



RAYSTAR

RAYSTAR Optronics, Inc.
曜凌光電股份有限公司



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RFF700A2-AIW-DNS

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 | 2018/08/21 | | First issue |

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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.

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3. General Specifications

- Size: 7.0 inch
- Dot Matrix: 800 x RGB x 480 (TFT) dots
- Module dimension: 165 x 100.0x 7.2 mm
- Active area: 154.08 x 85.92 mm
- Pixel Pitch: 0.1926 X 0.179 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
- Color arrangement: RGB-STRIFE
- Driver IC: Source IC: ST-5623D, Gate IC: ST5091D
- With /Without TP: With RTP
- Surface: Anti-Glare

*Color tone slight changed by temperature and driving voltage.

4.Interface

4.1. LCM PIN Definition

| Pin | Symbol | Function | Remark |
|-----|--------|----------------------------|--------|
| 1 | A | Power supply for backlight | |
| 2 | A | Power supply for backlight | |
| 3 | K | Backlight ground | |
| 4 | K | Backlight ground | |
| 5 | GND | Power ground | |
| 6 | VCOM | Common voltage | |
| 7 | VCC | Power for Digital Circuit | |
| 8 | MODE | DE/SYNC mode select | Note 1 |
| 9 | DE | Data Input Enable | |
| 10 | VS | Vertical Sync Input | |
| 11 | HS | Horizontal Sync Input | |
| 12 | B7 | Blue data(MSB) | |
| 13 | B6 | Blue data | |
| 14 | B5 | Blue data | |
| 15 | B4 | Blue data | |
| 16 | B3 | Blue data | |
| 17 | B2 | Blue data | |
| 18 | B1 | Blue data | Note 2 |
| 19 | B0 | Blue data(LSB) | Note 2 |
| 20 | G7 | Green data(MSB) | |
| 21 | G6 | Green data | |
| 22 | G5 | Green data | |
| 23 | G4 | Green data | |
| 24 | G3 | Green data | |
| 25 | G2 | Green data | |
| 26 | G1 | Green data | Note 2 |
| 27 | G0 | Green data(LSB) | Note 2 |
| 28 | R7 | Red data(MSB) | |
| 29 | R6 | Red data | |
| 30 | R5 | Red data | |
| 31 | R4 | Red data | |

| | | | |
|----|-------|--------------------------|--------|
| 32 | R3 | Red data | |
| 33 | R2 | Red data | |
| 34 | R1 | Red data | Note 2 |
| 35 | R0 | Red data(LSB) | Note 2 |
| 36 | GND | Power Ground | |
| 37 | DCLK | Sample clock | Note 3 |
| 38 | GND | Power Ground | |
| 39 | L/R | Left / right selection | Note 4 |
| 40 | U/D | Up/down selection | Note 5 |
| 41 | VGH | Gate ON Voltage | |
| 42 | VGL | Gate OFF Voltage | |
| 43 | AVDD | Power for Analog Circuit | |
| 44 | RESET | Global reset pin. | Note 6 |
| 45 | NC | No connection | |
| 46 | VCOM | Common Voltage | |
| 47 | DITHB | Dithering function | Note 7 |
| 48 | GND | Power Ground | |
| 49 | NC | No connection | |
| 50 | NC | No connection | |

I: input, O: output, P: Power

Note 1: When select DE mode, MODE="1", VS and HS must pull high.
 When select SYNC mode, MODE="0", DE must be grounded.

Note 2: When input 18 bits RGB data, the two low bits of R,G and B data must be grounded.

Note 3: Data shall be latched at the falling edge of DCLK.

Note 4: Source Right or Left sequence control

L/R="L", shift left: last data=S1←S2←S3...←S1200=first data

L/R="H", shift left: last data=S1←S2←S3...←S1200=last data

Note 5: Gate Up or Down scan control

U/D="L", STV2 output vertical start pulse and UD pin output logical "0" to gate driver

U/D="H", STV1 output vertical start pulse and UD pin output logical "1" to gate driver

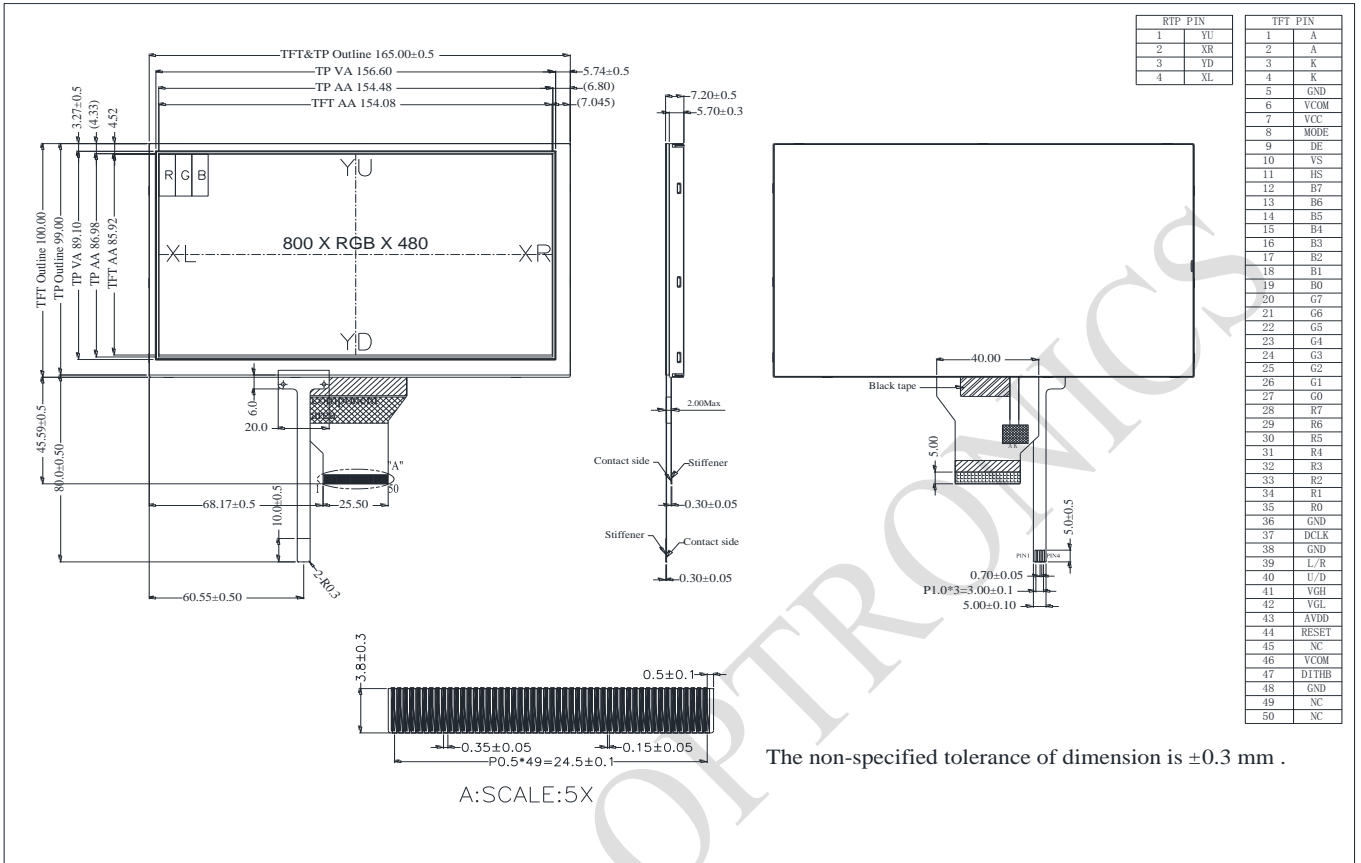
Note 6: Global reset pin. Active low to enter reset state . Suggest to connect with an RC reset circuit for stability. Normally pull high.

Note 7: Dithering function enable control, normally pull high.

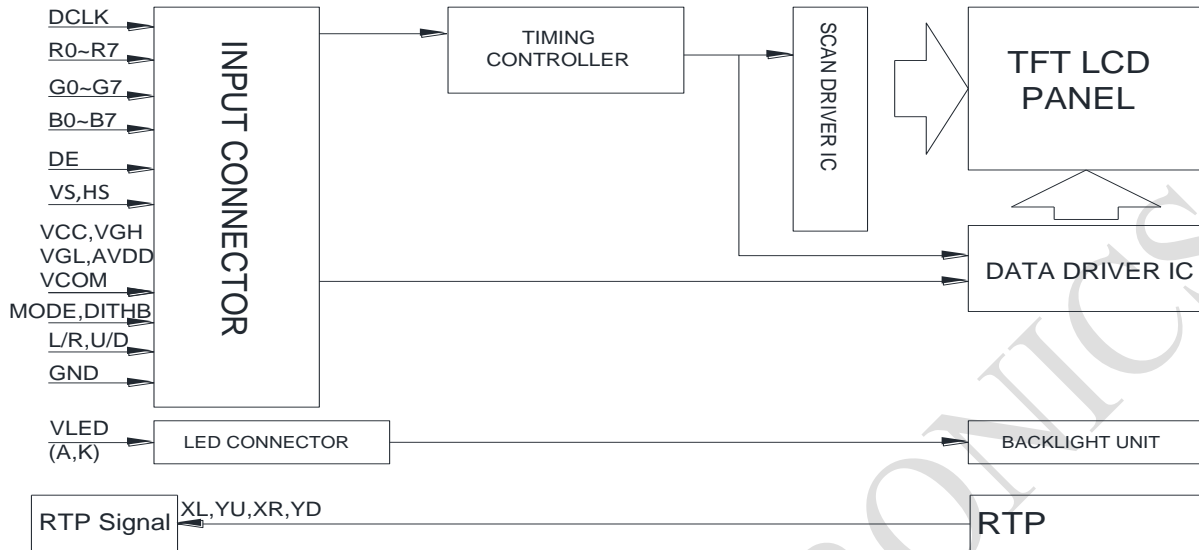
When DITHB="1", Disable internal dithering function,

When DITHB="0", Enable internal dithering function,

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

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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 2 |
| Power voltage | AVDD | - | 10.4 | - | V | |
| Power Supply For Current | VCC =3.3V | - | 4.3 | - | mA | - |
| Power voltage | VGH | 14.5 | 15.0 | 15.5 | V | - |
| Power voltage | VGL | -10.5 | -10 | -9.5 | V | - |
| Input signal voltage | VCOM | 3.54 | 4.04 | 4.54 | V | Note 4 |

Note: (1) Vcom must be adjusted to optimize display quality: cross-talk, contrast ratio and etc.

(2) VGH is TFT gate operating voltage

(3) VGL is TFT gate operating voltage

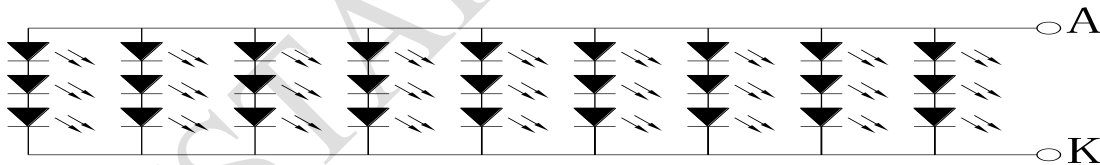
(4) Environmental condition: 25±5

(5) Reference waveform for panel light on is as below: (release after sample output)

8.2. LED driving conditions

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---------------|--------|------|--------|------|------|------------|
| LED current | - | - | 180 | - | mA | - |
| LED voltage | A~K | 8.4 | 9.8 | 11.0 | 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 Characteristics

| 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 | |

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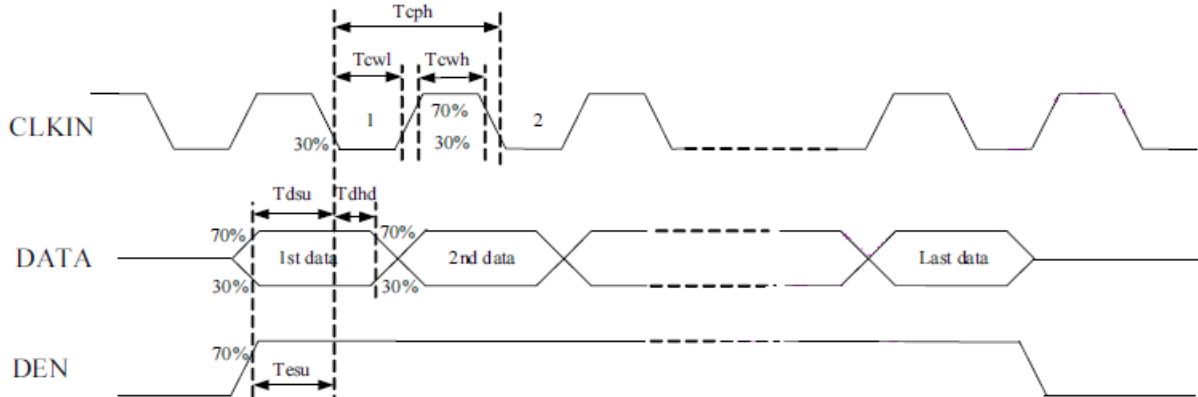
10.AC CHARATERISTICS

10.1. Parallel DE mode RGB input timing table

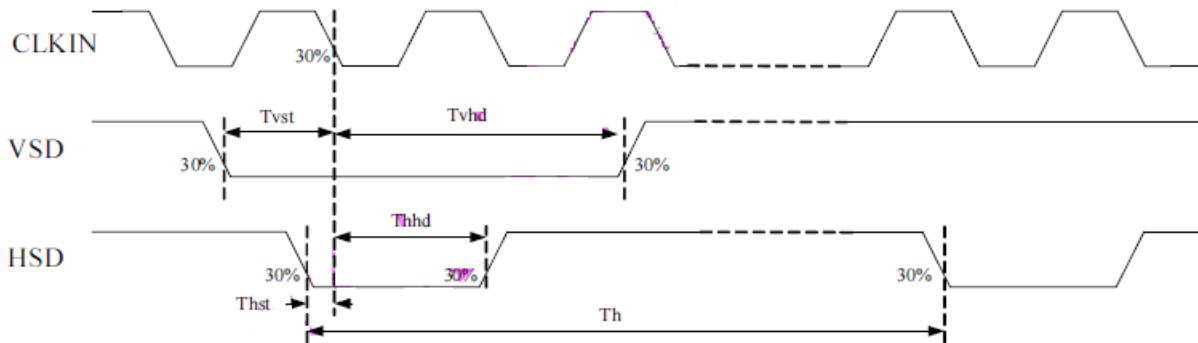
| Signal | Symbol | Min | Typ | Max | Unit | Conditions |
|--------------------------------|--------|-----|-----|-----|-------|--|
| VDD Power on Slew Rate | TPOR | - | - | 20 | ms | From 0V to 90% VDD |
| RSTB pulse width | TRST | 10 | - | - | us | Clkin=50MHz |
| CLKIN cycle time | Tcph | 20 | - | - | ns | |
| CLKIN pulse duty | Tcwh | 40 | 50 | 60 | % | |
| VSD setup time | Tvst | 8 | - | - | ns | |
| VSD hold time | Tvhd | 8 | - | - | ns | |
| HSD setup time | Thst | 8 | - | - | ns | |
| HSD hold time | Thhd | 8 | - | - | ns | |
| Data setup time | Tdsu | 8 | - | - | ns | D[7:0], D1[7:0], D2[7:0] to clkin |
| Date hold time | Tdhd | 8 | - | - | ns | D[7:0], D1[7:0], D2[7:0] to clkin |
| DE setup time | Tesu | 8 | - | - | ns | |
| DE hold time | Tehd | 8 | - | - | ns | |
| Output stable time | Tsst | - | - | 6 | us | 10% to 90% target voltage. CL=120pF, R=10Kohm |
| CLKIN Frequency | Fclk | - | 40 | 50 | MHz | VDD=3.0V~3.6V |
| CLKIN Cycle Time | Tclk | 20 | 25 | - | ns | |
| CLKIN Pulse Duty | Tcwh | 40 | 50 | 60 | % | Tclk |
| Time from HSD to Source Output | Thso | - | 20 | - | CLKIN | |
| Time from HSD to LD | Thld | - | 20 | - | CLKIN | |
| Time from HSD to STV | Thstv | - | 2 | - | CLKIN | |
| Time from HSD to CKV | Thckv | - | 20 | - | CLKIN | |
| Time from HSD to OEV | Thoev | - | 4 | - | CLKIN | |
| LD pulse width | Twld | - | 10 | - | CLKIN | |
| CKV pulse width | Twckv | - | 66 | - | CLKIN | |
| OEV pulse width | Twoev | - | 74 | - | CLKIN | |

10.2. Input Clock and Data Timing Diagram

DE MODE(CLKPOL="0")



SYNC MODE



10.3. Timing

Horizontal input timing

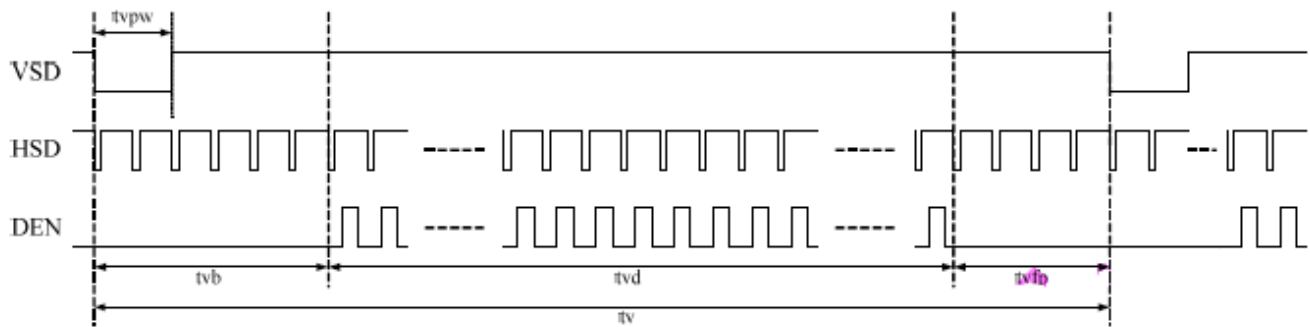
| Item | Symbol | Values | | | Unit |
|-------------------------|--------|--------|------|------|------|
| Horizontal display area | thd | 800 | | | DCLK |
| DCLK frequency | fclk | Min. | Typ. | Max. | MHz |
| | | - | 33.3 | 50 | |
| 1 Horizontal Line | th | 862 | 1056 | 1200 | DCLK |
| HSD pulse width | Min. | 1 | | | |
| | Typ. | - | | | |
| | Max. | 40 | | | |
| HSD Blanking | thb | 46 | 46 | 46 | |
| HSD Front Porch | thfp | 16 | 210 | 354 | |

Vertical input timing

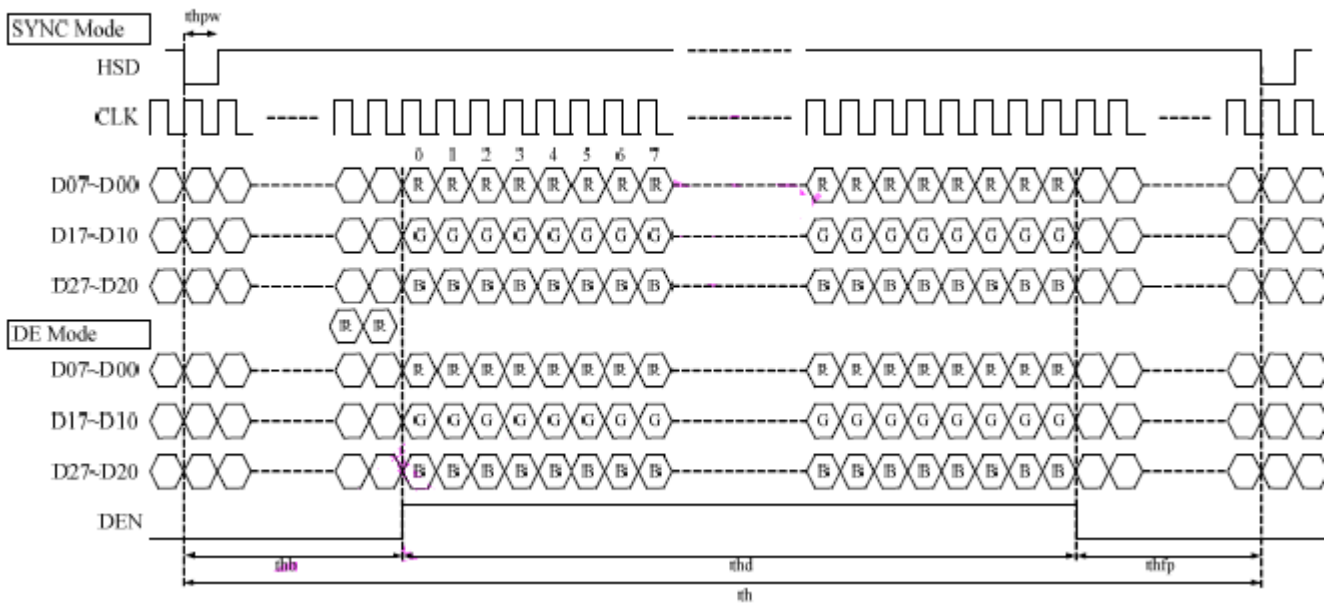
| Item | Symbol | Values | | | Unit |
|-----------------------|------------------|--------|------|------|------|
| | | Min | Typ. | Max. | |
| Vertical display area | tv _d | 480 | | | H |
| VSD period time | tv | 510 | 525 | 650 | H |
| VSD pulse width | tv _{pw} | 1 | - | 20 | H |
| VSD Blanking | tv _b | 23 | 23 | 23 | H |
| VSD Front Porch | tv _{fp} | 7 | 22 | 147 | H |

10.4. Data Input Format

Vertical input timing



Horizontal input timing



11. Optical Characteristics

| Item | Symbol | Condition. | Min | Typ. | Max. | Unit | Remark | |
|--|--------|-----------------------------------|-----------------------------|------|------|-------------------|-------------------|------------|
| Response time | Tr+ Tf | $\theta=0^\circ$ 、 $\phi=0^\circ$ | - | 25 | 50 | .ms | Note 3 | |
| Contrast ratio | CR | At optimized viewing angle | 500 | 800 | - | - | Note 4 | |
| Color Chromaticity | White | Wx | $\theta=0^\circ$ 、 $\phi=0$ | 0.26 | 0.31 | 0.36 | - | Note 2,5,6 |
| | | Wy | | 0.28 | 0.33 | 0.38 | - | |
| Viewing angle (Gray Scale Inversion Direction) | Hor. | Θ_R | CR ≥ 10 | 60 | 70 | - | Deg. | Note 1 |
| | | Θ_L | | 60 | 70 | - | | |
| | Ver. | Φ_T | | 50 | 60 | - | | |
| | | Φ_B | | 60 | 70 | - | | |
| Brightness | - | - | 200 | 250 | - | cd/m ² | Center of display | |
| Uniformity | (U) | - | 70 | - | - | % | Note 5 | |

Ta=25±2°C, IL=180mA

Note 1: Definition of viewing angle range

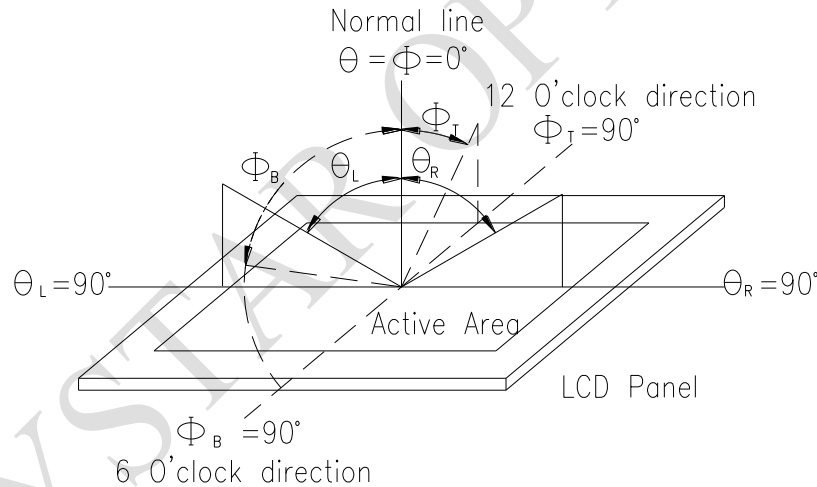


Fig. 11.1. Definition of viewing angle

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.

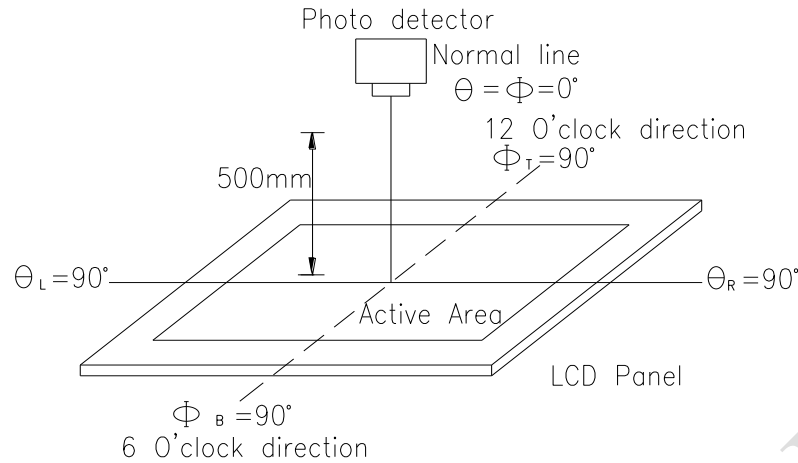
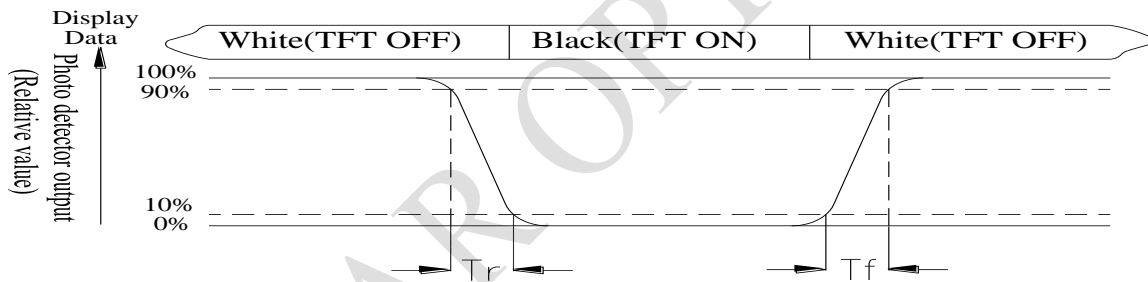


Fig. 11.2. Optical measurement system setup

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: 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.

$$\text{Luminance Uniformity (U)} = \text{Lmin/Lmax} \times 100\%$$

L = Active area length

W = Active area width

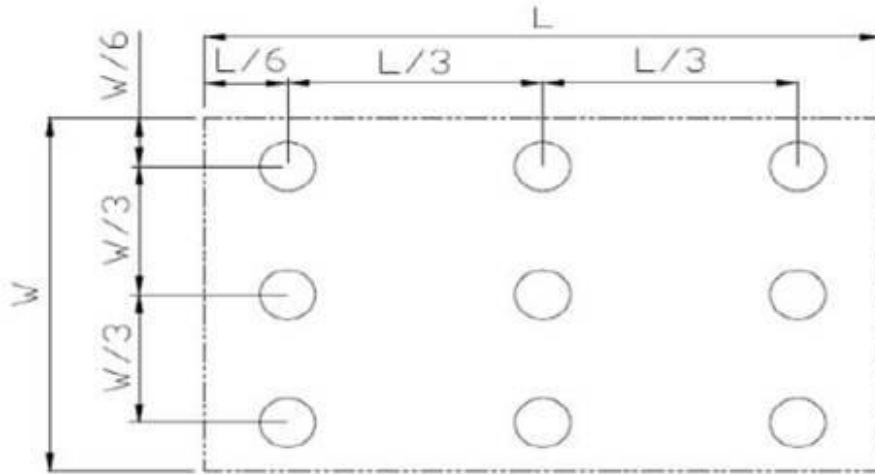


Fig11.3. Definition of uniformity

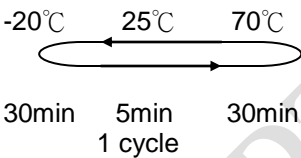
Note 6: Definition of color chromaticity (CIE 1931)

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.

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 <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 · Electronic Characteristics of Module :

| | | |
|-----------------------------|-------------------------------|-------------------------------------|
| 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 · Summary :

Sales signature : _____

Customer Signature : _____

Date : / /