

## LCD MODULE SPECIFICATION

|                 |                    |
|-----------------|--------------------|
| <b>Model:</b>   | UE028VG-RB25-A016A |
| <b>Version:</b> | V1.2               |
| <b>Date:</b>    | 20200602           |

### Customer Confirmation 客户确认

| Approved by | Notes |
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### VIEWE Confirmation 优奕确认

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|             |             |             |

## REVISION HISTORY

| Revision<br>版本号 | Date<br>日期 | Contents of Revision Change<br>修改内容  | Remark<br>备注 |
|-----------------|------------|--------------------------------------|--------------|
| V1.0            | 2020.02.26 | Preliminary release                  |              |
| V1.0            | 2020.04.01 | 修改 ID 接法                             |              |
| V1.1            | 2020.05.30 | 修改盖板、正面保护膜及 Sensor 外形，取消透孔           |              |
| V1.2            | 2020.06.02 | LCD FPC 取消靠近金手指处漏铜,取消方形半的 Sensor 避让孔 |              |
|                 |            |                                      |              |
|                 |            |                                      |              |
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## 1. GENERAL INFORMATION

### 1.1 Features

- 1) Pixel Arrangement: RGB Vertical Stripe
- 2) Interface Mode: 25PIN MIPI
- 3) Driver IC: ST7701S
- 4) Operation Temperature: -20~70℃
- 5) Storage Temperature: -30~80℃
- 6) Backlight Type: White LED
- 7) Display mode: Normally Black,
- 8) Pixel Density: 283 PPI
- 9) LED life time: 30,000 Hours

### 1.2 Mechanical Specification

| Item<br>项目               | Specification<br>规格       | Unit<br>单位        | Remark<br>备注 |
|--------------------------|---------------------------|-------------------|--------------|
| Pixel Driving element    | A-Si TFT                  | -                 | -            |
| Screen Size              | 2.83                      | Inch              | Diagonal     |
| Resolution               | 480(W)*3(RGB)*640(H)      | Dots              | -            |
| Interface                | MIPI                      | -                 | 2 LANES      |
| Module Power Consumption | 0.35                      | Watt              | Typ.         |
| VActive VArea            | 43.8(W)*58.20(H)          | mm                | -            |
| Pixel pitch (W*H)        | 0.030(W)*0.090(H)         | mm                | -            |
| Module Size (W*H*D)      | 49.71(W)*71.27(H)*2.93(D) | mm                | -            |
| Luminance                | 300                       | cd/m <sup>2</sup> | Typ.         |
| Viewing Direction        | All                       | O'clock           | -            |
| Display Color            | 16.7M                     | Colors            | 24bits       |

## 2. ABSOLUTE MAXIMUM RATINGS

| Item<br>项目            | Symbol<br>符号    | Min.<br>最小值 | Max.<br>最大值 | Unit<br>单位 | Remark<br>备注       |
|-----------------------|-----------------|-------------|-------------|------------|--------------------|
| Power supply voltage1 | VIO28_PMU       | -0.5        | 3.6         | V          | Note1              |
| Power supply voltage2 | VIO18_PMU       | -0.5        | 3.6         | V          |                    |
| Power supply voltage3 | VCAM-AF-2V8     | -0.5        | 3.6         | V          |                    |
| LED forward current   | I <sub>F</sub>  | -0.001      | 30          | mA         | For each led,Note1 |
| LED Reverse Voltage   | V <sub>R</sub>  | -           | 5           | V          | For each led,Note1 |
| Operating temperature | T <sub>op</sub> | -20         | 70          | °C         | Note1,2            |
| Storage temperature   | T <sub>st</sub> | -30         | 80          | °C         | Note1,2            |
| Humidity              | H <sub>st</sub> | 10          | 90          | %RH        | Note1,3            |

(Ta=+25°C,GND=0V)

Note1:If the module exceeds the absolute maximum ratings, it may be damaged permanently. Also if the module operates with the absolute maximum ratings for a long time, the reliability may drop.

Note2: In case of temperature below 0°C,the response time of liquid crystal (LC) becomes slower and the color of panel darker than normal one.

Note3: Temp. ≤ 60°C , 90% RH MAX.

Temp. >60°C , Absolute humidity shall be less than 90% RH.

[illegible]

## 4. I/O CONNECTION & BLOCK DIAGRAM

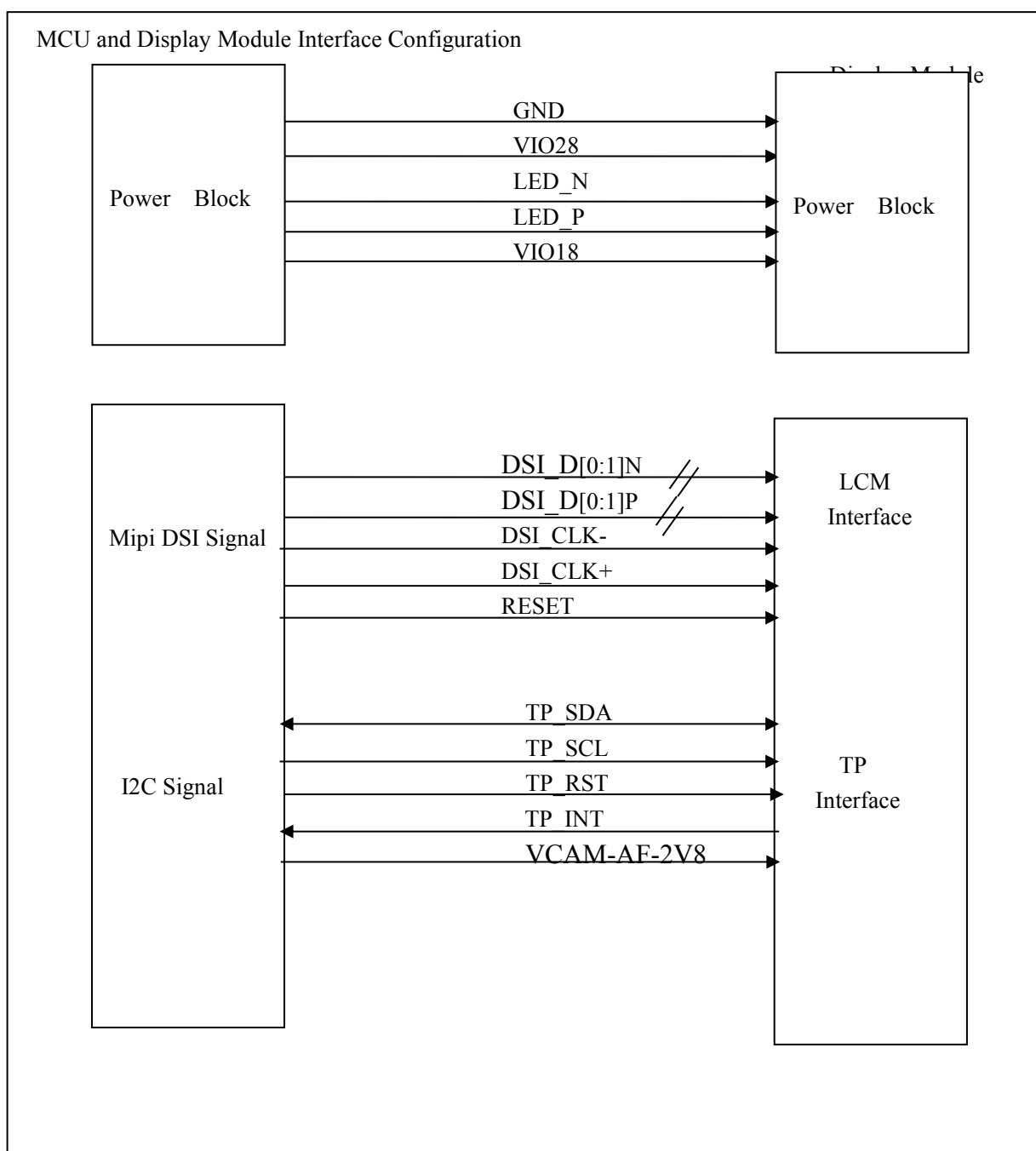
### 4.1 I/O Connection

| Pin No.<br>序号 | Symbol<br>符号 | I/O | Description<br>描述                                             |
|---------------|--------------|-----|---------------------------------------------------------------|
| 1             | LMIPI_D0P    | I   | MIPI-DSI data lane 0 positive-end input pin                   |
| 2             | LMIPI_D0N    | I   | MIPI-DSI data lane 0 negative-end input pin                   |
| 3             | GND          | P   | Power Ground                                                  |
| 4             | LMIPI_CP     | I   | MIPI-DSI clock lane positive-end input pin                    |
| 5             | LMIPI_CN     | I   | MIPI-DSI clock lane negative-end input pin                    |
| 6             | GND          | P   | Power Ground                                                  |
| 7             | LMIPI_D1P    | I   | MIPI-DSI data lane 1 positive-end input pin                   |
| 8             | LMIPI_D1N    | I   | MIPI-DSI data lane 1 negative-end input pin                   |
| 9             | GND          | P   | Power Ground                                                  |
| 10            | GND          | P   | Power Ground                                                  |
| 11            | VCAM_2V8     | P   | VCAM_2V8 Power Supply for TP                                  |
| 12            | TP_SCL0      | I   | I2C clock signals for TP                                      |
| 13            | TP_SDA0      | I   | I2C data signals for TP                                       |
| 14            | TP_EINT10    | O   | Interrupt signals for TP                                      |
| 15            | TP_RST       | I   | The signal will reset the TP, Signal is active low            |
| 16            | ID           | O   | ID Select.                                                    |
| 17            | GND          | P   | Power Ground                                                  |
| 18            | LPTE         | O   | Tearing effect output pin to synchronize MCU to frame writing |
| 19            | LCM_RSTN     | I   | The signal will reset the LCM, Signal is active low.          |
| 20            | GND          | P   | Power Ground                                                  |
| 21            | VIO28_PMU    | P   | Power supply to the internal logic power regulator( 1.8V)     |
| 22            | VIO28_PMU    | P   | Power supply to the internal power regulator( 2.8V)           |
| 23            | GND          | P   | Power Ground                                                  |
| 24            | LED_P        | P   | Power supply for backlight anode                              |
| 25            | LED_N        | P   | Power supply for backlight cathode                            |

I: Input; O: Output; P: Power

| TP PIN . | Symbol | I/O | Description                                        |
|----------|--------|-----|----------------------------------------------------|
| 1        | TP_VDD | P   | TP_VDD(2.8V) Power Supply for TP                   |
| 2        | TP_SCL | I   | I2C clock signals for TP                           |
| 3        | TP_SDA | I/O | I2C data signals for TP                            |
| 4        | TP_INT | O   | Interrupt signals for TP                           |
| 5        | TP_RST | I   | The signal will reset the TP, Signal is active low |
| 6-10     | GND    | P   | Ground.                                            |

## 4.2 Block Diagram



## 5. ELECTRICAL CHARACTERISTICS

### 5.1 TFT-LCD Panel Driving Section

| Item<br>项目               | Symbol符号         | Min.<br>最小值 | Typ.<br>典型值 | Max.<br>最大值 | Unit<br>单位 | Remark<br>备注 |
|--------------------------|------------------|-------------|-------------|-------------|------------|--------------|
| Power Supply Voltage1    | VIO28_PMU        | 2.6         | 2.8         | 3.6         | V          | -            |
| Power Supply Voltage2    | VIO18_PMU        | 1.6         | 1.8         | 3.6         | V          | -            |
| Power Supply Voltage3    | VCAM-AF-2V8      |             |             |             |            |              |
| Power Supply Current     | IVDD             | -           | 30          | -           | mA         | Note1        |
| Logic Input High Voltage | V <sub>IH</sub>  | 0.7V<br>CC  | -           | VCC         | V          | -            |
| Logic Input Low Voltage  | V <sub>IL</sub>  | 0           | -           | 0.3VCC      | V          | -            |
| Panel Power Consumption  | P <sub>VDD</sub> | -           | 0.099       | -           | Watt       | Note1        |
| Module Power Consumption | P <sub>LCM</sub> | -           | 0.483       | -           | Watt       | Note1,2      |

(Ta=+25°C,GND=0V)

Note1:Measurement Conditions (Video Mode): Full Screen Red Pattern,VDD=3.3V,60Hz Refresh.

Note2: P<sub>LCM</sub>= P<sub>VDD</sub>+ P<sub>B/L</sub>, About P<sub>B/L</sub> information, inference to 5.2 Back Light Driving Section.

### 5.2 Back Light Driving Section

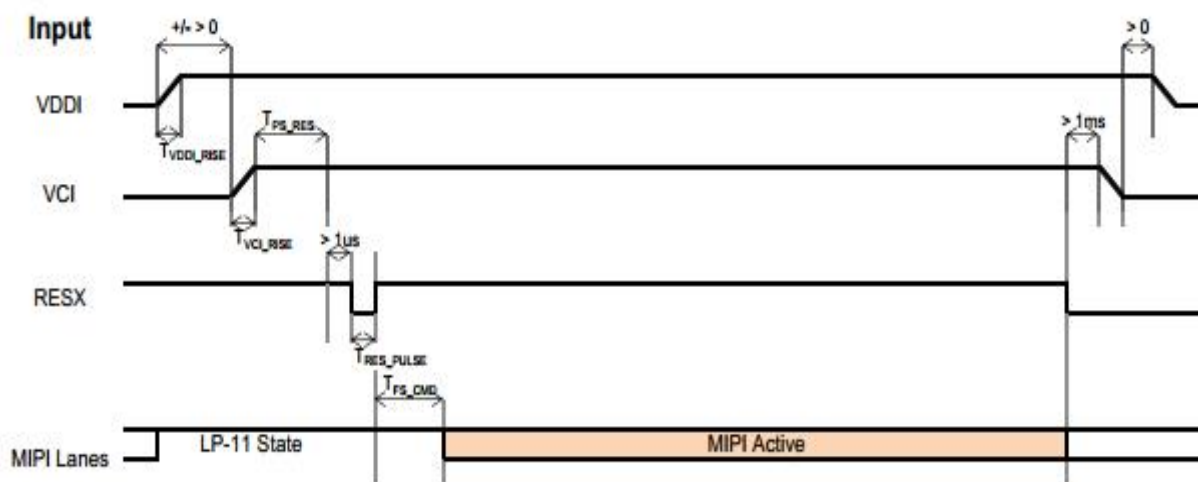
| Item<br>项目                  | Symbol<br>符号     | Min.<br>最小值 | Typ.<br>典型值 | Max.<br>最大值 | Unit<br>单位 | Remark<br>备注 |
|-----------------------------|------------------|-------------|-------------|-------------|------------|--------------|
| Forward Voltage             | V <sub>F</sub>   | -           | 19.2        |             | V          | Note1        |
| Forward Current             | I <sub>F</sub>   | -           | 20          | -           | mA         | Note1        |
| Backlight Power consumption | P <sub>B/L</sub> | -           | 0.384       | -           | Watt       | Note1        |
| LED life time               | -                | 30000       | -           | -           | Hrs        | Note2        |
| LED Quantity                |                  |             | 8           |             | PCS        |              |

(Ta=+25°C,GND=0V)

Note1: The LED driving condition is defined for each LED module (8 LED Serial)。For each LED :  
I<sub>F</sub>=20mA,V<sub>F</sub>=3.2V(Typ.)/3.4V(Max.),Ta=25°C。

Note2:The “LED life time” is defined as the module brightness decrease to 50% of original  
brightness at I<sub>LED</sub>=20mA(Per Led). The LED life time could be decreased if operating  
I<sub>LED</sub> is larger than 20mA.

## 5.3 Power On/Off Sequence



| Symbol           | Characteristics           | Min. | Typ. | Max. | Units |
|------------------|---------------------------|------|------|------|-------|
| $T_{VDDI\_RISE}$ | VDDI Rise time            | 100  | -    | -    | us    |
| $T_{VCI\_RISE}$  | VCI Rise time             | 130  | -    | -    | us    |
| $T_{PS\_RES}$    | VDDI/VCI on to Reset high | 5    | -    | -    | ms    |
| $T_{RES\_PULSE}$ | Reset low pulse time      | 10   | -    | -    | us    |
| $T_{FS\_CMD}$    | Reset to first command    | 10   | -    | -    | ms    |

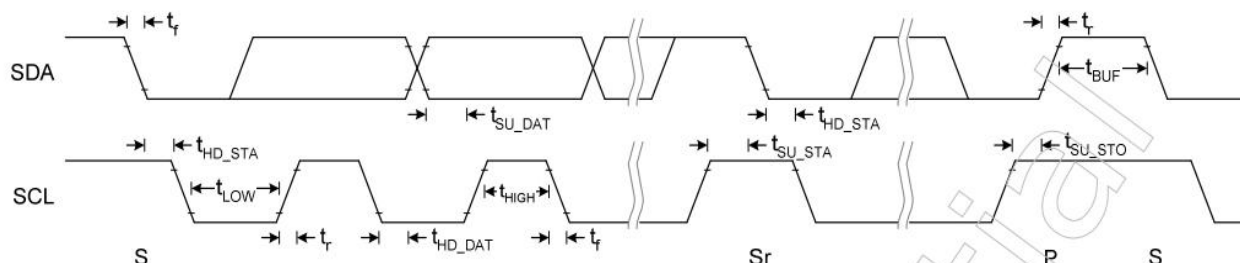
### 5.31 Power Off Sequence

The uncontrolled power-off means a situation which removed a battery without the controlled power off sequence. It will neither damage the module or the host interface.

If uncontrolled power-off happened, the display will go blank and there will not any visible effect on the display (blank display) and remains blank until "Power On Sequence" powers it up.

## Timing Characteristics

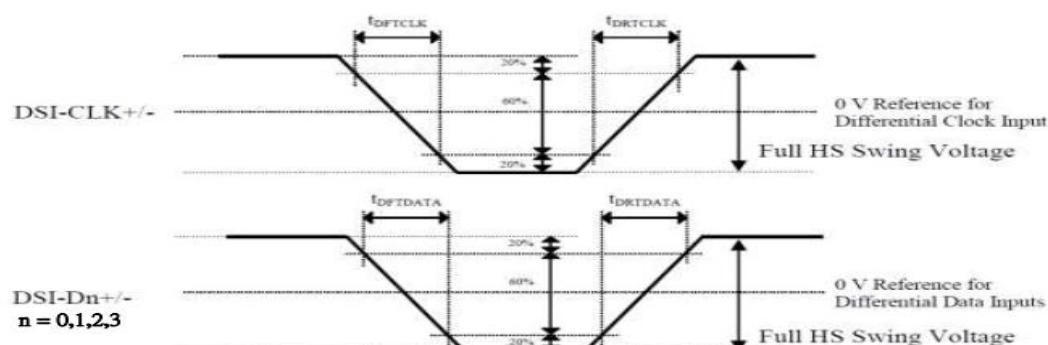
### 5.4.0 I2C interface timings



| Parameter                          | Symbol    | Min. | Max. | Unit |
|------------------------------------|-----------|------|------|------|
| SCL low period                     | $t_{Lo}$  | 1.3  | -    | us   |
| SCL high period                    | $t_{Hi}$  | 0.6  | -    | us   |
| SCL setup time for START condition | $t_{st1}$ | 0.6  | -    | us   |
| SCL setup time for STOP condition  | $t_{st3}$ | 0.6  | -    | us   |
| SCL hold time for START condition  | $t_{hd1}$ | 0.6  | -    | us   |
| SDA setup time                     | $t_{st2}$ | 0.1  | -    | us   |
| SDA hold time                      | $t_{hd2}$ | 0    | -    | us   |

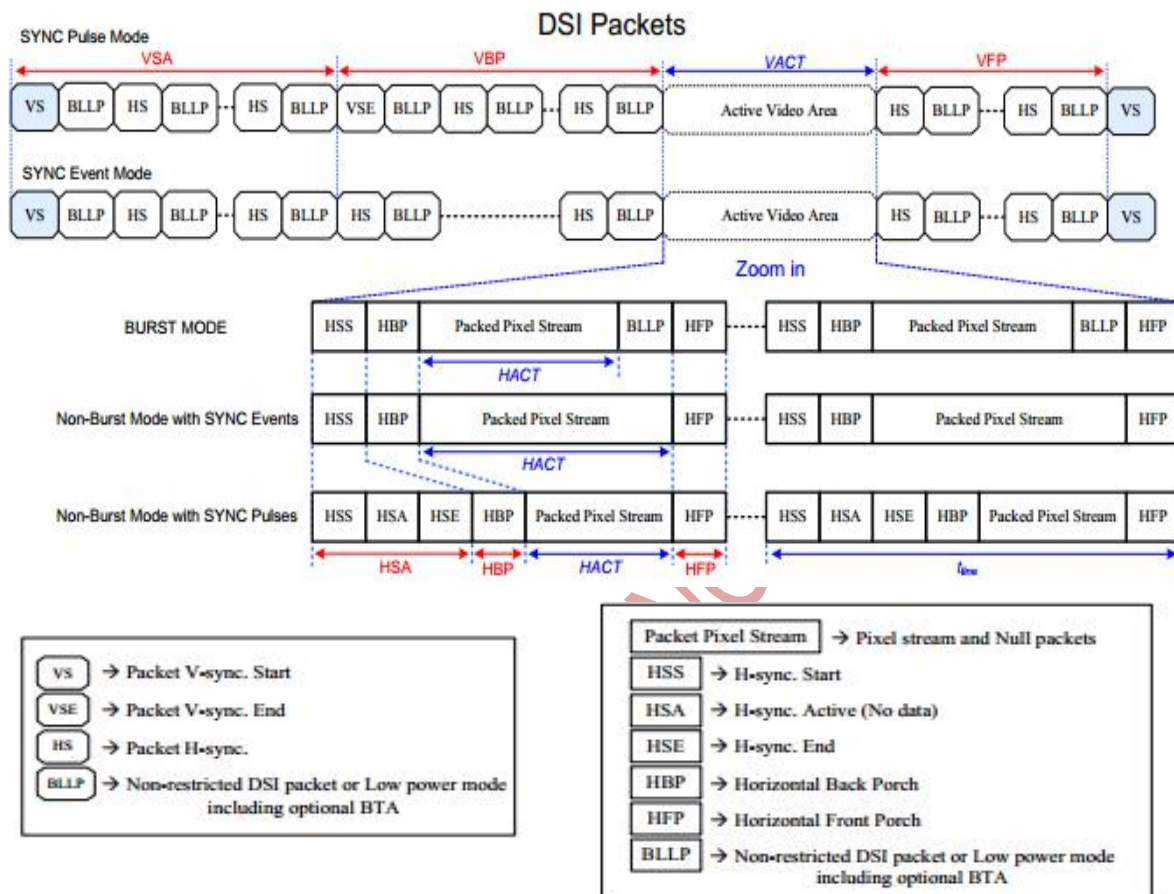
**Note:** 1.8V 通讯接口, 400Kbps 通讯速度, 上拉电阻 2K

| Parameter                        | Symbol        | Condition              | Specification |     |                 |
|----------------------------------|---------------|------------------------|---------------|-----|-----------------|
|                                  |               |                        | Min           | Typ | Max             |
| Differential Rise Time for Clock | $t_{DRTCLK}$  | DSI-CLK+/-             | 150 ps        | -   | 0.3UI<br>(Note) |
| Differential Rise Time for Data  | $t_{DRTDATA}$ | DSI-Dn+/-<br>n=0,1,2,3 | 150 ps        | -   | 0.3UI<br>(Note) |
| Differential Fall Time for Clock | $t_{DFTCLK}$  | DSI-CLK+/-             | 150 ps        | -   | 0.3UI<br>(Note) |
| Differential Fall Time for Data  | $t_{DFTDATA}$ | DSI-Dn+/-<br>n=0,1,2,3 | 150 ps        | -   | 0.3UI<br>(Note) |



## 5.5 Timing Diagram

### 5.5.1 Horizontal and Vertical Timings



### 5.5.3 Timing Parameters

| Parameter              | Symbol | Value |      |      | Unit   |
|------------------------|--------|-------|------|------|--------|
|                        |        | Min.  | Typ. | MAX. |        |
| Bit rate per lane      | BRPHY  | 80    | -    | 1000 | Mbps   |
| Active pixel per line  | HACT   | -     | 480  | -    | Pixels |
| Horizontal back porch  | tHBP   | -     | 10   | -    | DCLK   |
| Horizontal sync active | tHSA   | -     | 10   | -    | DCLK   |
| Horizontal front porch | tHFP   | -     | 38   | -    | DCLK   |
| Active pixel per frame | VACT   | -     | 640  | -    | H      |
| Vertical back porch    | tVBP   | -     | 4    | -    | H      |
| Vertical sync active   | tVSA   | -     | 4    | -    | H      |
| Vertical front porch   | tVFP   | -     | 8    | -    | H      |

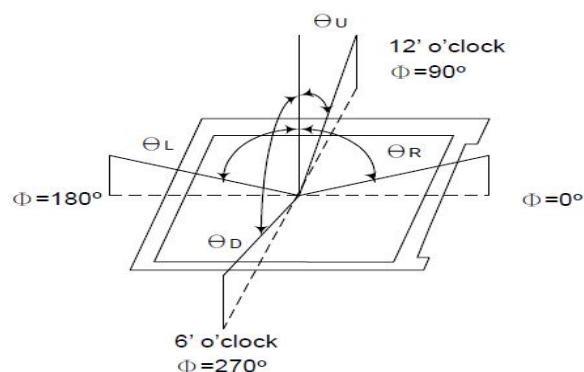
## 6. OPTICAL CHARACTERISTICS

| Parameter<br>参数         | Symbol<br>符号                    | Condition<br>条件                                                        | Min.<br>最小值 | Typ.<br>典型值 | Max.<br>最大值 | Unit<br>单位        | Remark<br>备注 |
|-------------------------|---------------------------------|------------------------------------------------------------------------|-------------|-------------|-------------|-------------------|--------------|
| Contrast Ratio          | C/R                             | $\theta = 0^\circ$                                                     | 1000        | 1500        | -           | -                 | Note(4)      |
| NTSC Ratio              | S                               | $\theta = 0^\circ$                                                     | -           | 70          | -           | %                 | Note(7)      |
| Luminance               | L                               | $\theta = 0^\circ$                                                     | -           | 300         | -           | cd/m <sup>2</sup> | Note(5)      |
| Luminance<br>uniformity | U <sub>W</sub>                  | $\theta = 0^\circ$                                                     | -           | 70          | -           | %                 | Note(3)      |
| Response Time           | T <sub>R</sub> + T <sub>F</sub> | 25 °C                                                                  | -           | 30          | 35          | ms                | Note(2)      |
| Color<br>Coordination   | W <sub>X</sub>                  | $\theta = 0^\circ$<br>(Center)<br>Normal<br>viewing<br>angle<br>B/L On | -0.03       | 0.294       | +0.03       | NTSC<br>(x,y)     | Note(6)      |
|                         | W <sub>Y</sub>                  |                                                                        |             | 0.313       |             |                   |              |
|                         | R <sub>X</sub>                  |                                                                        |             | 0.658       |             |                   |              |
|                         | R <sub>Y</sub>                  |                                                                        |             | 0.318       |             |                   |              |
|                         | G <sub>X</sub>                  |                                                                        |             | 0.250       |             |                   |              |
|                         | G <sub>Y</sub>                  |                                                                        |             | 0.570       |             |                   |              |
|                         | B <sub>X</sub>                  |                                                                        |             | 0.139       |             |                   |              |
|                         | B <sub>Y</sub>                  |                                                                        |             | 0.087       |             |                   |              |
| Viewing Angle           | $\theta_L$                      | C/R>10                                                                 | -           | 80          | -           | Degree            | Note(1)      |
|                         | $\theta_R$                      |                                                                        | -           | 80          | -           |                   |              |
|                         | $\theta_U$                      |                                                                        | -           | 80          | -           |                   |              |
|                         | $\theta_D$                      |                                                                        | -           | 80          | -           |                   |              |

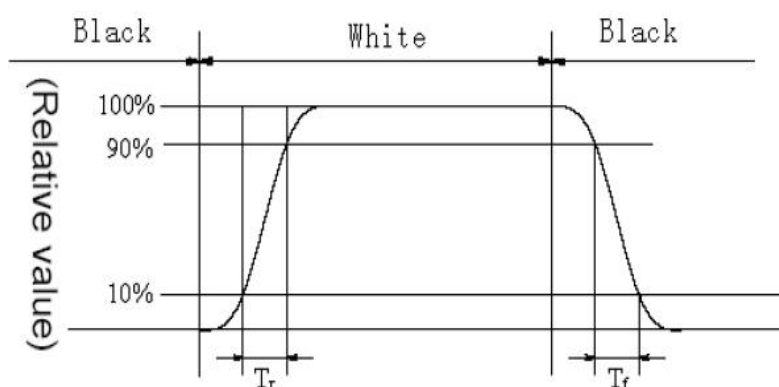
Test Conditions:

1. VDD=2.8V, I<sub>F</sub>=40mA (Backlight current), the ambient temperature is +25°C.
2. The test systems refer to Note 8.

**Note1:** Definition of Viewing Angle: The viewing angle range that the CR>10

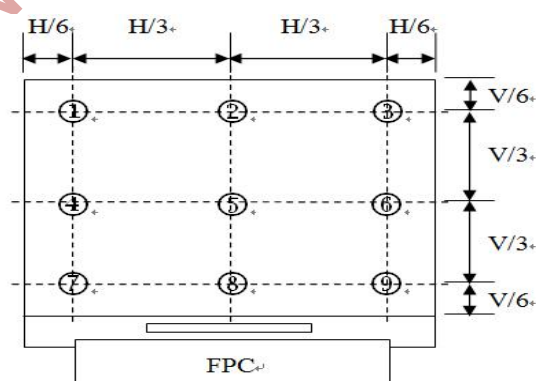


**Note2:** Definition of Response time: Sum of  $T_R$  and  $T_F$



**Note 3:** Definition of Luminance Uniformity: Active area is divided into 9 measuring areas, every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity} = \frac{\text{Min Luminance of white among 9-points}}{\text{Max Luminance of white among 9-points}} \times 100\%$$



**Note4:** Definition of Contrast Ratio (CR): measured at the center point of panel

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

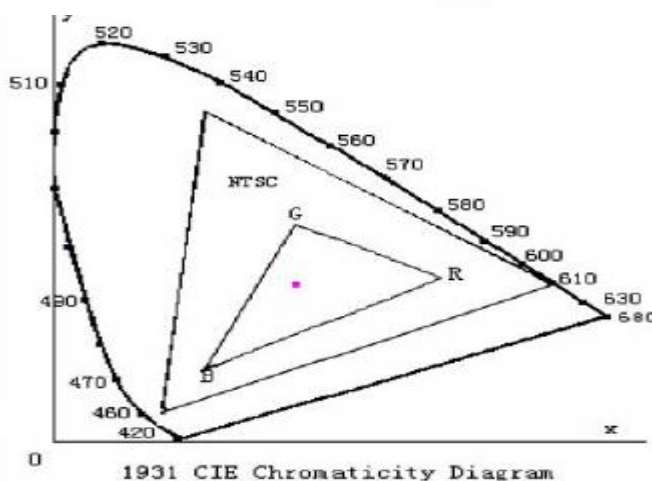
**Note 5:** Definition of Luminance: Center Luminance of white is defined as luminance values of 1 point average across the LCD surface.

**Note 6:** Definition of Color Chromaticity (CIE 1931)

Color coordinates of white & red, green, blue measured at center point of LCD.

**Note 7:** Definition of NTSC ratio:

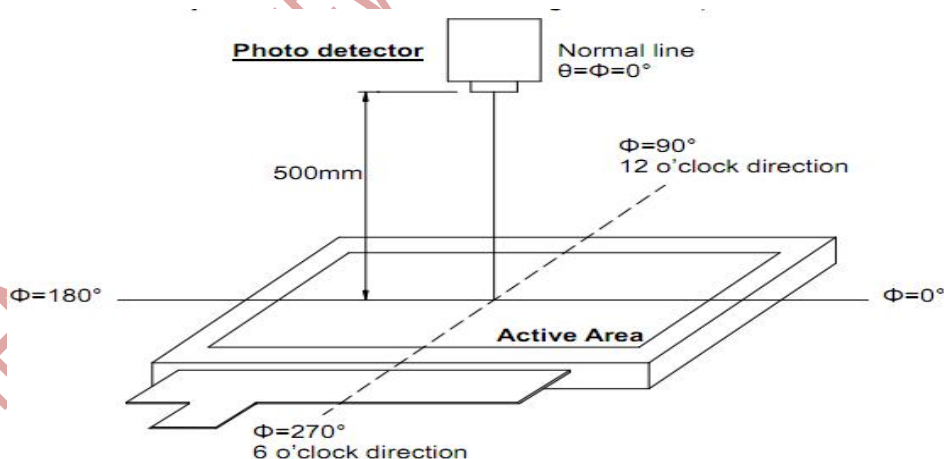
$$\text{NTSC ratio} = \frac{\text{Area of RGB triangle}}{\text{Area of NTSC triangle}}$$



**Note 8:** Definition of measurement system.

optical

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. (Response time is measured by Photo detector TOPCON BM-7, Field of view: 1°/Height: 500mm.)



## 7. RELIABILITY

| Item<br>项目                     | Test Condition<br>测试条件                                                      | Remark<br>备注 |
|--------------------------------|-----------------------------------------------------------------------------|--------------|
| High Temperature Storage       | Ta =+80°C / 96Hours                                                         | Note1,2,3    |
| Low Temperature Storage        | Ta =-30°C / 96Hours                                                         | Note1,2,3    |
| High Temperature Operating     | Ta =+70°C / 96Hours                                                         | Note1,2,3    |
| Low Temperature Operating      | Ta =-20°C / 96Hours                                                         | Note1,2,3    |
| Temperature Cycle storage Test | -30°C/30min ↔+80°C /30min for 30cycles, Transfer time less than 5min        | Note2,3      |
| Thermal humidity storage Test  | 60°C x 90%RH / 96Hours                                                      | Note2,3      |
| ESD test                       | Contact: ±8KV<br>Air: ±10KV<br>150PF/330Ω, 5Points/panel, 5times            |              |
| Package Vibration Test         | Frequency: 10Hz~55Hz, Amplitude: 1.5mm, 1 hrs for each direction of X, Y, Z | Note2        |

### Inspection after Test:

Note1: Ta is the ambient temperature of samples.

Note 2: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but doesn't guarantee all the cosmetic specification.

Note 3: Before cosmetic and function tests, the product must have enough recovery time, at least 2 hours at room temperature.

## 8. PACKAGE DRAWING

### 14. PACKING SPECIFICATIONS

#### 14.1 INNER BOX SPECIFICATIONS

