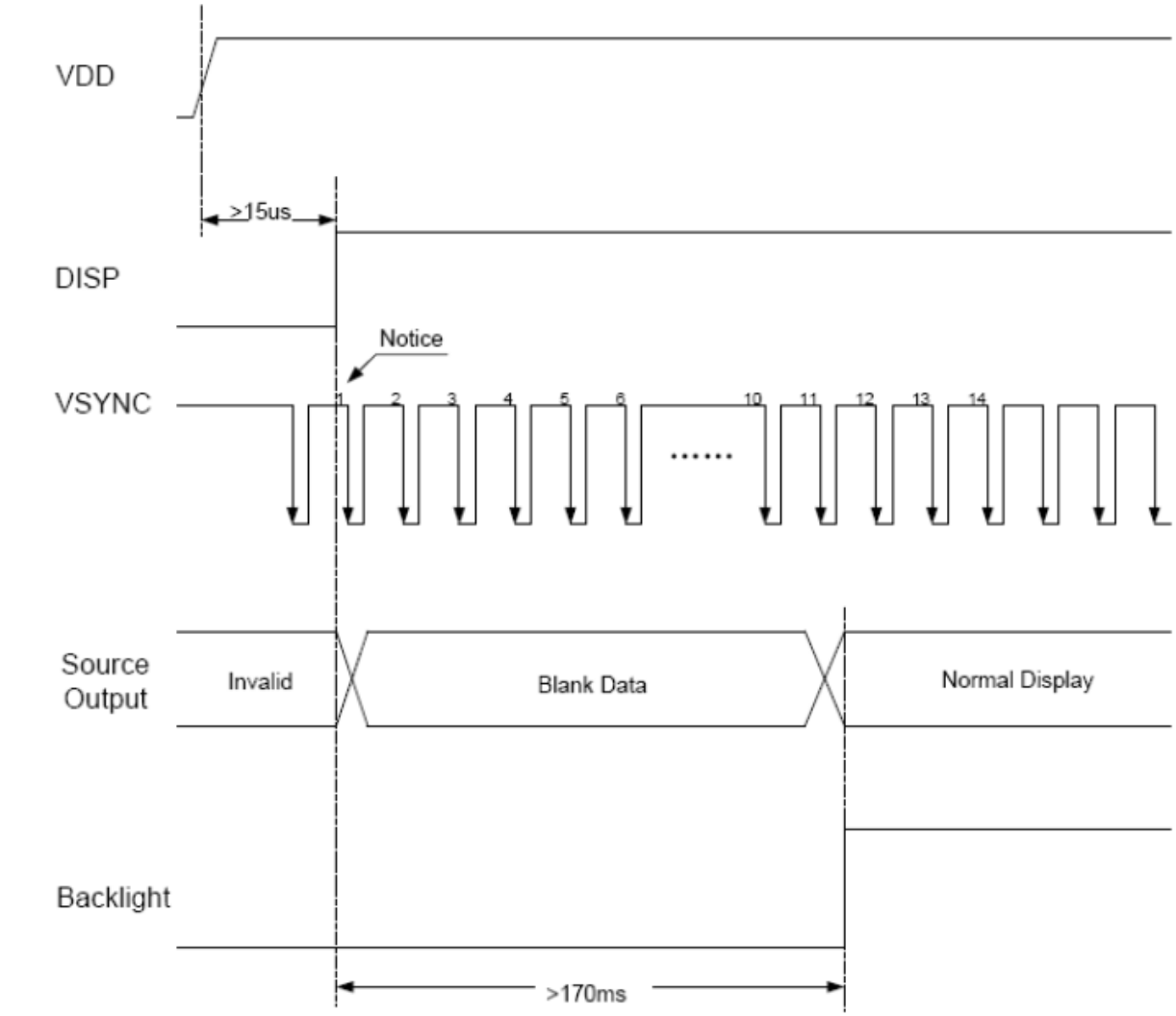
Note 2: Thf+ Thp+ Thb > 44 CLK

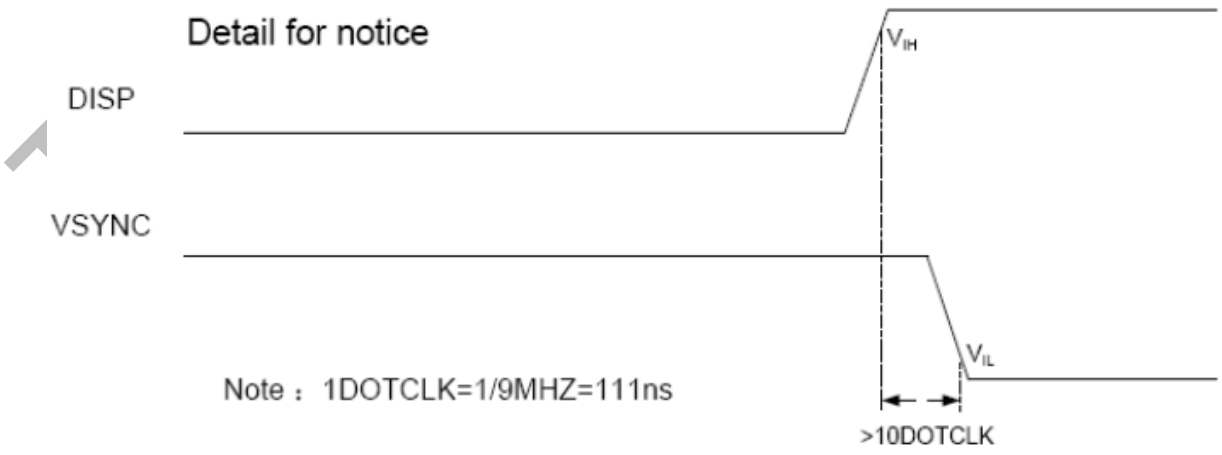
## 5.2 RGB Timing Chart



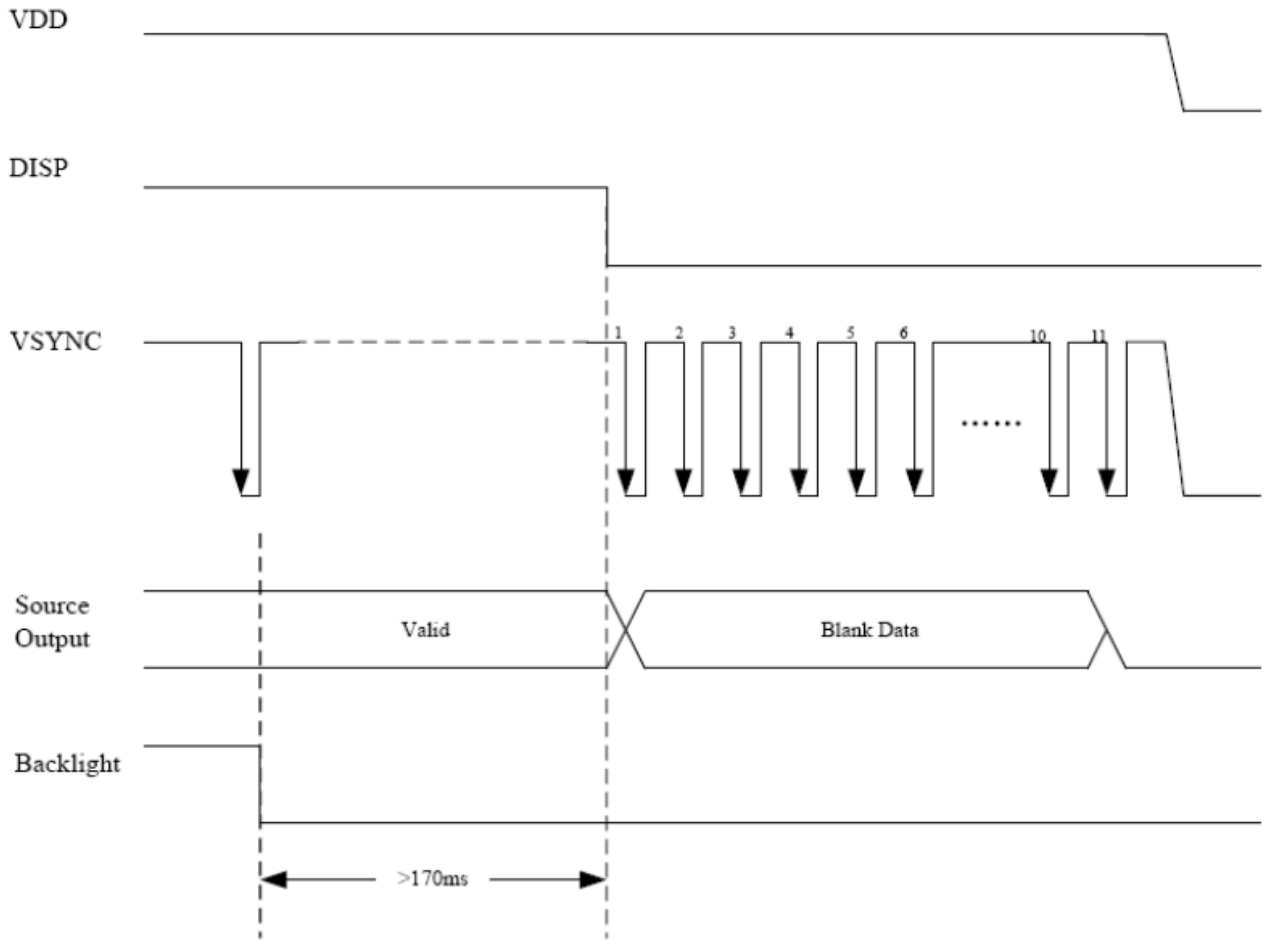


## 5.3 Power On Sequence



## 5.4 Power Off Sequence



# 6 Optical Characteristics

## 6.1 Optical Specification

Ta=25℃

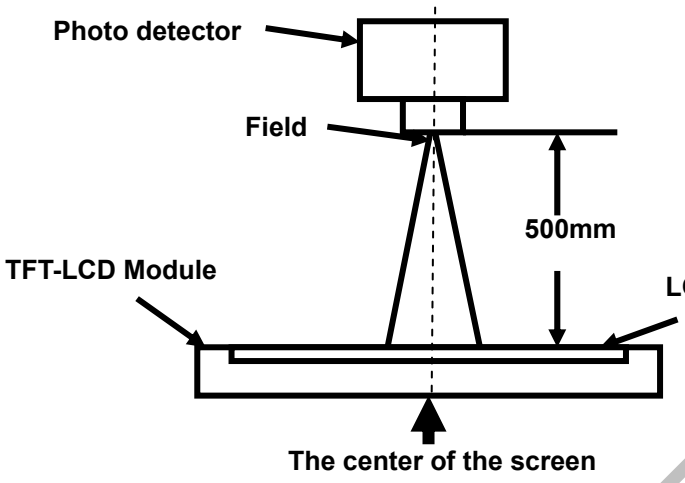
| Item | | Symbol | Condition | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| View Angles | | ΘT | CR≧10 | 50 | 60 | - | Degree | Note 2 |
| | | ΘB | | 60 | 70 | - | | |
| | | ΘL | | 60 | 70 | - | | |
| | | ΘR | | 60 | 70 | - | | |
| Contrast Ratio | | CR | Θ=0° | 300 | 500 | - | | Note1 Note3 |
| Response Time | | $T_{ON}$ | 25℃ | - | 25 | 40 | ms | Note1 Note4 |
| | | $T_{OFF}$ | | | | | | |
| Chromaticity | White | x | Backlight is on | 0.260 | 0.310 | 0.360 | | Note5, Note1 |
| | | y | | 0.280 | 0.330 | 0.380 | | |
| | Red | x | | 0.550 | 0.600 | 0.650 | | |
| | | y | | 0.300 | 0.350 | 0.400 | | |
| | Green | x | | 0.290 | 0.340 | 0.390 | | |
| | | y | | 0.510 | 0.560 | 0.610 | | |
| | Blue | x | | 0.090 | 0.140 | 0.190 | | |
| | | y | | 0.050 | 0.100 | 0.150 | | |
| Uniformity | | U | | 75 | 80 | - | % | Note1 Note6 |
| NTSC | | | | - | 50 | - | % | Note 5 |
| Luminance(without TP) | | L | | 280 | 320 | - | $cd/m^2$ | Note1 Note7 |

Test Conditions:

1. VDD=3.3V, $I_L$=20mA(LED current), the ambient temperature is 25℃.
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)。

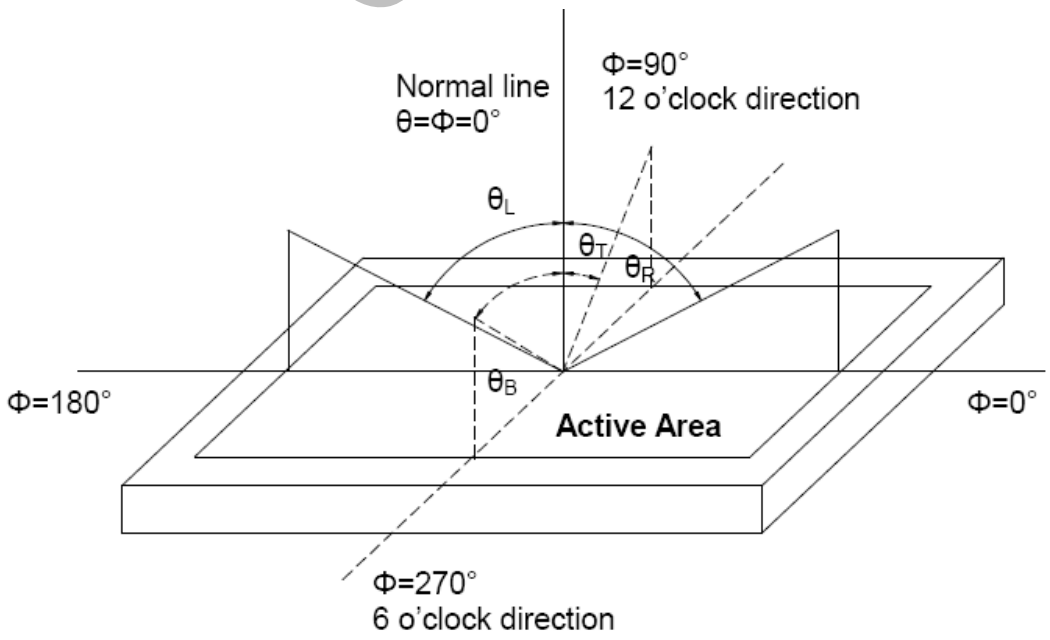



Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

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

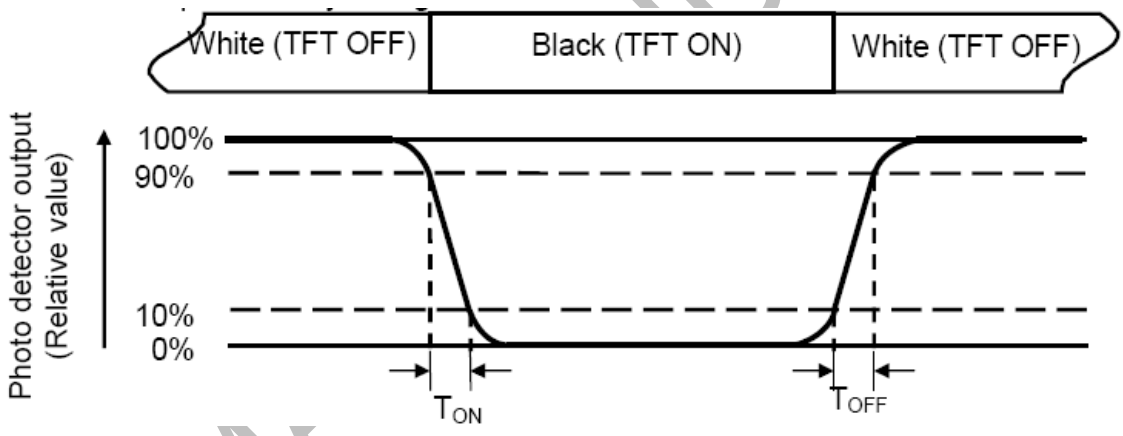
“White state “:The state is that the LCD should driven by Vwhite.

“Black state”: The state is that the LCD should driven by Vblack.

Vwhite: To be determined Vblack: 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 (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) 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) = Lmin/ Lmax

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

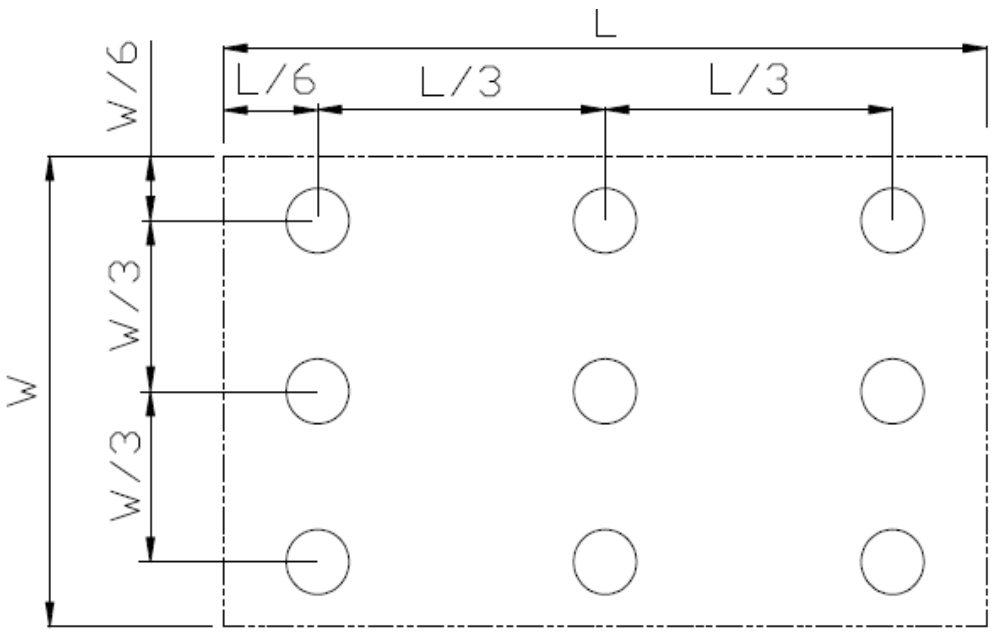



Fig. 2 Definition of uniformity

Lmax: The measured maximum luminance of all measurement position.

Lmin: The measured minimum luminance of all measurement position.

## Note 7: Definition of Luminance :

Measure the luminance of white state at center point.

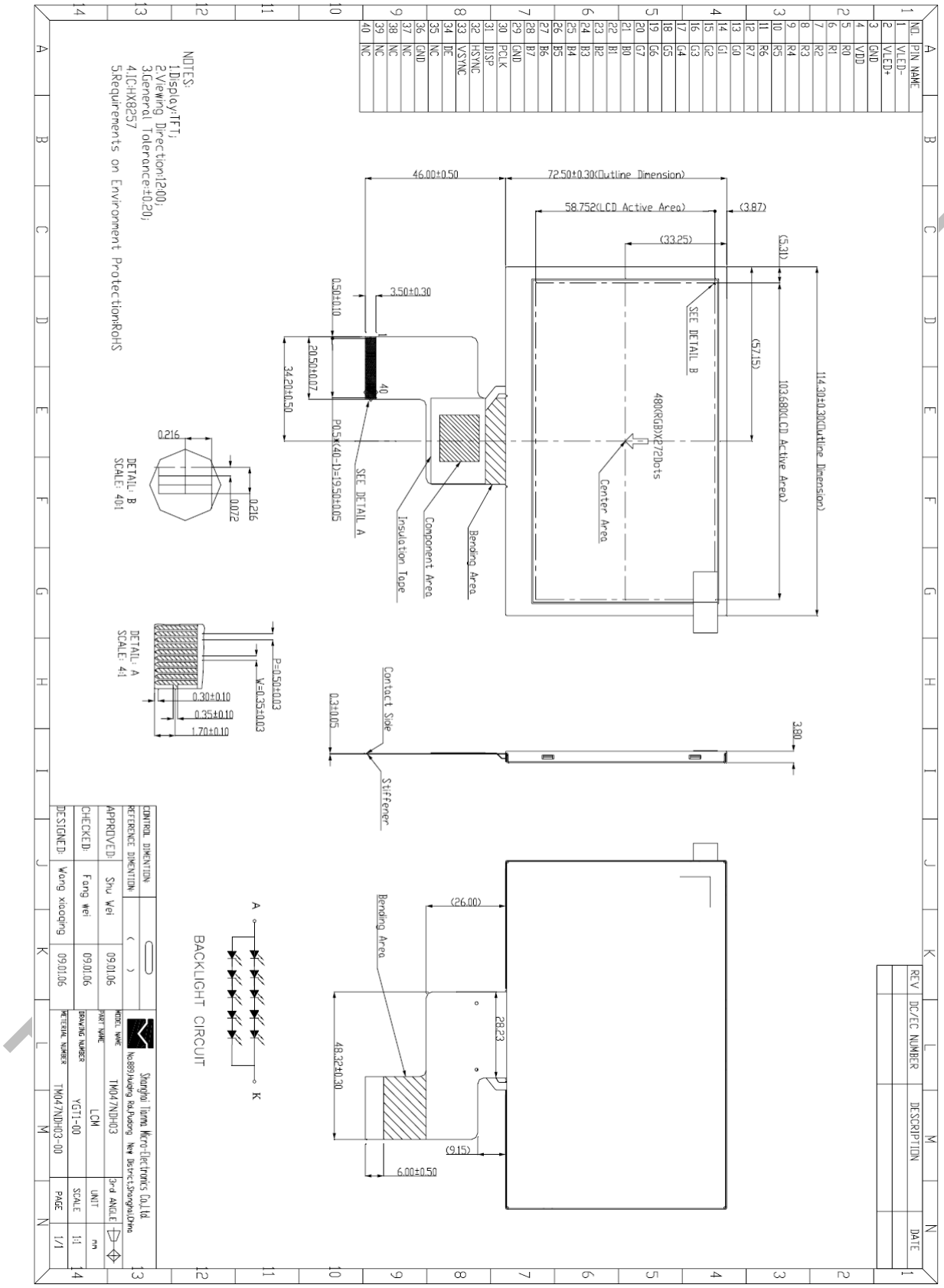
# 7 Environmental / Reliability Test

| No | Test Item | Condition | Remarks |
|---|---|---|---|
| 1 | High Temperature Operation | Ts=+60℃, 240hrs | Note1<br>IEC60068-2-1,GB2423.2 |
| 2 | Low Temperature Operation | Ta=-20℃, 240hrs | IEC60068-2-1<br>GB2423.1 |
| 3 | High Temperature Storage | Ta=+70℃, 240hrs | IEC60068-2-2,<br>GB2423.2 |
| 4 | Low Temperature Storage | Ta=-30℃, 240hrs | IEC60068-2-1<br>GB2423.1 |
| 5 | High Temperature & High Humidity Storage | Ta=+60℃, 90% RH<br>240 hours | Note2<br>IEC60068-2-78 ,<br>GB/T2423.3 |
| 6 | Thermal Shock (Non-operation) | -30℃ 30 min~+70℃ 30 min,<br>Change time:5min, 20 Cycles | Start with cold temperature,<br>End with high temperature,<br>IEC60068-2-14,GB2423.22 |
| 7 | Electro Static Discharge (Operation) | C=150pF, R=330Ω，5points/panel<br>Air:±8KV, 5times;<br>Contact:±4KV, 5 times;<br>（Environment: 15℃～35℃,<br>30%～60%, 86Kpa～106Kpa） | IEC61000-4-2<br>GB/T17626.2 |
| 8 | Vibration (Non-operation) | Frequency range:10~55Hz,<br>Stroke:1.5mm<br>Sweep:10Hz~55Hz~10Hz 2 hours<br>for each direction of X.Y.Z.<br>(6 hours for total)(Package condition) | IEC60068-2-6<br>GB/T2423.10 |
| 9 | Package Drop Test | Height:80 cm,<br>1 corner, 3 edges, 6 surfaces | IEC60068-2-32<br>GB/T2423.8 |

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

Note2: Ta is the ambient temperature of sample.

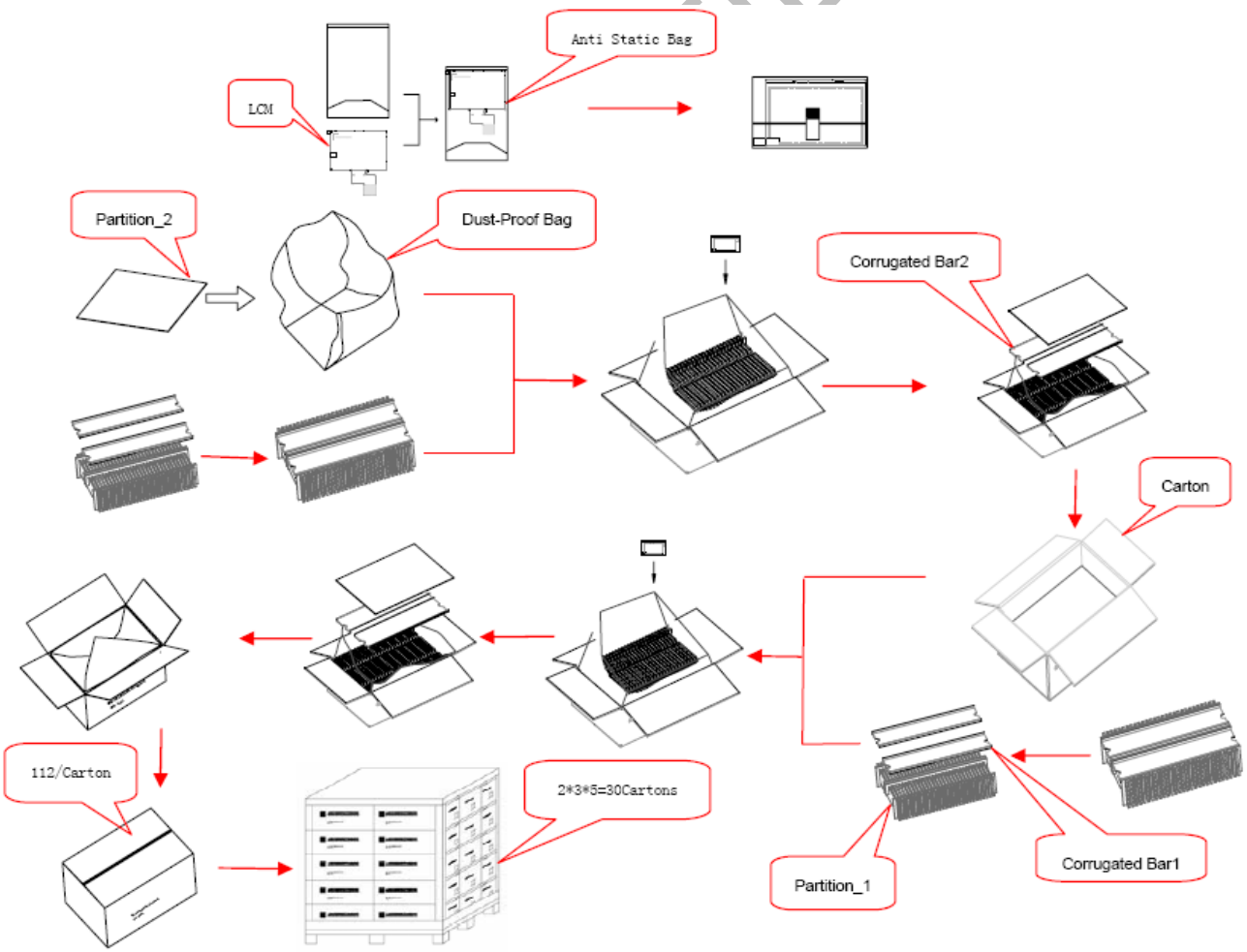
# 8 Mechanical Drawing



# 9 Packing Drawing

| No | Item | Model (Material) | Dimensions (mm) | Unit Weight (Kg) | Quantity | Remark |
|---|---|---|---|---|---|---|
| 1 | LCM module | TM047NDH03 | 114.3x72.5x3.8 | 0.0600 | 112 | |
| 2 | Partition_1 | Corrugated Paper | 513x333x106 | 0.7000 | 2 | |
| 3. | Anti-Static Bag | PE | 175.8x125x0.05 | 0.0007 | 112 | Anti-static |
| 4 | Dust-Proof Bag | PE | ---------- | 0.0600 | 1 | |
| 5 | Partition_2 | Corrugated Paper | 505x332x4.00 | 0.0900 | 3 | |
| 6 | Corrugated Bar | Corrugated paper | 513x160x3 | 0.0400 | 8 | |
| 8 | Carton | Corrugated Paper | 530x350x250 | 1.1000 | 1 | |
| 9 | Total weight(kg) | 11.5±5% | | | | |





# 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:

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