



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

RFF500B-AIH-DNN

SPECIFICATION

CUSTOMER:

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

FOR CUSTOMER USE ONLY

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

Release DATE:

TFT Display Inspection Specification: <https://www.raystar-optronics.com/download/products.htm>

Precaution in use of TFT module: <https://www.raystar-optronics.com/download/declaration.htm>

Revision History

| VERSION | DATE | REVISED PAGE NO. | Note |
|---------|------------|------------------|------------------------------|
| 0 | 2016/04/28 | | First issue |
| A | 2016/06/21 | | Modify contour drawing(AA) |
| B | 2016/08/11 | | Modify Vibration test |
| C | 2016/11/04 | | Modify Summary |
| D | 2016/11/18 | | Add Aspect Ratio |
| E | 2017/03/10 | | Modify HS/VS=NC/HS & NC/VS |
| F | 2017/05/03 | | Modify HS/VS=NC |
| G | 2018/01/15 | | Add Note (Interface) |
| H | 2019/06/24 | | Add the maximum width of FPC |
| I | 2020/03/12 | | Add Uniformity |

RAYSTAR OPTRO

Contents

- 1.Module Classification Information
- 2.Summary
- 3.General Specification
- 4.Interface
- 5.Contour Drawing
- 6.Absolute Maximum Ratings
- 7.Electrical Characteristics
- 8.Optical Characteristics
- 9.Reliability
- 10.Other

RAYSTAR OPTRONICS

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,

RAYSTAR OPTRONICS

3. General Specifications

- Size: 5.0 inch
- Dot Matrix: 800× 3(RGB) × 480 dots
- Module dimension: 120.7(W) ×75.8(H) ×2.8mm
- 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
- Aspect Ratio: 16:9
- Backlight Type: LED ,Normally White
- With /Without TP: Without TP
- Surface: Anti-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.

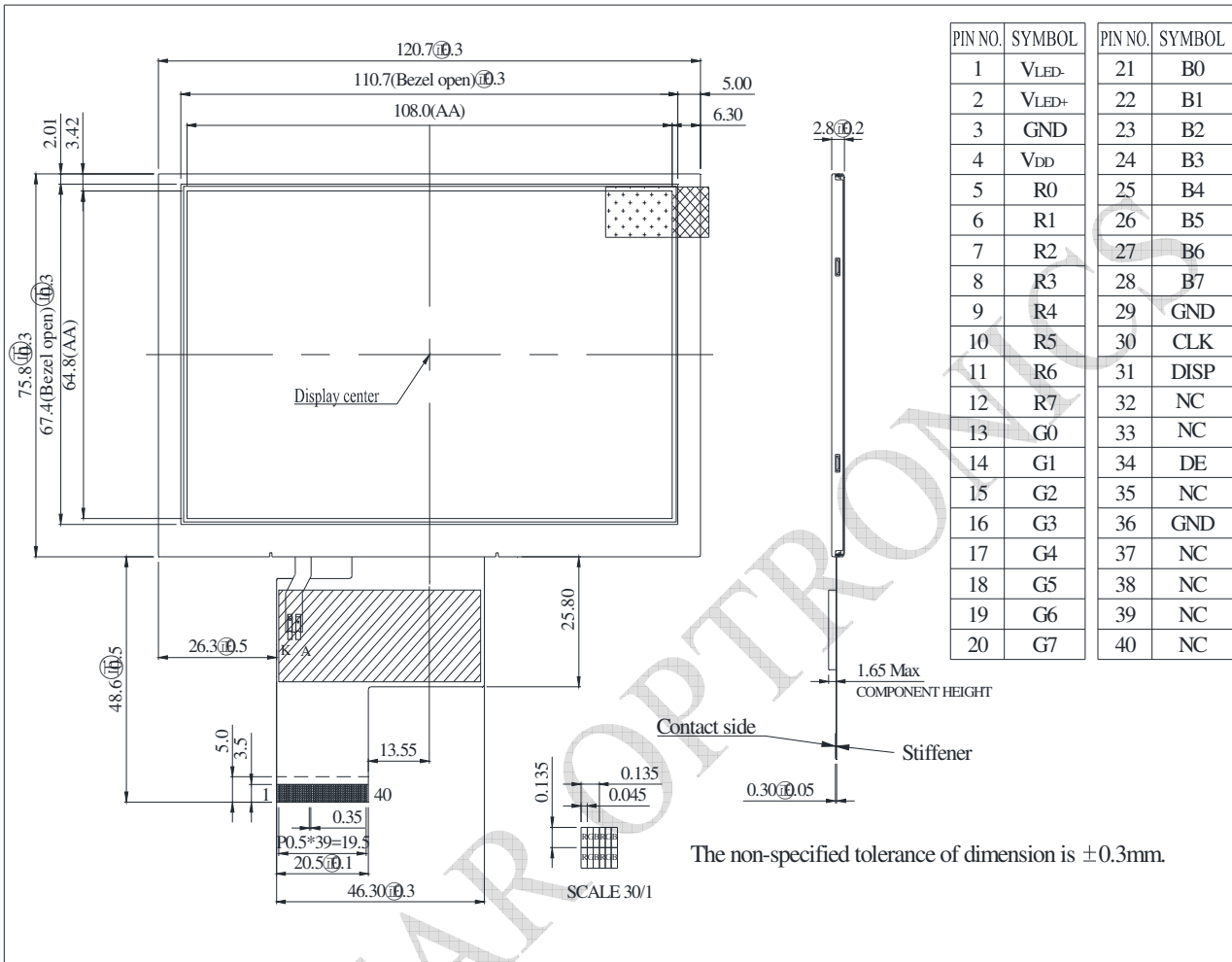
| Pin | Symbol | Function | Remark |
|-----|--------|-----------------------------------|--------|
| 1 | VLED- | Power for LED backlight (Cathode) | |
| 2 | VLED+ | Power for LED backlight (Anode) | |
| 3 | GND | Power Ground | |
| 4 | VDD | Power voltage | |
| 5 | R0 | Red data (LSB) | |
| 6 | R1 | 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 .

RAYSTAR OPTRONICS

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°C

RAYSTAR OPTRONICS

7. Electrical Characteristics

7.1. Typical Operation Conditions

| Item | Symbol | Values | | | Unit | Remark |
|---------------------------|--------|---------|------|---------|------|----------|
| | | Min. | Typ. | Max. | | |
| Power voltage | VDD | 3.0 | 3.3 | 3.6 | V | |
| Current for Driver(Black) | IDD | - | 110 | 170 | mA | VDD=3.3V |
| Input logic high voltage | VIH | 0.7 VDD | - | VDD | V | Note 1 |
| Input logic low voltage | VIL | 0 | - | 0.3 VDD | | |

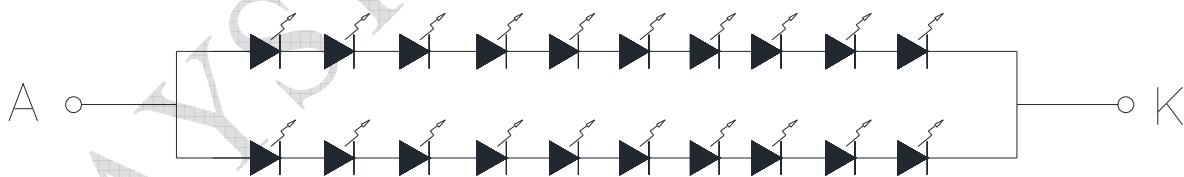
Note1: CLK,DE,R0~R7, G0~7, B0~7.

7.2. Backlight Driving Conditions

| Item | Symbol | Values | | | Unit | Remark |
|---------------------------|--------|--------|--------|------|------|--------|
| | | Min. | Typ. | Max. | | |
| Voltage for LED backlight | VL | 27 | 30 | 34 | V | Note 1 |
| Current for LED backlight | IL | -- | 40 | -- | mA | |
| LED life time | - | -- | 50,000 | - | Hr | Note 2 |

Note 1: The LED Supply Voltage is defined by the number of LED at $T_a=25^{\circ}\text{C}$ and $I_L=20\text{mA/pcs}$.

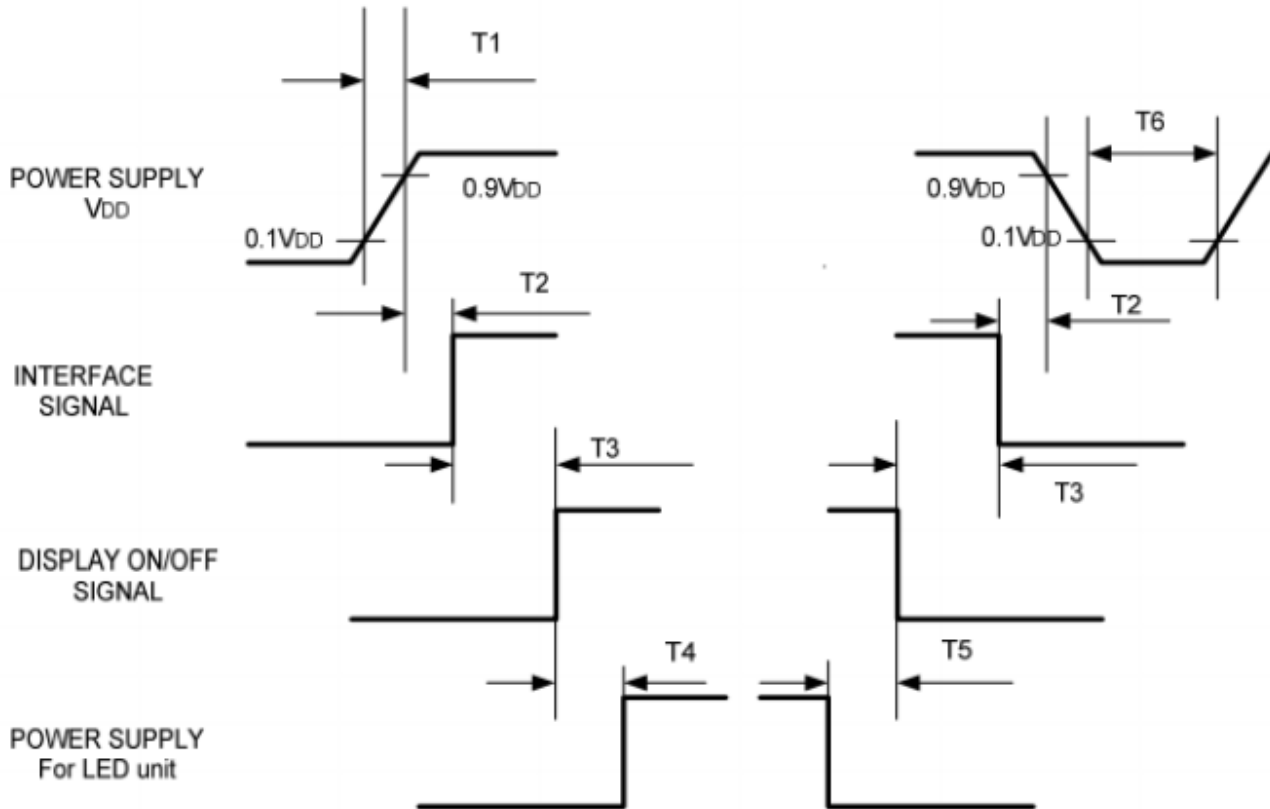
Note 2: The "LED life time" is defined as the module brightness decrease to 50% Original brightness at $T_a=25^{\circ}\text{C}$ and $I_L=20\text{mA/pcs}$. The LED lifetime could be decreased if operating I_L is larger than 25mA/pcs .



CIRCUIT DIAGRAM

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 | $16 \text{ msec} \leq T6$ |



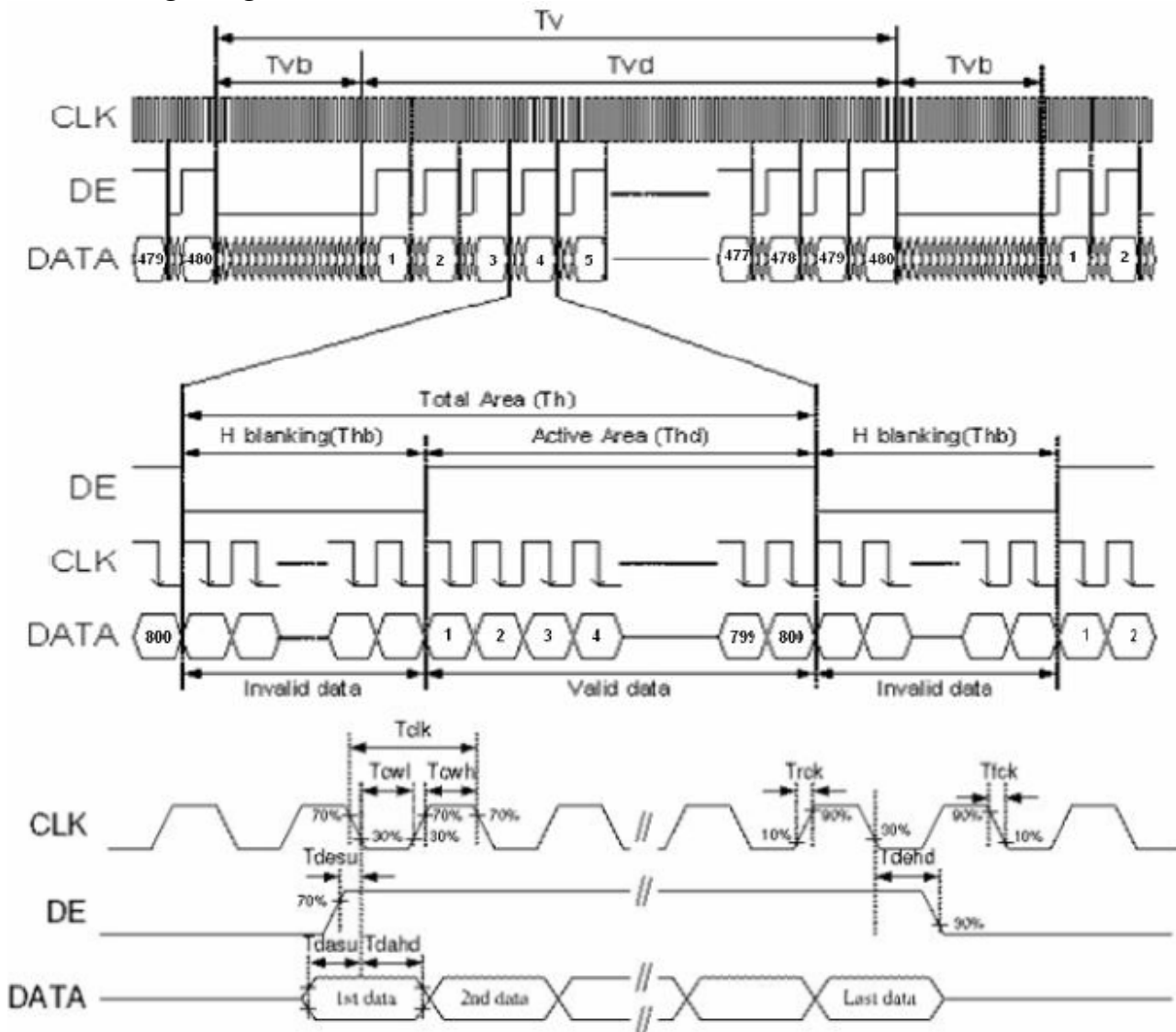
7.4. Timing Characteristics

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



RAYSTAR

8. Optical Characteristics

| Item | Symbol | Condition. | Min | Typ. | Max. | Unit | Remark | |
|---|--------|-------------------------------------|------------|------|------|-----------------------|-------------------|------------|
| Response time | Tr | $\theta=0^\circ \cdot \Phi=0^\circ$ | - | 10 | 20 | .ms | Note 3, | |
| | Tf | | - | 15 | 30 | .ms | | |
| Contrast ratio | CR | At optimized viewing angle | 400 | 500 | - | - | Note 4, | |
| Color Chromaticity | White | $\theta=0^\circ \cdot \Phi=0^\circ$ | Wx | 0.26 | 0.31 | 0.36 | | Note 2,6,7 |
| | | | Wy | 0.28 | 0.33 | 0.38 | | |
| 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 | - | - | 800 | 950 | - | cd/ m ² | Center of display | |
| Uniformity | (U) | - | 75 | - | - | % | Note5 | |

Ta=25±2°C

Note 1: Definition of viewing angle range

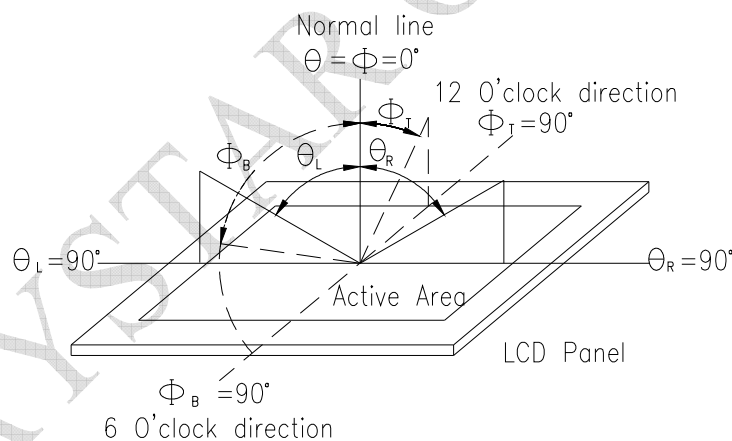


Fig. 8.1. Definition of viewing angle

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-7or BM-5 luminance meter 1.0° field of view at a distance of 50cm and normal direction.

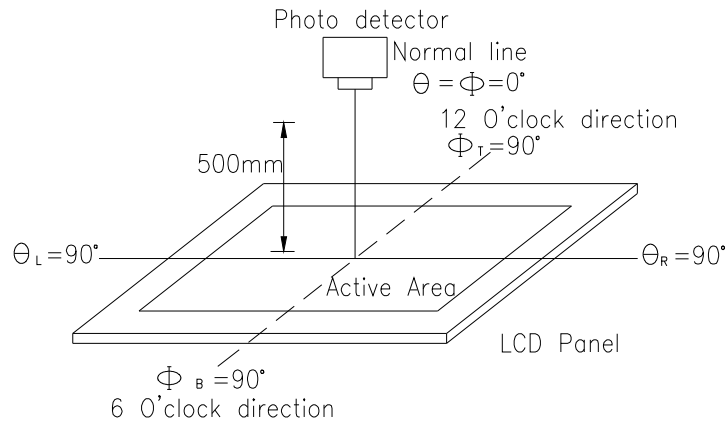
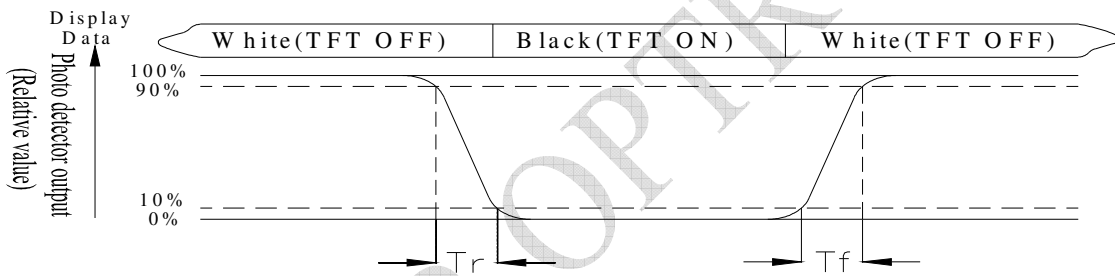


Fig. 8.2. Optical measurement system setup

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: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (reference the picture in below). Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (U)} = L_{\min}/L_{\max} \times 100\%$$

L = Active area length

W = Active area width

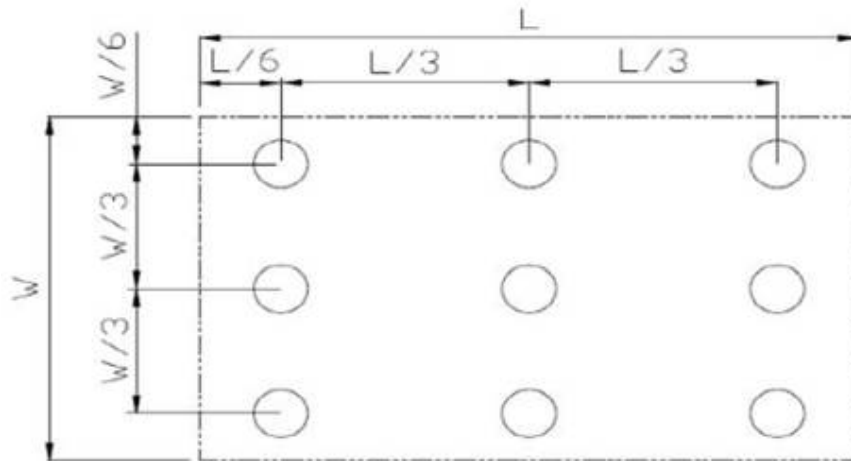


Fig8.3. . Definition of uniformity

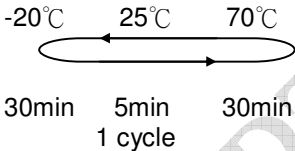
Note 6: Definition of color chromaticity (CIE 1931)

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 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 <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 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.

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 style="text-align: right;"> Sales signature : _____ Customer Signature : _____ Date : / / _____ </p> | | |