



上海冠显光电科技有限公司  
Shanghai Top Display Optoelectronics Co., LTD

## LCD MODULE SPECIFICATION

Customer: \_\_\_\_\_

Module No.: TS060WVV02NP-I1360A

Date: 2025-11-15

Version: 1.3

For Customer's Acceptance:

| Approved by | Comment |
|-------------|---------|
|             |         |

| Approved by | Checked by    | Prepared by |
|-------------|---------------|-------------|
| Haitao.Zhou | Chenchen.Wang | Hongwei.Li  |

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## Record of Revision

| Rev. | Date       | Description                   | Editor     |
|------|------------|-------------------------------|------------|
| 1.0  | 2025-01-11 | First release                 | Hongwei.Li |
| 1.1  | 2025-10-14 | Change brightness information | Hongwei.Li |
| 1.2  | 2025-10-27 | Change brightness information | Hongwei.Li |
| 1.3  | 2025-11-15 | Change interface information  | Hongwei.Li |
|      |            |                               |            |
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## 1 General Specifications

| No. | Item                           | Specification          | Remark |
|-----|--------------------------------|------------------------|--------|
| 1   | LCD Size                       | 6.0 inch               |        |
| 2   | Driver Element                 | a-Si TFT active matrix |        |
| 3   | Resolution                     | 480 (RGB) ×960         |        |
| 4   | Display Mode                   | Normally Black         |        |
| 5   | Pixel Pitch                    | --                     |        |
| 6   | Display Colors                 | 262K                   |        |
| 7   | Surface Treatment              | --                     |        |
| 8   | Color Arrangement              | RGB-Stripe             |        |
| 9   | Interface                      | QSPI/SPI               |        |
| 10  | Viewing Direction              | ALL                    |        |
| 11  | Gray Scale Inversion Direction | --                     | Note 1 |
| 12  | Outline Dimension (mm)         | 70.24(W) × 142.59(H)   |        |
| 13  | Active Area (mm)               | 68.04 (W) × 136.08 (H) |        |
| 14  | Touch Screen                   | Without CTP            |        |
| 15  | Display Driver IC              | TR230S                 |        |
| 16  | Touch Driver IC                | --                     |        |

Note 1: Viewing direction for best image quality is different from TFT definition. There is a 180°shift.

Note 2: RoHS compliant.

## 2 Pin Assignment

### 2.1 Pin assignment

Match connector 1: XF2M-2015-1A (OMRON) or equivalent.

| N  | Symbol   | I/O | Description                                                                                                                                | Remark |
|----|----------|-----|--------------------------------------------------------------------------------------------------------------------------------------------|--------|
| 1  | GND      | P   | Ground                                                                                                                                     |        |
| 2  | VCC      | P   | POWER INPUT                                                                                                                                |        |
| 3  | GND      | P   | Ground                                                                                                                                     |        |
| 4  | CS#      | I   | Chip selection:LOW active                                                                                                                  |        |
| 5  | GND      | P   | Ground                                                                                                                                     |        |
| 6  | SDO1     | I   | SPI:SPI-MISO<br>QSPI:QSPI-DATA1                                                                                                            |        |
| 7  | SDO0     | I   | SPI:SPI-MOSI<br>QSPI:SPI-DATA0                                                                                                             |        |
| 8  | SCL      | I   | SPI/QSPI:SPI-Clock                                                                                                                         |        |
| 9  | SDO3     | I   | QSPI:QSPI-DATA3                                                                                                                            |        |
| 10 | SDO2     | I   | QSPI:QSPI-DATA2                                                                                                                            |        |
| 11 | RESET#   | I   | TR230S Module_RESET and LCD-RESET: LOW active                                                                                              |        |
| 12 | WAIT#    | I   | WAIT# STATUS flag,<br>0: Sending Command Not Allowed<br>1: Sending Command Allowed                                                         |        |
| 13 | QSPI-INT | O   | Touch interrupt                                                                                                                            | Note2  |
| 14 | D/C#     | I   | DATA or COMMAND flag when choose ,<br>QSPI: NOT CONNECTION<br>SPI-4WIRE interface:<br>D/C#="H" is DATA or parameter<br>D/C#="L" is COMMAND |        |
| 15 | TP-INT   | O   | NC                                                                                                                                         |        |
| 16 | TP-SDA   | I/O | NC                                                                                                                                         |        |
| 17 | TP-SCL   | I   | NC                                                                                                                                         |        |
| 18 | TP-RST   | I   | NC                                                                                                                                         |        |
| 19 | TP-VCC   | P   | NC                                                                                                                                         |        |
| 20 | TP-GND   | P   | NC                                                                                                                                         |        |

I---Input, O---Output, P--- Power/Ground

Match connector 2: 2mm spacing 2X7 Pin Header

| N  | Symbol   | I/O | Description                                                                                                                                | Remark |
|----|----------|-----|--------------------------------------------------------------------------------------------------------------------------------------------|--------|
| 1  | VCC      | P   | POWER INPUT                                                                                                                                |        |
| 2  | GND      | P   | Ground                                                                                                                                     |        |
| 3  | GND      | P   | Ground                                                                                                                                     |        |
| 4  | CS#      | I   | Chip selection:LOW active                                                                                                                  |        |
| 5  | GND      | P   | Ground                                                                                                                                     |        |
| 6  | SDO1     | O   | SPI:SPI-MISO<br>QSPI:QSPI-DATA1                                                                                                            |        |
| 7  | SDO0     | I   | SPI:SPI-MOSI<br>QSPI:SPI-DATA0                                                                                                             |        |
| 8  | SCL      | I   | SPI/QSPI:SPI-Clock                                                                                                                         |        |
| 9  | SDO3     | I   | QSPI:QSPI-DATA3                                                                                                                            |        |
| 10 | SDO2     | I   | QSPI:QSPI-DATA2                                                                                                                            |        |
| 11 | RESET#   | I   | TR230S Module_RESET and LCD-RESET: LOW active                                                                                              |        |
| 12 | WAIT#    | I/O | WAIT# STATUS flag,<br>0: Sending Command Not Allowed<br>1: Sending Command Allowed                                                         |        |
| 13 | QSPI-INT | I/O | Touch interrupt                                                                                                                            | Note2  |
| 14 | D/C#     | I/O | DATA or COMMAND flag when choose ,<br>QSPI: NOT CONNECTION<br>SPI-4WIRE interface:<br>D/C#="H" is DATA or parameter<br>D/C#="L" is COMMAND |        |

I---Input, O---Output, P--- Power/Ground

Note1: IM[1:0] Configuration table

| IMO | IM1 | INTERFACE | Related Pins                                  | Max. Clock |
|-----|-----|-----------|-----------------------------------------------|------------|
| 0   | 0   | SPI-4WIRE | CS# 、 SCL 、 SDO0 、 D/C# 、 WAIT#               | 100MHz     |
| 1   | 0   | QSPI-4SDA | CS# 、 SCL 、 SDO0 、 SDO1 、 SDO2 、 SDO3 、 WAIT# | 100MHz     |

Note2:

The PIN HOST does not need to be connected when the user drives the touch screen directly through the IIC.If the TR230 drives the touch screen, the user needs to detect the PIN to decide whether to read the touch event.

### 3 Absolute Maximum Ratings

Ta = 25°C

| Item                           | Symbol           | Min.  | Max. | Unit  | Remark |
|--------------------------------|------------------|-------|------|-------|--------|
| Power Voltage                  | VCC              | -0.30 | +5.8 | V     |        |
| Operating Temperature          | Top              | -20.0 | 70.0 | °C    |        |
| Storage Temperature            | T <sub>st</sub>  | -30.0 | 80.0 | °C    |        |
| Operating and Storage Humidity | H <sub>stg</sub> | 10%   | 90%  | %(RH) |        |

## 4 Electrical Characteristics

### 4.1 Recommended Operating Condition

VCC=5V, GND=0V, Ta = 25℃

| Item                 | Symbol           | Min.            | Typ.    | Max. | Unit    | Remark                    |
|----------------------|------------------|-----------------|---------|------|---------|---------------------------|
| Power supply Voltage | VCC              | 3.3             | 5       | 5.5  | V       |                           |
| Input Signal Voltage | Low Level        | V <sub>IL</sub> | -0.3    | -    | 0.3*3.3 | V                         |
|                      | High Level       | V <sub>IH</sub> | 0.7*3.3 | -    | 3.3+0.3 | V                         |
| Power supply Voltage | I <sub>VCC</sub> | -               | 307     |      | mA      | VCC=5V, color bar pattern |

### 4.2 Backlight Unit Driving Condition

| Item                        | Symbol          | Min.  | Typ. | Max. | Unit | Remark                                             |
|-----------------------------|-----------------|-------|------|------|------|----------------------------------------------------|
| Forward Current             | I <sub>F</sub>  | -     | 40   | 45   | mA   | 16LEDs<br>(8 LED Serial,<br>2LED<br>Parallel)Note5 |
| Forward Current Voltage     | V <sub>F</sub>  | -     | 25.6 | -    | V    |                                                    |
| Backlight Power Consumption | W <sub>BL</sub> | -     | 1024 | -    | mW   |                                                    |
| Operating Life Time         | --              | 30000 | --   | --   | hrs  | Note 2, Note 3                                     |

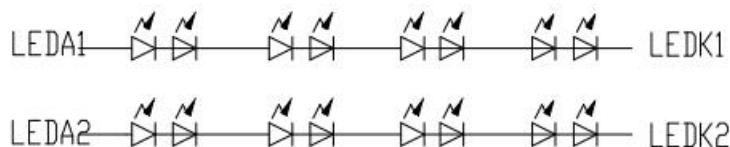
Note1: The LED driving condition is defined for each module (8 LED Serial, 2 LED Parallel).

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

Note3: Optical performance should be evaluated at Ta=25℃ When LED is driven at 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.

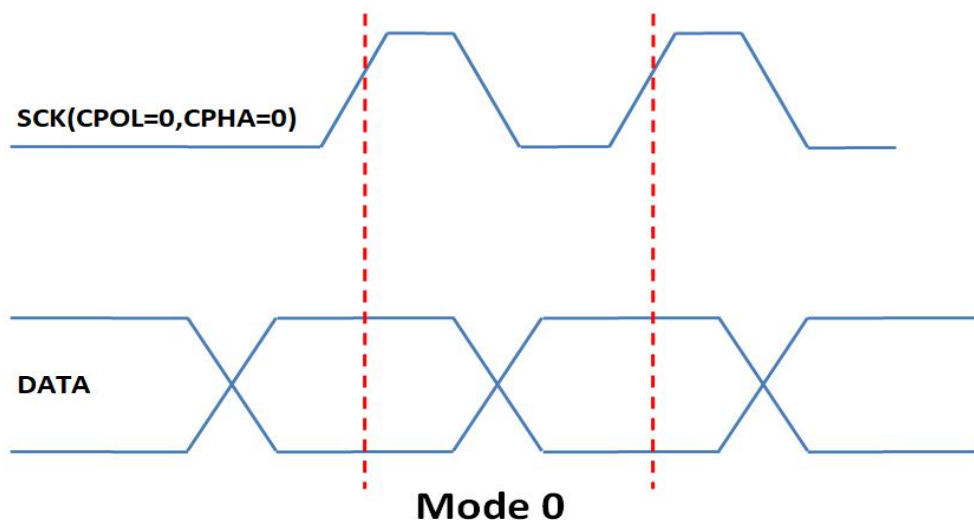
Note4: The LED driving condition is defined for each LED module.

Note5:The product has already integrated the backlight driving circuit.



## 5 Interface Description

If there is no special indication, TR230S works on Mode 0, That means data transmission occurs during rising edge of the clock.



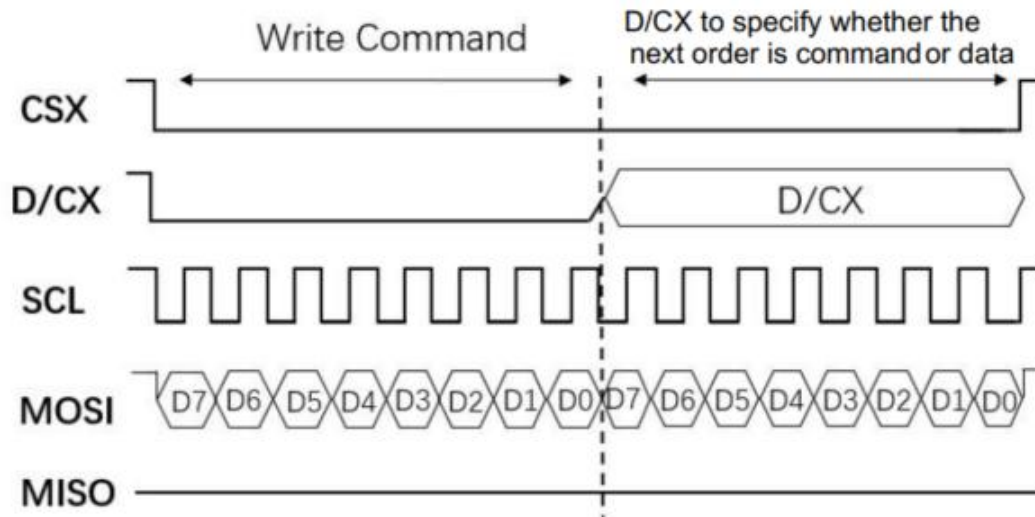
### 5.1 PIN DESCRIPTION

| PIN NAME | Description                                                                        |
|----------|------------------------------------------------------------------------------------|
| CS#      | Chip selection: LOW active                                                         |
| SCL      | Serial Interface Clock                                                             |
| SDO0     | SPI: MOSI<br>QSPI: QSPI-DATA0                                                      |
| SDO1     | SPI: MISO<br>QSPI: QSPI-DATA1                                                      |
| SDO2     | QSPI: QSPI-DATA2                                                                   |
| SDO3     | QSPI: QSPI-DATA3                                                                   |
| D/C#     | DATA or COMMAND flag, 0:COMMAND 1:DATA                                             |
| WAIT#    | WAIT# STATUS flag,<br>0: Sending Command Not Allowed<br>1: Sending Command Allowed |

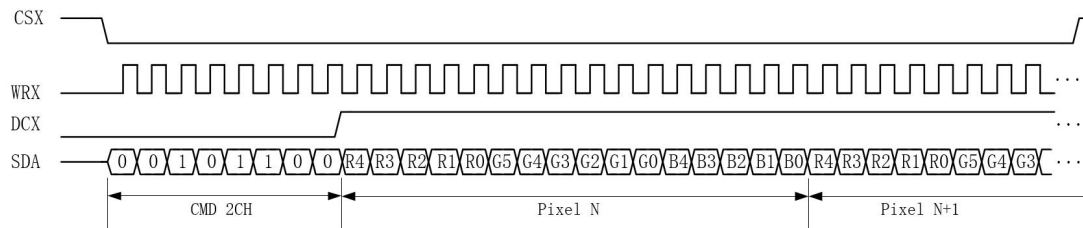
## 5.2 INTERFACE TIMING

### • SPI-4WIRE

Timing for sending command and data:



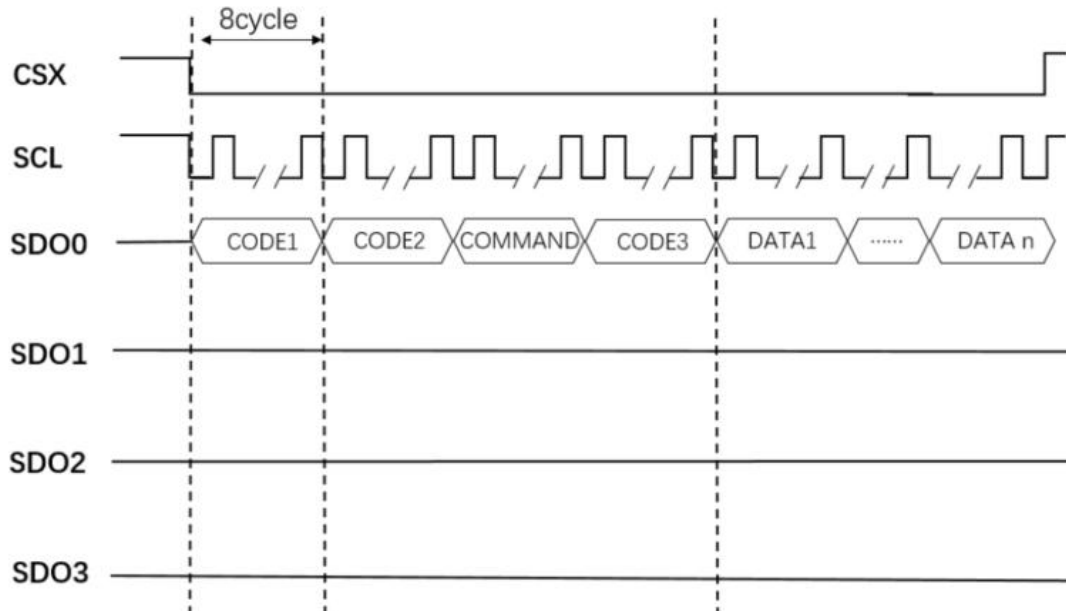
Display data writing format:



## • QSPI-4SDA

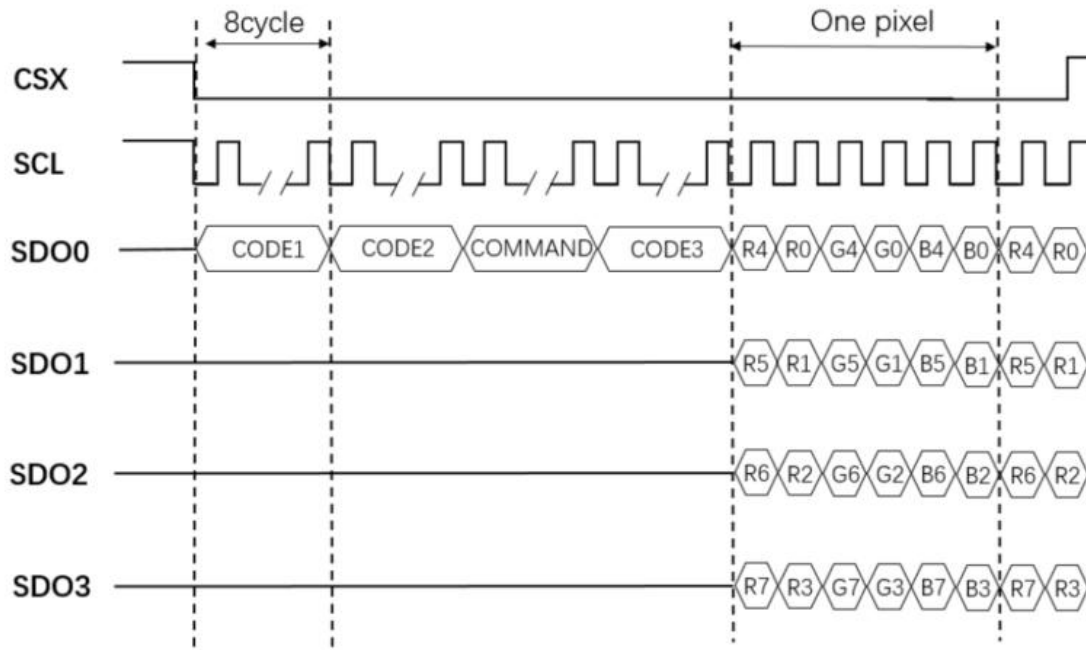
Timing for sending command:

(CODE1=0x02, CODE2=CODE3=0x00)



Display data writing format:

(CODE1=0x12, CODE2=CODE3=0x00 COMMAND = 0x2C)



## 6 Optical Characteristics

Ta=25°C

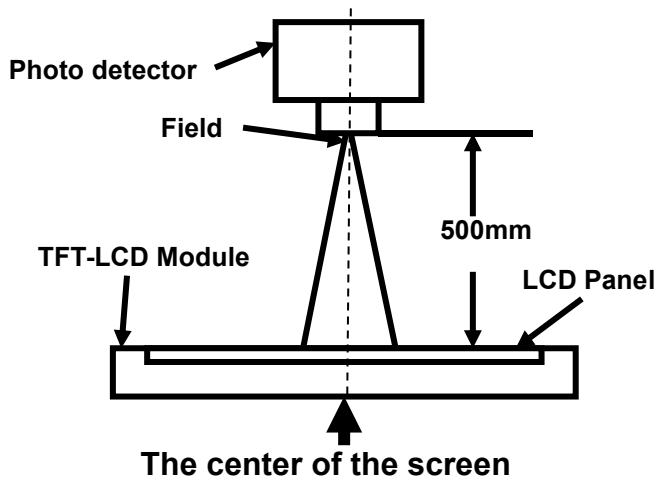
| Item           | Symbol     | Condition        | Min. | Typ. | Max. | Unit              | Remark         |
|----------------|------------|------------------|------|------|------|-------------------|----------------|
| View Angles    | $\theta T$ | $CR \geq 10$     | -    | 80   | -    | Degree            | Note 2         |
|                | $\theta B$ |                  | -    | 80   | -    |                   |                |
|                | $\theta L$ |                  | -    | 80   | -    |                   |                |
|                | $\theta R$ |                  | -    | 80   | -    |                   |                |
| Contrast Ratio | CR         | $\theta=0^\circ$ | 700  | 900  | -    |                   | Note1<br>Note3 |
| Response Time  | $T_{ON}$   | 25°C             | -    | 30   | 40   | ms                | Note1<br>Note4 |
|                | $T_{OFF}$  |                  |      |      |      |                   |                |
| Uniformity     | U          |                  | 70   | 80   | -    | %                 | Note1<br>Note6 |
| NTSC           |            |                  | -    | 70   | -    | %                 | Note 5         |
| Luminance      | L          |                  | --   | 650  | -    | cd/m <sup>2</sup> | Note1<br>Note7 |

Test Conditions:

1.  $I_F = 40 \text{ mA}$ ,  $V_F = 25.6 \text{ V}$  and the ambient temperature is  $25 \pm 2^\circ \text{C}$ . humidity is  $65 \pm 7\%$
2. The test systems refer to Note 1 and Note 2.

### Note 1: Definition of optical measurement system.

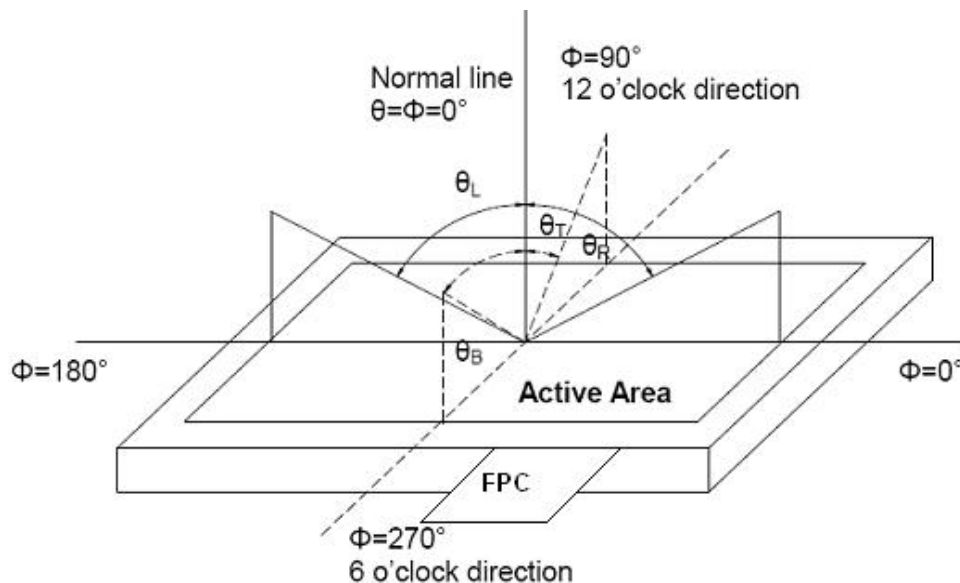
Properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



| 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

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

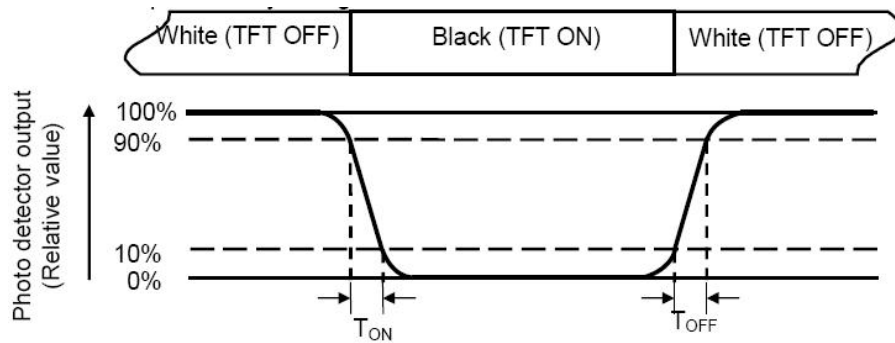
“White state”: The state is that the LCD should drive by V<sub>white</sub>.

“Black state”: The state is that the LCD should drive by V<sub>black</sub>.

V<sub>white</sub>: To be determined      V<sub>black</sub>: 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)

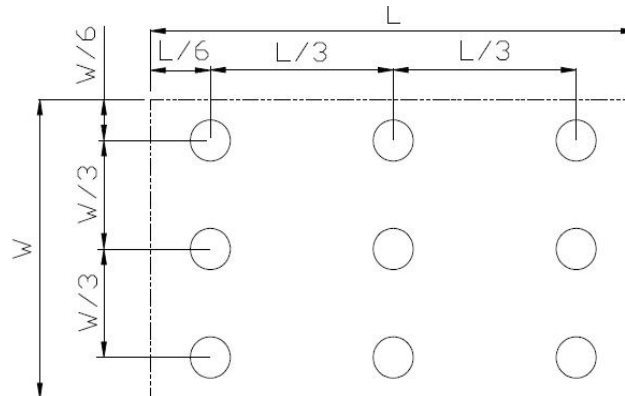
Color coordinates measured at center point of LCD.

#### 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.

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

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



$L_{\max}$ : The measured Maximum luminance of all measurement position.

$L_{\min}$ : The measured Minimum luminance of all measurement position.

#### Note 7: Definition of luminance:

Measure the luminance of white state at center point.

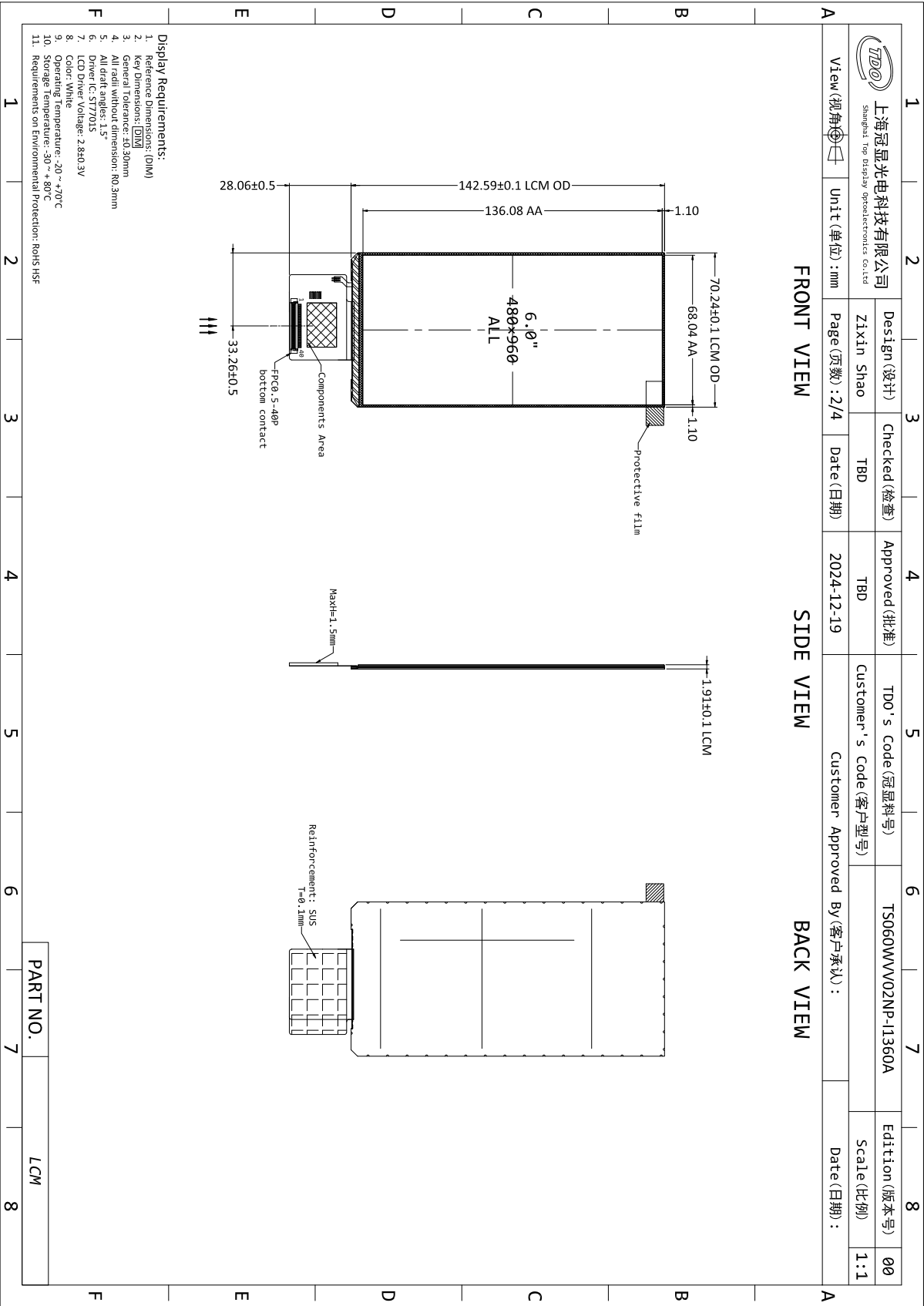
## 7 Environmental / Reliability Test

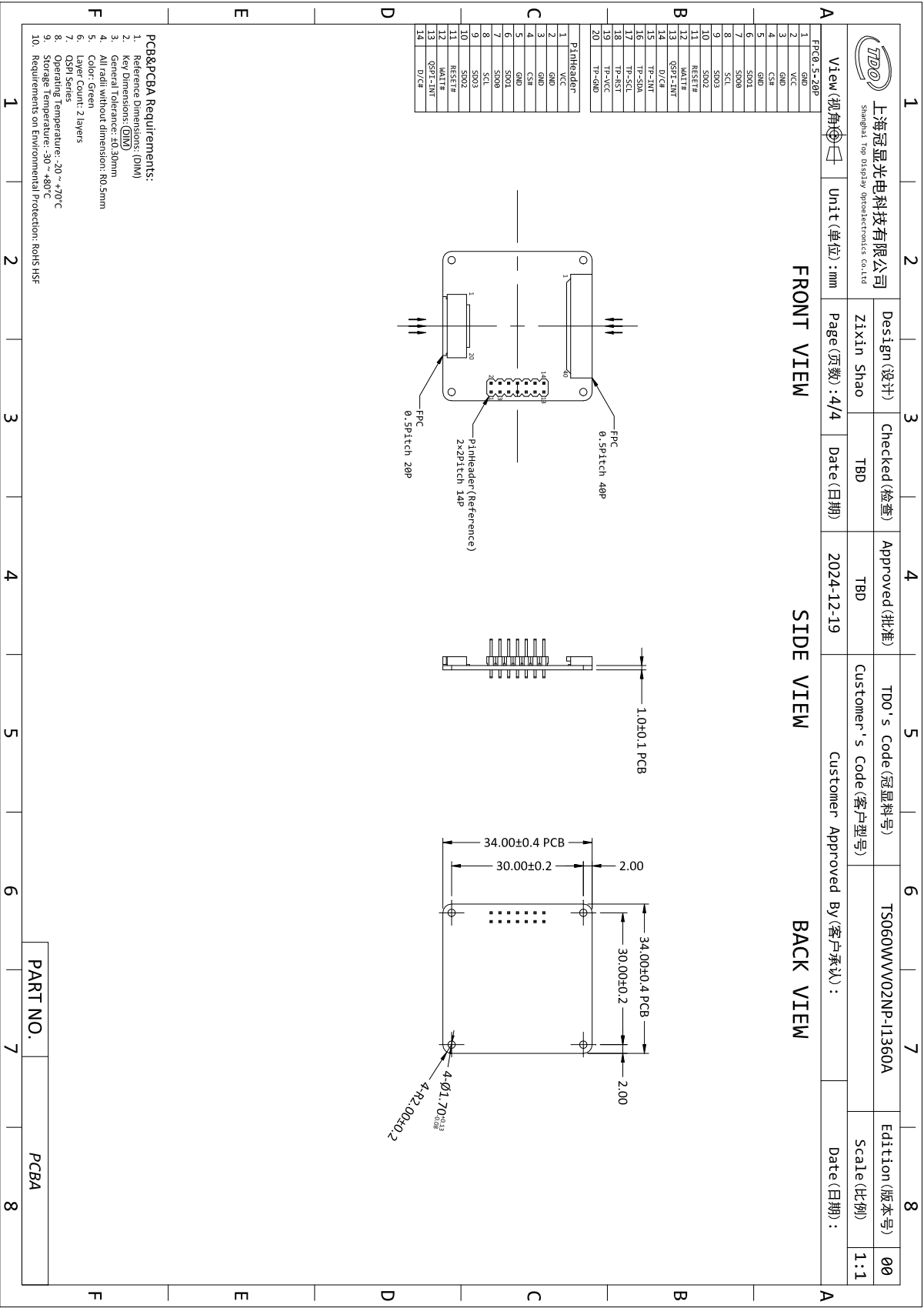
| No | Test Item                                | Condition                                                                                                                                      | Remarks                                                    |
|----|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
| 1  | High Temperature Operation               | Ts = +70°C, 240 hours                                                                                                                          | No abnormalities in functions                              |
| 2  | Low Temperature Operation                | Ta = -20°C, 240 hours                                                                                                                          | No abnormalities in functions                              |
| 3  | High Temperature Storage                 | Ta = +80°C, 240 hours                                                                                                                          | No abnormalities in functions                              |
| 4  | Low Temperature Storage                  | Ta = -30°C, 240 hours                                                                                                                          | No abnormalities in functions                              |
| 5  | Storage at High Temperature and Humidity | Ta = +60°C, 90% RH max, 240 hours                                                                                                              | No abnormalities in functions                              |
| 6  | Thermal Shock (non-operating)            | -30°C 30 min ~ +70°C 30 min,<br>Change time: 0.5 hour ← 5 min → 0.5 hour. 10 Cycle                                                             | Start with cold temperature,<br>End with high temperature, |
| 7  | ESD                                      | C=150pF, R=330Ω, 5 point/panel<br>Air: ±8Kv, 5 times;<br>Contact: ±4Kv, 5 times<br>(Environment: 15°C ~ 35°C,<br>30% ~ 60% RH, 86Kpa ~ 106Kpa) | No abnormalities in functions                              |

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

Note2: Ta is the ambient temperature of samples.

# 8 Mechanical Drawing





## 9 Precautions for Use of LCD Modules

### Handling Precautions

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

9.1.2 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.

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

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

9.1.5 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

9.1.6 Do not attempt to disassemble the LCD Module.

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

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

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

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

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

9.1.8.4 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.

### Storage Precautions

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

9.2.2 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°C ~ 40°C      Relatively humidity: ≤80%

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

### Transportation Precautions

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