



**RAYSTAR**

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## RFF50CB-AIW-DNG

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### 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       | 2018/06/13 |                  | First issue |

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# 1.Module Classification Information

|          |          |          |           |           |          |          |          |          |          |          |          |          |
|----------|----------|----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|
| <b>R</b> | <b>F</b> | <b>F</b> | <b>50</b> | <b>CB</b> | <b>-</b> | <b>A</b> | <b>I</b> | <b>W</b> | <b>-</b> | <b>D</b> | <b>N</b> | <b>G</b> |
| 1        | 2        | 3        | 4         | 5         | -        | 6        | 7        | 8        | -        | 9        | 10       | 11       |

| Item | Description   |  |
|------|---|--|
| 1    | R : Raystar Optronics Inc.  |  |
| 2    | Display Type : F→TFT Type, J→ Custom TFT  |  |
| 3    | Solution: A: 128x160    B:320x234    C:320x240    D:480x234    E:480x272<br>F:800x480    G:640x480    H:1024x600    I:320x480    J:240x320<br>K:1280x800    L:240x400    M:1024x768    N:128x128    O:480x800<br>P:640x320    Q:800x600    S:480x128    T:800x320 |  |
| 4    | Display Size : 5.0" TFT   |  |
| 5    | Version Code.   |  |
| 6    | Model Type:<br>A : TFT LCD<br>E : TFT+FR+CONTROL BOARD<br>J : TFT+FR+A/D BOARD<br>N : TFT+FR+A/D BOARD+CONTROL BOARD<br>S : TFT+FR+POWER BOARD (DC TO DC)<br>1 : TFT+CONTROL BOARD  | 6 : TFT+FR<br>H : TFT+D/V BOARD<br>I : TFT+FR+D/V BOARD<br>B : TFT+POWER BD  |
| 7    | Polarizer Type,<br>Temperature range,<br>View direction   | I→Transmissive, W. T, 6:00 ;    C→Transmissive, N. T, 6:00<br>L→Transmissive, W.T,12:00 ;    F→Transmissive, N.T,12:00<br>Y→Transmissive,W.T, IPS TFT ;<br>A→Transmissive, N.T, IPS TFT<br>Z→Transmissive, W.T, O-TFT<br>R→Transmissive, Super W.T, O-TFT<br>N→Transmissive, Super W.T, 6:00;<br>Q→Transmissive, Super W.T, 12:00<br>V→Transmissive, Super W.T, VA TFT |
| 8    | Backlight   | W : LED, White                    H : LED, High Light White<br>F : CCFL, White   |
| 9    | Driver Method   | D: Digital    A: Analog    L : LVDS    M:MIPI  |
| 10   | Interface   | N : without control board    A : 8Bit    B : 16Bit<br>S:SPI Interface    R: RS232    U:USB    I: I2C   |
| 11   | TS  | N : Without TS    S : resistive touch panel<br>C : capacitive touch panel capacitive touch panel (G-F-F)<br>G : capacitive touch panel(G-G)  |

## 2.Summary

TFT 5.0” 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,

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### 3.General Specifications

- Size: 5.0 inch
- Dot Matrix: 800× 3(RGB) × 480 dots
- Module dimension: 120.7(W) ×75.8(H) ×4.475mm
- Active area: 108(W) ×64.8 (H) mm
- Dot pitch: 0.135(W) ×0.135(H) mm
- LCD type: TFT, Normally White, Transmissive
- View Direction: 12 o'clock
- Gray Scale Inversion Direction: 6 o'clock
- TFT Interface: 24-bit RGB
- Aspect Ratio: 16:9
- Backlight Type: LED ,Normally White
- CTP IC: FT5426DQ8 Or Equal
- CTP Interface: I2C
- CTP FW Version: 2
- With /Without TP: With CTP
- Surface: Glare

\*Color tone slight changed by temperature and driving voltage.

## 4.Interface

### 4.1. LCM PIN Definition

FPC Connector is used for the module electronics interface.

| Pin | Symbol | Function                          | Remark |
|-----|--------|-----------------------------------|--------|
| 1   | VLED-  | Power for LED backlight (Cathode) |        |
| 2   | VLED+  | Power for LED backlight (Anode)   |        |
| 3   | GND    | Power Ground                      |        |
| 4   | VDD    | Power voltage                     |        |
| 5   | R0     | Red data (LSB)                    |        |
| 6   | R1     | Red data                          |        |
| 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)                   |        |
| 14  | G1     | Green data                        |        |
| 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)                    |        |
| 22  | B1     | Blue data                         |        |
| 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                         |        |
| 31 | DISP  | Display on/off                       |        |
| 32 | NC/HS | No connection /Horizontal sync input | (Note) |
| 33 | NC/VS | No connection /Vertical sync input   | (Note) |
| 34 | DE    | Data input enable                    |        |
| 35 | NC    | No connection                        |        |
| 36 | GND   | Power Ground                         |        |
| 37 | NC    | No connection                        |        |
| 38 | NC    | No connection                        |        |
| 39 | NC    | No connection                        |        |
| 40 | NC    | No connection                        |        |

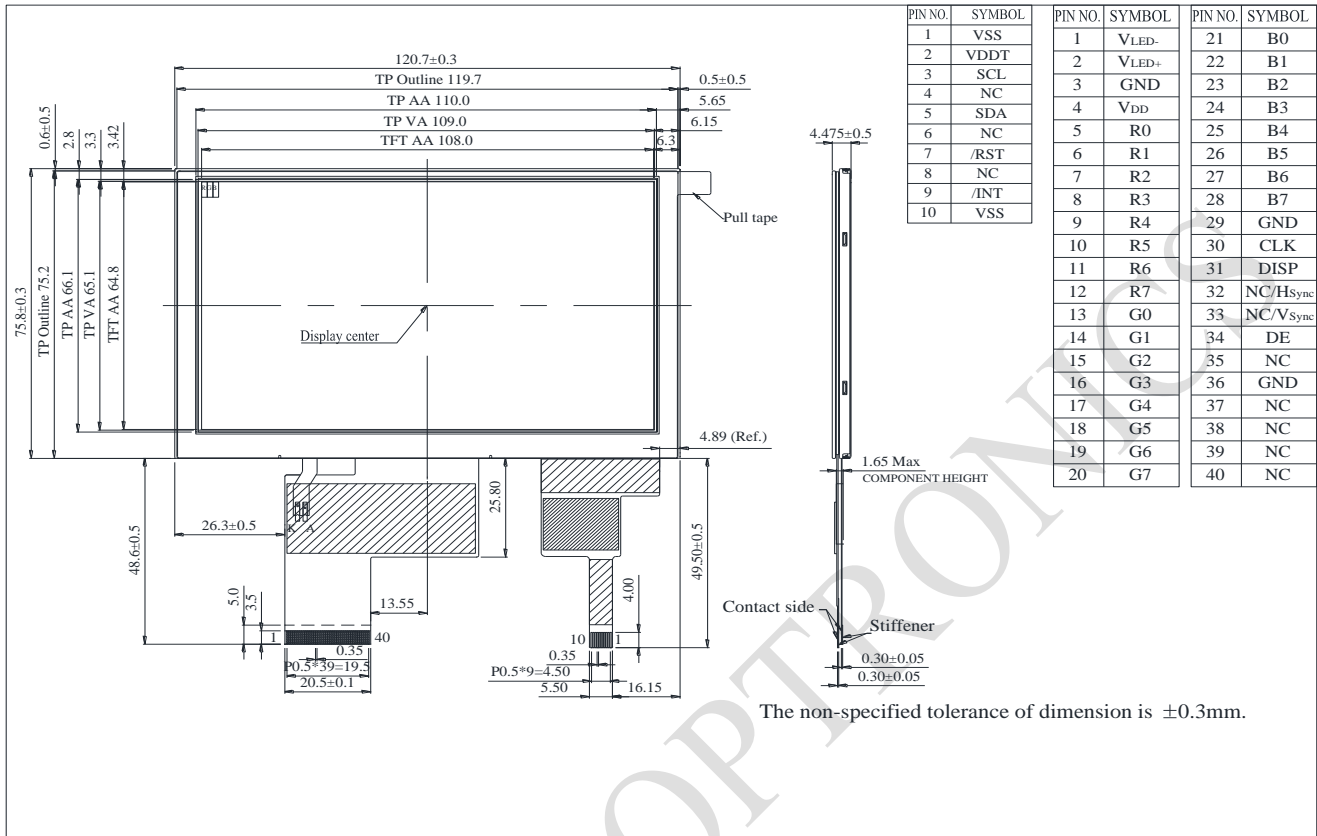
Note : This module default function is for DE mode, if this module want change to use SYNC mode , the FPC have to modify resistive jumper .

#### 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 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. 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  $60^{\circ}\text{C}$

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## 7. Electrical Characteristics

### 7.1. Typical Operation Conditions

| Item                      | Symbol          | Values  |      |         | Unit | Remark   |
|---------------------------|-----------------|---------|------|---------|------|----------|
|                           |                 | Min.    | Typ. | Max.    |      |          |
| Power voltage             | VDD             | 3.1     | 3.3  | 3.5     | V    |          |
| Current for Driver(Black) | I <sub>dd</sub> | -       | 110  | 170     | mA   | VDD=3.3V |
| Input logic high voltage  | V <sub>IH</sub> | 0.7 VDD | -    | VDD     | V    | Note 1   |
| Input logic low voltage   | V <sub>IL</sub> | 0       | -    | 0.3 VDD |      |          |

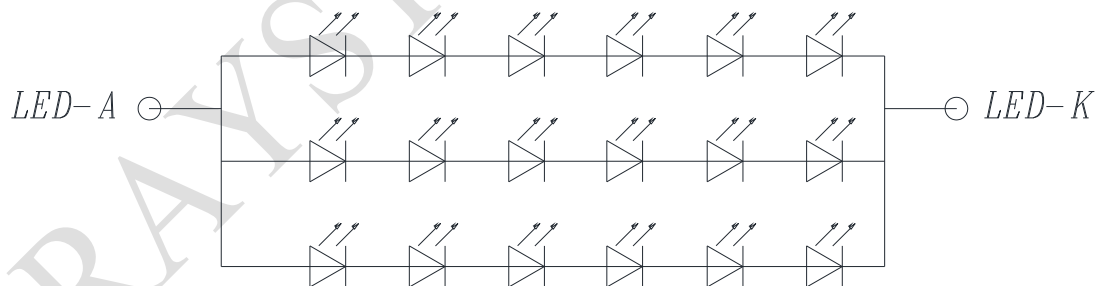
Note1: CLK,DE,R0~R7, G0~7, B0~7.

### 7.2. Backlight Driving Conditions

| Item                      | Symbol         | Values |        |      | Unit | Remark |
|---------------------------|----------------|--------|--------|------|------|--------|
|                           |                | Min.   | Typ.   | Max. |      |        |
| Voltage for LED backlight | V <sub>L</sub> | 18     | 19.2   | 20   | V    | Note 1 |
| Current for LED backlight | I <sub>L</sub> | --     | 60     | --   | mA   |        |
| LED life time             | -              | --     | 50,000 | -    | Hr   | Note 2 |

Note 1: The LED Supply Voltage is defined by the number of LED at Ta=25°C and I<sub>L</sub>=20mA/pcs.

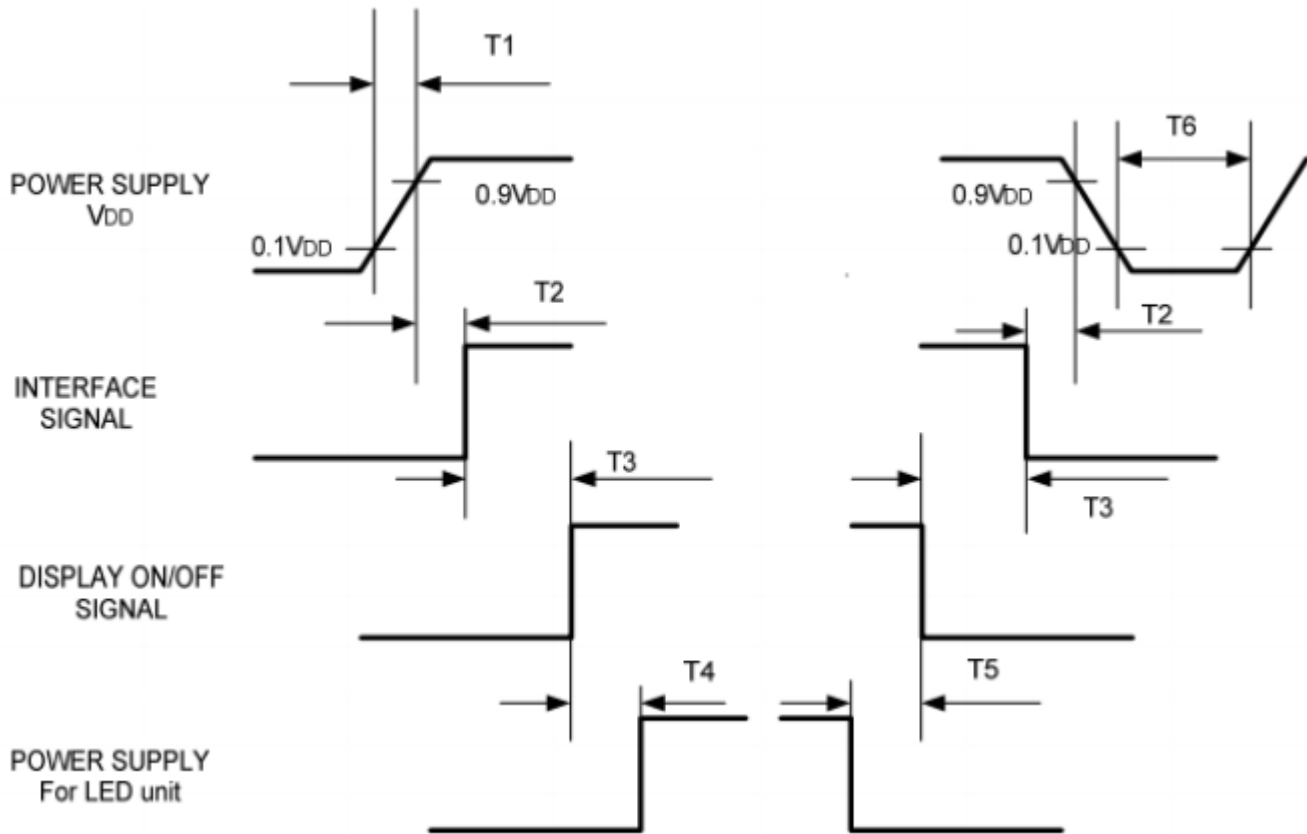
Note 2: The “LED life time” is defined as the module brightness decrease to 50% Original brightness at Ta=25°C and I<sub>L</sub>=20mA/pcs. The LED lifetime could be decreased if operating I<sub>L</sub> is larger than 25mA/pcs.



CIRCUIT DIAGRAM : 6\*3 Dice

### 7.3. Power Sequence

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence should be as the diagram below.



| Symbol | Specification                      | Symbol | Specification              |
|--------|------------------------------------|--------|----------------------------|
| T1     | $0 \leq T1 \leq 10 \text{ msec}$   | T4     | $200 \text{ msec} \leq T4$ |
| T2     | $16 \leq T2 \leq 100 \text{ msec}$ | T5     | $100 \text{ msec} \leq T5$ |
| T3     | $0 \leq T3 \leq 200 \text{ msec}$  | T6     | $16 \text{ msec} \leq T6$  |

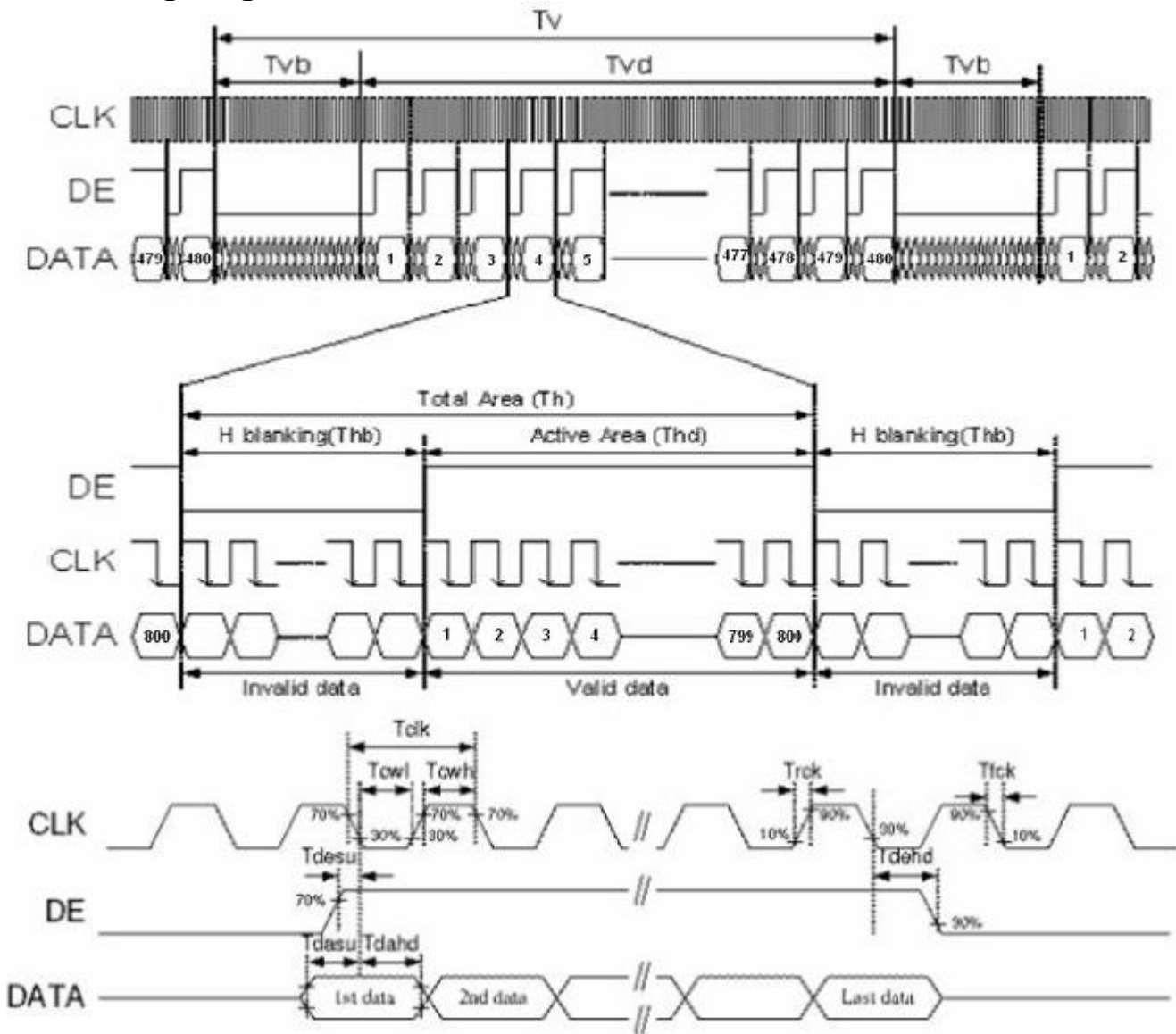
## 7.4. Timing Characteristics

Timing conditions

Parallel DE mode RGB input timing table

| Parameter                 | Symbol | Values |      |      | Unit | Remark |
|---------------------------|--------|--------|------|------|------|--------|
|                           |        | Min.   | Typ. | Max. |      |        |
| CLK frequency             | Fclk   | 26.4   | 33.3 | 46.8 | MHz  |        |
| DEV period time           | Tv     | 510    | 525  | 650  | H    |        |
| DEV display area          | Tvd    | 480    |      |      | H    |        |
| DEV blanking              | Tvd    | 30     | 45   | 170  | H    |        |
| DEH period time           | Th     | 862    | 1056 | 1200 | CLK  |        |
| DEH display area          | Thd    | 800    |      |      | CLK  |        |
| DEH blanking              | THb    | 62     | 256  | 400  | CLK  |        |
| CLK cycle time            | Tclk   | 21.3   | 30   | 37.8 | ns   |        |
| Clock width of high level | Tcwh   | 40     | 50   | 60   | %    |        |
| Clock width of low level  | Tcwl   | 40     | 50   | 60   | %    |        |
| Clock rising time         | Trck   | 8      | -    | -    | ns   |        |
| Clock falling time        | Tfck   | 8      | -    | -    | ns   |        |
| Data Setup Time           | Tdasu  | 8      | -    | -    | ns   |        |
| Data Hold Time            | Tdahd  | 8      | -    | -    | ns   |        |
| DE Setup Time             | Tdesu  | 8      | -    | -    | ns   |        |
| DE Hold Time              | Tdehd  | 8      | -    | -    | ns   |        |

### 7.5. Timing diagram



## 8. Optical Characteristics

| Item   | Symbol | Condition.                        | Min                         | Typ. | Max. | Unit              | Remark            |            |
|--|--------|-----------------------------------|-----------------------------|------|------|-------------------|-------------------|------------|
| Response time                                  | Tr     | $\theta=0^\circ$ 、 $\phi=0^\circ$ | -                           | 10   | 20   | .ms               | Note 3,5          |            |
|  | Tf     |                                   | -                           | 15   | 30   | .ms               |                   |            |
| Contrast ratio                                 | CR     | At optimized viewing angle        | 400                         | 500  | -    | -                 | Note 4,5          |            |
| Color Chromaticity                             | White  | Wx                                | $\theta=0^\circ$ 、 $\phi=0$ | 0.26 | 0.31 | 0.36              |                   | Note 2,6,7 |
|  |        | Wy                                |                             | 0.28 | 0.33 | 0.38              |                   |            |
| Viewing angle (Gray Scale Inversion Direction) | Hor.   | $\theta_R$                        | $CR \geq 10$                | 60   | 70   | -                 | Deg.              | Note 1     |
|  |        | $\theta_L$                        |                             | 60   | 70   | -                 |                   |            |
|  | Ver.   | $\phi_T$                          |                             | 40   | 50   | -                 |                   |            |
|  |        | $\phi_B$                          |                             | 60   | 70   | -                 |                   |            |
| Brightness                                     | -      | -                                 | 300                         | 400  | -    | cd/m <sup>2</sup> | Center of display |            |

Ta=25±2°C

Note 1: Definition of viewing angle range

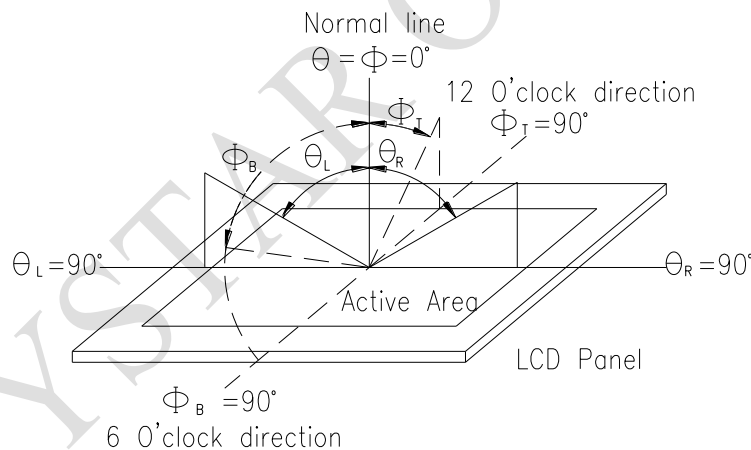
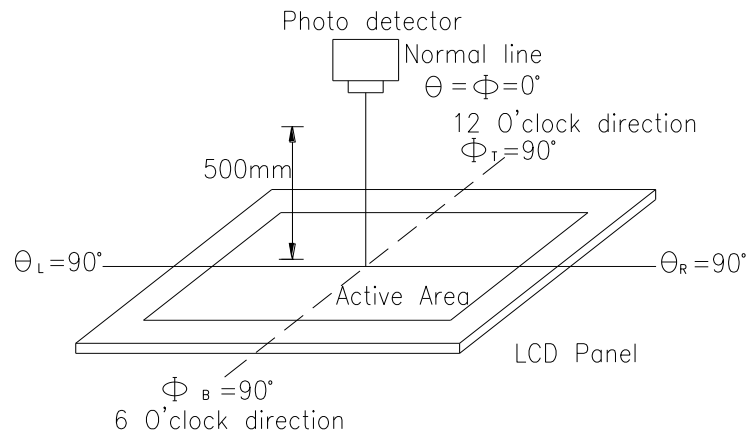


Fig. 8.1. Definition of viewing angle

Note 2: Test equipment setup:

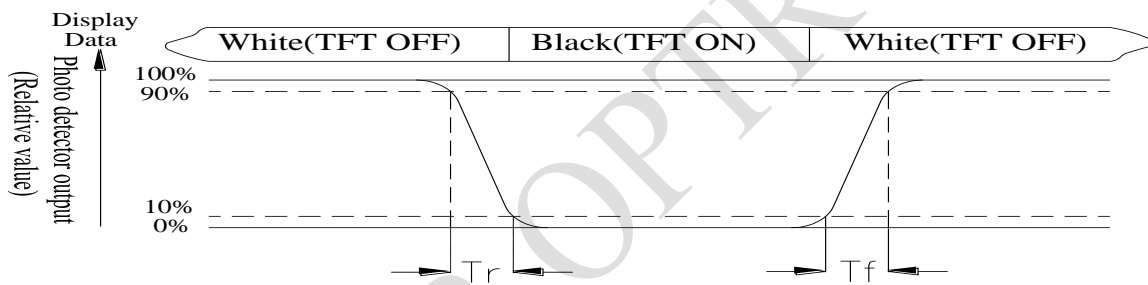
After stabilizing and leaving the panel alone at a driven temperature for 10 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7 or BM-5 luminance meter 1.0° field of view at a distance of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



**Fig. 8.2. 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)**

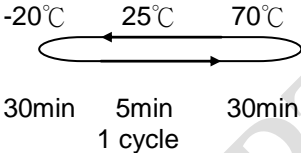
Color coordinates measured at the center point of LCD

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



## 9. Reliability

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

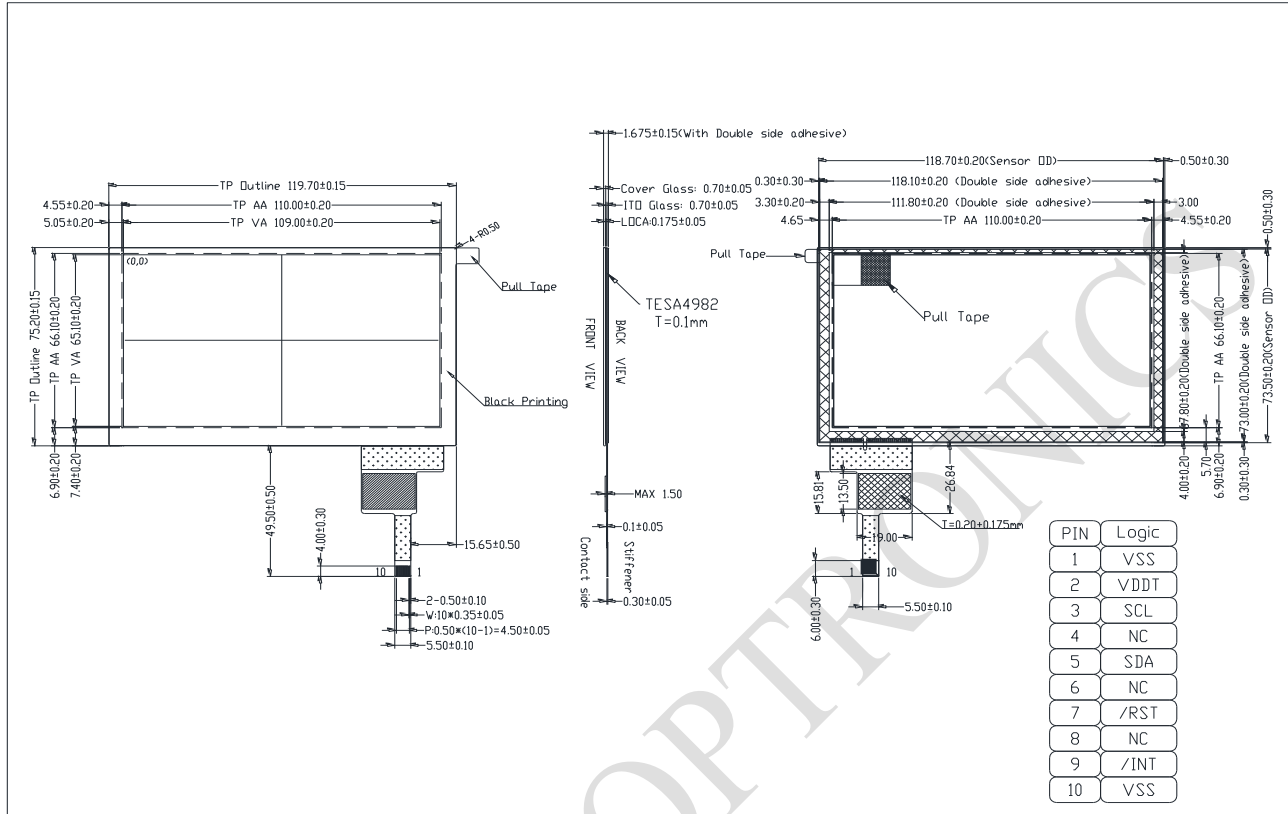
| Environmental Test                   |   |  |      |
|--------------------------------------|---|--|------|
| Test Item                            | Content of Test   | Test Condition   | Note |
| High Temperature storage             | Endurance test applying the high storage temperature for a long time.   | 80°C<br>200hrs   | 2    |
| Low Temperature storage              | Endurance test applying the low storage temperature for a long time.  | -30°C<br>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<br>200hrs   | —    |
| Low Temperature Operation            | Endurance test applying the electric stress under low temperature for a long time.  | -20°C<br>200hrs  | 1    |
| High Temperature/ Humidity Operation | The module should be allowed to stand at 60°C,90%RH max   | 60°C,90%RH<br>96hrs  | 1,2  |
| Thermal shock resistance             | The sample should be allowed stand the following 10 cycles of operation<br><br><div style="text-align: center;">  <p>-20°C      25°C      70°C</p> <p>30min    5min    30min</p> <p>1 cycle</p> </div> | -20°C/70°C<br>10 cycles  | —    |
| Vibration test                       | Endurance test applying the vibration during transportation and using.  | Total fixed amplitude : 3<br>1.5mm<br>Vibration Frequency :<br>10~55Hz<br>One cycle 60<br>seconds to 3<br>directions of X,Y,Z for<br>Each 15 minutes | 3    |
| Static electricity test              | Endurance test applying the electric stress to the terminal.  | VS=±600V(contact)<br>,±800v(air),<br>RS=330Ω<br>CS=150pF<br>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.

# 10.Touch Panel Information



**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 , _____ |

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|   |                               |                                     |
|---|-------------------------------|-------------------------------------|
| <b>Module Number :</b> _____  |                               |                                     |
| <b>5 · <u>Electronic Characteristics of Module</u> :</b>  |                               |                                     |
| 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 , _____ |
| <b>6 · <u>Summary</u> :</b>   |                               |                                     |
| <p style="text-align: right;">Sales signature : _____</p> <p style="text-align: right;">Customer Signature : _____      <u>Date</u> :   /   / _____</p> |                               |                                     |