深圳显旸光电科技有限公司
Shenzhen Xianyang Optoelectronic Technology Co., Ltd

# PRODUCTION SPECIFICATION OF LCD MODULE

# MODULE NO.：XY013QVV01-H1055A

| | | | |
|---|---|---|---|
| **Customer Name:** | | | |
| **Customer Part Number:** | | | |
| **Approved By:** | | **Date:** | |

| Prepared By | Checked By | Approved By |
|---|---|---|
| | | |

# Table of Contents

# Revision History

| Rev | Issued Date | Description | Page | Editor |
|---|---|---|---|---|
| 1.0 | JUN 12,2018 | First release | All | |
| 2.0 | AGU 1,2018 | Change the PIN Description | | |
| 3.0 | Mar,03,2020 | Revise PN | ALL | |

# 1 General Specifications

| Feature | | Specifications |
|---|---|---|
| **Display Spec.** | LCD type | 1.3 inch |
| | Resolution (H*V) | 240(RGB)×240 |
| | Technology Type | a-Si TFT |
| | Pixel Configuration | R.G.B. Vertical Stripe |
| | Display Mode | Transmissive / Normally Black |
| | Surface Treatment | Anti-Glare |
| | Viewing Direction | ALL |
| **Mechanical Characteristics** | OutlineDimensions (W x H x T) (mm) | 26.2*29.22*1.9 |
| | Active Area(mm) | 23.4*23.4 |
| | With /Without Touch screen | Without |
| | Match Connector Type | FH26-15S |
| | Backlight Type | White LED |
| | Weight (g) | TBD |
| **Electrical Characteristics** | Interface | 3wire SPI |
| | Number of color | 262K |
| | Driver IC | ST7789V |

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

## 2 Pin Assignment

| NO. | PIN NAME | I/O | Description |
|---|---|---|---|
| **1** | **LED+** | **I** | LED Anode |
| **2** | **LED-** | **I** | LED Cathode |
| **3** | **GND** | P | Ground |
| **4** | **VCC2.8V** | P | Power Supply 2.8V Voltage |
| **5** | **IOVCC** | P | Power Supply 1.8V Voltage |
| **6** | **GND** | P | Ground |
| **7** | **CS** | I | Chip select |
| **8** | **RESET** | I | Reset |
| **9** | **NC** | - | None connect |
| **10** | **LSCK** | I | Serial Clock |
| **11** | **NC** | - | None connect |
| **12** | **SDA** | I/O | Serial data |
| **13** | **NC** | - | None connect |
| **14** | **TE** | O | Tearing effect |
| **15** | **NC** | - | None connect |

Note1: I/O definition: I-----Input O---Output P----Power/Ground

# 3 Absolute Maximum Ratings

GND=0V, Ta= 25℃

| Item | Symbol | Value | Unit |
|---|---|---|---|
| **Power supply voltage for logic** | $V_{DD}$ | 0.3~3.6 | V |
| **Input voltage** | Vin | $V_{DD}$+0.3 | V |
| **Operating temperature** | Topr | -20 to 70 | °C |
| **Storage temperature** | Tstg | -30 to 80 | °C |

# 4 Electrical Characteristics

## 4.1 Driving TFT LCD Panel

GND=0V, Ta=25℃

| Item | Symbol | Min | Type | Max | Unit | Test condition |
|---|---|---|---|---|---|---|
| Operating voltage | $V_{DD}$ | 2.6 | 2.8 | - | V | - |
| Supply current | $I_{DD}$ | - | - | 15 | mA | $V_{DD}$=2.8V,Ta=25°C |
| Input voltage | $V_{IH}$ | 0.8VDD | - | VDD | V | - |
| | $V_{IL}$ | 0 | - | 0.2VDD | V | |
| Input leakage current | $I_{IL}$ | -1.0 | - | 1.0 | μA | $V_{IN}$=$V_{DD}$ or $V_{SS}$ |

Note: Voltage greater than above may damage the module.

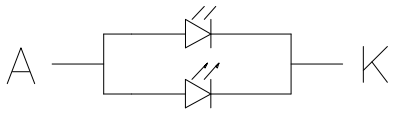
All voltages are specified relative to VSS=0V.

## 4.2 Driving Backlight

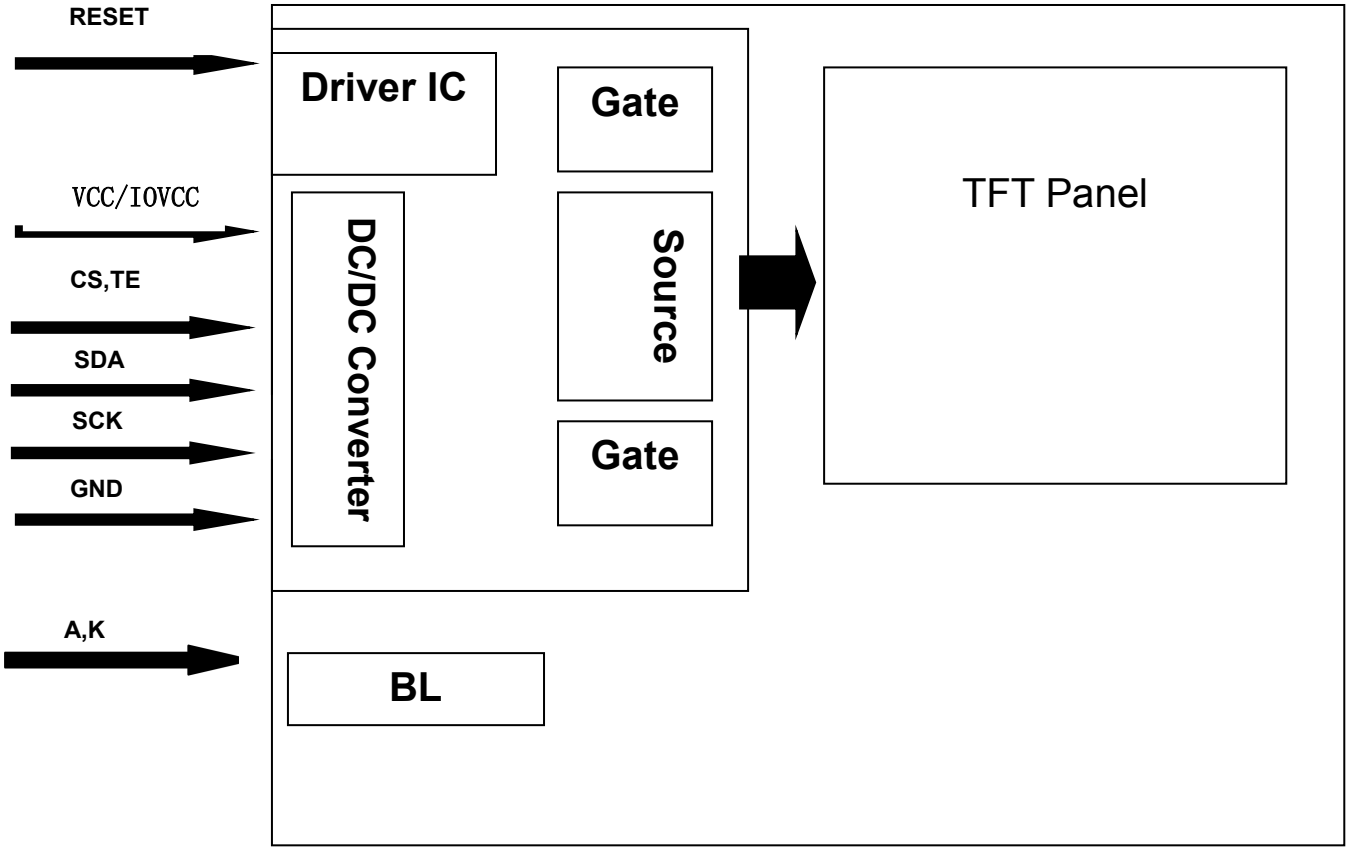
Ta=25℃

| Item | Symbol | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|
| Forward Current | $I_F$ | -- | 40 | 50 | mA | |
| Forward Voltage | $V_F$ | - | 3.2 | - | V | |
| Connection mode | P | -- | 2 Parallel | -- | | |
| LED number | / | | 2 | | pcs | |

Note1: Optical performance should be evaluated at Ta=25℃ only .If LED is driven by 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.



### 4.3 Block Diagram



# 5 INTERFACE TIMING

## 5.1 SPI Interface Characteristics.

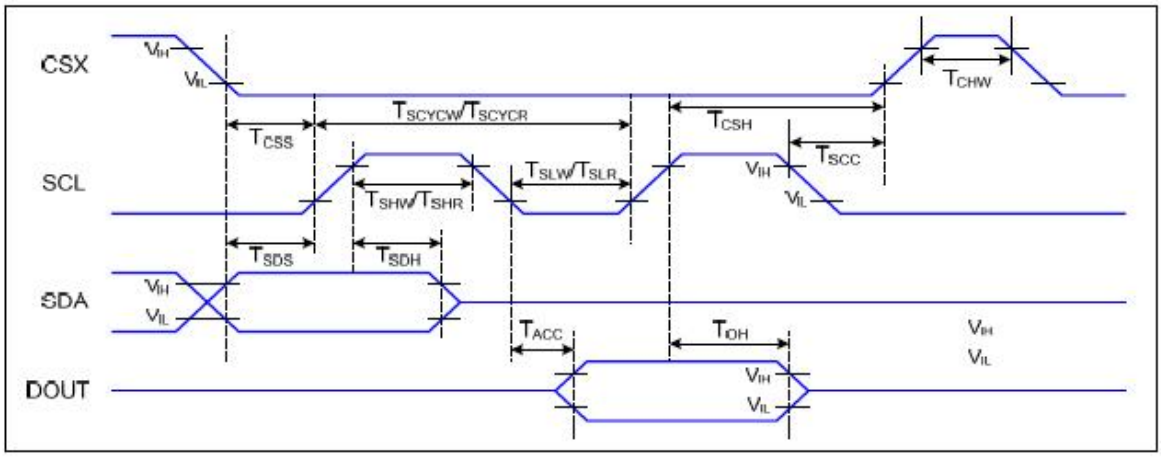


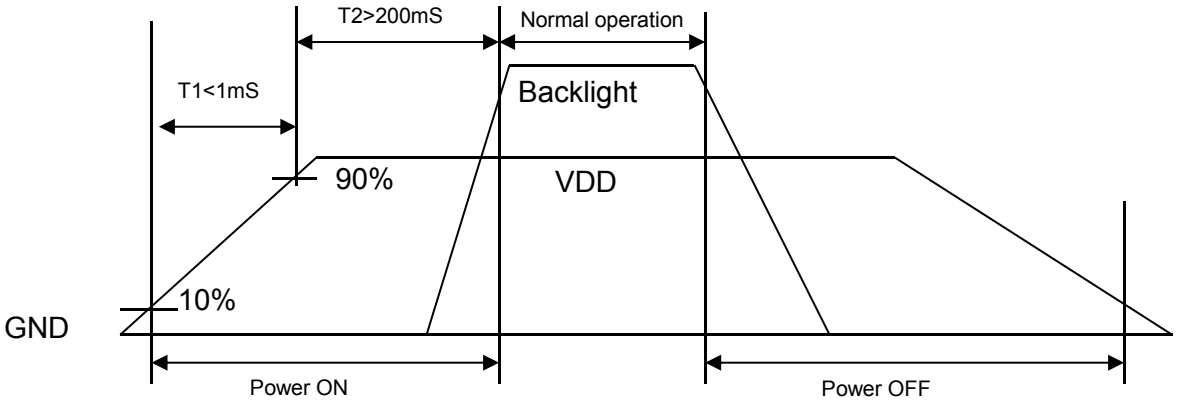

**Figure 4 3-line serial Interface Timing Characteristics**

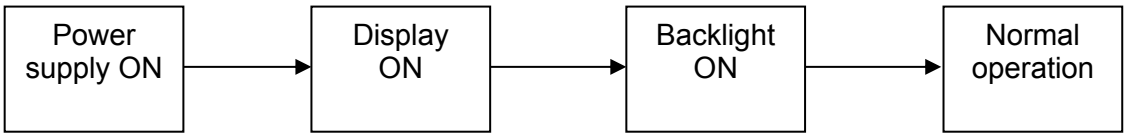
*VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=-30 to 70*

| Signal | Symbol | Parameter | Min | Max | Unit | Description |
|---|---|---|---|---|---|---|
| CSX | $T_{CSS}$ | Chip select setup time (write) | 15 | | ns | |
| | $T_{CSH}$ | Chip select hold time (write) | 15 | | ns | |
| | $T_{CSS}$ | Chip select setup time (read) | 60 | | ns | |
| | $T_{SCC}$ | Chip select hold time (read) | 65 | | ns | |
| | $T_{CHW}$ | Chip select "H" pulse width | 40 | | ns | |
| SCL | $T_{SCYCW}$ | Serial clock cycle (Write) | 66 | | ns | |
| | $T_{SHW}$ | SCL "H" pulse width (Write) | 15 | | ns | |
| | $T_{SLW}$ | SCL "L" pulse width (Write) | 15 | | ns | |
| | $T_{SCYCR}$ | Serial clock cycle (Read) | 150 | | ns | |
| | $T_{SHR}$ | SCL "H" pulse width (Read) | 60 | | ns | |
| | $T_{SLR}$ | SCL "L" pulse width (Read) | 60 | | ns | |
| SDA (DIN) | $T_{SDS}$ | Data setup time | 10 | | ns | |
| | $T_{SDH}$ | Data hold time | 10 | | ns | |
| DOUT | $T_{ACC}$ | Access time | 10 | 50 | ns | For maximum CL=30pF |
| | $T_{OH}$ | Output disable time | 15 | 50 | ns | For minimum CL=8pF |

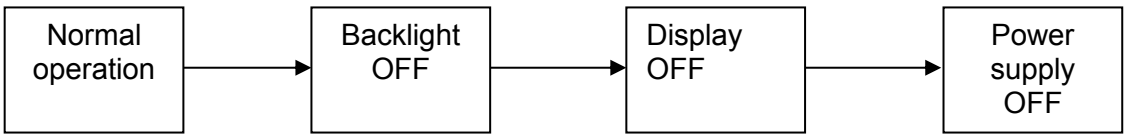
**Table 5 3-line serial Interface Characteristics**

## 5.2 Power ON/OFF Timing




Power ON sequence




Power OFF sequence

# 6 Optical Characteristics

Ta=25℃

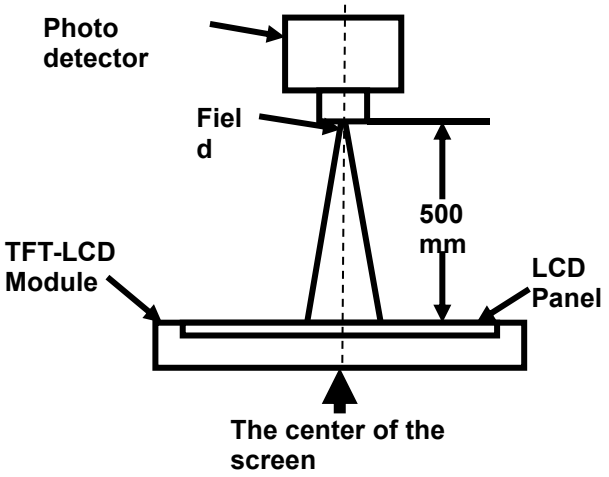
| Item | Symbol | Condition | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|---|
| View Angles | θT | CR≧10 | - | 80 | - | Degree | Note 2 |
| | θB | | - | 80 | - | | |
| | θL | | - | 80 | - | | |
| | θR | | - | 80 | - | | |
| Contrast Ratio | CR | θ=0° | 600 | 800 | - | - | Note1<br>Note3 |
| Response Time | $T_{ON}$ | 25℃ | - | 30 | 35 | ms | Note1<br>Note4 |
| | $T_{OFF}$ | | | | | | |
| Uniformity | U | - | 70 | 80 | - | % | Note1<br>Note6 |
| NTSC | - | - | - | 50 | - | % | Note 5 |
| Luminance | L | | 250 | 280 | - | $cd/m^2$ | Note1<br>Note7 |

Test Conditions:

1. $V_F$=3.2V, $I_F$=40mA (One LED channel), the ambient temperature is 25℃.
2. The test systems refer to Note 1 and Note 2.

## Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 minutes operation, the optical 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)。

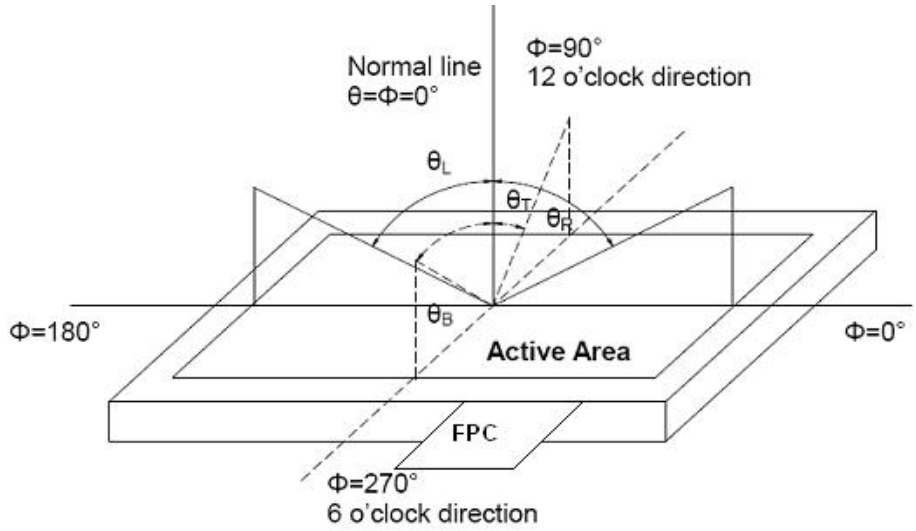



Fig. 1 Definition of viewing angle

## Note 3: Definition of contrast ratio

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

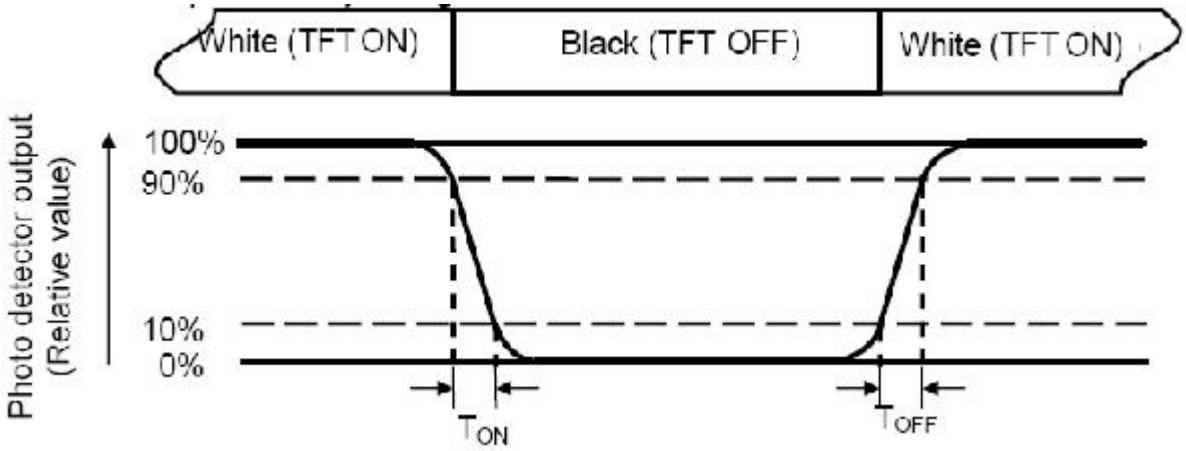
“White state “:The state is that the LCD should be driven by Vwhite.

“Black state”: The state is that the LCD should be driven by Vblack.

Vwhite: To be determined Vblack: 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 (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) 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.

Luminance Uniformity (U) = Lmin/ Lmax

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

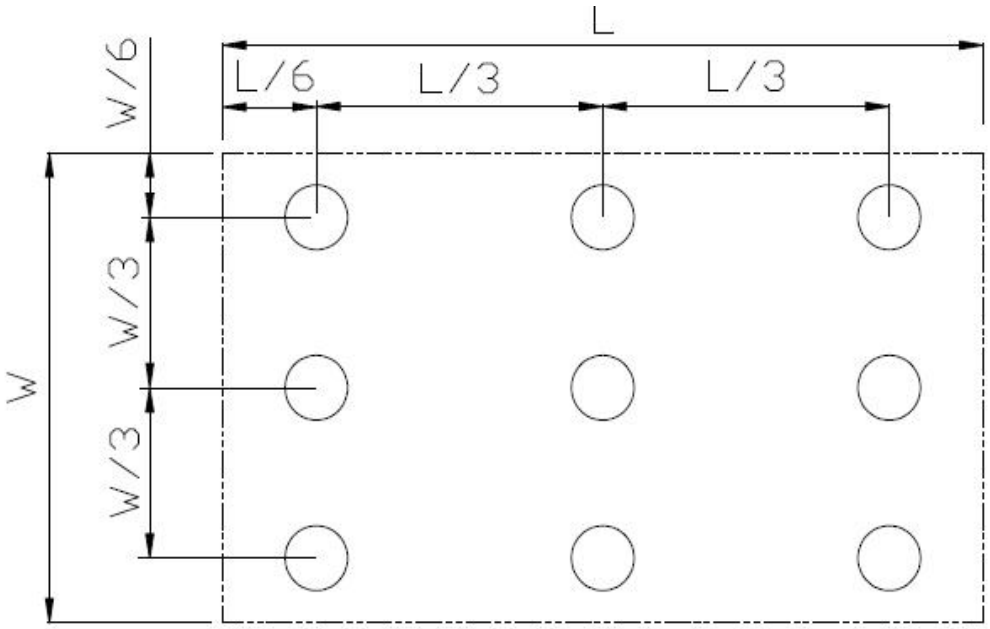



Fig. 2 Definition of uniformity

Lmax: The measured maximum luminance of all measurement position.

Lmin: The measured minimum luminance of all measurement position.

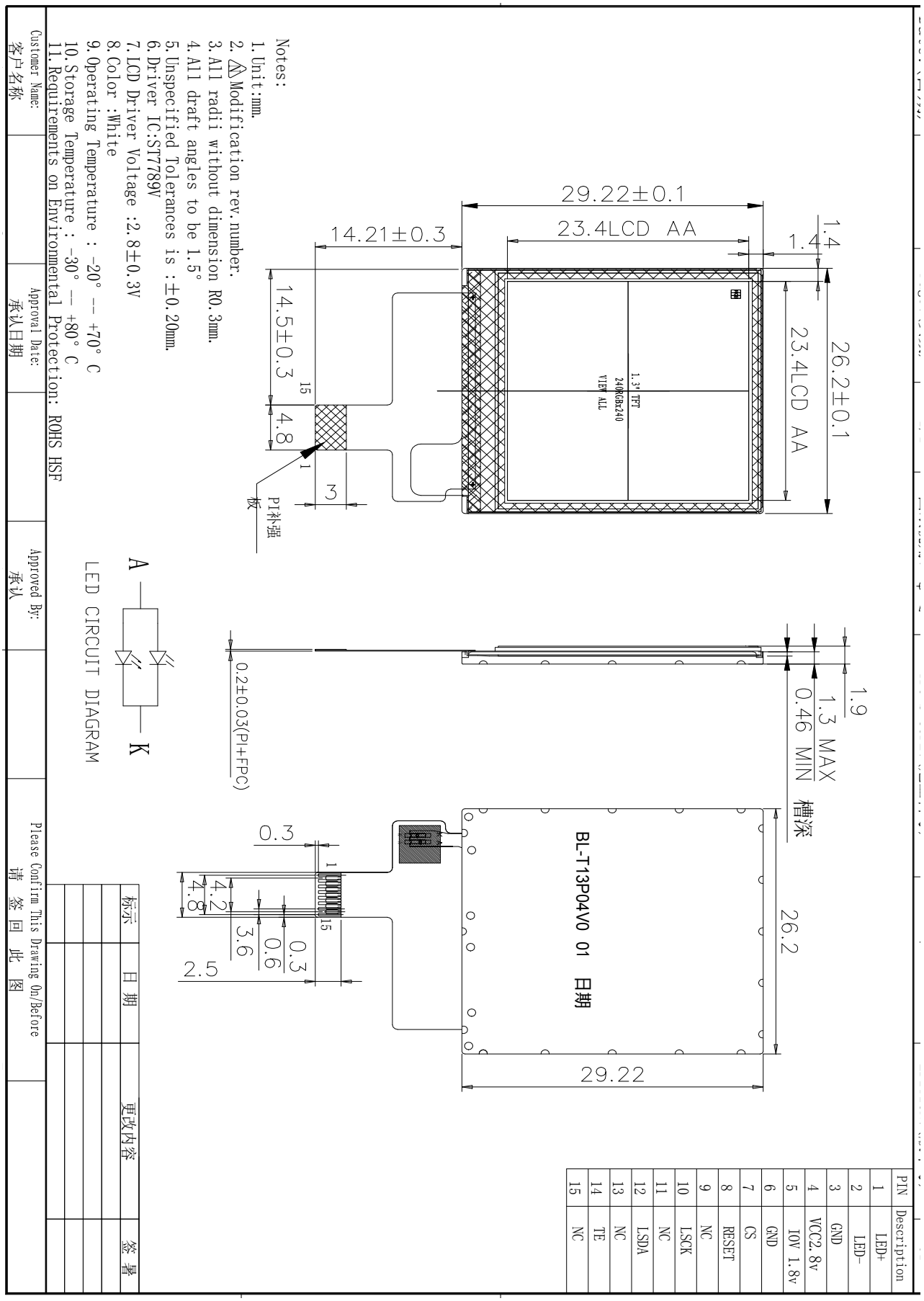
## Note 7: Definition of Luminance:

Measure the luminance of white state at center point.

# 7 Environmental / Reliability Test

| Item | Condition | Time (hrs) | Assessment |
|---|---|---|---|
| High temp. Storage | 80°C | 120 | No abnormalities in functions and appearance |
| High temp. Operating | 70°C | 120 | |
| Low temp. Storage | -30°C | 120 | |
| Low temp. Operating | -20°C | 120 | |
| Humidity | 40°C/ 90%RH | 120 | |
| Thermal Shock(Non-operation) | -20°C ← 25°C →70°C (0.5 hour ← 5 min → 0.5 hour) | 10cycles | |

# 8 Mechanical Drawing



# 9 Precautions For Use of LCD Modules

## 9.1 Handling Precautions

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

9.1.1.2 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.

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

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

9.1.1.5 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

9.1.1.6 Do not attempt to disassemble the LCD Module.

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

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

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

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

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

9.1.1.12 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.

9.1.1.13 Storage precautions

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

9.1.1.15 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:

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

## 9.2 Transportation Precautions

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