MODEL NO. : TM070RBH01

ISSUED DATE: 2009-12-14

VERSION : Ver 2.2

□Preliminary Specification
■Final Product Specification

Customer :

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

SHANGHAI TIANMA Confirmed :

| Prepared by | Checked by | Approved by |
|---|---|---|
| 聂翌 2010.1.13 | 张振东 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 | 2008-11-10 | Preliminary Specification Release | Yuna Wang |
| 1.1 | 2008-11-25 | Update Model Name<br>from TS070RAATB01-00 to TM070RBH01 | Yuna Wang |
| 2.0 | 2009-04-08 | Final Product Specification Release | Yuna Wang |
| 2.1 | 2009-09-24 | Update Source driver input timing parameters;<br>Add Gamma Correction Reference Voltage Setting Note | Xing Nie |
| 2.2 | 2009-12-14 | Revise Interface to RGB18 bits without TCON in page 4<br>Update Operating Life Time in page 12<br>Revise View Angles in page 19<br>Update Reliability Test Remarks in page 22 | Xing Nie |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

# 1 General Specifications

| Feature | | Spec |
|---|---|---|
| **Display Spec.** | Size | 6.95 inch |
| | Resolution | 800(RGB) x 480 |
| | Interface | RGB18 bits without TCON |
| | Color Depth | 262K |
| | Technology Type | a-Si |
| | Pixel Pitch (mm) | 0.1965x0.1715 |
| | Pixel Configuration | R.G.B. Vertical Stripe |
| | Display Mode | TM with Normally White |
| | Surface Treatment(Up Polarizer) | Anti Glare |
| | Surface Treatment(TSP) | Anti Glare |
| | Viewing Direction | 12 o'clock |
| | Gray Scale Inversion Direction | 6 o'clock |
| **Mechanical Characteristics** | LCM (W x H x D) (mm) | 167.40x93.70x4.69 |
| | Active Area(mm) | 157.20x82.32 |
| | With /Without TSP | With TSP |
| | Weight (g) | 146.5 |
| | LED Numbers | 27 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: +/- 5%

# 2 Input/Output Terminals

**TFT-LCD Panel Driving**

Matching Connector of SUNCAGEY BL114-35-RU-TAND

J1 of FPC2

| Pin | Symbol | I/O | Description | Remark |
|---|---|---|---|---|
| 1 | LED+ | P | LED Anode | |
| 2 | NC | N | No connection | |
| 3 | LED1- | P | LED Cathode | |
| 4 | LED2- | P | LED Cathode | |
| 5 | LED3- | P | LED Cathode | |
| 6 | DIO1 | I/O | Horizontal start pulse signal | Note2 |
| 7 | VSS1 | P | Ground | Note1 |
| 8 | VDD1 | P | Power supply | Note1 |
| 9 | CLK | I | Horizontal shift clock | |
| 10 | VSS1 | P | Ground | Note1 |
| 11 | R/L | I | Right/left selection | Note2 |
| 12 | R0 | I | Red data(LSB) | |
| 13 | R1 | I | Red data | |
| 14 | R2 | I | Red data | |
| 15 | R3 | I | Red data | |
| 16 | R4 | I | Red data | |
| 17 | R5 | I | Red data | |
| 18 | VSS1 | P | Ground | Note1 |
| 19 | G0 | I | Green data(LSB) | |
| 20 | G1 | I | Green data | |
| 21 | G2 | I | Green data | |
| 22 | G3 | I | Green data | |
| 23 | G4 | I | Green data | |
| 24 | G5 | I | Green data | |
| 25 | VSS1 | P | Ground | Note1 |
| 26 | B0 | I | Blue data(LSB) | |
| 27 | B1 | I | Blue data | |

| | | | | |
|---|---|---|---|---|
| 28 | B2 | I | Blue data | |
| 29 | B3 | I | Blue data | |
| 30 | B4 | I | Blue data | |
| 31 | B5 | I | Blue data | |
| 32 | LD | I | Load output signal | Note2 |
| 33 | REV | I | Data invert control | |
| 34 | POL | I | Polarity selection | |
| 35 | DIO2 | I/O | Horizontal start pulse signal | Note2 |

**J2 of FPC1**

| Pin | Symbol | I/O | Description | Remark |
|---|---|---|---|---|
| 1 | VSS2 | P | Ground | Note1 |
| 2 | V1 | I | Gamma voltage 1 | Note1 |
| 3 | V2 | I | Gamma voltage 2 | |
| 4 | V3 | I | Gamma voltage 3 | |
| 5 | V4 | I | Gamma voltage 4 | |
| 6 | V5 | I | Gamma voltage 5 | |
| 7 | V6 | I | Gamma voltage 6 | |
| 8 | V7 | I | Gamma voltage 7 | |
| 9 | VSS2 | P | Ground | Note1 |
| 10 | V8 | I | Gamma voltage 8 | |
| 11 | V9 | I | Gamma voltage 9 | |
| 12 | V10 | I | Gamma voltage 10 | |
| 13 | V11 | I | Gamma voltage 11 | |
| 14 | V12 | I | Gamma voltage 12 | |
| 15 | V13 | I | Gamma voltage 13 | |
| 16 | V14 | I | Gamma voltage 14 | |
| 17 | VSS2 | P | Ground | Note1 |
| 18 | VDD2 | P | Voltage for analog circuit | Note1 |
| 19 | VCOM | P | Common voltage | |
| 20 | XON | N | No connection | |
| 21 | OE | I | Output enable | Note1 |

| | | | | |
|---|---|---|---|---|
| 22 | U/D | I | Up/down selection | Note2 |
| 23 | CKV | I | Vertical shift clock | Note1 |
| 24 | STVU | I/O | Vertical shift pulse signal | Note1,2 |
| 25 | STVD | I | Vertical shift pulse signal | Note2 |
| 26 | VGG | P | Gate on voltage | |
| 27 | GND | P | Ground | |
| 28 | VCC | P | Voltage for logic circuit | |
| 29 | GND | P | Ground | |
| 30 | VEE | P | Gate off voltage | |
| 31 | NC | N | No connection | |
| 32 | XL | P | Touch panel left | |
| 33 | YD | P | Touch panel down | |
| 34 | XR | P | Touch panel right | |
| 35 | YU | P | Touch panel up | |

Note1: I/O definition.

I---Input pin, O---Output pin, P--- Power/Ground, N--- No connection

Note2:

| Scan Control Input | | IN/OUT State For Start Pulse | | | | Scanning Direction |
|---|---|---|---|---|---|---|
| U/D | R/L | STVD | STVU | DIO2 | DIO1 | |
| GND | VCC | O | I | O | I | Up to down, left to right |
| VCC | GND | I | O | I | O | Down to up, right to left |
| GND | GND | O | I | I | O | Up to down, right to left |
| VCC | VCC | I | O | O | I | Down to up, left to right |

# 3 Absolute Maximum Ratings

VSS1=VSS2=GND=0V, Ta = 25℃

| Item | Symbol | Min | Max | Unit | Remark |
|---|---|---|---|---|---|
| Power Voltage | VCC | -0.50 | 5.00 | V | |
| | VDD1 | -0.50 | 5.00 | V | |
| | VDD2 | -0.50 | 13.50 | V | |
| | VGG | -0.30 | 40.00 | V | |
| | VEE | -20.00 | 0.30 | V | |
| | VGG-VEE | -0.30 | 40.00 | V | |
| Touch Panel Forward Voltage | $V_{TP}$ | - | 7.0 | V | |
| Backlight Forward Current | $I_{LED}$ | - | 25.0 | mA | For each LED |
| Operating Temperature | $T_{OPR}$ | -20 | 60 | ℃ | |
| Storage Temperature | $T_{STG}$ | -30 | 70 | ℃ | |

# 4 Electrical Characteristics

## 4.1 Recommended Operating Condition

VSS1=VSS2=GND=0V, Ta = 25℃

| Item | | Symbol | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|---|
| Digital Supply Voltage | | VDD1 | 3.00 | 3.30 | 3.60 | V | |
| Digital Supply Voltage | | VCC | 3.00 | 3.30 | 3.60 | V | |
| Analog Supply Voltage | | VDD2 | 9.45 | 9.84 | 10.23 | V | |
| Gate On Voltage | | VGG | 17.10 | 19.00 | 20.90 | V | |
| Gate Off Voltage | | VEE | -7.70 | -7.00 | -6.30 | V | |
| Common Electrode Driving Signal | | VCOM | - | 4.21 | - | V | |
| Input Level Of Gamma Voltage | | V1~V7 | 0.4xAVDD | - | VDD2-0.1 | V | |
| | | V8~V14 | 0.10 | - | 0.6xVDD2 | V | |
| Input Signal Voltage | Low Level | $V_{IL}$ | 0 | - | 0.2xVDD1 | V | CLK,R/L,R0~R5,G0~G5, DIO1,B0~B5,LD,REV, POL,DIO2,V1~V14,OE, U/D,CKV,STVD,STVU, |
| | High Level | $V_{IH}$ | 0.8xVDD1 | - | VDD1 | V | |
| Output Signal Voltage | Low Level | $V_{OL}$ | 0 | - | 0.2xVDD1 | V | STVU,DIO2,DIO1 |
| | High Level | $V_{OH}$ | 0.8xVDD1 | - | VDD1 | V | |

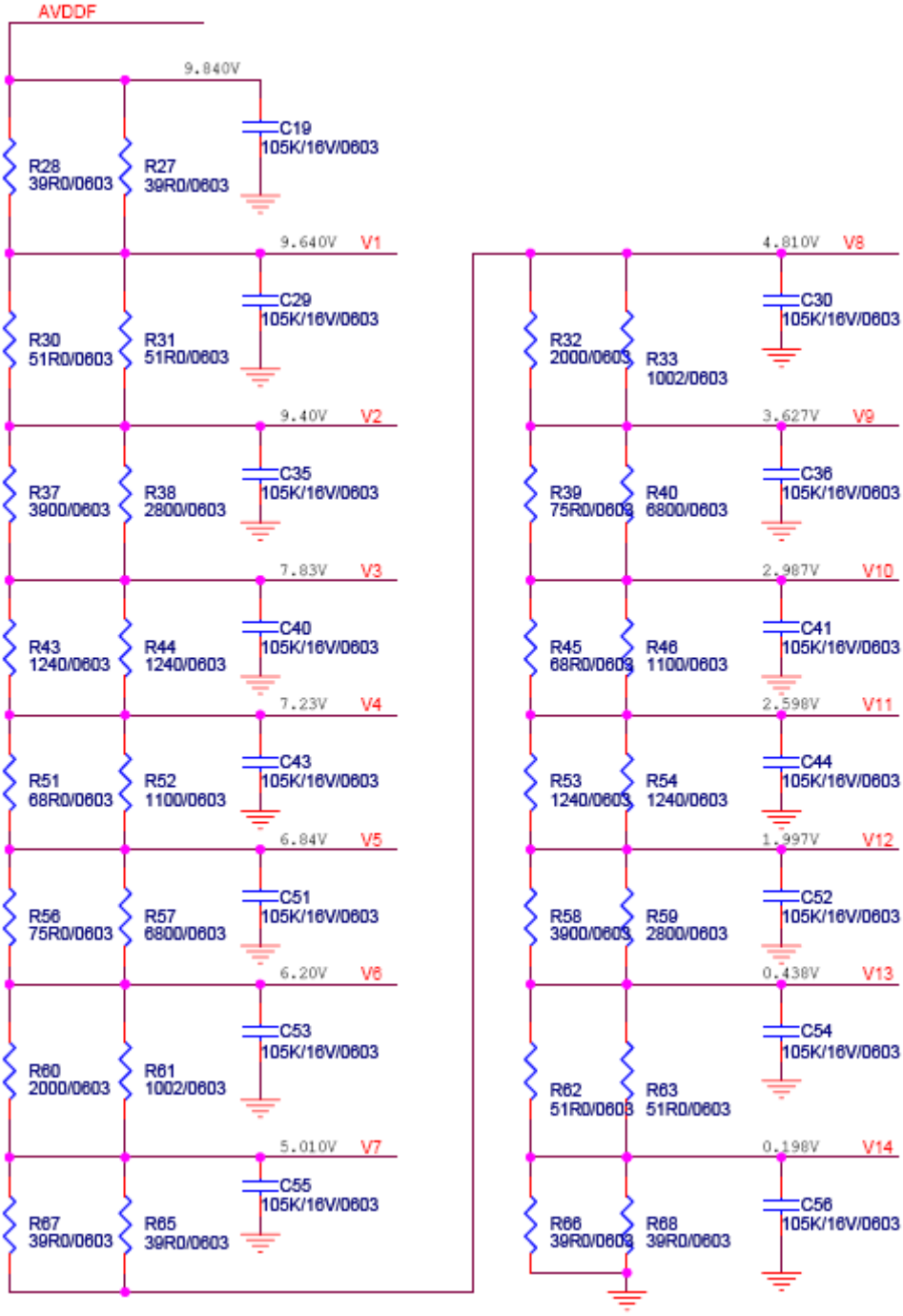
Note: The value is for design stage only.

### 4.2 Gamma Correction Reference Voltage Setting

| Parameter | Symbol | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|
| Gamma correction reference voltage V1~V14 | V1 | - | 9.640 | VDD2-0.1 | V | |
| | V2 | - | 9.400 | - | V | |
| | V3 | - | 7.830 | - | V | |
| | V4 | - | 7.230 | - | V | |
| | V5 | - | 6.840 | - | V | |
| | V6 | - | 6.200 | - | V | |
| | V7 | - | 5.010 | - | V | |
| | V8 | - | 4.810 | - | V | |
| | V9 | - | 3.627 | - | V | |
| | V10 | - | 2.987 | - | V | |
| | V11 | - | 2.598 | - | V | |
| | V12 | - | 1.997 | - | V | |
| | V13 | - | 0.438 | - | V | |
| | V14 | VSS2+0.1 | 0.198 | - | V | |

Note: the value is for design stage only;

VDD2-0.1>V1>V2>V3>V4>V5>V6>V7, V8>V9>V10>V11>V12>V13>V14>VSS2+0.1




NOTE：The gamma circuit only apply to AVDD=9.840V,Connect LCM to the gamma circuit and keep LCM operation, you can get correct gamma voltage, V1=9.64V、V2=9.40V etc.

### 4.3 Recommended Driving Condition for Backlight

Ta=25℃

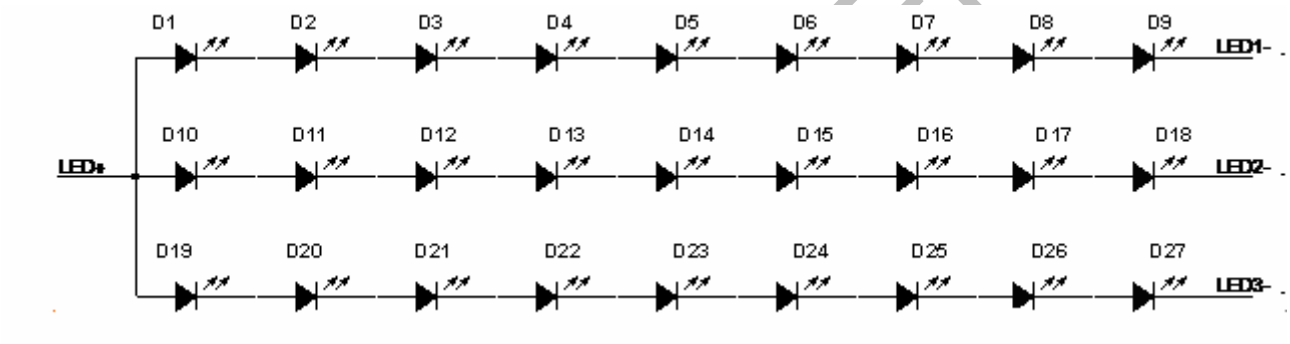
| Item | Symbol | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|
| Forward Current | $I_{LED}$ | - | 60.00 | 75.00 | mA | |
| Forward Voltage | $V_{LED}$ | 27.45 | 28.80 | 31.05 | V | |
| Power Consumption | $P_{BL}$ | - | 1.73 | 2.33 | W | |
| Operating Life Time | -- | 10000 | （20000） | -- | hrs | |

Note1: The LED driving condition is defined for each LED module （9 LED Serial, 3 LED Parallel）.

Input current = 20 mA x 3 = 60 mA

Note2: Under LCM operating, the stable forward current should be inputted. And forward voltage is for reference only.

Note3: The LED driving condition is defined for each LED module.




Note 4: $I_F$ 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.

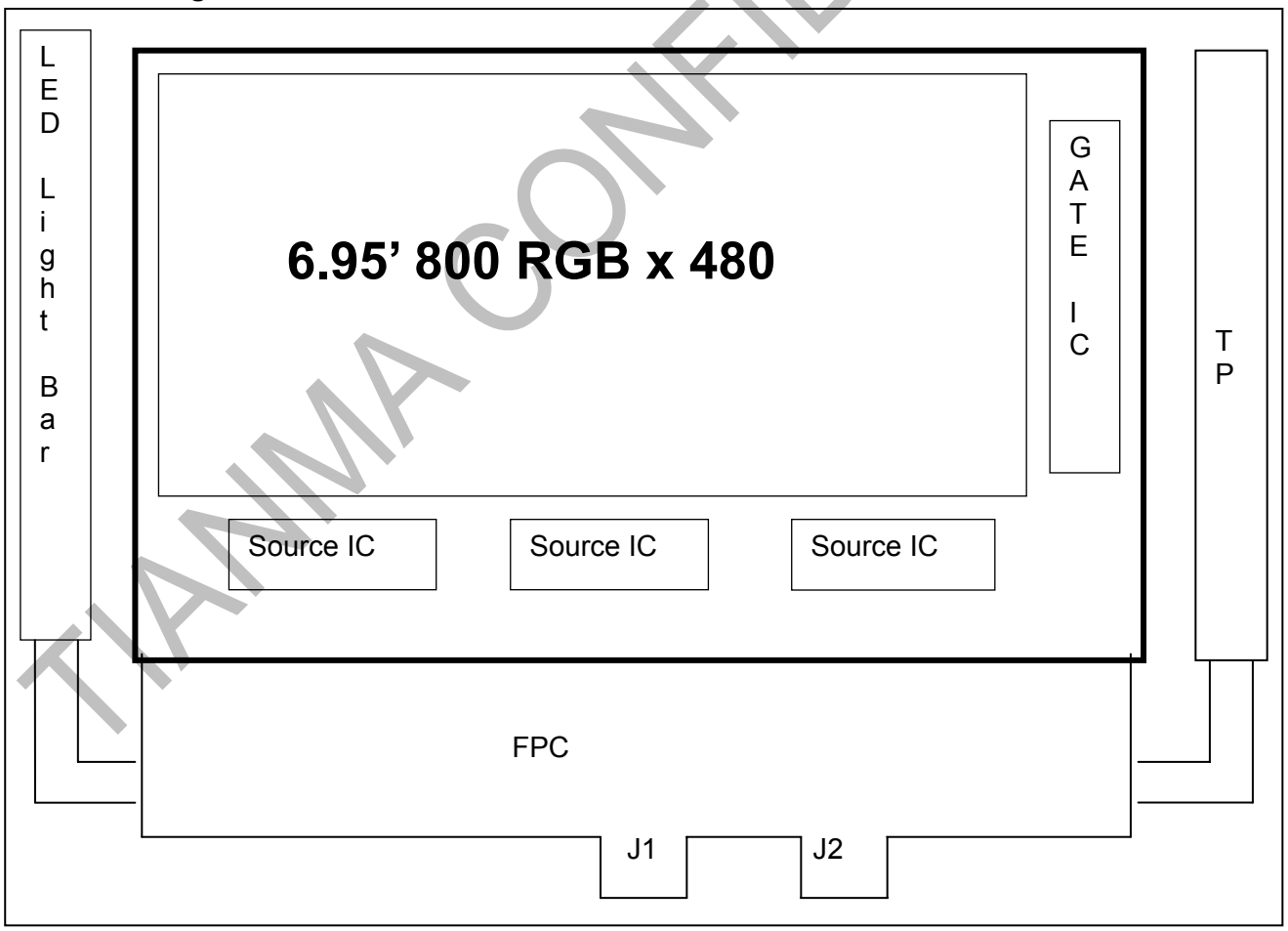
### 4.4 Power Consumption

VSS1=VSS2=GND=0V, Ta = 25℃

| Item | Symbol | Condition | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|---|
| Digital Supply Current | $I_{VDD1}$ | VDD1=3.3V | - | 3.50 | 5.16 | mA | |
| Digital Supply Current | $I_{VCC}$ | VCC=3.3V | - | 3.50 | 5.16 | mA | |
| Analog Supply Current | $I_{VDD2}$ | VDD2=9.84V | - | 39.00 | 56.00 | mA | |
| Gate On Current | $I_{VGG}$ | VGG=19.0V | - | 0.22 | 0.40 | mA | |
| Gate Off Current | $I_{VEE}$ | VEE=-7.0V | - | 0.22 | 0.40 | mA | |
| Power Consumption | Panel &gamma | | - | 0.42 | 0.60 | W | |
| | Backlight | | - | 1.73 | 2.33 | W | |
| | Total | | - | 2.15 | 2.93 | W | |

Note: Analog Supply Current and Power Consumption condition is defined as colorbar pattern and with gamma circuit.

### 4.5 Block Diagram



# 5 Timing Chart

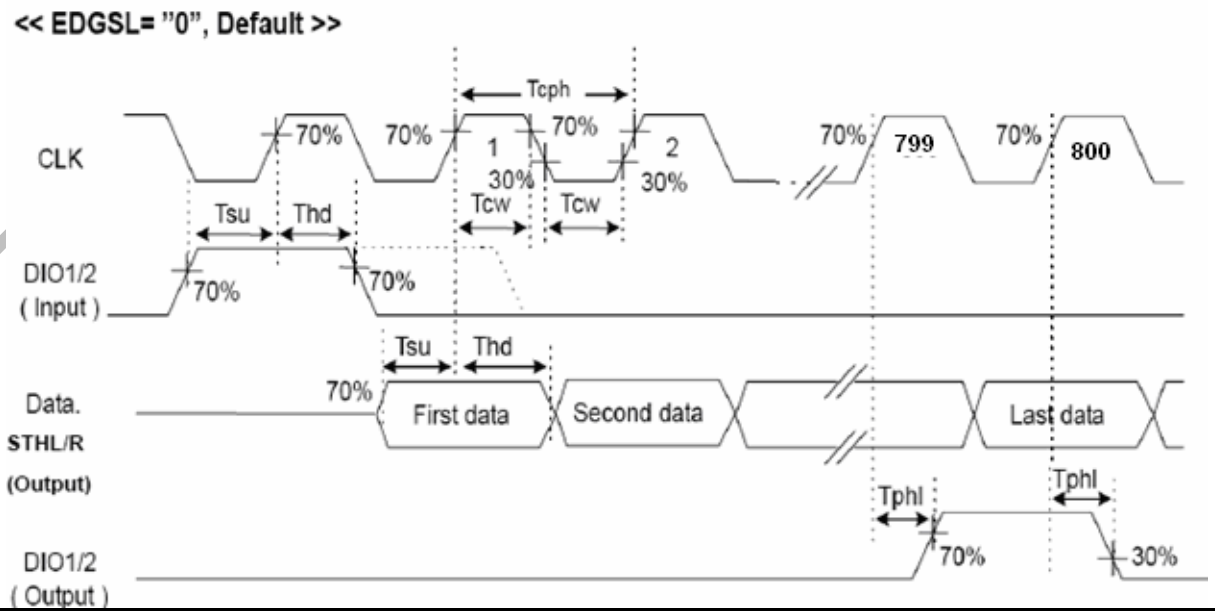
## 5.1 Source Driver Input Timing

(VDD1=3.3V, VDD2=9.84V, VSS1=VSS2=GND=0V, Ta=25℃)

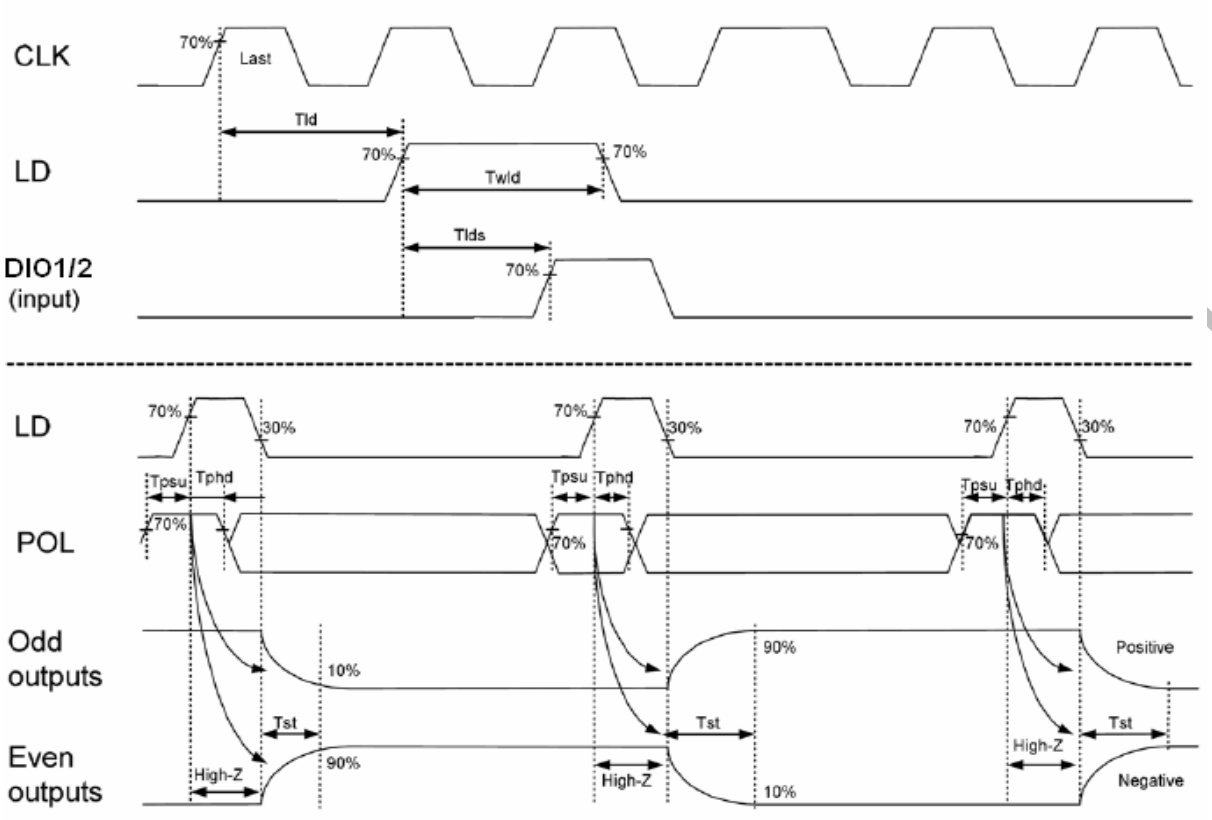
| Parameter | Symbol | Min | Typ | Max | Unit | Conditions |
|---|---|---|---|---|---|---|
| CLK frequency | Fclk | - | 33.3 | 40.0 | MHz | EDGSL="0" |
| CLK high/low Pulse Width | Tcw | 10 | - | - | ns | Tcph is CLK cycle 1 Tcw=1/Fclk |
| Data Set-up Time | Tsu | 6 | - | - | ns | R0~R5，G0~G5，B0~B5，REV and DIO1/2 to CLK |
| Data Hold Time | Thd | 4 | - | - | ns | R0~R5，G0~G5，B0~B5，REV and DIO1/2 to CLK |
| Propagation delay of STHR/L | Tphl | 5 | 10 | 15 | ns | CL=25pF |
| Time that the last data to LD | Tld | 1 | - | - | Tcph | |
| Pulse width of LD | Twld | 2 | - | - | Tcph | |
| Time that LD to STHL/R | Tlds | 5 | - | - | Tcph | |
| POL set-up time | Tpsu | 6 | - | - | ns | POL to LD |
| POL hold time | Tphd | 6 | - | - | ns | POL to LD |
| Output stable time | Tst | - | - | 12 | us | 10% or 90% Target voltage. CL=60pF, R=2Kohm |



### 5.1.1 EDGSL='0' , Source Driver Input Timing



5.1.2 Source Driver Input Timing



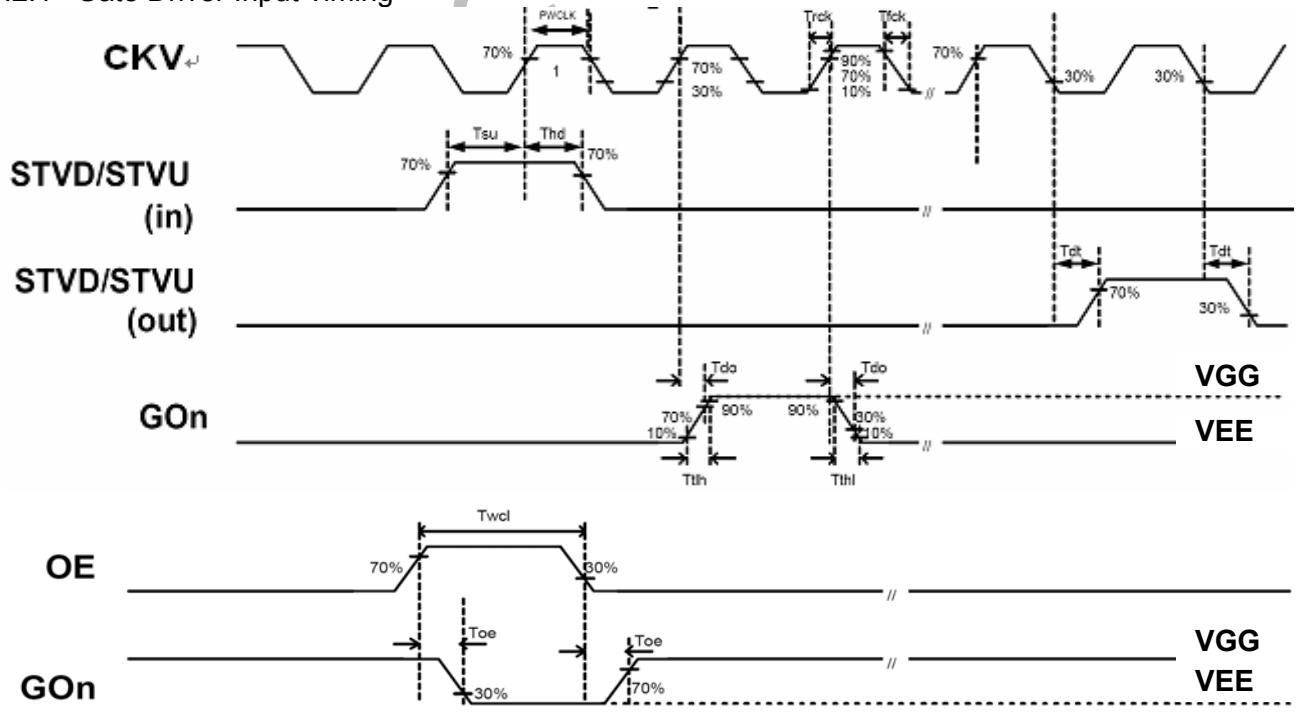
## 5.2 Gate Driver Input Timing

(VGG=19V, VEE=-7V, VDD1=3.3V, VSS1=GND=0V, Ta=25℃)

| Parameter | Symbol | Min | Typ | Max | Unit | Conditions |
|---|---|---|---|---|---|---|
| STVD/STVU Delay Time | Tdt | - | - | 500 | ns | CL=20pF |
| Driver Output Delay Time | Tdo | - | - | 900 | ns | CL=200pF |
| Output Falling Time | Tthl | - | 400 | 800 | ns | CL=200pF<br>90% to 10% |
| Output Rising Time | Ttlh | - | 500 | 1000 | ns | CL=200pF<br>10% to 90% |
| XON To Driver Output Delay Time | Txon | - | - | 20 | ns | CL=200pF |
| OE To Driver Output Delay Time | Toe | - | - | 900 | ns | CL=200pF |
| Clock Frequency | Fclk | - | - | 200 | KHz | In cascade connection |
| Clock Rising Time | Trck | - | - | 100 | ns | CL=20pF |
| Clock Falling Time | Tfck | - | - | 100 | ns | CL=20pF |
| Clock Pulse Width(High & Low) | PWCLK | 500 | - | - | ns | |
| STVD/STVU Set-up Time | Tsu | 200 | - | - | ns | |
| STVD/STVU Hold Time | Thd | 300 | - | - | ns | |
| Output Enable Pulse Width | Twcl | 1 | - | - | us | |



5.2.1 Gate Driver Input Timing



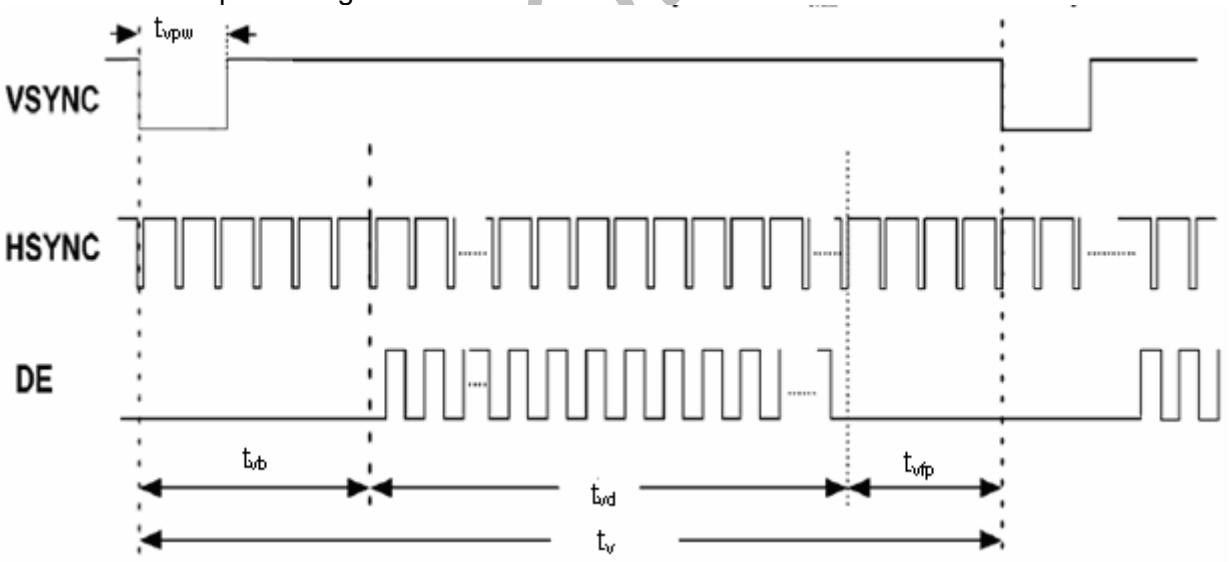
## 5.3 Recommended Timing Setting Of TCON At HV Mode

### 5.3.1 DCLK/ HSYNC/VSYNC Timing

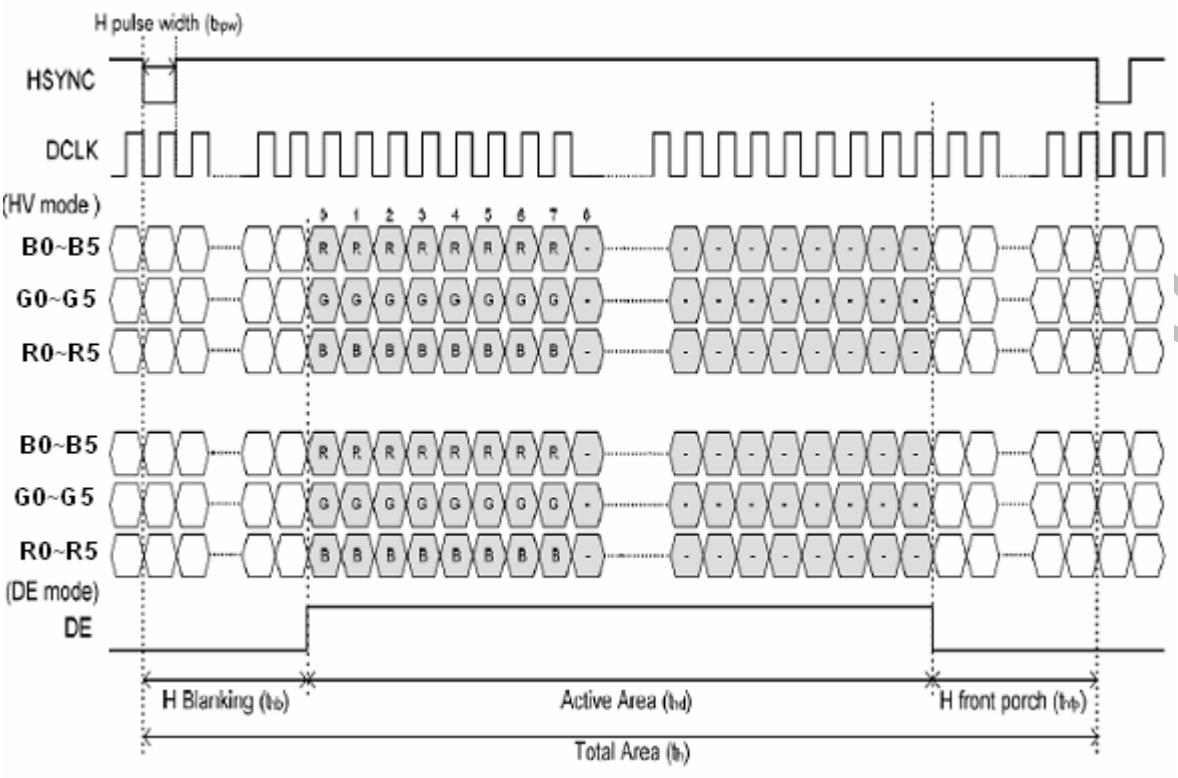
| Parameter | Symbol | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|
| DCLK | Fclk | 26.4 | 33.3 | 40.0 | MHZ | |
| | Tclk | 37.9 | 30.0 | 25.0 | ns | |
| HSYNC | $t_h$ | 862 | 1056 | 1200 | Tclk | |
| | $t_{hd}$ | 800 | 800 | 800 | Tclk | |
| | $t_{hpw}$ | 1 | - | 40 | Tclk | |
| | $t_{hb}$ | 46 | 46 | 46 | Tclk | |
| | $t_{hfp}$ | 16 | 210 | 354 | Tclk | |
| VSYNC | $t_v$ | 510 | 525 | 650 | th | |
| | $t_{vd}$ | 480 | 480 | 480 | th | |
| | $t_{vpw}$ | 1 | - | 20 | th | |
| | $t_{vb}$ | 23 | 23 | 23 | th | |
| | $t_{vfp}$ | 7 | 22 | 147 | th | |

Note: Base on TCON NT39703-5

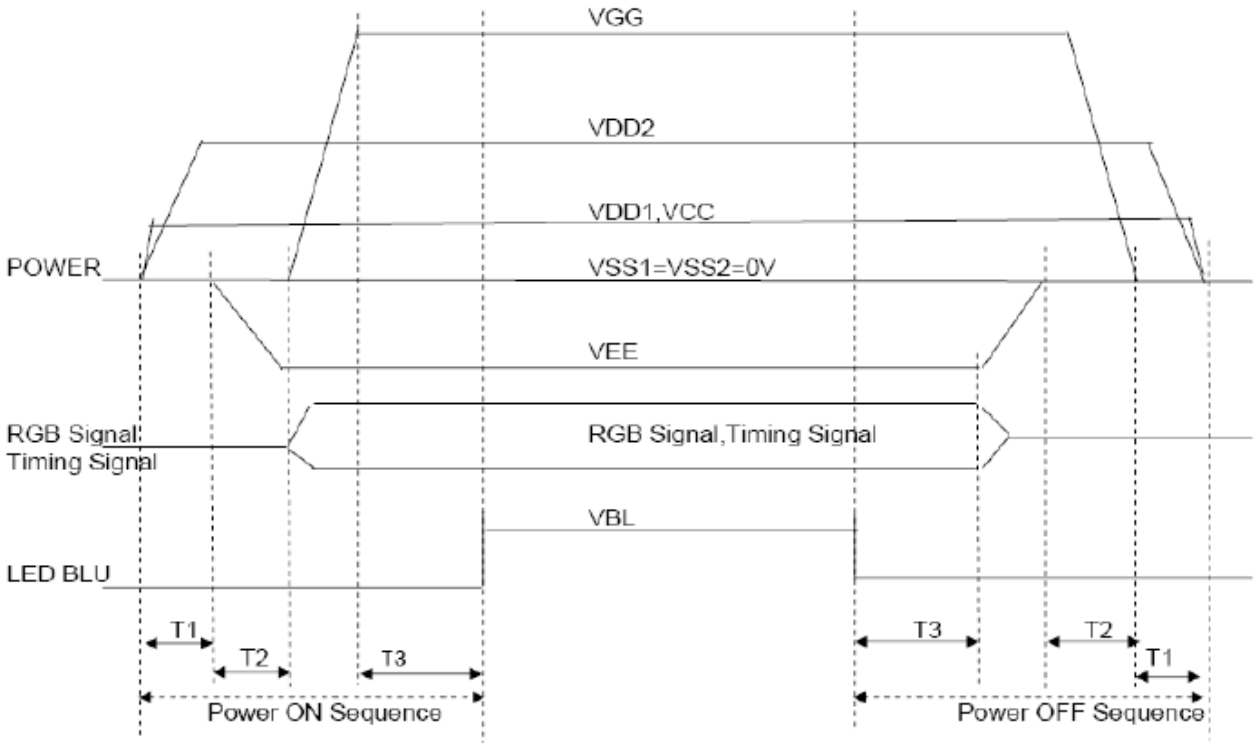
### 5.3.2 Vertical Input Timing



5.3.3 Horizontal Input Timing




## 5.4 Power On/Off Sequence




NOTE: T1≥10ms; T2≥20ms; T3≥100ms;

# 6 Optical Characteristics

Ta=25℃

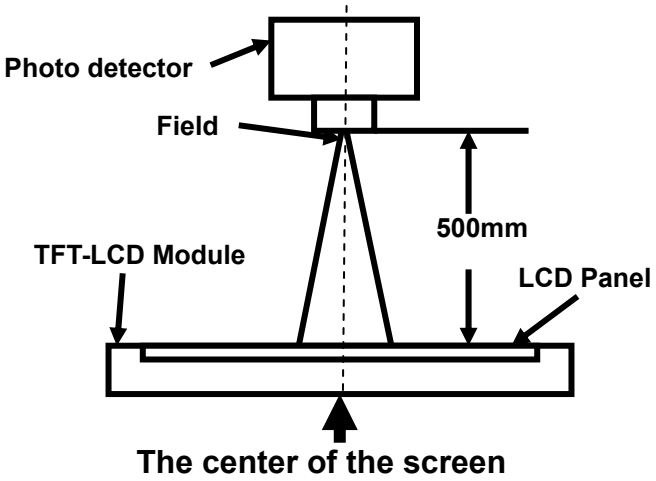
| Item | | Symbol | Condition | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| View Angles | | θT | CR≧10 | 50 | 60 | - | Degree | Note2,3 |
| | | θB | | 60 | 70 | - | | |
| | | θL | | 60 | 70 | - | | |
| | | θR | | 60 | 70 | - | | |
| Contrast Ratio | | CR | θ=0° | 300 | 400 | - | | Note 3 |
| Response Time | | $T_{ON}$ | 25℃ | - | 25 | 40 | ms | Note 4 |
| | | $T_{OFF}$ | | | | | | |
| Chromaticity | White | x | Backlight is on | 0.271 | 0.321 | 0.371 | | Note 1,5 |
| | | y | | 0.298 | 0.348 | 0.398 | | |
| | Red | x | | 0.528 | 0.578 | 0.628 | | Note 1,5 |
| | | y | | 0.302 | 0.352 | 0.402 | | |
| | Green | x | | 0.293 | 0.343 | 0.393 | | Note 1,5 |
| | | y | | 0.532 | 0.582 | 0.632 | | |
| | Blue | x | | 0.096 | 0.146 | 0.196 | | Note 1,5 |
| | | y | | 0.056 | 0.106 | 0.156 | | |
| Uniformity | | U | | 70 | 80 | - | % | Note 6 |
| NTSC | | | | - | 50 | - | % | Note 5 |
| Luminance（with TSP） | | L | | 220 | 280 | - | $cd/m^2$ | Note 7 |

Test Conditions:

1. $I_F$= 20 mA, and the ambient temperature is 25℃.
2. The test systems refer to Note 1 and Note 2.

Note 1: Definition of optical measurement system.

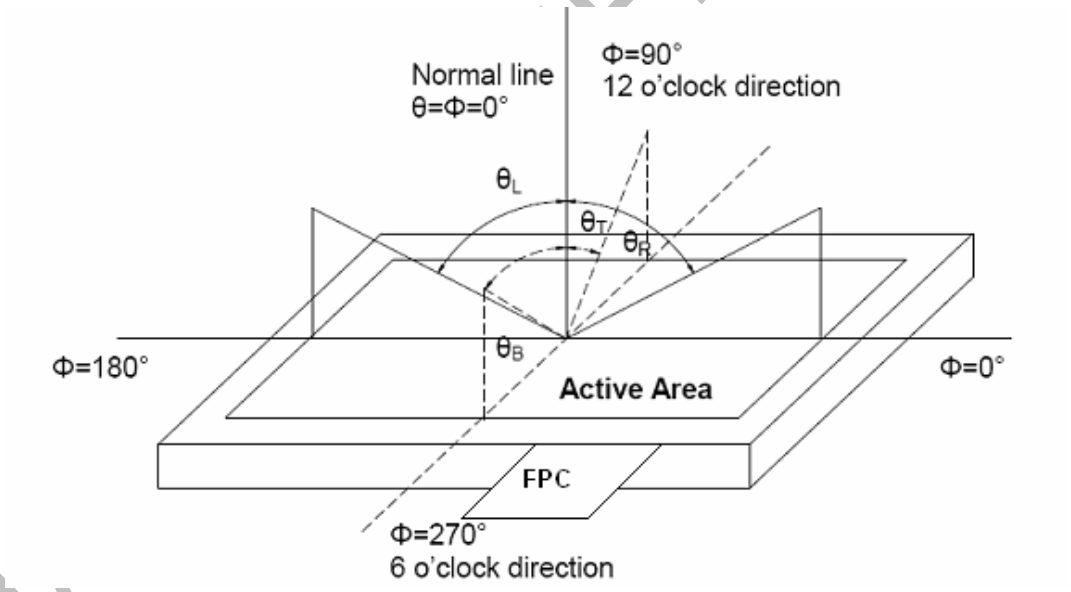
The optical characteristics should be measured in dark room. After 5 Minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.




| 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)。




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 Vwhite.

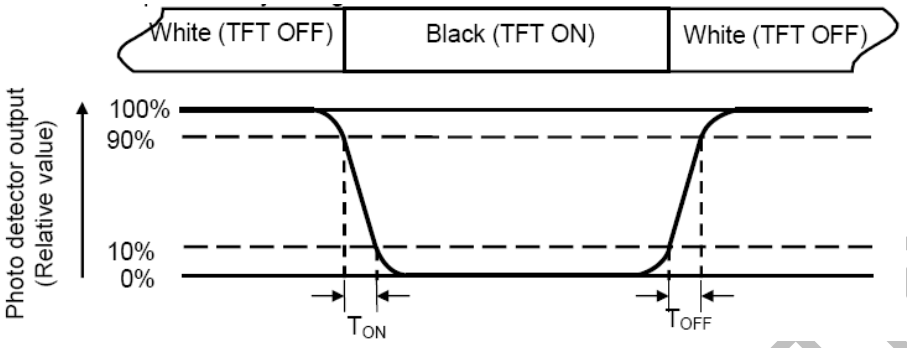
“Black state”: The state is that the LCD should drive by Vblack.

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 ($T_{ON}$) 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)

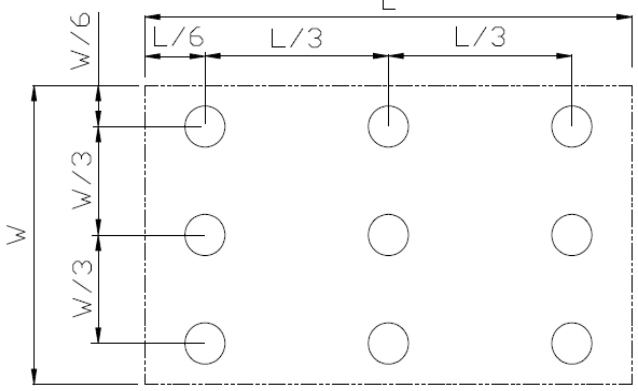
Color coordinates measured at center point of LCD.

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.

Luminance Uniformity (U) = Lmin/ Lmax

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




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

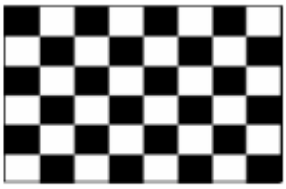
| No | Test Item | Condition | Remarks |
|---|---|---|---|
| 1 | High Temperature Operation | Ts = +60℃, 240 hours | Note1<br>IEC60068-2-1,GB2423.2 |
| 2 | Low Temperature Operation | Ta = -20℃, 240 hours | IEC60068-2-1<br>GB2423.1 |
| 3 | High Temperature Storage | Ta = +70℃, 240 hours | IEC60068-2-1<br>GB2423.2 |
| 4 | Low Temperature Storage | Ta = -30℃, 240 hours | IEC60068-2-1<br>GB2423.1 |
| 5 | Operation at High Temperature and Humidity | Ta = +40℃, 90% RH max,240hours | Note2<br>IEC60068-2-78<br>GB/T2423.3 |
| 6 | Thermal Shock (non-operation) | -20℃ 30 min~+60℃ 30 min, Change time:5min, 30 Cycle | Start with cold temperature, End with high temperature,<br>IEC60068-2-14,GB2423.22 |
| 7 | Electro Static Discharge (Operation) | C=150pF,R=330Ω,5point/panel<br>Air:±8Kv,5times;<br>Contact:±4Kv,5times | IEC61000-4-2<br>GB/T17626.2 |
| 8 | Vibration (Non-operation) | Sine Wave<br>Frequency range:10~55Hz<br>Stroke:1.5mm<br>Sweep:10Hz~55Hz~10Hz<br>2 hours for each direction of X.Y.Z. (6 hours for total) | IEC60068-2-6<br>GB/T2423.10 |
| 9 | Shock (Non-operation) | Half Sine Wave<br>60G 6ms, ±X,±Y,±Z 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 | Baseline Function Test | Room Temp 72 hours | Note3 |
| 12 | Operating Temp & Humidity Test | Temp -20℃~+60℃,<br>Humi 0~90%RH,96 hours | Note3 |
| 13 | Storage Test | Temp -40℃~+75℃,<br>Humi 0~90%RH,96 hours | Note3 |
| 14 | Thermal Shock Test | -20℃~+60℃, 10 cycle<br>-40℃~+75℃, 10 cycle | Note3 |
| 15 | Image Sticking | Room Temp,24 hours | Note4 |

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

Note2: Ta is the ambient temperature of samples.

Note3: The conditions is requested by MITAC.

Note4: Image Sticking Bum In Pattern is the following Cross pattern. And check patterns are Full Screen White, Red, Blue, Green and Black Pattern.



Cross Pattern

Judgment:

Main LCD should work under the normal condition.

After the temperature and humidity test, the luminance and CR (Contrast Ratio) should not be changed over 50% compared with those before the test.

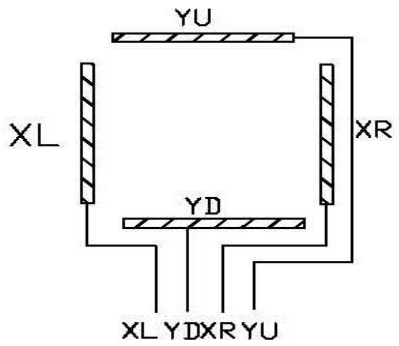
# 8 Touch Screen Panel

## 8.1 Electrical Characteristics

| Item | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|
| Linearity | -1.5 | - | 1.5 | % | Analog X and Y directions |
| Terminal Resistance | 100 | - | 1300 | ohm | X |
| | 100 | - | 900 | ohm | Y |
| Insulation Resistance | 10 | - | - | ohm | DC 25V |
| Voltage | - | 5 | 7 | V | DC |
| Chattering | - | - | 10 | Ms | 100k pull-up |
| Transparency | 78 | - | - | % | JIS-K7105,ASTM D1003,@550nm |

Note1: Do not operate it with a thing except a placental pen (tip R0.8mm or more) or a finger, especially those with hard or sharp tips such as a ball point pen or a mechanical pencil.

Note2: The figure below shows the connection of touch panel.



### 8.2 Mechanical& Reliability Characteristics

| Item | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|
| Activation Force | - | - | 80 | g | Note1 |
| Durability(Surface Scratching) | Write 100,000 | - | - | characters | Note2 |
| Durability(Surface Pitting) | 1,000,000 | - | - | touches | Note3 |
| Surface Hardness | 3 | - | - | H | JIS-K5400, ASTM D3363 |

Note1: Stylus pen input: R0.8mm placental pen or finger.

Note2: Measurement for surface area:

Scratch 100,000 times straight line on the film with a stylus change every 20,000 times

Force: 250gf

Speed: 60 mm/sec

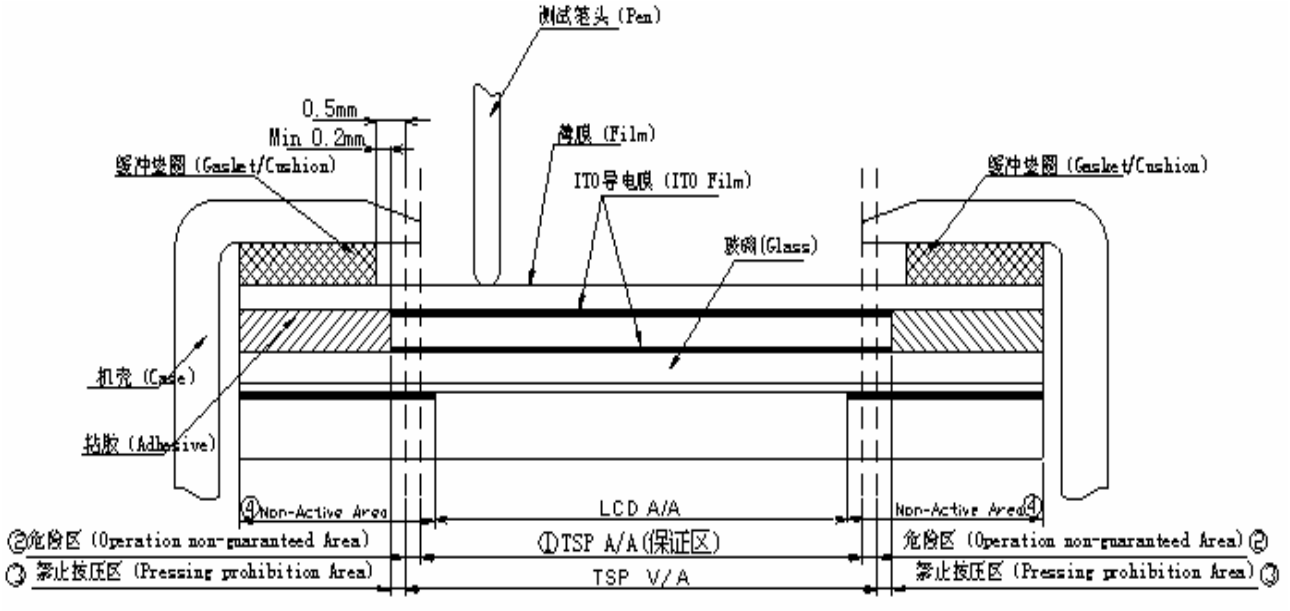
Stylus: R0.8 placental tip

Note3: Pit 1,000,000 times on the film with a R8.0 silicon rubber.

Force: 250gf

Speed: 2 times/sec

# 9 Mechanical Design Guide




## 9.1 Explain

9.1.1 Active area

The area which guarantees a touch panel operation normally when pressed.

9.1.2 Operation non-guaranteed area

The area which does not guarantee a touch panel operation and its function. When this area is pressed, touch panel shows degradation of its performance and durability such as a pen sliding durability becomes about one-tenth compared. With the active area (Area-(a) as guaranteed area) and its operation force requires about double. About 0.5mm~1mm out side form a boundary of the active corresponds to this area.

9.1.3 Pressing prohibition area

The area which forbids pressing, because an excessive load is applied a transparent electrode and a serious damage is given to touch panel function by pressing.

9.1.4 Non-Active area

The area which does not activate even if passed.

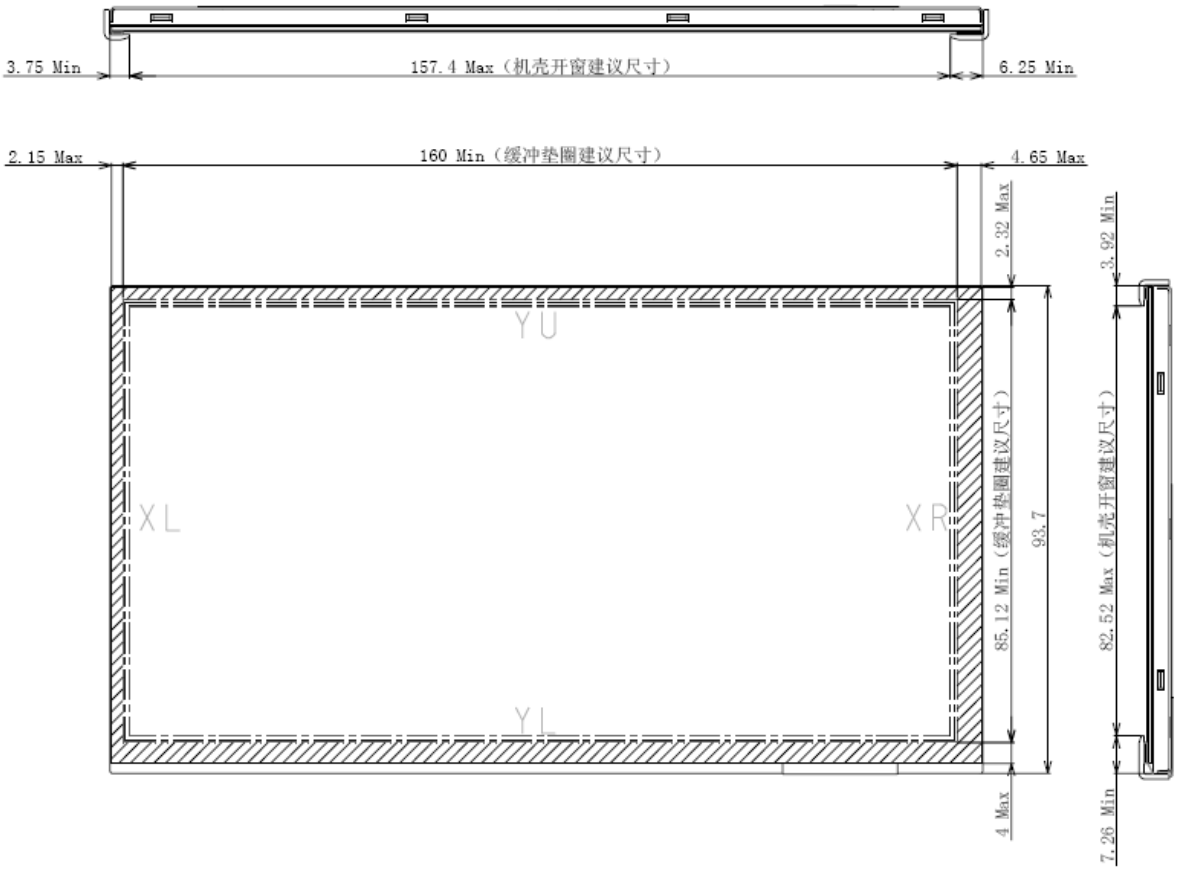
## 9.2 The handling of sensitive area

9.2.1 The sensitive area is between the edge of the double-side tape and the edge of the active area. Because the double-side tape has a certain height, the more transformative the ITO layer is pressed, the easier it would be to be broken. So it is suggested that pointed tools should be put away from the sensitive area to avoid them touching the sensitive area during operation.

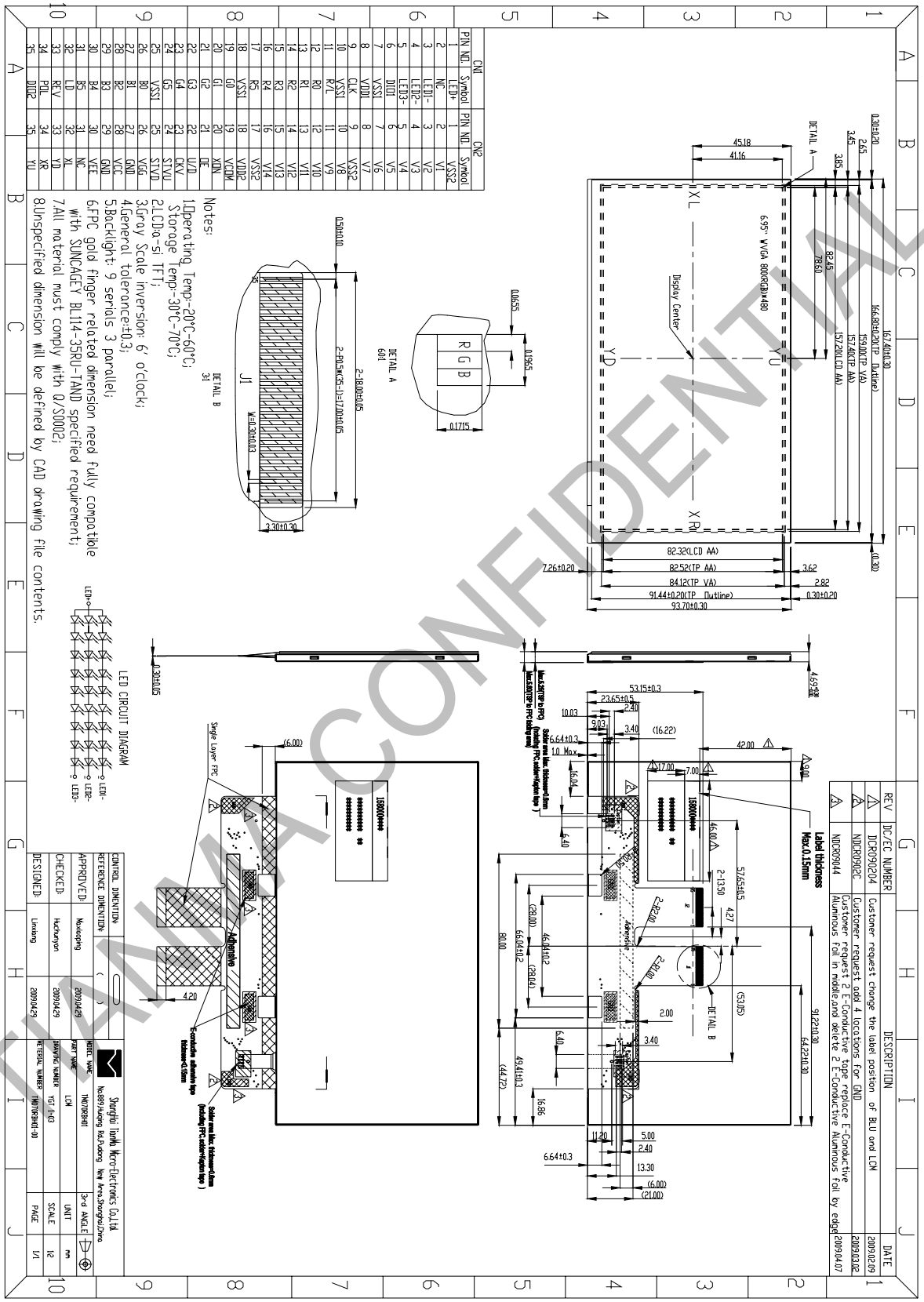
9.2.2 When assembling the touch panel, it would be better to add a protective gasket on the surface of the product before assembling on to the housing. The gasket should be placed on the double-side tape and should not go beyond it.

9.2.3 If the housing is designed bigger than the active area, the edge of the sensitive area would be left outside of it. In addition, the protective gasket adds the thickness of this area, so do not use pens or other pointed tools to score along with the screen edge which may cause the damage of the ITO layer. If the panel is drawn with large force, the glass would even be broken.

9.2.4 If the housing is designed smaller than the active area, it can cover the sensitive area completely, in which case the scoring along with screen edge does no harm to the ITO layer.Nevertheless, due to the housing extending into the active area, the thickness of the gasket is very important. If it is too thick, the gap between the housing and the ITO film surface would be too wide which may affect the appearance of the product. If it is too thin, the housing would be pressed on the film surface which may cause short-circuit. The gap between the housing and the film should better be kept between 0.2mm and 0.3mm.

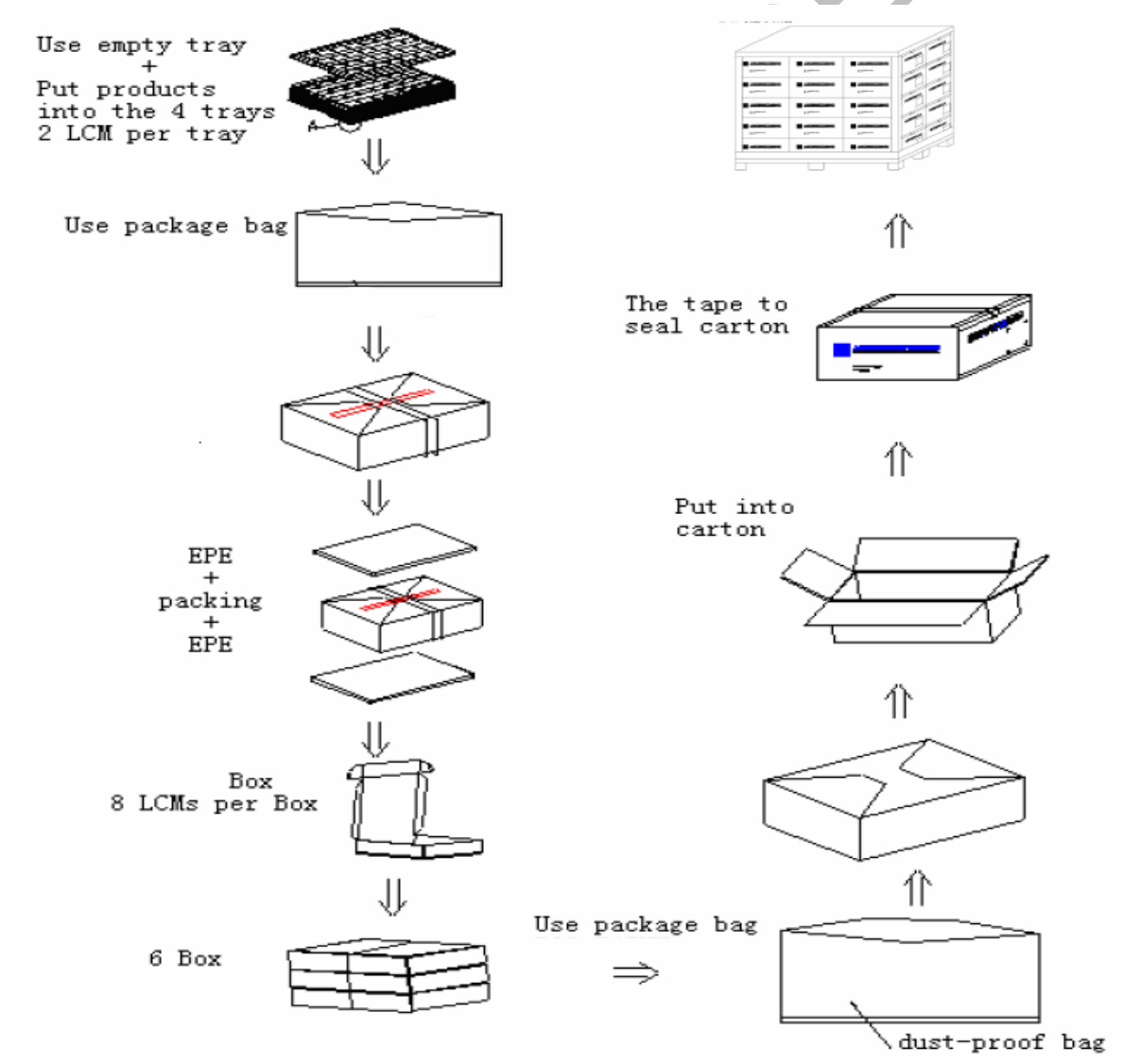


# 10 Mechanical Drawing



# 11 Packing Drawing

| No | Item | Model(Material) | Dimensions (mm) | Unit Weigt (Kg) | Quantity | Remark |
|---|---|---|---|---|---|---|
| 1 | LCM module | TM070RBH01 | 167.40x93.70x4.69 | 0.146 | 48 | |
| 2 | Tray | PET(Transmit) | 315x247x13 | 0.087 | 30 | Anti-static |
| 3 | EPP | EPE | 315x247x5 | 0.009 | 12 | |
| 4 | Dust-Proof Bag | PE | 700x545 | 0.05 | 1 | |
| 5 | Box | Corrugated Paper | 260x345x70 | 0.227 | 6 | |
| 6 | Dust-Proof Bag | PE | 327x270 | 0.021 | 6 | |
| 7 | Carton | Corrugated Paper | 544x365x250 | 1.01 | 1 | |
| 8 | Total Weight (Kg) | 12.274 | | | | |



# 12 TFT- LCD Module Incoming Inspection Standard

## 12.1 Scope

The incoming inspection standards shall be applied to TFT-LCD Modules (hereinafter called "Modules") that supplied by Shanghai Tianma Micro-Electronics Corporation.

## 12.2 Incoming Inspection

The customer shall inspect the modules within twenty calendar days of the delivery date（the “inspection period）at its own cost. The result of the inspection（acceptance or rejection）shall be recorded in writing, and a copy of this writing will be promptly sent to the seller, If the results of the inspecting from buyer does not send to the seller within twenty calendar days of the delivery date. The modules shall be regards as acceptance.

Should the customer fail to notify the seller within the inspection period, the buyer’s right to reject the modules. Shall be lapsed and the modules shall be deemed to have been accepted by the buyer.

## 12.3 Inspection Sampling Method

Lot size: Quantity per shipment lot per model

Sampling type: Normal inspection, Single sampling

Inspection level: II

Sampling table: MIL-STD-105D

Acceptable quality level （AQL）

Major defect: AQL=0.65

Minor defect: AQL=1.00

## 12.4 Inspection Conditions

12.4.1 ambient conditions:

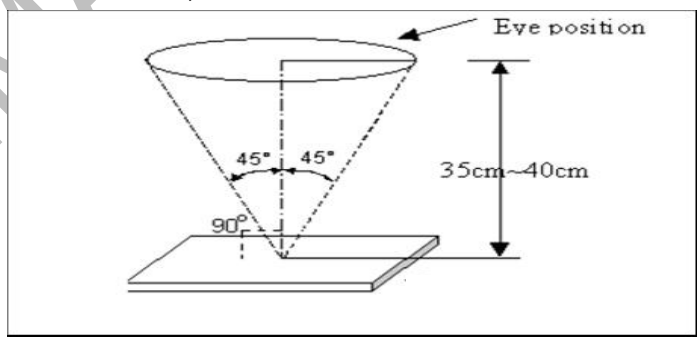
a. Temperature: Room temperature 25±5℃

b. Humidity: (60±10) ％RH

c. Illumination: Single fluorescent lamp non-directive (1000 to 1200 Lux)

12.4.2 The viewing distance between the LCD and the inspector’s eyes shall be at least 30±5㎝.

12.4.3 Viewing Angle: U/D: 45º/45º, L/R: 45º/45º



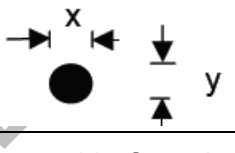
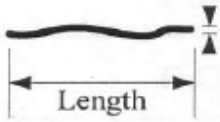

## 12.5 Inspection Criteria

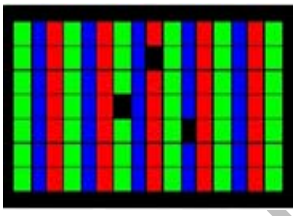
Defects are classified as major defects and minor defects according to the degree of defectiveness defined herein.

**Major defect**

| Item | Inspection Standard |
|---|---|
| All Functional Defects | 1) No display<br>2) Display abnormally<br>3) Short circuit<br>4) line defect |
| Missing | Missing function component |
| Crack | Glass Crack |

**Minor defect**

<table>
<tr><th>No</th><th>Item</th><th colspan="2">Inspection Standard</th></tr>
<tr><td rowspan="6">1</td><td rowspan="6">Spot Defect<br>(Including black spot and white spot)</td><td colspan="2">φ=（x+y）／2<br> 
<br>For black/white spot is defined</td></tr>
<tr><td>Size φ(mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>φ≤0.20</td><td>Ignore</td></tr>
<tr><td>0.20<φ≤0.30</td><td>2</td></tr>
<tr><td>0.30<φ≤0.40</td><td>1</td></tr>
<tr><td>0.40<φ</td><td>Not allowed</td></tr>
<tr><td rowspan="5">2</td><td rowspan="5">Line Defect (Including black line, white line and scratch)</td><td colspan="2"> 
<br>Define:</td></tr>
<tr><td>Width(mm) Length(mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>W≤0.03</td><td>Ignore</td></tr>
<tr><td>0.03<W≤0.1 0.8<L≤2.0</td><td>2</td></tr>
<tr><td>0.1<W or L>2.0</td><td>Not allowed</td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">Polarizer Dent/Bubble</td><td>Sizeφ(mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>φ≤0.1</td><td>Ignore</td></tr>
<tr><td>0.1＜Φ≤0.3</td><td>2</td></tr>
<tr><td>0.3<φ</td><td>0</td></tr>
</table>

<table>
<tr><td rowspan="6">4</td><td rowspan="6">Electrical Dot Defect</td><td colspan="2">Bright and black dot define:<br>  and  </td></tr>
<tr><td colspan="2">Inspection pattern: Full white、Full black、Red、green and blue screens</td></tr>
<tr><td>Item</td><td>Acceptable Quantity</td></tr>
<tr><td>Black dot defect</td><td>2</td></tr>
<tr><td>Bright dot defect</td><td>1</td></tr>
<tr><td>Total Dot</td><td>2</td></tr>
<tr><td rowspan="4">5</td><td rowspan="4">Touch Panel Scratch</td><td>Width(mm) Length(mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>W≤0.03</td><td>Ignore</td></tr>
<tr><td>0.03<W≤0.1 0.8<L≤2.0</td><td>2</td></tr>
<tr><td>0.1<W or L>2.0</td><td>Not allowed</td></tr>
<tr><td rowspan="5">6</td><td rowspan="5">Touch Panel Bubble/Dent</td><td>Width(mm) Length(mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>φ≤0.20</td><td>Ignore</td></tr>
<tr><td>0.20<φ≤0.30</td><td>2</td></tr>
<tr><td>0.30<φ≤0.40</td><td>1</td></tr>
<tr><td>0.40<φ</td><td>Not allowed</td></tr>
<tr><td rowspan="2">7</td><td rowspan="2">TSP Bagginess</td><td>Sizeφ(mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>D≤0.4</td><td>Ignore</td></tr>
<tr><td rowspan="2">8</td><td rowspan="2">Newton Ring</td><td>Sizeφ(mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>D <15mm</td><td>1</td></tr>
</table>

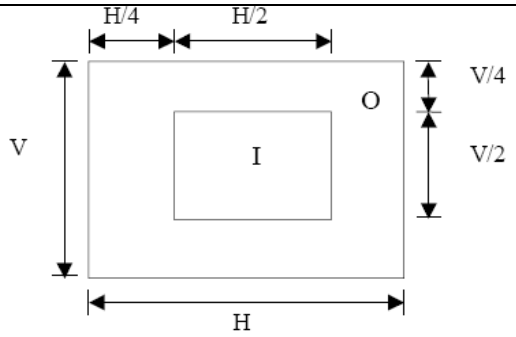
Note1: Dot defect is defined as the defective area of the dot area is larger than 50% of the dot area.

Note2: The distance between two bright dot defects (red, green, blue, and white) should be larger than 10mm.

Note3: The distance between black dot defects or black and bright dot defects should be more than 5mm apart.

Note4: The definitions of the inner display area and outer display area

I: Inner display area O: Outer display area




Note5: Polarizer bubble is defined as the bubble appears on active display area. The defect of polarizer bubble shall be ignored if the polarizer bubble appears on the outside of active display area.

### 12.6 Mechanics specification

As for the outside dimension, weight of the modules, please refer to product specification for more details

# 13 Precautions for Use of LCD Modules

## 13.1 Handling Precautions

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

13.1.2 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.

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

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

13.1.5 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

13.1.6 Do not attempt to disassemble the LCD Module.

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

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

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

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

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

13.1.8.4 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.

## 13.2 Storage precautions

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

13.2.2 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%

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

## 13.3 Transportation Precautions

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