

# Product Specification

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

Basic Model: SAT070BO50R04H-FG165100TK

Model Name: 7.0"

ERP NO. : 1090700050

☒ **Preliminary Specification**

☐ **Final Specification**

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

| Prepared by | Reviewed by | Approved by |
|-------------|-------------|-------------|
|             |             |             |

## Revision Status

| Version | Revise Date | Page | Content       | Modified by |
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# 1. General Description

7.0" is a color active matrix thin film transistor (TFT) TN liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. It is composed of a TFT LCD panel, Driver IC, FPC and Backlight.

## 1.1 LCD Characteristics

| NO. | Item                           | Specification            | Remark            |
|-----|--------------------------------|--------------------------|-------------------|
| 1   | Panel Size                     | 7.0 inch(Diagonal)       |                   |
| 2   | Driver Method                  | a-Si TFT active matrix   |                   |
| 3   | Display Color                  | 16.7M                    |                   |
| 4   | Display Mode                   | Normally White           |                   |
| 5   | Viewing Direction              | 6 o'clock                |                   |
|     | Gray Scale Inversion Direction | 12 o'clock               |                   |
| 6   | Resolution                     | 1024 x 3(RGB) x 600      |                   |
| 7   | Active Area                    | 154.2144(W)x85.92(H)mm   |                   |
| 8   | Dot Pitch                      | 0.0502(W)x0.1432(H)mm    |                   |
| 9   | Pixel Arrangement              | RGB-stripe               |                   |
| 10  | Module Size                    | 164.9(W)x100(H)x3.3(D)mm |                   |
| 11  | Interface                      | TTL                      |                   |
| 12  | Driving IC                     | EK79001+EK73215          |                   |
| 13  | Luminance                      | 180(TYP)                 | cd/m <sup>2</sup> |
| 14  | Backlight                      | White LED                |                   |
| 15  | Weight                         | TBD                      | g                 |

Note 1: Color tune is slightly changed by temperature and driving voltage.

Note 2: LCM weight tolerance:  $\pm 5\%$ 

## 1.2 Touch Characteristics

| Parameter             | Specification                  | Unit | Remarks |
|-----------------------|--------------------------------|------|---------|
| Type of Master IC     | /                              | -    |         |
| Touch Structure       | F+G                            | -    |         |
| ITO Film Out Size     | 164.1(W)x99.2(H)x0.188(D)      | mm   |         |
| ITO Film View Area    | 156.7(W)x89.8(H)               | mm   |         |
| ITO Film Action Area  | 155.08(W)x86.92(H)             | mm   |         |
| ITO Glass Out Size    | 164.1(W)x99.2(H)x1.1(D)        | mm   |         |
| Operating Voltage     | 5.0V                           | -    |         |
| Signal Voltage        | 5.0V                           | -    |         |
| Insulation Resistance | $\geq 20\text{M}\Omega$ DC 25V | -    |         |
| Transmittance         | $\geq 76\%$                    | -    |         |
| Operating Temperature | -20 ℃ ~ 60 ℃                   | -    |         |
| Storage Temperature   | -20 ℃ ~ 70 ℃                   | -    |         |

## 2. PIN Description

### 2.1. LCM PIN Description

| No.   | Symbol | Function                         | Remarks |
|-------|--------|----------------------------------|---------|
| 1-2   | VLED+  | Power for LED backlight(anode)   |         |
| 3-4   | VLED-  | Power for LED backlight(Cathode) |         |
| 5     | GND    | Power Ground                     |         |
| 6     | VCOM   | Common Voltage                   |         |
| 7     | DVDD   | Power for Digital Circuit        |         |
| 8     | MODE   | DE/SYNC mode select              |         |
| 9     | DE     | Data input enable                |         |
| 10    | VS     | Vertical Sync input              |         |
| 11    | HS     | Horizontal Sync input            |         |
| 12~19 | B7~B0  | Blue data                        |         |
| 20~37 | G7~G0  | Green data                       |         |
| 28~35 | R7~R0  | Red data                         |         |
| 36    | GND    | Power Ground                     |         |
| 37    | DCLK   | Sample clock                     |         |
| 38    | GND    | Power ground                     |         |
| 39    | L/R    | Left/right selection             |         |
| 40    | U/D    | Up/Down selection                |         |
| 41    | VGH    | Gate On Voltage                  |         |
| 42    | VGL    | Gate Off Voltage                 |         |
| 43    | AVDD   | Power for Analog Circuit         |         |
| 44    | RESET  | Global reset pin                 |         |
| 45    | NC     | No connection                    |         |
| 46    | VCOM   | Common Voltage                   |         |
| 47    | DITHB  | Dithering function               |         |
| 48    | GND    | Power ground                     |         |
| 49-50 | NC     | GND                              |         |

## 2.2. TP PIN Description

[illegible]

## 3. Electrical Characteristics

### 3.1. Absolute Maximum Ratings

Voltage (AGND=GND=0V, Ta = 25°C)

| Item                  | Symbol          | Values |       | Unit | Remark |
|-----------------------|-----------------|--------|-------|------|--------|
|                       |                 | Min.   | Max.  |      |        |
| Power Voltage         | DVDD            | -0.3   | 3.96  | V    |        |
|                       | AVDD            | -0.5   | 14.85 | V    |        |
|                       | VGH             | -0.3   | 40.0  | V    |        |
|                       | VGL             | -20.0  | 0.3   | V    |        |
|                       | VGH-VGL         | 12.0   | 40.0  | V    |        |
| Operating Temperature | T <sub>op</sub> | -20    | 55    | °C   |        |
| Storage Temperature   | T <sub>st</sub> | -20    | 60    | °C   |        |

**Note:** The absolute maximum rating values of this product are not allowed to be exceeded at any time. Should a module be used with any of the absolute maximum ratings case, the module may be permanently destroyed.

#### 3.1.1. Typical Operation Range

| Item                     | Symbol          | values              |      |                     | Unit |
|--------------------------|-----------------|---------------------|------|---------------------|------|
|                          |                 | Min.                | Typ. | Max.                |      |
| Power Voltage            | DVDD            | 3.0                 | 3.3  | 3.6                 | V    |
|                          | AVDD            | 9.4                 | 9.6  | 9.8                 |      |
|                          | VGH             | 17                  | 18   | 19                  |      |
|                          | VGL             | -7                  | -6   | -5.4                |      |
|                          | VCOM            | 3.5                 | 3.8  | 4.1                 |      |
| Input logic high voltage | V <sub>IH</sub> | 0.7DV <sub>DD</sub> | -    | DV <sub>DD</sub>    | V    |
| Input logic low voltage  | V <sub>IL</sub> | 0                   | -    | 0.3DV <sub>DD</sub> | V    |

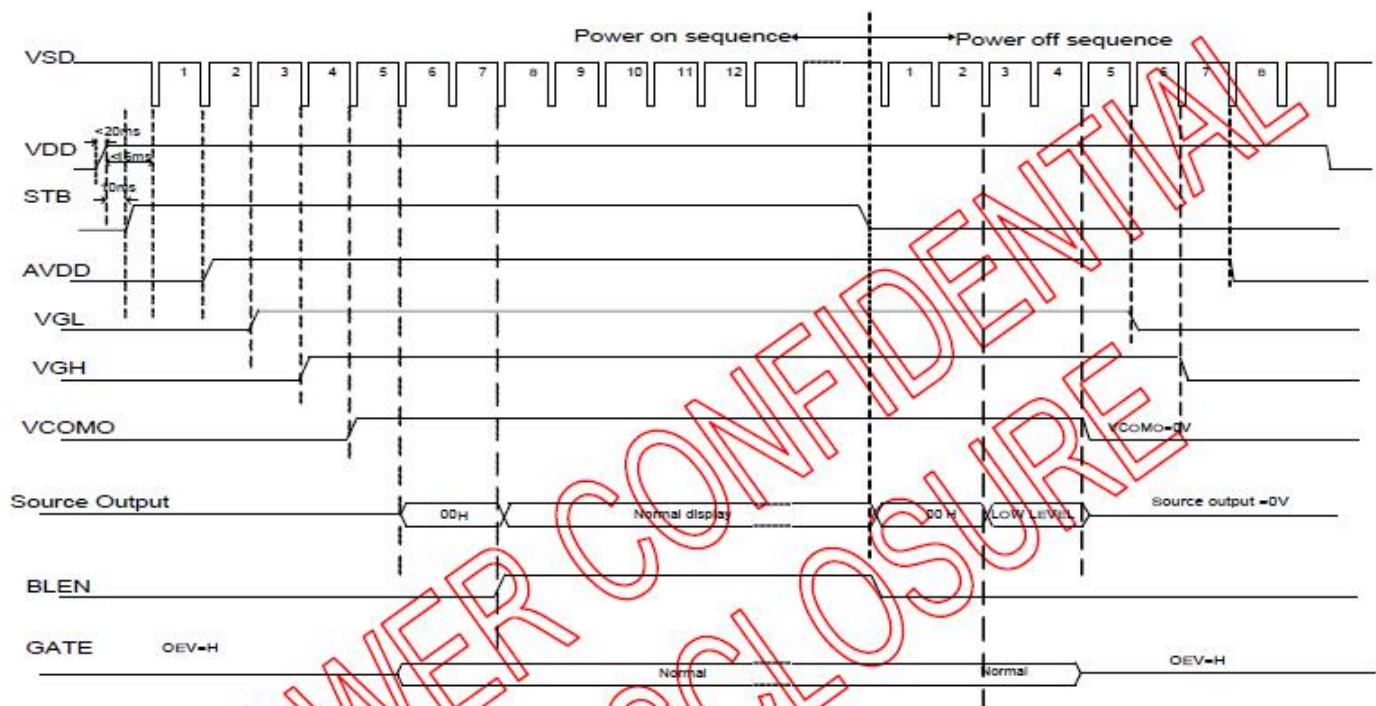
### 3.1.2. Current Consumption

| Item               | Symbol            | Values |      |      | Unit | Remark                 |
|--------------------|-------------------|--------|------|------|------|------------------------|
|                    |                   | Min.   | Typ. | Max. |      |                        |
| Current for Driver | I <sub>GH</sub>   | -      | 0.2  | 14   | V    | V <sub>GH</sub> =18.0V |
|                    | I <sub>GL</sub>   | -      | 0.2  | 50   | mA   | V <sub>GL</sub> =-6.0V |
|                    | I <sub>VDD</sub>  | -      | 15   | -    | mA   | V <sub>DD</sub> =3.3V  |
|                    | I <sub>AVDD</sub> | -      | 15   | -    | mA   | A <sub>VDD</sub> =9.6V |

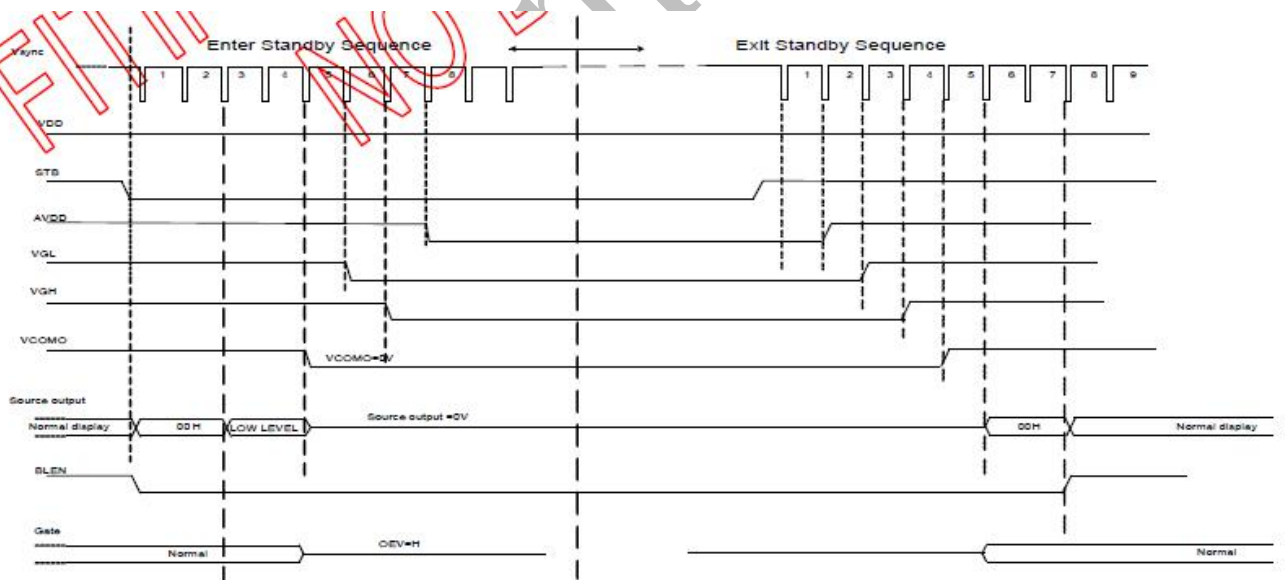
### 3.1.3. Backlight Driving Conditions

| Parameter                                  | Symbol         | Min.  | Typ. | Max. | Unit              |
|--------------------------------------------|----------------|-------|------|------|-------------------|
| Supply voltage of white LED backlight      | V <sub>L</sub> | 9.0   | 9.6  | 10.5 | V                 |
| Current for LED backlight                  | I <sub>L</sub> | 90    | 120  | 150  | mA                |
| Luminance<br>(on the module surface ,BM-7) |                | -     | 180  | -    | cd/m <sup>2</sup> |
| LED life time                              | -              | 30000 | -    | -    | Hr                |

## 3.2. Power Sequence



Power On/Off timing chart



Enter and Exit Standby Mode timing chart

Note: Low level=3Fh,when NBW=L(Normally white)  
Low level=00h,when NBW=H(Normally black)

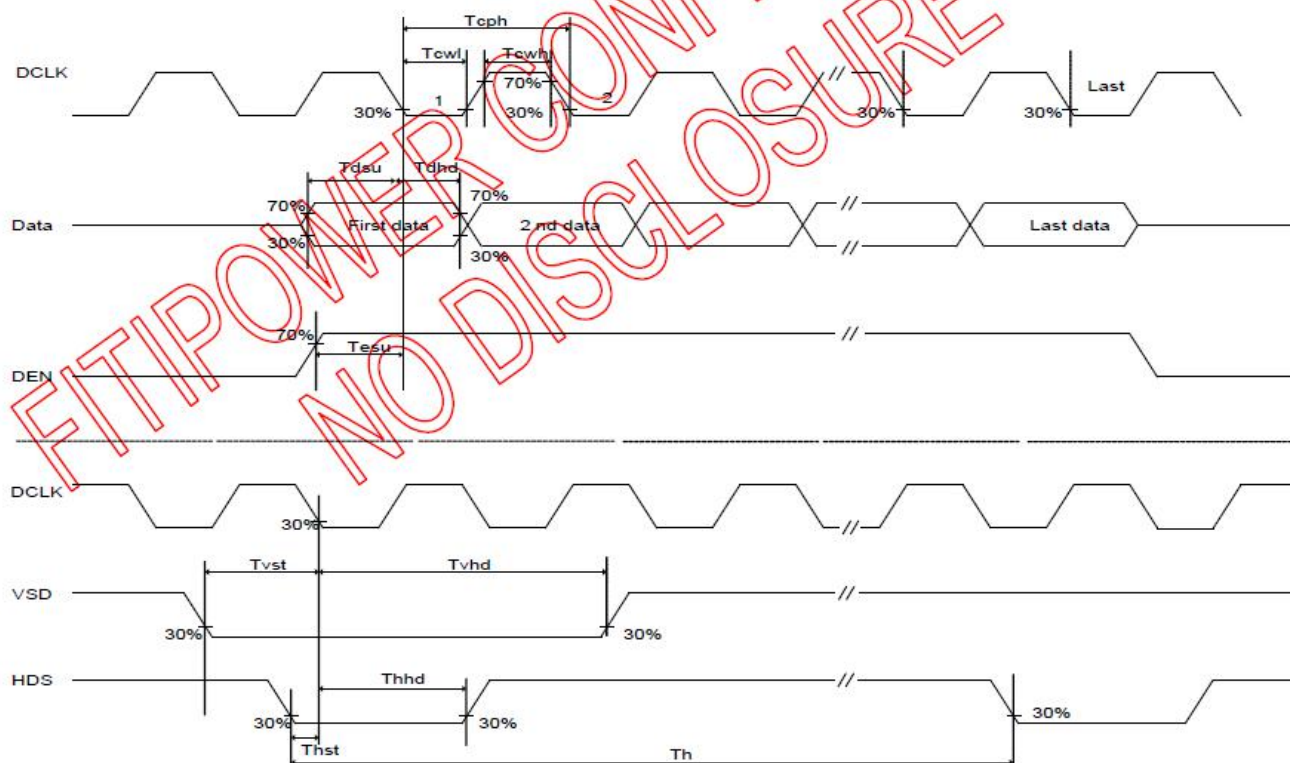
## 3.3. Timing Characteristics

### 3.3.1. AC Electrical Characteristics

TTL mode

| Parameter              | Symbol | Condition                         | Min. | Typ. | Max. | Unit |
|------------------------|--------|-----------------------------------|------|------|------|------|
| VDD Power On Slew rate | TPOR   | From 0V to 90% VDD                | 1    | -    | 20   | ms   |
| RST pulse width        | TRST   | DCLK = 65MHz                      | 50   | -    | -    | us   |
| DCLK cycle time        | Tcph   | -                                 | 14   | -    | -    | ns   |
| DCLK pulse duty        | Tcwh   | -                                 | 40   | 50   | 60   | %    |
| VSD setup time         | Tvst   | -                                 | 5    | -    | -    | ns   |
| VSD hold time          | Tvhd   | -                                 | 5    | -    | -    | ns   |
| HSD setup time         | Thst   | -                                 | 5    | -    | -    | ns   |
| HSD hold time          | Thhd   | -                                 | 5    | -    | -    | ns   |
| Data set-up time       | Tdsu   | D0[7:0], D1[7:0], D2[7:0] to DCLK | 5    | -    | -    | ns   |
| Data hold time         | Tdhd   | D0[7:0], D1[7:0], D2[7:0] to DCLK | 5    | -    | -    | ns   |
| DE setup time          | Tesu   | -                                 | 5    | -    | -    | ns   |
| DE hold time           | Tehd   | -                                 | 5    | -    | -    | ns   |
| Output stable time     | Tsst   | Dual gate                         | -    | -    | 3    | us   |

### 3.3.2. Input Clock and Date Timing Diagram



Parallel Input Clock and Data timing

### 3.3.3. Timing

#### DE mode

| DE mode                         |          |       |      |      |      |
|---------------------------------|----------|-------|------|------|------|
| Parameter                       | Symbol   | Value |      |      | Unit |
|                                 |          | Min.  | Typ. | Max. |      |
| DCLK frequency @Frame rate=60hz | fclk     | 40.8  | 51.2 | 67.2 | Mhz  |
| Horizontal display area         | thd      | 1024  |      |      | DCLK |
| HSYNC period time               | th       | 1114  | 1344 | 1400 | DCLK |
| HSYNC blanking                  | thb+thfp | 90    | 320  | 376  | DCLK |
| Vertical display area           | tvd      | 600   |      |      | H    |
| VSYNC period time               | tv       | 610   | 635  | 800  | H    |
| VSYNC blanking                  | tvb+tvfp | 10    | 35   | 200  | H    |

#### HV mode(1)

HV mode

Horizontal input timing

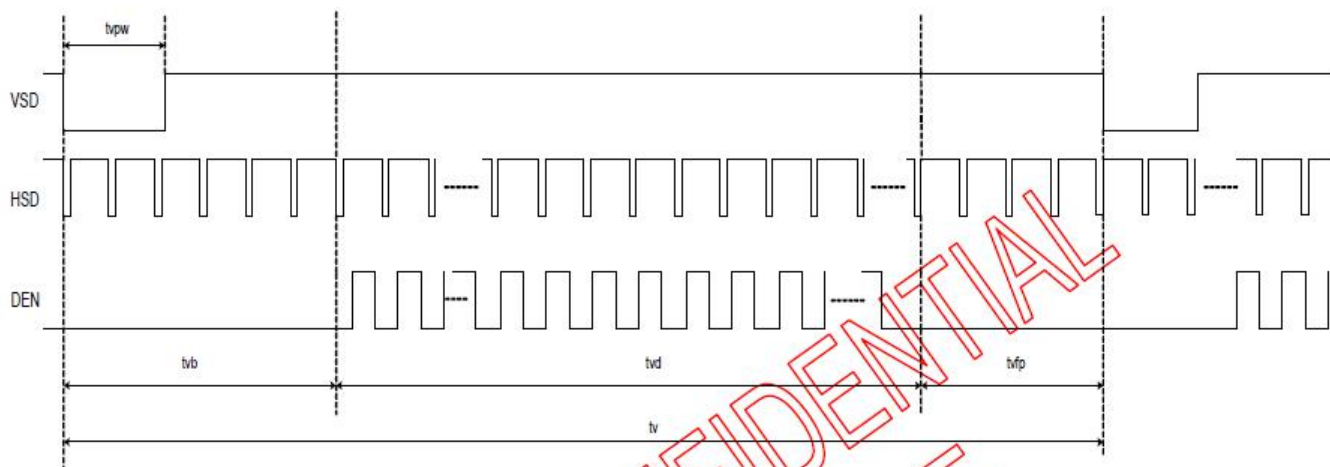
| Parameter                       |      | Symbol | Value |      |      | Unit |
|---------------------------------|------|--------|-------|------|------|------|
| Horizontal display area         |      | thd    | 1024  |      |      | DCLK |
| DCLK frequency@ Frame rate=60hz |      | fclk   | Min.  | Typ. | Max. |      |
|                                 |      |        | 44.9  | 51.2 | 63   |      |
| 1 Horizontal Line               |      | th     | 1200  | 1344 | 1400 | DCLK |
| HSYNC pulse width               | Min. | thpw   | 1     |      |      |      |
|                                 | Typ. |        | —     |      |      |      |
|                                 | Max. |        | 140   |      |      |      |
| HSYNC back porch                |      | thbp   | 160   | 160  | 160  |      |
| HSYNC front porch               |      | thfp   | 16    | 160  | 216  |      |

#### HV mode(2)

| Vertical input timing |        |       |      |      |      |
|-----------------------|--------|-------|------|------|------|
| Parameter             | Symbol | Value |      |      | Unit |
|                       |        | Min.  | Typ. | Max. |      |
| Vertical display area | tvd    | 600   |      |      | H    |
| VSYNC period time     | tv     | 624   | 635  | 750  | H    |
| VSYNC pulse width     | tvpw   | 1     | —    | 20   | H    |
| VSYNC back porch      | tvb    | 23    | 23   | 23   | H    |
| VSYNC front porch     | tvfp   | 1     | 12   | 127  | H    |

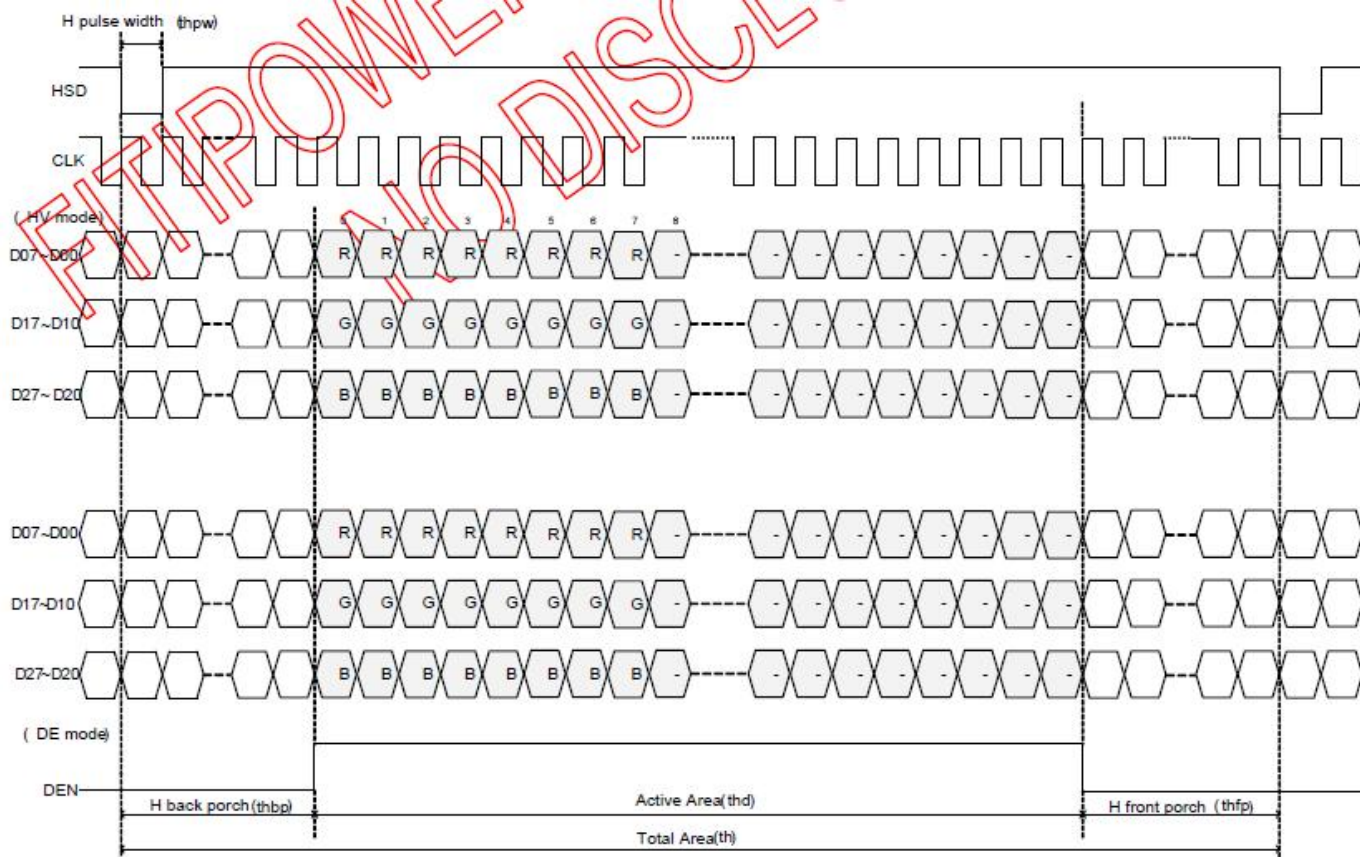
## 3.3.4. Date Input Format

### Vertical input timing



### Vertical input timing

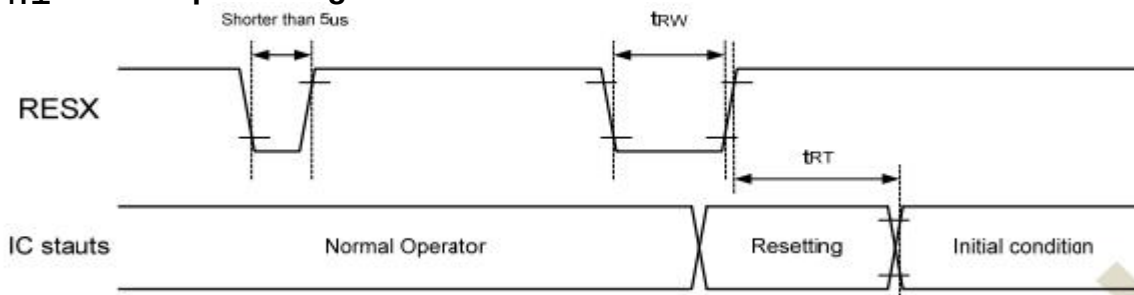
### Horizontal input timing



### Horizontal input timing

## 4. Sequential Chart

### 4.1 Reset input timings



| Symbol   | Parameter                          | Related pins | Min. | Max.               | Unit    |
|----------|------------------------------------|--------------|------|--------------------|---------|
| $t_{RW}$ | Reset pulse width <sup>(2)</sup>   | RESX         | 10   | -                  | $\mu s$ |
| $t_{RT}$ | Reset complete time <sup>(3)</sup> | -            | -    | 5<br>(Note 5)      | ms      |
|          |                                    | -            | -    | 120<br>(Note 6, 7) | ms      |

Note:

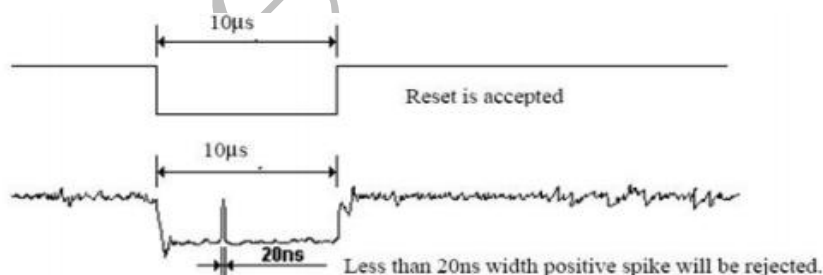
(1) The reset complete time also required time for loading ID bytes from OTP to registers. This loading is done every time when there is HW reset cancel time ( $t_{RT}$ ) within 5 ms after a rising edge of RESX.

(2) Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below.

| RESX Pulse                       | Action         |
|----------------------------------|----------------|
| Shorter than 5 $\mu s$           | Reset Rejected |
| Longer than 10 $\mu s$           | Reset          |
| Between 5 $\mu s$ and 10 $\mu s$ | Reset Start    |

(3) During the resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out -mode. The display remains the blank state in Sleep In -mode) and then returns to Default condition for H/W reset.

(4) Spike Rejection also applies during a valid reset pulse as shown below:



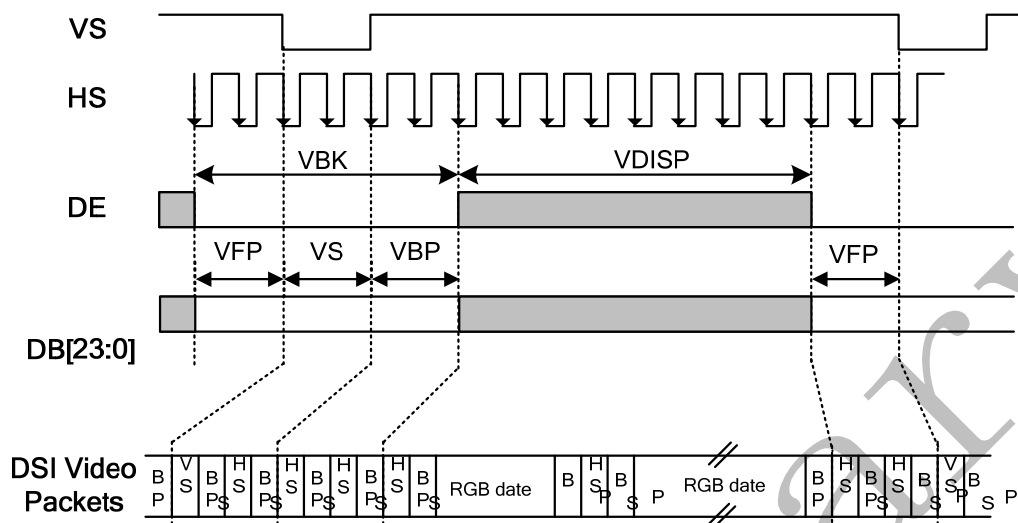
(5) When Reset is applied during Sleep In Mode.

(6) When Reset is applied during Sleep Out Mode.

(7) It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

## 4.2. Timings for DSI Video mode

## Vertical Timings



**Figure 11.9: Vertical Timings for DPI I/F**

**Resolution=800x1280(T<sub>A</sub>=25°C, IOVCC=1.8V, VCIP=2.8V, VCI=2.8V)**

| Item                     | Symbol | Condition  | Min. | Typ. | Max.           | Unit |
|--------------------------|--------|------------|------|------|----------------|------|
| Vertical low pulse width | VS     | -          | 2    | 4    | 200<br>Note(1) | Line |
| Vertical front porch     | VFP    | -          | 4    | 20   | 200            | Line |
| Vertical back porch      | VBP    | -          | 2    | 10   | 200<br>Note(1) | Line |
| Vertical blanking period | VBK    | VS+VBP+VFP | 8    | 34   | 250            | Line |
| Vertical active area     | -      | VDISP      | -    | 1280 | -              | Line |
| Vertical Refresh rate    | VRR    | -          | -    | 60   | -              | Hz   |

**Note:** (1) The VS and VBP pulse width are related to GIP start pulse and GIP clock pulse timing. The GIP start pulse and GIP clock pulse must be set at corresponding position for LCD normal display.

Resolution=768x1280 ( $T_A=25^{\circ}\text{C}$ , IOVCC=1.8V, VCIP=2.8V, VCI=2.8V)

| Item                     | Symbol | Condition  | Min. | Typ. | Max.           | Unit |
|--------------------------|--------|------------|------|------|----------------|------|
| Vertical low pulse width | VS     | -          | 2    | -    | 200<br>Note(1) | Line |
| Vertical front porch     | VFP    | -          | 4    | -    | 200            | Line |
| Vertical back porch      | VBP    | -          | 2    | -    | 200<br>Note(1) | Line |
| Vertical blanking period | VBK    | VS+VBP+VFP | 8    | -    | 250            | Line |
| Vertical active area     | -      | VDISP      | -    | 1280 | -              | Line |
| Vertical Refresh rate    | VRR    | -          | -    | 60   | -              | Hz   |

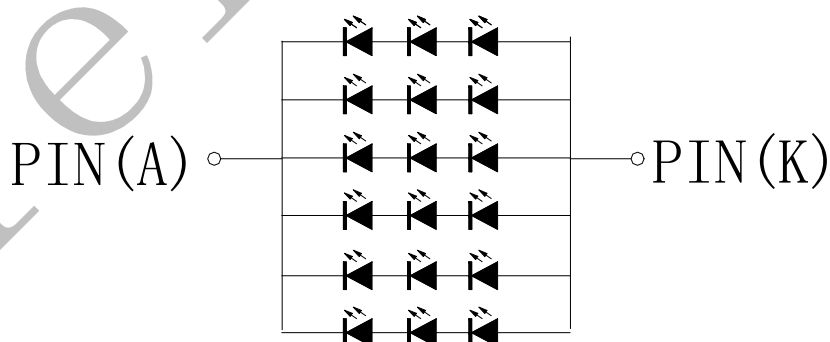
**Note:** (1) The VS and VBP pulse width are related to GIP start pulse and GIP clock pulse timing. The GIP start pulse and GIP clock pulse must be set at corresponding position for LCD normal display.

## 5.Optical Characteristics

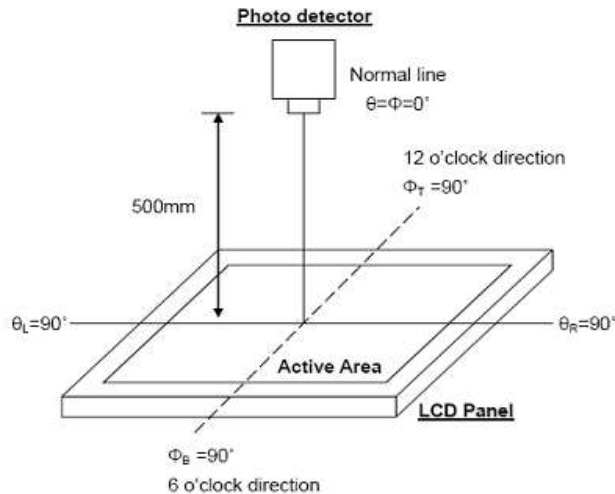
| Item                 |       | Symbol | Condition       | Min.  | Typ.  | Max.  | Unit   | Note |
|----------------------|-------|--------|-----------------|-------|-------|-------|--------|------|
| Viewing Angle        |       | θT     | CR≥10           | 30    | 40    | -     | degree | -    |
|                      |       | θB     |                 | 40    | 50    | -     |        |      |
|                      |       | θL     |                 | 40    | 50    | -     |        |      |
|                      |       | θR     |                 | 40    | 50    | -     |        |      |
| Contrast Ratio       |       | CR     | Θ=0°            | 300   | 500   | -     | -      | -    |
| Response Time        |       | Ton    | 25℃             | -     | 10    | 15    | ms     | -    |
|                      |       | Toff   |                 | -     | 15    | 25    | ms     | -    |
| Chromaticity         | White | X      | Backlight is on | 0.255 | 0.285 | 0.315 | -      | -    |
|                      |       | Y      |                 | 0.300 | 0.330 | 0.360 |        |      |
| Luminance (center)   |       | L      |                 | 150   | 180   | -     | cd/m2  | -    |
| Luminance Uniformity |       | ΔL     |                 | 75    | 80    | -     | %      | -    |

### Test Condition:

1、VDD=3.3V,  $I_L=120mA$ (Backlight current), the ambient temperature is  $25^\circ C$ .

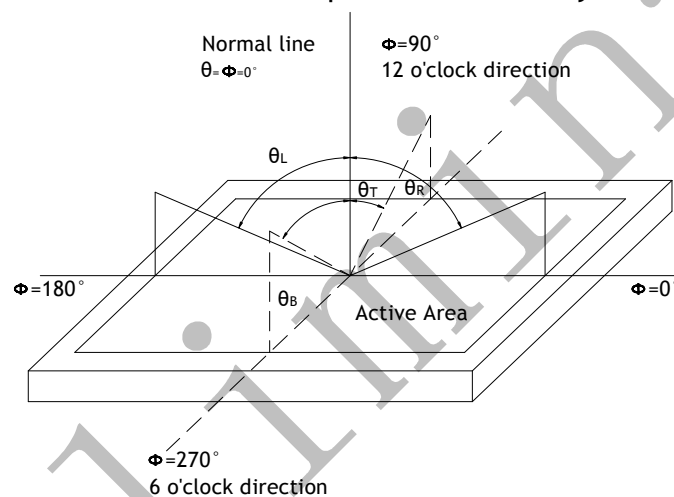


电路原理图：  
( $I_f=120mA$ .  $V_f=9.6V$ )



Note2: Definition of viewing angle range and measurement system

Viewing angle is measured at the center point of the LCD by CONOSCOPE (ergo-80).



Note3: 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%.

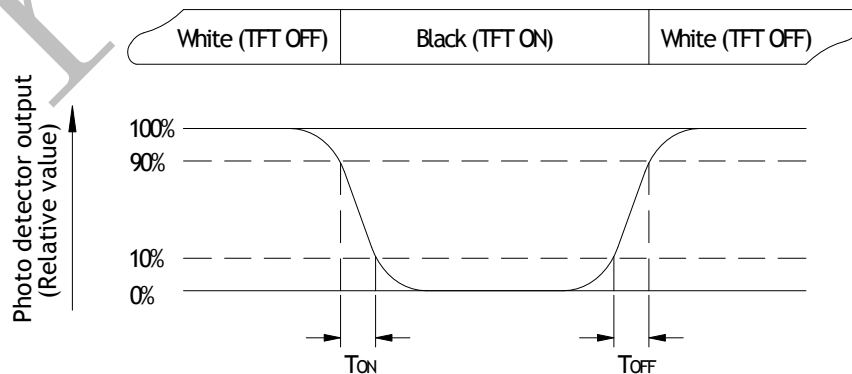


Fig. 6-3 Definition of response time

Note4: Definition of contrast ratio

**Luminance measured when LCD on the Whitestate**

Contrast ratio(CR)= **Luminance measured when LCD on the Blackstate**

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

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

Vwhite: To be determined Vblack: To be determined.

Note5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

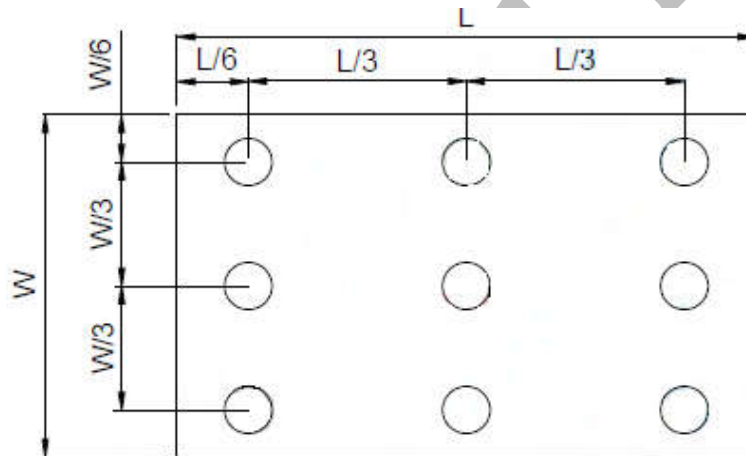
Note6: All input terminals LCD panel must be ground while measuring the center area of the panel. The LED driving condition is IL=180mA.

Note7: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas. Every measuring point is placed at the center of each measuring area.

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

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



Bmax: The measured maximum luminance of all measurement position.

Bmin: The measured minimum luminance of all measurement position.

## 6. Reliability Test Items

| Item                                       | Test Conditions                                                                                         | Remark       |
|--------------------------------------------|---------------------------------------------------------------------------------------------------------|--------------|
| High Temperature Storage                   | Ta=60℃ 120h                                                                                             | Note1 ,Note4 |
| Low Temperature Storage                    | Ta=-20℃ 120h                                                                                            | Note1, Note4 |
| High Temperature Operation                 | Ts=55℃ 120h                                                                                             | Note2 ,Note4 |
| Low Temperature Operation                  | Ts=-20℃ 120h                                                                                            | Note4        |
| Operation at High Temperature and Humidity | +60℃,90%RH 120h                                                                                         | Note4        |
| Thermal Shock                              | -20℃/30min~+60℃/30min for a total 100 cycles, Start with cold temperature and end with high temperature |              |
| Package Drop Test                          | Height 60cm<br>1corner, 3edges, 6surfaces                                                               |              |
| Elector Static Discharge                   | ±2KV, Human Body Mode, 150pF/330Ω                                                                       |              |

Note1: Ta is the ambient temperature of samples.

Note2: Ts is the temperature of panel's surfaces.

Note3: 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 of the cosmetic specification.

Note4: before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

## 7. General Precaution

### 7.1 Safety

1. Do not swallow any liquid crystal, even if there is no proof that liquid crystal is poisonous.
2. If the LCD panel breaks, be careful not to get liquid crystal to touch your skin.
3. If skin is exposed to liquid crystal, wash the area thoroughly with alcohol or soap.

### 7.2 Storage Conditions

1. Store the panel or module in a dark place where the temperature is  $23 \pm 5^{\circ} \text{C}$  and the humidity is below  $50 \pm 20\% \text{RH}$ .
2. Store in anti-static electricity container.
3. Store in clean environment, free from dust, active gas, and solvent.
4. Do not place the module near organic solvents or corrosive gases.
5. Do not crush, shake, or jolt the module.

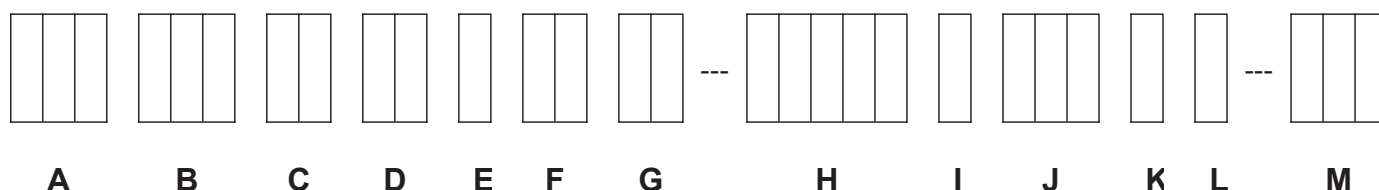
### 7.3 Handling Precautions

- (1) Avoid static electricity which can damage the CMOS LSI.
- (2) The polarizing plate of the display is very fragile. So, please handle it very carefully.
- (3) Do not give external shock.
- (4) Do not apply excessive force on the surface.
- (5) Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
- (6) Do not use ketone solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.
- (7) Do not operate it above the absolute maximum rating.
- (8) Do not remove the panel or frame from the module.
- (9) When the module is assembled, it should be attached to the system firmly. Be careful not to twist and bend the module.
- (10) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining and discoloration may occur.
- (11) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.

### 7.4 Warranty

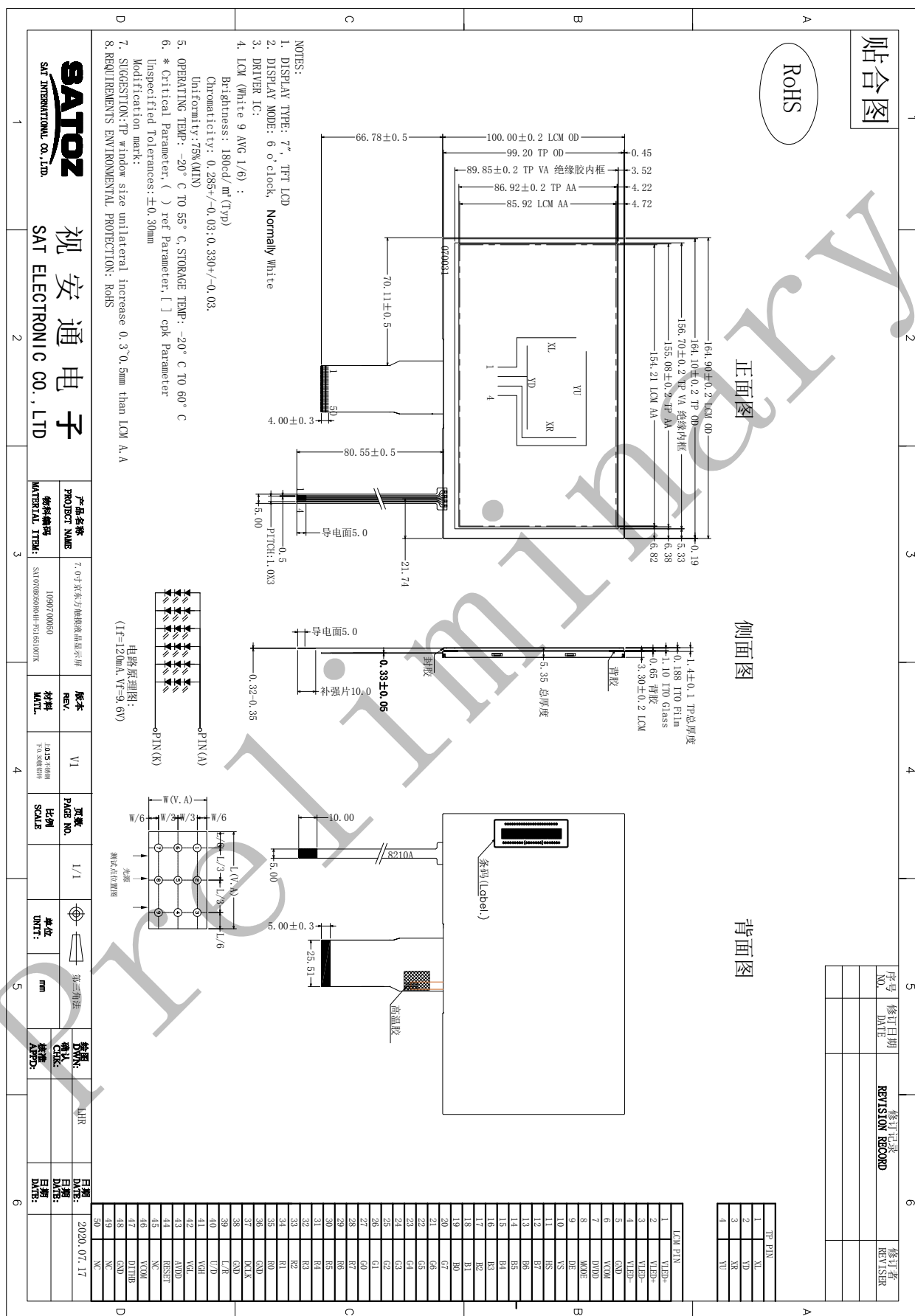
- (1) The period is within twelve months since the date of shipping out under normal using and storage conditions.
- (2) Do not repaired or modified the LCM. It may cause function to lose efficacy. PINGBO does not warrant the LCM.
- (3) All process and material comply ROHS.

## 8. Numbering System



| NO. | Definition                               | Specifications                                                                                            |
|-----|------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| A   | Company code                             | SAT INTERNATIONAL CO.LTD.                                                                                 |
| B   | Display monitor opposite angle line size | Unit : inch<br>(size<10inch:take two integers;size>=10inch:takes three integers)                          |
| C   | LCD Brands                               | AU-AUO; CP-CPT; IV-IVO; TM-TIANMA; HS-HSD; CM-CMO; BO-BOE; AT--INNOLUX;                                   |
| D   | Interface PIN Number                     | Arabic numerals from 01 to 99                                                                             |
| E   | LCD Type                                 | A--Alternated Video Signal;<br>D--Data Video Signal;<br>H--High Definition ;<br>I--IPS                    |
| F   | Backlight LED Number                     | Arabic numerals from 01 to 99                                                                             |
| G   | Backlight Color Are                      | Include R1、R2、Y0、Y1、B1、B2;                                                                                |
| H   | Structure Size                           | Include module length and width size                                                                      |
| I   | Interface Mode                           | T:TTL<br>L:LVDS<br>M:MIPI                                                                                 |
| J   | FPC Length                               | It represents the length of FPC with three figures, divided into long rows ,middle rows and short rows    |
| K   | View Angles                              | Z : represent narrow viewing angle<br>K : represent wide viewing angle<br>I : represent all viewing angle |
| L   | Operating Mode                           | D: DE mode<br>V: VSD mode<br>F: Inverting mode<br>N: No mode requirements                                 |
| M   | Suffix                                   | 1. NULL ;<br>2. TP/CTP-- Touch panel;<br>3. other--Insignificance                                         |

## 9. Mechanical Drawing



## 10.Package Drawing

