



RAYSTAR

曜凌光電股份有限公司

住址: 42878 台中市大雅区科雅路 25 號 5F WEB: <http://www.Raystar-Optronics.com>
5F., No.25, Keya Rd., Daya Dist., Taichung E-mail: sales@raystar-optronics.com
City 428, Taiwan Tel:886-4-2565-0761 Fax : 886-4-2565-0760

RFF700Y-AIW-DNG

SPECIFICATION

CUSTOMER:

| | |
|-------------|--|
| APPROVED BY | |
| PCB VERSION | |
| DATE | |

FOR CUSTOMER USE ONLY

| SALES BY | APPROVED BY | CHECKED BY | PREPARED BY |
|----------|-------------|------------|-------------|
| | | | |

Release DATE:

Revision History

| VERSION | DATE | REVISED PAGE NO. | Note |
|---------|------------|------------------|---|
| 0 | 2016/03/23 | | First issue |
| A | 2016/06/01 | | Modify Touch Panel Information |
| B | 2016/07/25 | | Modify Interface Modify Absolute Maximum Ratings |
| C | 2016/08/11 | | Modify Vibration test |
| D | 2016/10/08 | | Modify Summary |
| E | 2017/04/06 | | Modify CTP Interface |

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2.Summary

TFT 7.0”is a TN transmissive type color active matrix TFT liquid crystal display that use amorphous silicon TFT as switching devices. This module is a composed of a TFT_LCD module, It is usually designed for industrial application and this module follows RoHs.

3.General Specifications

- Size: 7.0 inch
- Dot Matrix: 800 x RGBx480(TFT) dots
- Module dimension: 165.0(W) x 100(H) x 7.475(D) mm
- Active area: 154.08 x 85.92 mm
- Dot pitch: 0.0642 x 0.179 mm
- LCD type: TFT, Normally White, Transmissive
- View Direction: 12 o'clock
- Gray Scale Inversion Direction: 6 o'clock
- CTP FW Version: 09
- Backlight Type: LED, Normally White
- With /Without TP: With CTP
- Surface: Glare

*Color tone slight changed by temperature and driving voltage.

4.Interface

4.1. LCM PIN Definition

| Pin | Symbol | Function | Remark |
|-----|--------|----------------------------|----------|
| 1 | VLED- | Backlight ground | |
| 2 | VLED+ | Power supply for backlight | |
| 3 | GND | Power ground | |
| 4 | VCC | Power for Digital Circuit | |
| 5 | R0 | Red data(LSB) | Note 1 |
| 6 | R1 | Red data | Note 1 |
| 7 | R2 | Red data | |
| 8 | R3 | Red data | |
| 9 | R4 | Red data | |
| 10 | R5 | Red data | |
| 11 | R6 | Red data | |
| 12 | R7 | Red data(MSB) | |
| 13 | G0 | Green data(LSB) | Note 1 |
| 14 | G1 | Green data | Note 1 |
| 15 | G2 | Green data | |
| 16 | G3 | Green data | |
| 17 | G4 | Green data | |
| 18 | G5 | Green data | |
| 19 | G6 | Green data | |
| 20 | G7 | Green data(MSB) | |
| 21 | B0 | Blue data(LSB) | Note 1 |
| 22 | B1 | Blue data | Note 1 |
| 23 | B2 | Blue data | |
| 24 | B3 | Blue data | |
| 25 | B4 | Blue data | |
| 26 | B5 | Blue data | |
| 27 | B6 | Blue data | |
| 28 | B7 | Blue data(MSB) | |
| 29 | GND | Power Ground | |
| 30 | CLK | Sample clock | Note 2 |
| 31 | R/L | Right /Left selection | Note 3,4 |
| 32 | Hsync | Horizontal Sync Input | |
| 33 | Vsync | Vertical Sync Input | |
| 34 | NC | No connection | |
| 35 | U/D | Up/down selection | Note 3,4 |
| 36 | RESET | Global reset pin. | |
| 37 | NC | No connection | |
| 38 | NC | No connection | |
| 39 | NC | No connection | |
| 40 | NC | No connection | |

Note 1: When input 18 bits RGB data, the two low bits of R,G and B data must be grounded.

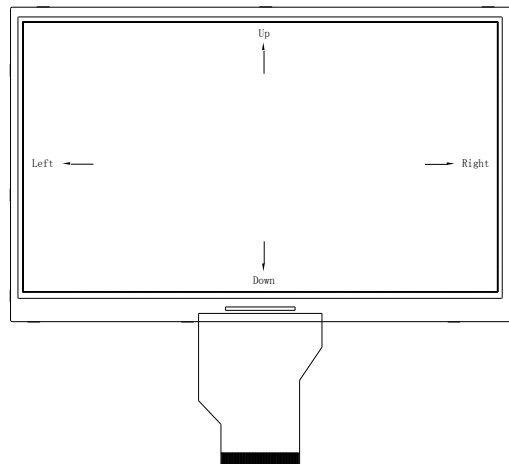
Note 2: Data shall be latched at the falling edge of CLK.

Note 3: Selection of scanning mode

| Setting of scan control | | Scanning direction |
|-------------------------|-----|---------------------------|
| U/D | R/L | |
| L | H | Up to down, left to right |
| H | L | Down to up, right to left |
| L | L | Up to down, right to left |
| H | H | Down to up, left to right |

Note 4: Definition of scanning direction.

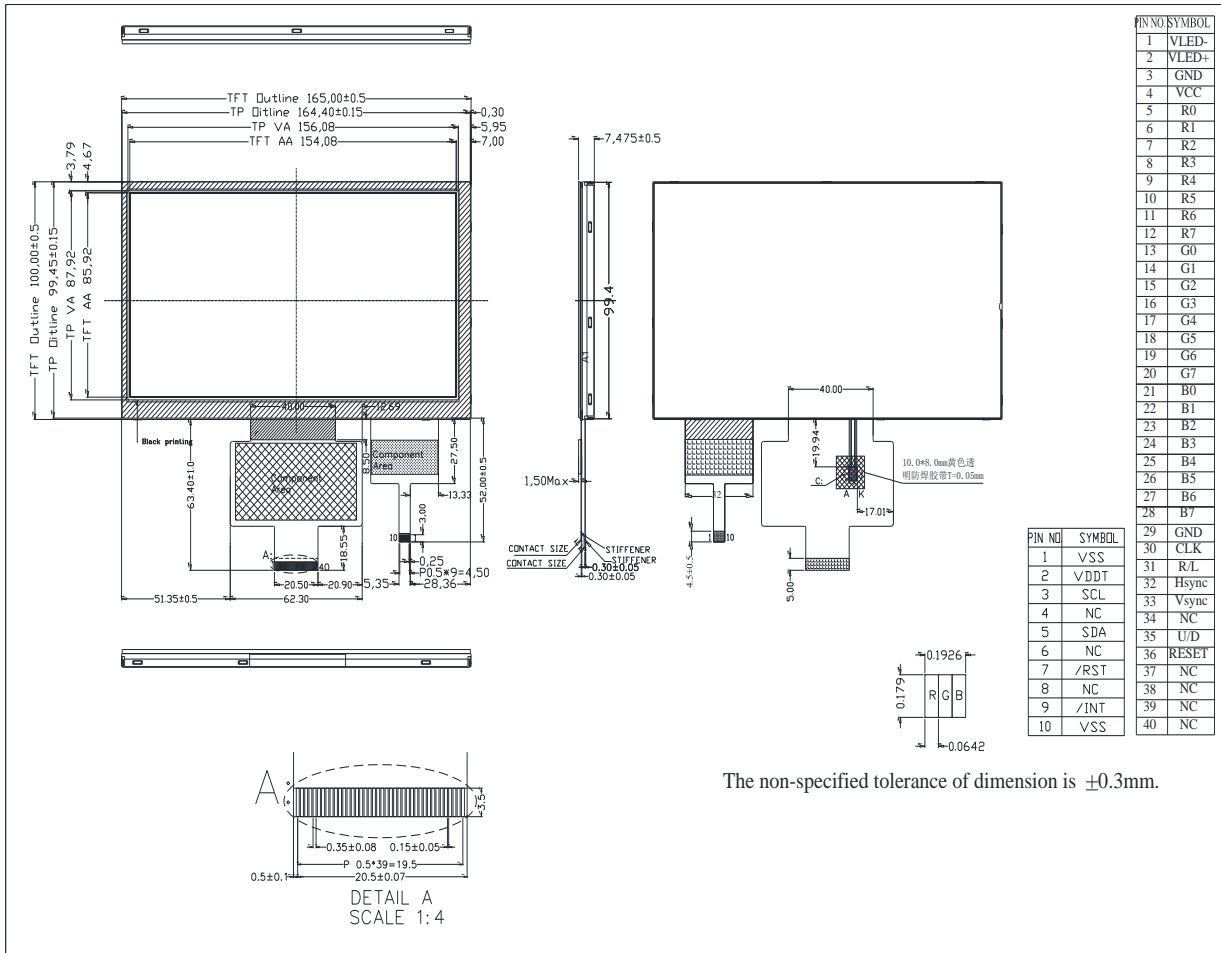
Refer to the figure as below:



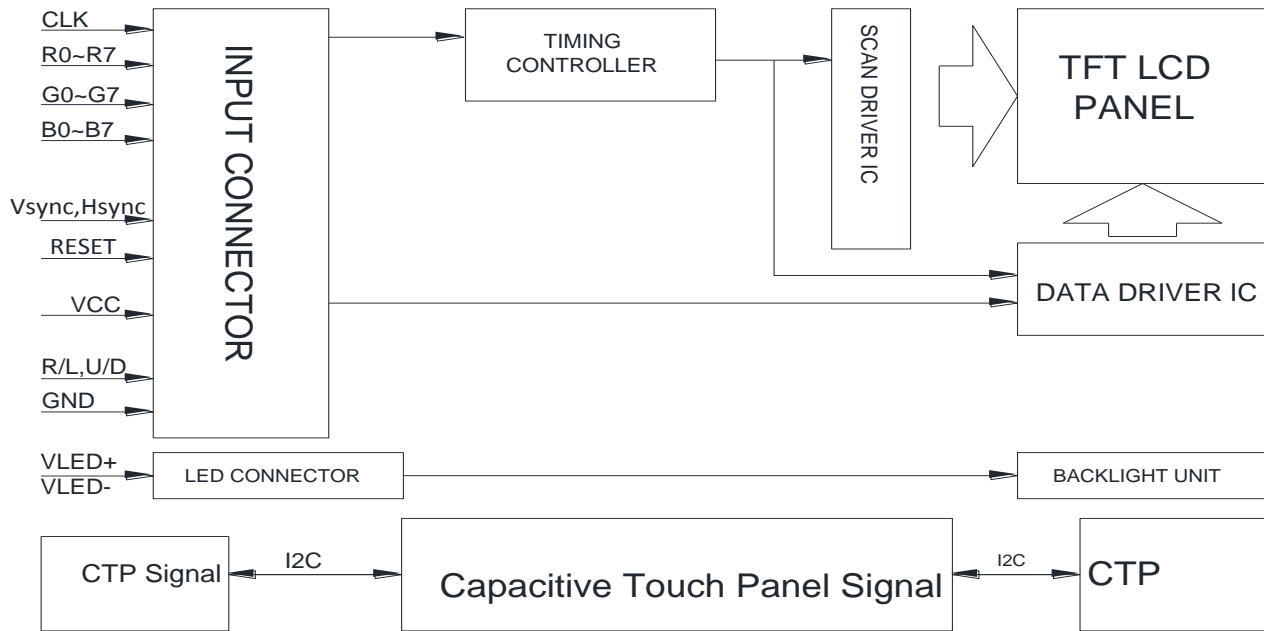
4.2. CTP PIN Definition

| Pin | Symbol | Function | Remark |
|-----|--------|--------------------------------|--------|
| 1 | VSS | Ground for analog circuit | |
| 2 | VDDT | Power Supply : +3.0V | |
| 3 | SCL | I2C clock input | |
| 4 | NC | No connect | |
| 5 | SDA | I2C data input and output | |
| 6 | NC | No connect | |
| 7 | /RST | External Reset, Low is active | |
| 8 | NC | No connect | |
| 9 | /INT | External interrupt to the host | |
| 10 | VSS | Ground for analog circuit | |

5. Contour Drawing



6. Block Diagram



7. Absolute Maximum Ratings

| Item | Symbol | Min | Typ | Max | Unit |
|-----------------------|--------|-----|-----|-----|------|
| Operating Temperature | TOP | -20 | — | +70 | °C |
| Storage Temperature | TST | -30 | — | +80 | °C |

Note: Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above

Temp. $\leq 60^{\circ}\text{C}$, 90% RH MAX. Temp. $> 60^{\circ}\text{C}$, Absolute humidity shall be less than 90% RH at 60°C

8. Electrical Characteristics

8.1. Operating conditions:

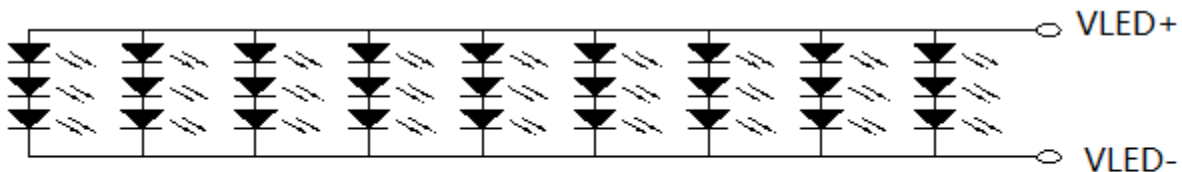
| Item | Symbol | Min | Typ | Max | Unit | Remark |
|--------------------------------|-----------|-----|-----|-----|------|--------|
| Supply Voltage For Logic | VCC | 3.0 | 3.3 | 3.6 | V | Note 1 |
| Power Supply For Current | VCC =3.3V | | 110 | 165 | mA | |
| Supply Voltage For Touch Logic | VDDT | 2.8 | — | 3.3 | V | |

Note 1 : This value is test for Vcc=3.3V , Ta=25°C only

8.2. LED driving conditions

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark |
|-------------------|--------|------|--------|------|------|------------|
| LED current | - | - | 180 | - | mA | - |
| Power Consumption | - | 1620 | - | 1890 | mW | - |
| LED voltage | VLED+ | 9.0 | - | 10.5 | V | Note 1 |
| LED Life Time | - | - | 50,000 | - | Hr | Note 2,3,4 |

Note 1 : There are 1 Groups LED



Backlight LED Circuit

Note 2 : Ta = 25 °C

Note 3 : Brightness to be decreased to 50% of the initial value

Note 4 : The single LED lamp case

9.DC CHARATERISTICS

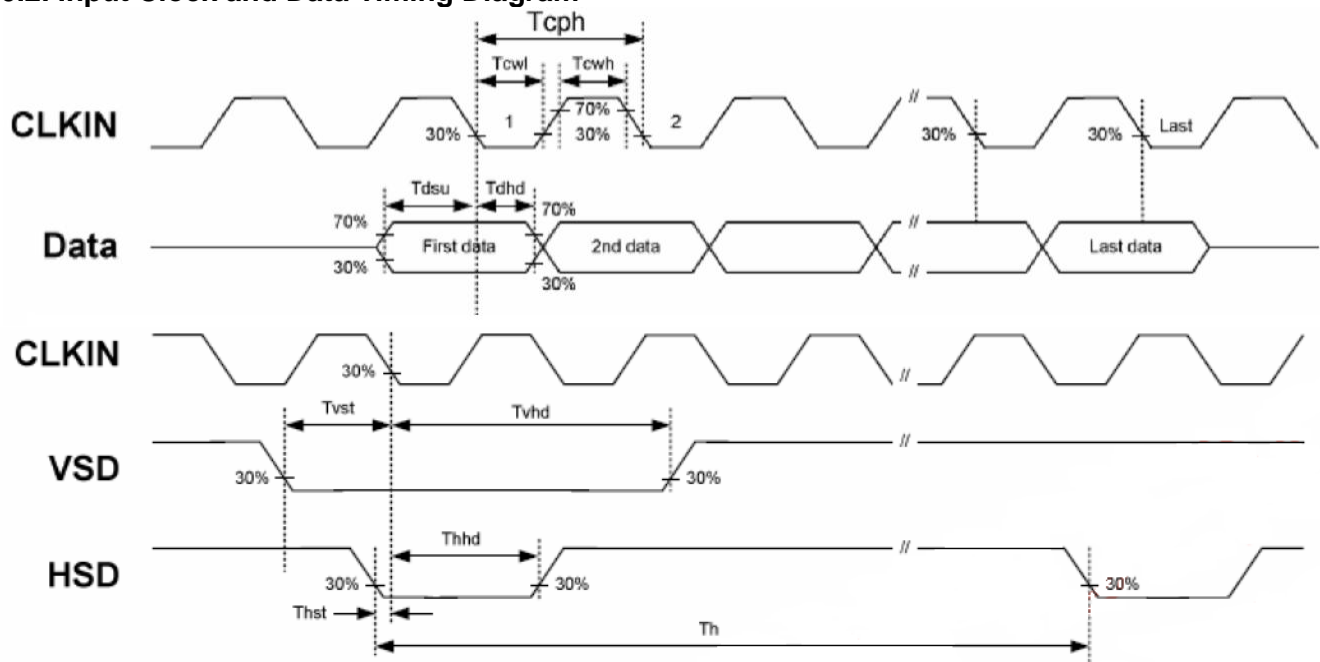
| Parameter | Symbol | Rating | | | Unit | Condition |
|--------------------------|----------|--------|-----|--------|------|-----------|
| | | Min | Typ | Max | | |
| Low level input voltage | V_{IL} | 0 | - | 0.3VCC | V | |
| High level input voltage | V_{IH} | 0.7VCC | - | VCC | V | |

10.AC CHARATERISTICS

10.1. AC Electrical Characteristics

| Signal | Symbol | Min | Typ | Max | Unit |
|------------------------|--------|-----|-----|-----|------|
| HS setup time | Thst | 8 | - | - | ns |
| HS hold time | Thhd | 8 | - | - | ns |
| VS setup time | Tvst | 8 | - | - | ns |
| VS hold time | Tvhd | 8 | - | - | ns |
| Data setup time | Tdsu | 8 | - | - | ns |
| Data hole time | Tdhd | 8 | - | - | ns |
| VCC Power On Slew rate | TPOR | - | - | 20 | ms |
| RESET pulse width | TRst | 1 | - | - | ms |
| DCLK cycle time | Tcoh | 20 | - | - | ns |
| DCLK pulse duty | Tcwh | 40 | 50 | 60 | % |

10.2. Input Clock and Data Timing Diagram



10.3. Timing

| Item | Symbol | Values | | | Unit | Remark |
|-------------------------|--------|--------|------|------|------|--------|
| | | Min. | Typ. | Max. | | |
| CLK Frequency (DCLK) | fclk | 26.4 | 33.3 | 46.8 | MHz | |
| Horizontal Display Area | thd | - | 800 | - | CLK | |
| One Horizontal Line | th | 862 | 1056 | 1200 | CLK | |
| HS pulse width | thpw | 1 | - | 40 | CLK | |
| HS Blanking | thb | 46 | 46 | 46 | CLK | |
| HS Front Porch | thfp | 16 | 210 | 354 | CLK | |
| Vertical Display Area | tvd | - | 480 | - | TH | |
| VS period time | tv | 510 | 525 | 650 | TH | |
| VS pulse width | tvpw | 1 | - | 20 | TH | |
| VS Blanking | tvb | 23 | 23 | 23 | TH | |
| VS Front Porch | tvfp | 7 | 22 | 147 | TH | |

10.4. Data Input Format

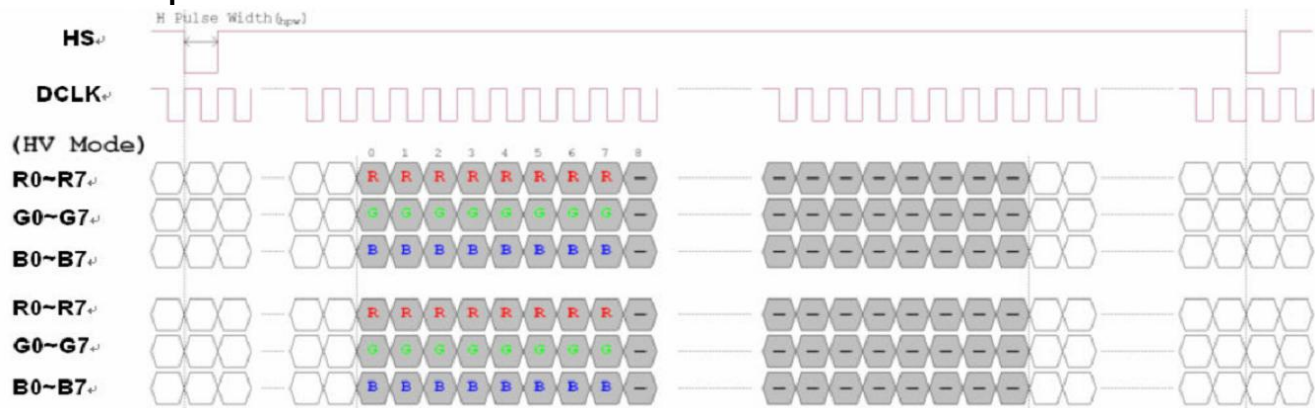


Fig. Horizontal input timing diagram

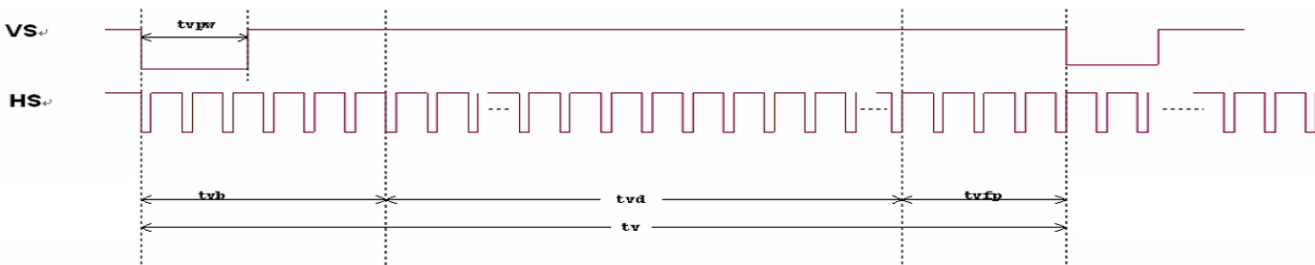


Fig. Vertical input timing diagram

11. Optical Characteristics

| Item | Symbol | Condition. | Min | Typ. | Max. | Unit | Remark | |
|---|--------|--------------------------------|------------|------|------|-------------------|-------------------|------------|
| Response time | T_r | $\theta=0^\circ, \Phi=0^\circ$ | - | 10 | 20 | .ms | Note 3 | |
| | T_f | | - | 15 | 30 | .ms | | |
| Contrast ratio | CR | At optimized viewing angle | 400 | 500 | - | - | Note 4 | |
| Color Chromaticity | White | $\theta=0^\circ, \Phi=0^\circ$ | W_x | 0.26 | 0.30 | 0.32 | - | Note 2,5,6 |
| | | | W_y | 0.27 | 0.28 | 0.33 | - | |
| Viewing angle (Gray Scale Inversion Direction) | Hor. | $CR \geq 10$ | Θ_R | 60 | 70 | - | Deg. | Note 1 |
| | | | Θ_L | 60 | 70 | - | | |
| | Ver. | | Φ_T | 40 | 50 | - | | |
| | | | Φ_B | 60 | 70 | - | | |
| Brightness | - | - | 250 | 350 | - | cd/m ² | Center of display | |

Ta=25±2°C, IL=180mA

Note 1: Definition of viewing angle range

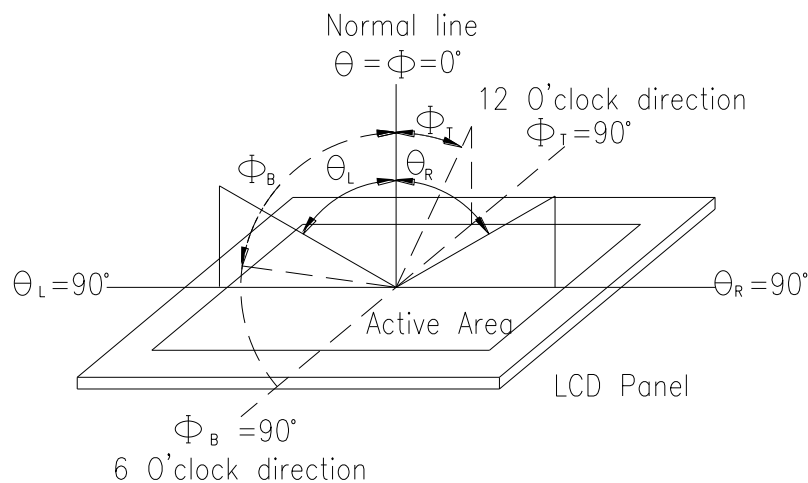


Fig. 11.1. Definition of viewing angle

Note 2: Test equipment setup:

After stabilizing and leaving the panel alone at a driven temperature for 10 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7orBM-5 luminance meter 1.0° field of view at a distance of 50cm and normal direction.

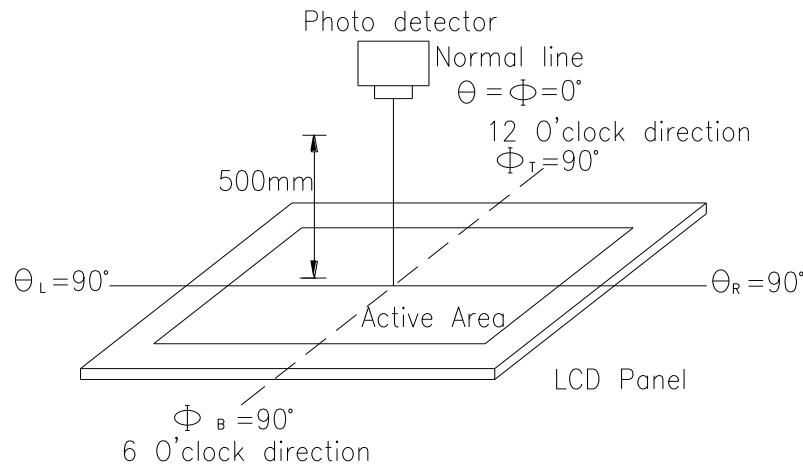
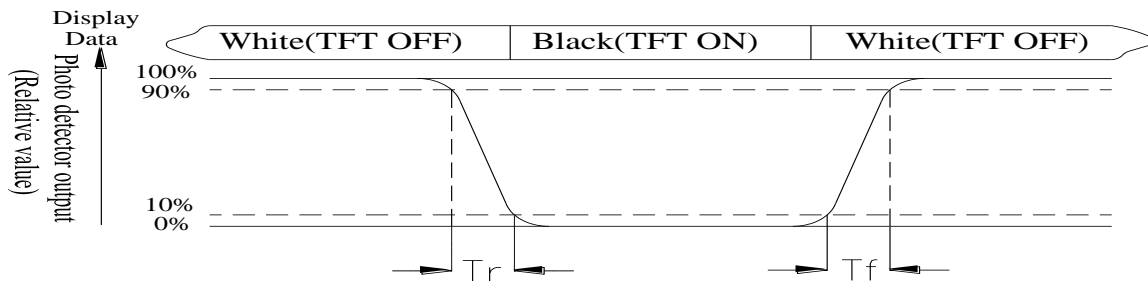


Fig. 11.2. Optical measurement system setup

Note 3: 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_r , is the time between photo detector output intensity changed from 90% to 10%. And fall time, T_f , is the time between photo detector output intensity changed from 10% to 90%



Note 4: Definition of contrast ratio:

The contrast ratio is defined as the following expression.

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

Note 5: White $V_i = V_{i50} \pm 1.5V$

Black $V_i = V_{i50} \pm 2.0V$

“±” means that the analog input signal swings in phase with VCOM signal.

“±” means that the analog input signal swings out of phase with VCOM signal.

The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.

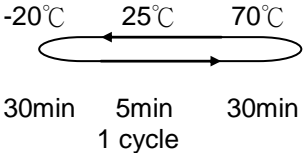
Note 6: Definition of color chromaticity (CIE 1931)

Color coordinates measured at the center point of LCD

Note 7: Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

12. Reliability

Content of Reliability Test (Wide temperature, -20°C~70°C)

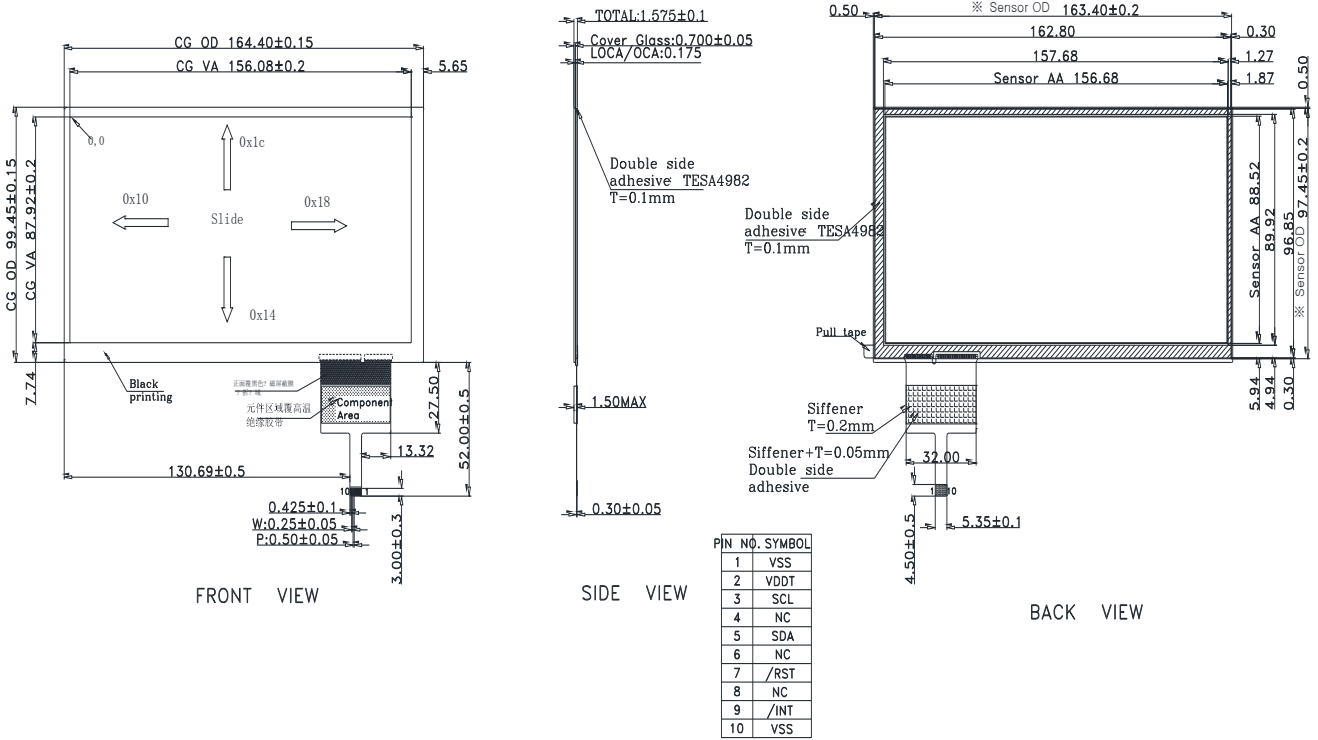
| Environmental Test | | | |
|--------------------------------------|--|--|------|
| Test Item | Content of Test | Test Condition | Note |
| High Temperature storage | Endurance test applying the high storage temperature for a long time. | 80°C 200hrs | 2 |
| Low Temperature storage | Endurance test applying the low storage temperature for a long time. | -30°C 200hrs | 1,2 |
| High Temperature Operation | Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time. | 70°C 200hrs | — |
| Low Temperature Operation | Endurance test applying the electric stress under low temperature for a long time. | -20°C 200hrs | 1 |
| High Temperature/ Humidity Operation | The module should be allowed to stand at 60°C,90%RH max | 60°C,90%RH 96hrs | 1,2 |
| Thermal shock resistance | The sample should be allowed stand the following 10 cycles of operation  | -20°C/70°C 10 cycles | — |
| Vibration test | Endurance test applying the vibration during transportation and using. | Total fixed amplitude : 3 1.5mm Vibration Frequency : 10~55Hz One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes | 3 |
| Static electricity test | Endurance test applying the electric stress to the terminal. | VS=±600V(contact) ,±800v(air), RS=330Ω CS=150pF 10 times | — |

Note1: No dew condensation to be observed.

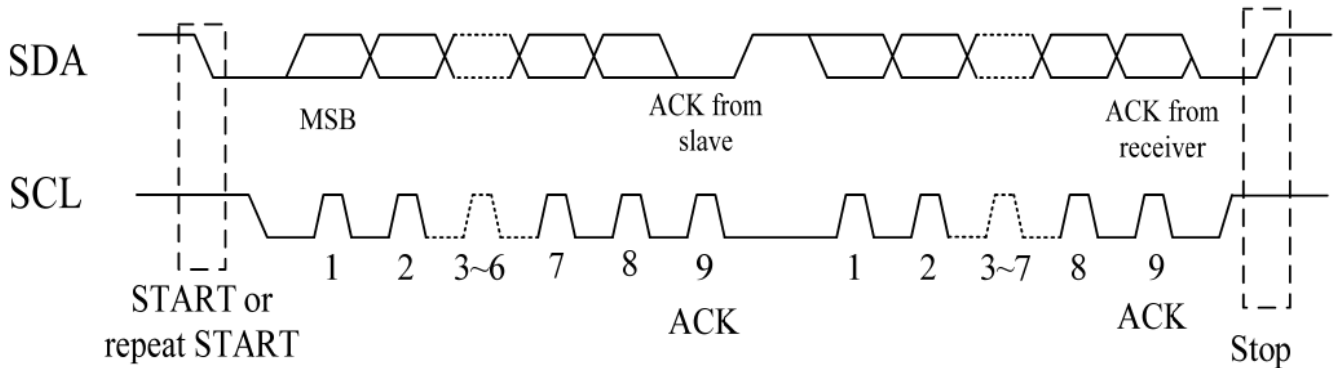
Note2: The function test shall be conducted after 4 hours storage at the normal Temperature and humidity after remove from the test chamber.

Note3: The packing have to including into the vibration testing.

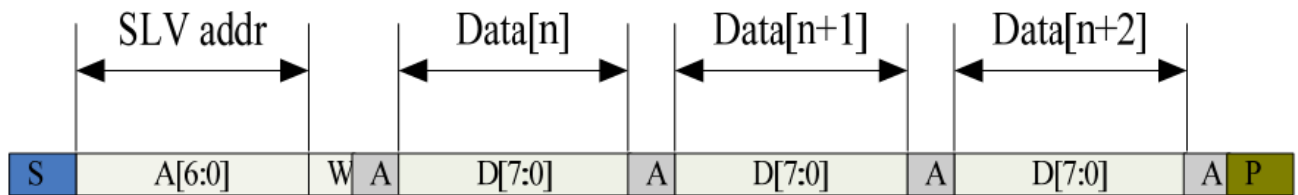
13.Touch Panel Information



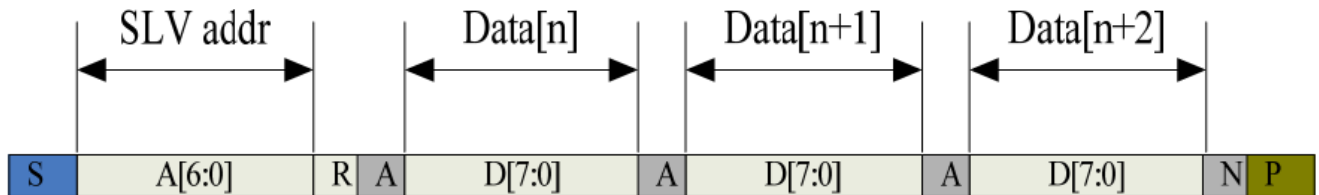
13.1. CTP I2C Timing:



I2C Serial Data Transfer Format



I2C master write, slave read



I2C master read, slave write

| Mnemonics | Description |
|-----------|--|
| S | I2C Start or I2C Restart |
| A[6:0] | Slave address |
| R/W | READ/WRITE bit, '1' for read, '0' for write |
| A(N) | ACK(NACK) bit |
| P | STOP: the indication of the end of a packet (if this bit is missing, S will indicate the end of the current packet and the beginning of the next packet) |

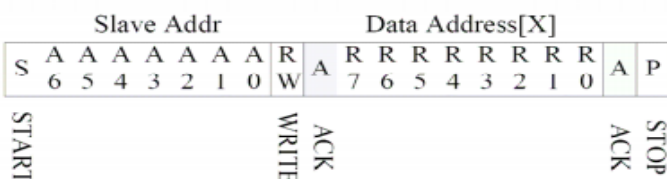
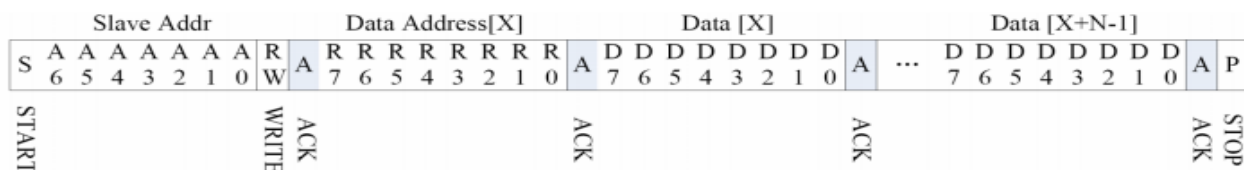
Lists the meanings of the mnemonics used in the above figures

| Parameter | Unit | Min | Max |
|--|------|-----|-----|
| SCL frequency | KHz | 0 | 400 |
| Bus free time between a STOP and START condition | us | 1.3 | \ |
| Hold time (repeated) START condition | us | 0.6 | \ |
| Data setup time | ns | 100 | \ |
| Setup time for a repeated START condition | us | 0.6 | \ |
| Setup time for STOP condition | us | 0.6 | \ |

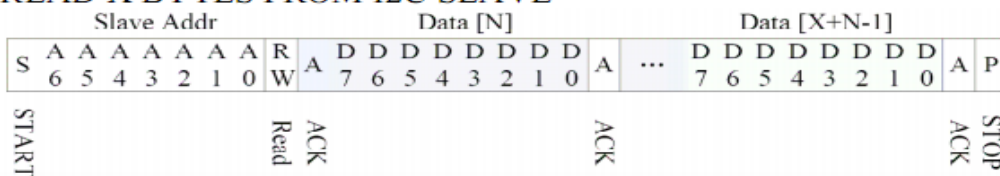
Interface Timing Characteristics

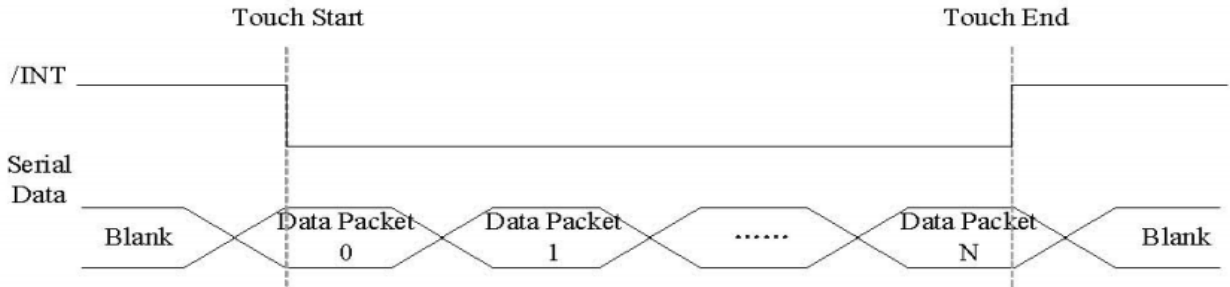
AS FOR STANDARD CTPM, HOST NEED TO USE BOTH INTERRUPT CONTROL SIGNAL AND SERIAL DATA INTERFACE TO GET THE TOUCH DATA. HERE IS THE TIMING TO GET TOUCH DATA.

WRITE BYTES TO I2C SLAVE



READ X BYTES FROM I2C SLAVE





Address: 0X38

TOUCH DATA READ PROTOCOL

| NAME | VALUE | DESCRIPTION |
|----------------------------------|-------|--|
| START CH | 0X00 | START COMMAND FOR CTPM TOUCH DATA PACKET,HOST MUST SEND CTPM A START CH COMMAND BEFORE READ TOUCH DATA |
| Lst READ BYTE~ LAST READ BYTE | | TOUCH DATA PACKET SENT BY CTPM,EACH BYTE HAS 8-BIT DATA ,A TOUCH DATA PACKET CONSISTS OF N BYTE |

| Address | Name | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 | Host Access |
|---------|--------------|---------------------------------------|-------------------|------|------|--|------|------|------|-------------|
| 00h | Devide__Mode | — | Device Model[2:0] | | | — | | | | RW |
| 01h | Gest__ID | Gesture ID[7:0] | | | | | | | | R |
| 02h | TD__Status | — | | | | Number of touch points[3:0] | | | | R |
| 03h | Touch1__XH | 1 st Event Flag | — | | | 1 st Touch X Position[11:8] | | | | R |
| 04h | Touch1__XL | 1 st Touch X Position[7:0] | | | | | | | | R |
| 05h | Touch1__YH | 1 st Touch ID[3:0] | | | | 1 st Touch Y Position[11:8] | | | | R |
| 06h | Touch1__YL | 1 st Touch Y Position[7:0] | | | | | | | | R |
| 09h | Touch2__XH | 2 nd Event Flag | — | | | 2 nd Touch X Position[11:8] | | | | R |

| | | | | | |
|-----|------------|---|---------------------------------|------------------------------|----------------|
| 0Ah | Touch2__XL | 2 nd Touch X Position[7:0] | R | 0Ah | Touch2__ XL |
| 0Bh | Touch2__YH | 2nd Touch ID[3:0] | 2ndTouch Y Position[11:8] | 0Bh | Touch2__ YH |
| 0Ch | Touch2__YL | 2nd Touch Y Position[7:0] | R | 0Ch | Touch2__ YL |
| 0Fh | Touch3__XH | 3rdEvent Flag | — | 3rdTouch X Position[11:8] | R |
| 10h | Touch3__XL | 3rd Touch X Position[7:0] | | | R |
| 11h | Touch3__YH | 3rdTouch ID[3:0] | 3rdTouch Y Position[11:8] | | R |
| 12h | Touch3__YL | 3rd Touch Y Position[7:0] | | | R |
| 15h | Touch4__XH | 4thEvent Flag | — | 4thTouch X Position[11:8] | R |
| 16h | Touch4__XL | 4th Touch X Position[7:0] | | | R |
| 17h | Touch4__YH | 4thTouch ID[3:0] | 4thTouch Y Position[11:8] | | R |
| 18h | Touch4__YL | 4th Touch Y Position[7:0] | | | R |
| 1Bh | Touch5__XH | 5thEvent Flag | — | 5thTouch X Position[11:8] | R |
| 1Ch | Touch5__XL | 5th Touch X Position[7:0] | | | R |
| 1Dh | Touch5__YH | 5thTouch ID[3:0] | 5thTouch Y Position[11:8] | | R |
| 1Eh | Touch5__YL | 5th Touch Y Position[7:0] | | | R |

LCM Sample Estimate Feedback Sheet

Module Number : _____

1 、 Panel Specification :

| | | |
|----------------------------|-------------------------------|-------------------------------------|
| 1. Panel Type : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 2. View Direction : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 3. Numbers of Dots : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 4. View Area : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 5. Active Area : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 6. Operating Temperature : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 7. Storage Temperature : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 8. Others : _____ | | |

2 、 Mechanical Specification :

| | | |
|-----------------------------|-------------------------------|-------------------------------------|
| 1. PCB Size : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 2. Frame Size : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 3. Material of Frame : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 4. Connector Position : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 5. Fix Hole Position : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 6. Backlight Position : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 7. Thickness of PCB : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 8. Height of Frame to PCB : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 9. Height of Module : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 10. Others : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |

3 、 Relative Hole Size :

| | | |
|-----------------------------|-------------------------------|-------------------------------------|
| 1. Pitch of Connector : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 2. Hole size of Connector : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 3. Mounting Hole size : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 4. Mounting Hole Type : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 5. Others : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |

4 、 Backlight Specification :

| | | |
|---|-------------------------------|-------------------------------------|
| 1. B/L Type : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 2. B/L Color : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 3. B/L Driving Voltage (Reference for LED Type) : <input type="checkbox"/> Pass <input type="checkbox"/> NG , _____ | | |
| 4. B/L Driving Current : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 5. Brightness of B/L : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 6. B/L Solder Method : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 7. Others : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |

>> **Go to page 2** <<

| | | |
|--|-------------------------------|-------------------------------------|
| Module Number : _____ | | |
| 5 · <u>Electronic Characteristics of Module</u> : | | |
| 1.Input Voltage : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 2.Supply Current : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 3.Driving Voltage for LCD : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 4.Contrast for LCD : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 5.B/L Driving Method : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 6.Negative Voltage Output : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 7.Interface Function : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 8.LCD Uniformity : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 9.ESD test : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 10.Others : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 6 · <u>Summary</u> : | | |
| <p>Sales signature : _____</p> <p>Customer Signature : _____ Date : / / _____</p> | | |