# CDTech(H.K.)Electronics Limited

## Product Specification

| | |
|---|---|
| **Model Name** | S043HWQ50EG |
| **Description** | Standard LCD Module<br>4.3" WQVGA<br>480(RGB)x272 Dots |
| **Date** | 2019/7/5 |
| **Version** | 1.0 |

| **Approved by/Date** | **Check by/Date** | **Prepared by/Date** |
|---|---|---|
| ZHP 2019/7/5 | HZX 2019/7/5 | Yigui.Han 2019/7/5 |

| **Customer Approval** | |
|---|---|
| | |
| **Date** | |

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## 1. Record of Revision

| Rev | Issued Date | Description | Editor |
|---|---|---|---|
| 1.0 | 2019/7/5 | First Release. | Yigui.Han |
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## 2. General Specifications

| Feature | | Spec |
|---|---|---|
| Characteristics | Size | 4.3 inch |
| | Resolution | 480(horizontal)*272(Vertical) |
| | Interface | RGB-24bit |
| | Connect type | Connector |
| | Display Colors | 16.7M |
| | Technology type | a-Si |
| | Pixel pitch (mm) | 0.198*0.198 |
| | Pixel Configuration | R.G.B-Stripe |
| | Display Mode | Normally Black |
| | LCD Driver IC | TBD |
| | Viewing Direction | Full view |
| Mechanical | LCM (W x H x D) (mm) | 105.50*67.20*2.95 |
| | Active Area(mm) | 95.04 x53.86 |
| | Weight (g) | TBD |
| | LED Numbers | 16 LEDs |

Note 1: Requirements on Environmental Protection: RoHs
Note 2: LCM weight tolerance: +/- 5%

## 3. Input/Output Terminals

LCD PIN-MAP

| No. | Symbol | Description |
|---|---|---|
| 1 | VLED- | Backlight LED Cathode |
| 2 | VLED+ | Backlight LED Anode. |
| 3 | GND | Ground |
| 4 | VDD | Power supply |
| 5~12 | R0~R7 | Data bus |
| 13~20 | G0~G7 | Data bus |
| 21~28 | B0~B7 | Data bus |
| 29 | GND | Ground |
| 30 | DCLK | Dot clock signal input. Latching input data at its rising edge. |
| 31 | DISP | Standby mode. Normally pulled high.<br>DISP="1": Normally operation (Default)<br>DISP="0": Timing controller, source driver will turn off ,all output are High-Z. |
| 32 | HSYNC | Horizontal sync input. Negative polarity. |
| 33 | VSYNC | Vertical sync input. Negative polarity.. |
| 34 | DE | Data enable input. Active high to enable the input data bus under "DE Mode." |
| 35 | NC | No connect |
| 36 | GND | Ground |
| 37 | XR(NC) | The right side signal of TP |
| 38 | YD(NC) | The down side signal of TP |
| 39 | XL(NC) | The left side signal of TP |
| 40 | YU(NC) | The up side signal of TP |

## 4. Absolute Maximum Rating

| Item | Symbol | MIN | Typ | MAX | Unit | Remark |
|---|---|---|---|---|---|---|
| Supply Voltage | VDD | -0.5 | - | 5 | V | - |
| Operating Temperature | TOPR | -30 | - | 85 | ℃ | - |
| Storage Temperature | TSTG | -30 | - | 85 | ℃ | |

# 5. Electrical Characteristics

## 5.1 Driving TFT LCD Panel

| Item | | Symbol | MIN | TYP | MAX | Unit | Remark |
|---|---|---|---|---|---|---|---|
| Supply Voltage | | VDD | 3.0 | 3.3 | 3.6 | V | |
| Input Signal Voltage | Low Leve | VIL | GND | - | 0.3x VDD | V | |
| | High Level | VIH | 0.7x VDD | - | VDD | V | |
| Output Signal Voltage | Low Leve | VIL | GND | - | VDD+0.4 | V | |
| | High Level | VIH | VDD-0.4 | - | VDD | V | |
| (Panel+LSI) Power Consumption | | Black Mode (60Hz) | - | 74 | | nW | |
| | | Standby | - | 50 | - | uW | |

## 5.2 LED Driving Conditions

| Item | Symbol | MIN | TYP | MAX | Unit | Remark |
|---|---|---|---|---|---|---|
| Forward Current | $I_F$ | - | 40 | 50 | mA | |
| Forward Voltage | $V_F$ | 22.4 | 25 | 27.6 | V | |
| Backlight Power consumption | $W_{BL}$ | - | 1.0 | 1.38 | W | |
| LED Lifetime | | - | 30000 | - | Hrs | |

Note 1: Each LED: IF =20 mA, VF =3.2+/0.2V.
Note 2: Optical performance should be evaluated at Ta=25℃ only.
Note 3: 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.

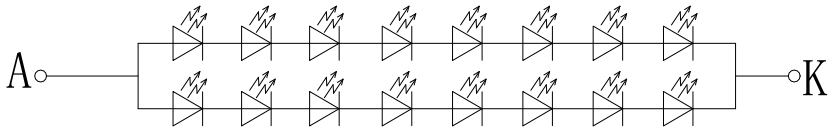
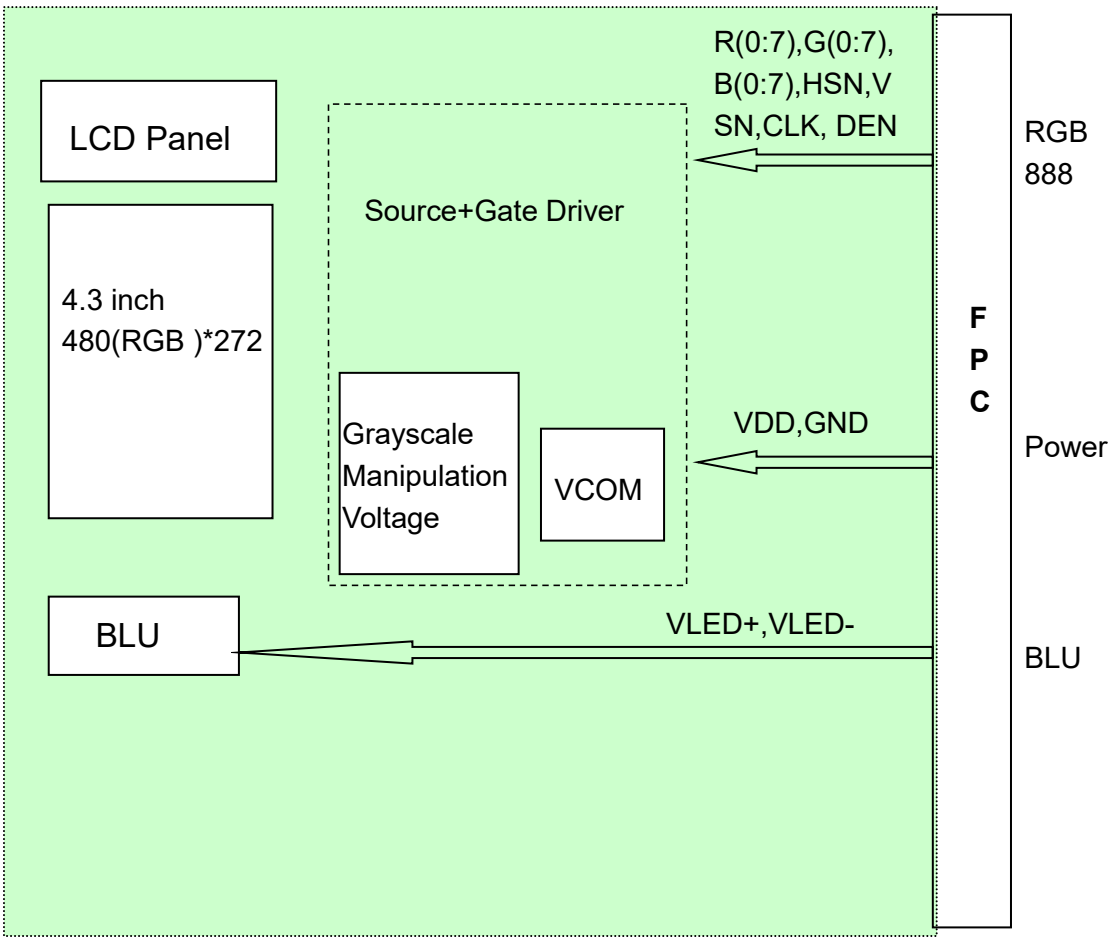


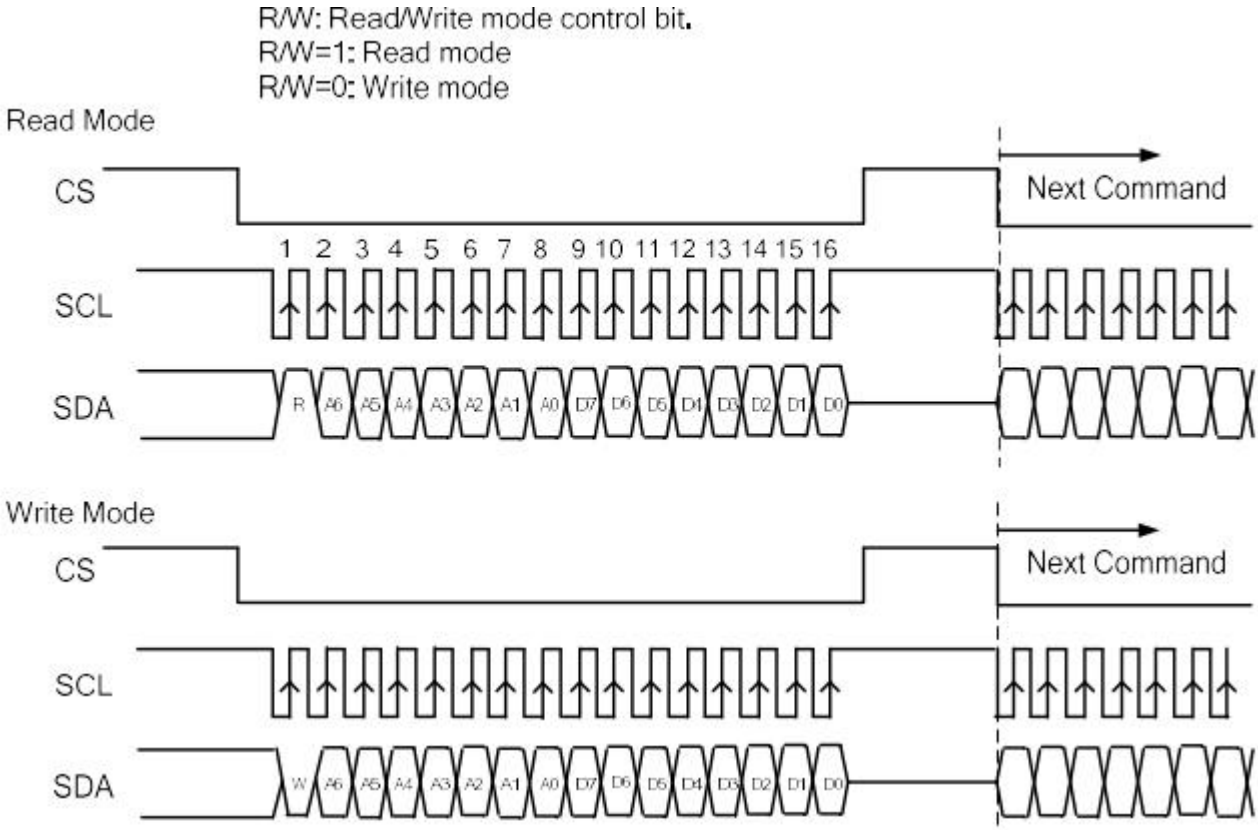

Figure: LED connection of backlight(Constant Current)

**5.3 Block Diagram**



# 6. Interface Timing

## 6.1 3-wire Serial Interface




**a.** Each serial command consists of 16 bits of data which is loaded one bit a time at the rising edge of serial clock SCL.

**b.** Command loading operation starts from the falling edge of CS and is completed at the next rising edge of CS.

**c.** The serial control block is operational after power on reset, but commands are established by the VSYNC signal. If command is transferred multiple times for the same register, the last command before the VSYNC signal is valid.

**d.** If less than 16 bits of SCL are input while CS is low, the transferred data is ignored.

**e.** If 16 bits or more of SCL are input while CS is low, the previous 16 bits of transferred data before then rising edge of CS pulse are valid data.

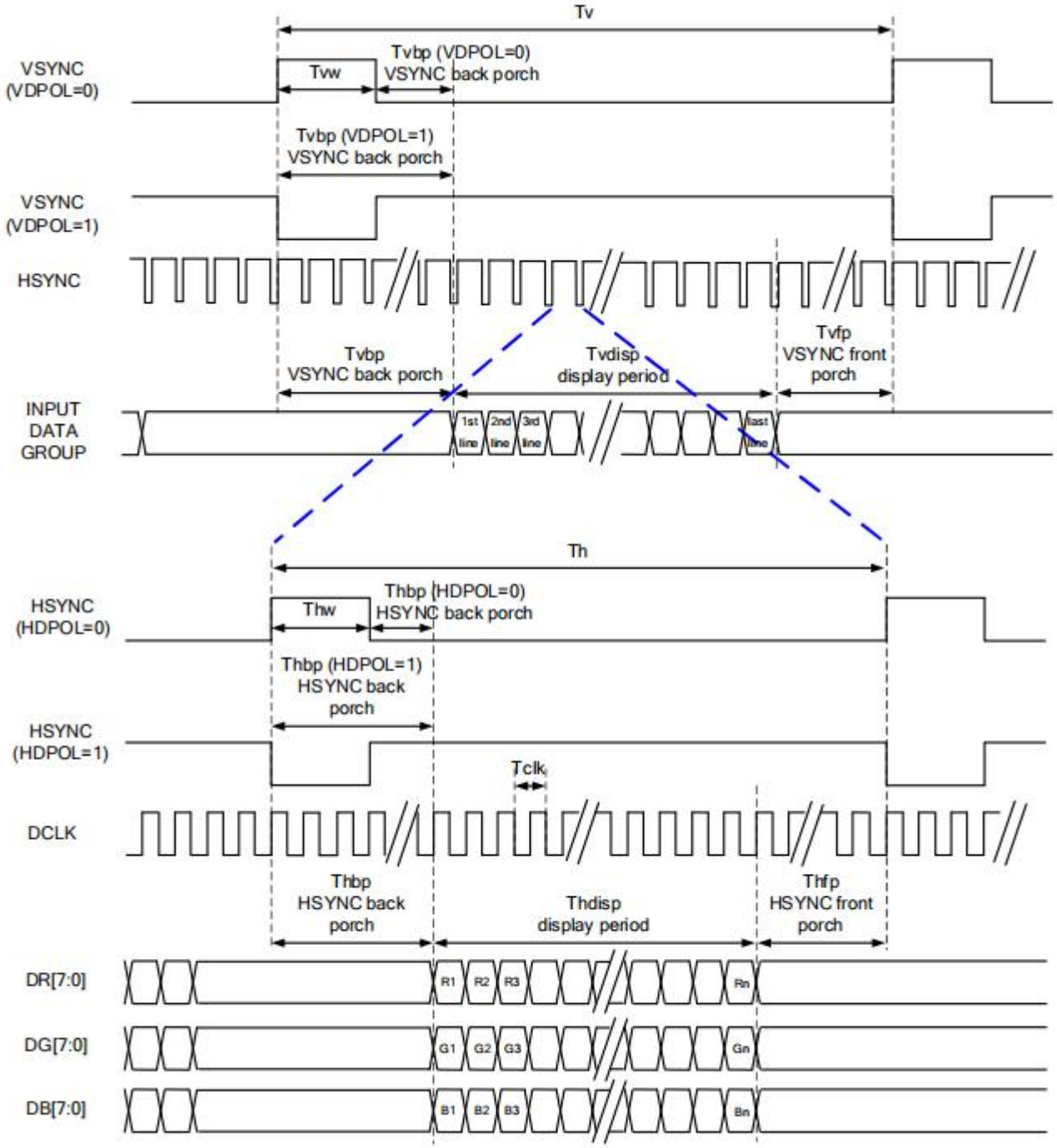
**f.** Serial block operates with the SCL clock

**g.** Serial data can be accepted in the power save mode.

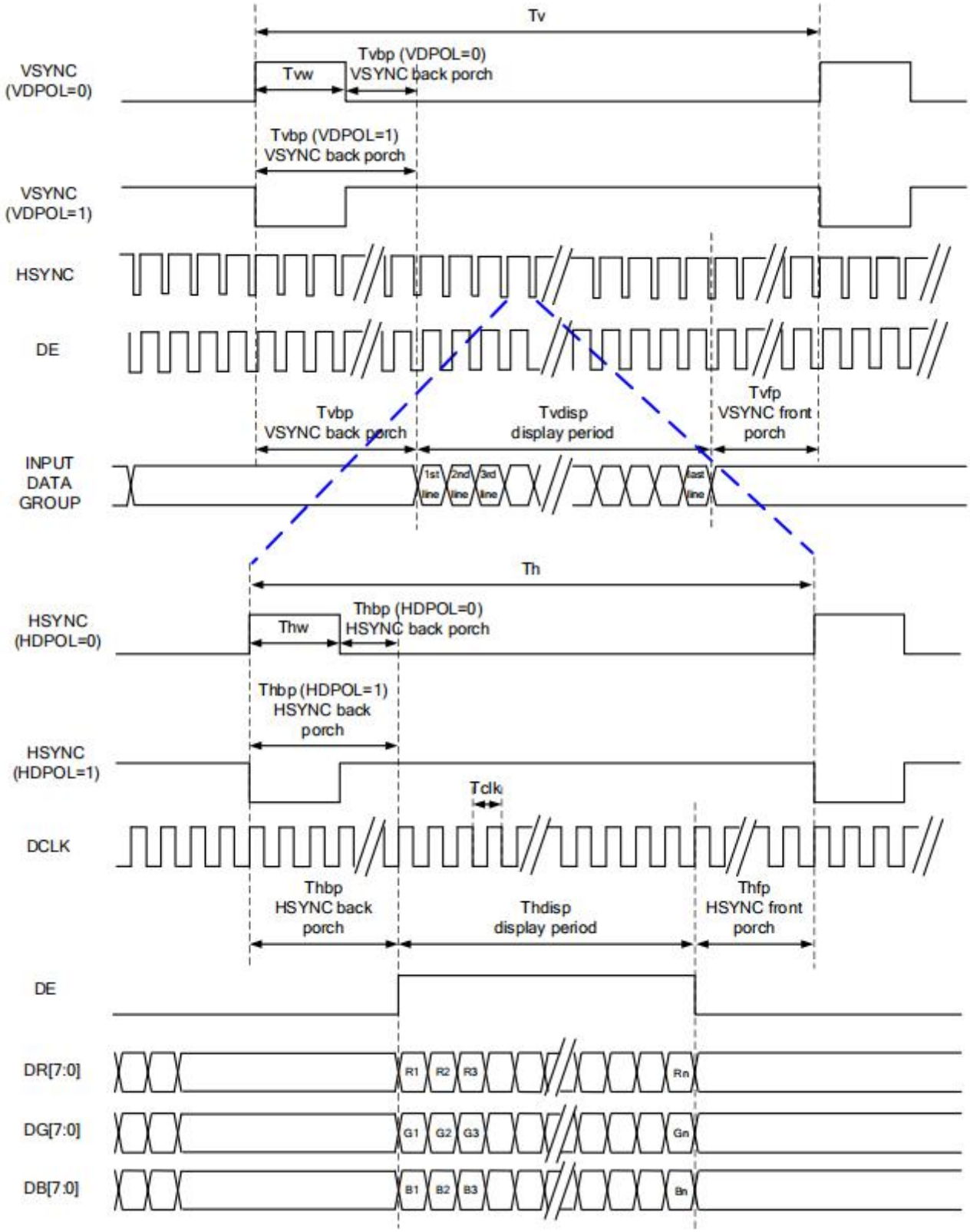
**h.** After power on reset or GRB reset, it is required 100ms delay to begin SPI communication.

## 6.2 RGB Interface

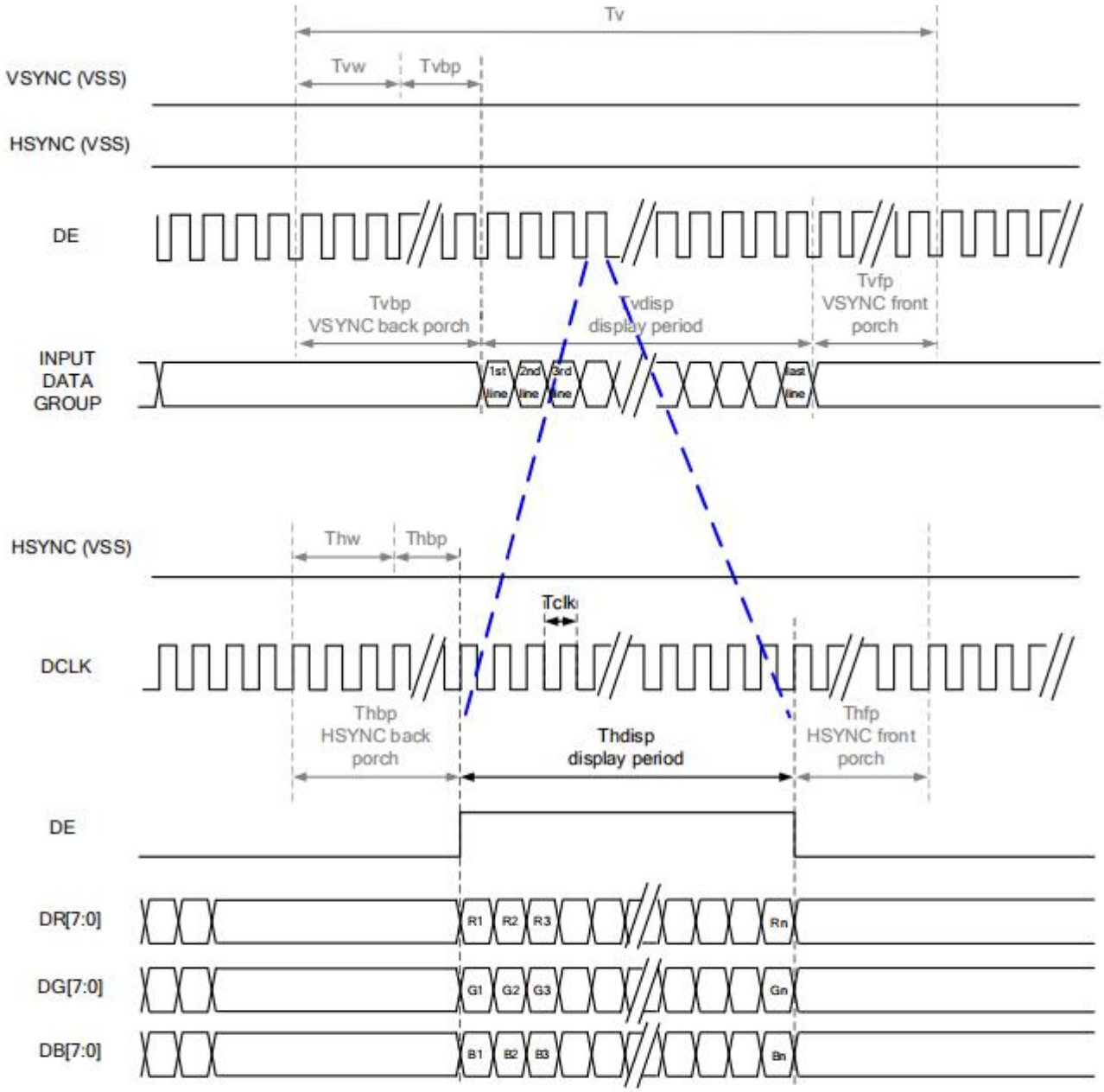
### 6.2.1 SYNC Mode



### 6.2.2 SYNC-DE Mode



### 6.2.3 DE Mode




| RGB Mode Selection Table | DCLK | HSYNC | VSYNC | DE |
|---|---|---|---|---|
| SYNC - DE Mode | Input | Input | Input | Input |
| SYNC Mode | Input | Input | Input | GND |
| DE Mode | Input | GND | GND | Input |

*Note: "Input" means these signals are driven by host side.*

## 6.2.4 Parallel 24 bit RGB Input Timing Table

Parallel 24-bit RGB Input Timing (PVDD=VDD=VDDI= 3.3V, AGND= 0V, TA=25°C)

| 480RGB X 272 Resolution Timing Table | | | | | | | |
|---|---|---|---|---|---|---|---|
| Item | | Symbol | Min. | Typ. | Max. | Unit | Remark |
| DCLK Frequency | | Fclk | 8 | 9 | 12 | MHz | |
| DCLK Period | | Tclk | 83 | 111 | 125 | ns | |
| HSYNC | Period Time | Th | 485 | 531 | 598 | DCLK | |
| | Display Period | Thdisp | | 480 | | DCLK | |
| | Back Porch | Thbp | 3 | 43 | 43 | DCLK | By H_BLANKING setting |
| | Front Porch | Thfp | 2 | 8 | 75 | DCLK | |
| | Pulse Width | Thw | 2 | 4 | 43 | DCLK | |
| VSYNC | Period Time | Tv | 276 | 292 | 321 | HSYNC | |
| | Display Period | Tvdisp | | 272 | | HSYNC | |
| | Back Porch | Tvbp | 2 | 12 | 12 | HSYNC | By V_BLANKING setting |
| | Front Porch | Tvfp | 2 | 8 | 37 | HSYNC | |
| | Pulse Width | Tvw | 2 | 4 | 12 | HSYNC | |

*Note: It is necessary to keep Tvbp =12 and Thbp =43 in sync mode. DE mode is unnecessary to keep it.*

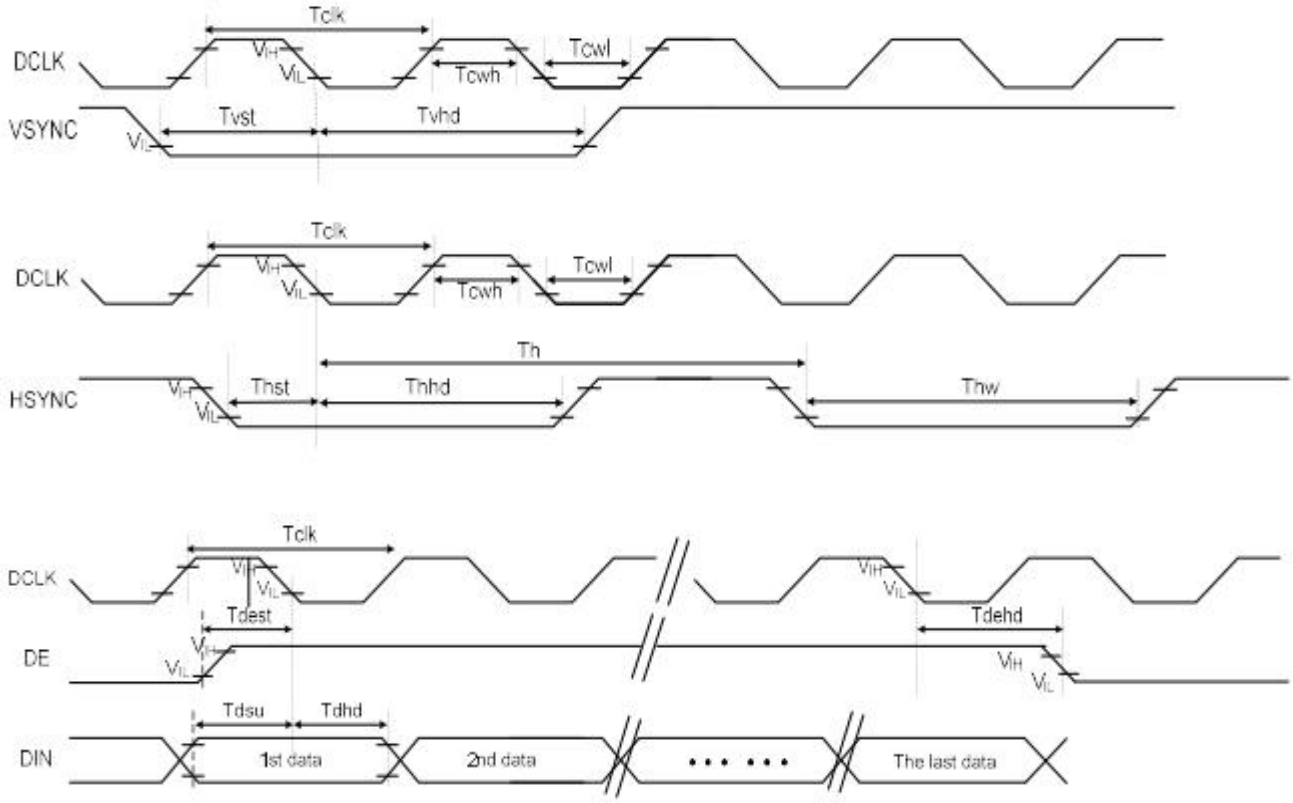
## 6.2.5 Serial 8 bit RGB Input Timing Table

Serial 8-bit RGB Input Timing (PVDD=VDD=VDDI= 3.3V, AGND= 0V, TA=25°C)

| 480RGB X 272 Resolution Timing Table | | | | | | | |
|---|---|---|---|---|---|---|---|
| Item | | Symbol | Min. | Typ. | Max. | Unit | Remark |
| DCLK Frequency | | Fclk | 24 | 27 | 30 | MHz | |
| DCLK Period | | Tclk | 33 | 37 | 42 | ns | |
| HSYNC | Period Time | Th | 1445 | 1491 | 1558 | DCLK | |
| | Display Period | Thdisp | | 1440 | | DCLK | |
| | Back Porch | Thbp | 3 | 43 | 43 | DCLK | By H_BLANKING setting |
| | Front Porch | Thfp | 2 | 8 | 75 | DCLK | |
| | Pulse Width | Thw | 2 | 4 | 43 | DCLK | |
| VSYNC | Period Time | Tv | 276 | 292 | 321 | HSYNC | |
| | Display Period | Tvdisp | | 272 | | HSYNC | |
| | Back Porch | Tvbp | 2 | 12 | 12 | HSYNC | By V_BLANKING setting |
| | Front Porch | Tvfp | 2 | 8 | 37 | HSYNC | |
| | Pulse Width | Tvw | 2 | 4 | 12 | HSYNC | |

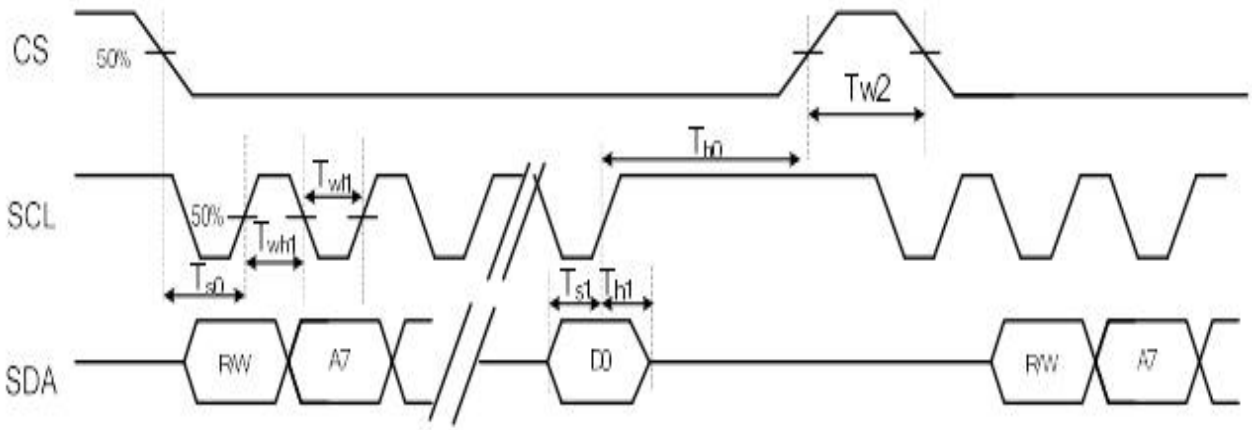
*Note: It is necessary to keep Tvbp =12 and Thbp =43 in sync mode. DE mode is unnecessary to keep it.*

## 6.3 System Bus Timing for RGB Interface




| Item | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|---|---|---|---|---|---|---|
| CLK Pulse Duty | Tcw | 40 | 50 | 60 | % | |
| HSYNC Width | Thw | 2 | - | - | DCLK | |
| HSYNC Period | Th | 55 | 60 | 65 | us | |
| VSYNC Setup Time | Tvst | 12 | - | - | ns | |
| VSYNC Hold Time | Tvhd | 12 | - | - | ns | |
| HSYNC Setup Time | Thst | 12 | - | - | ns | |
| HSYNC Hold Time | Thhd | 12 | - | - | ns | |
| Data Setup Time | Tdsu | 12 | - | - | ns | |
| Data Hold Time | Tdhd | 12 | - | - | ns | |
| DE Setup Time | Tdest | 12 | - | - | ns | |
| DE Hold Time | Tdehd | 12 | - | - | ns | |

## 6.4 System Bus Timing for 3-Wire SPI Interface




| Item | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|---|---|---|---|---|---|---|
| CS Input Setup Time | Ts0 | 50 | - | - | ns | |
| Serial Data Input Setup Time | Ts1 | 50 | - | - | ns | |
| CS Input Hold Time | Th0 | 50 | - | - | ns | |
| Serial Data Input Hold Time | Th1 | 50 | - | - | ns | |
| SCL Write Pulse High Width | Twh1 | 50 | - | - | ns | |
| SCL Write Pulse Low Width | Twl1 | 50 | - | - | ns | |
| SCL Read Pulse High Width | Trh1 | 300 | - | - | ns | |
| SCL Read Pulse Low Width | Trl1 | 300 | - | - | ns | |
| CS Pulse High Width | Tw2 | 400 | - | - | ns | |

## 7. Optical Characteristics

| Items | | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark | Note |
|---|---|---|---|---|---|---|---|---|---|
| Response time | | Tr+Tf | - | - | 30 | 40 | ms | FIG.1 | Note4 |
| Contrast Ratio | | CR | | 600 | 800 | - | - | FIG.2 | Note1 |
| Surface luminance | | LV | θ =0° | 900 | 1000 | - | cd/m2 | FIG.2 | Note2 |
| Luminance uniformity | | Yu | θ =0° | 75 | 80 | - | % | FIG.2 | Note3 |
| NTSC | | - | θ =0° | - | 50 | - | % | FIG.2 | Note5 |
| Viewing angle | | $\theta_T$ | Center CR≥10 | - | 80 | - | deg | FIG.3 | Note6 |
| | | $\theta_B$ | | - | 80 | - | deg | FIG.3 | |
| | | $\theta_L$ | | - | 80 | - | deg | FIG.3 | |
| | | $\theta_R$ | | - | 80 | - | deg | FIG.3 | |
| Chromaticity | Red | $R_X$ | θ =0° ∅ =0° Ta=25° | 0.579 | 0.629 | 0.679 | - | FIG.2 CIE1931 | Note5 |
| | | $R_Y$ | | 0.276 | 0.326 | 0.376 | - | | |
| | Green | $G_X$ | | 0.287 | 0.337 | 0.387 | - | | |
| | | $G_Y$ | | 0.496 | 0.546 | 0.596 | - | | |
| | Blue | $B_X$ | | 0.086 | 0.136 | 0.186 | - | | |
| | | $B_Y$ | | 0.093 | 0.143 | 0.193 | - | | |
| | White | $W_X$ | | 0.274 | 0.324 | 0.374 | - | | |
| | | $W_Y$ | | 0.298 | 0.348 | 0.398 | - | | |

**Note1. Definition of contrast ratio**

Contrast ratio(Cr) is defined mathematically by the following formula. For more information see FIG.2.

$$\text{Contrast ratio} = \frac{\text{Luminance measured when LCD on the “White” state}}{\text{Luminance measured when LCD on the “Black” state}}$$

For contrast ratio, Surface Luminance, Luminance uniformity and CIE,the testing data is base on TOPCON’s BM-5 or BM-7 photo detector or compatible.

**Note2. Definition of surface luminance.**

Surface luminance is the luminance with all pixels displaying white. For more information see FIG.2.

Lv = Average Surface Luminance with all white pixels(P1,P2,P3, ......,Pn)

**Note3. Definition of luminance uniformity**

The luminance uniformity in surface luminance is determined by measuring luminance at each test position 1 through n, and then dividing the maximum luminance of n points luminance by minimum luminance of n points luminance.For more information see FIG.2.

$$YU = \frac{\text{Minimum surface luminance with all white pixels (P1,P2,P3,.....,Pn)}}{\text{Maximum surface luminance with all white pixels (P1,P2,P3,.....,Pn)}}$$

**Note4. Definition of response time**

The response time is defined as the LCD optical switching time interval between “White” state and “Black”state.Rise time (Tr) is the time between photo detector output intensity changed from 90% to 10%. And fall time (Tf) is the time between photo detector output intensity changed from 10% to 90%.

For additional information see FIG1.

**Note5. Definition of color chromaticity (CIE1931)**

CIE (x,y) chromaticity,The x,y value is determined by screen active area center position P5.For more information see FIG.2.

**Note6. Definition of viewing angle**

Viewing angle is the angle at which the contrast ratio is greater than 10. Angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG.3.

For viewing angle and response time testing, the testing data is base on Autronic-Melchers’s ConoScope or DMS series Instruments or compatible.

**FIG.1.The definition of response Time**

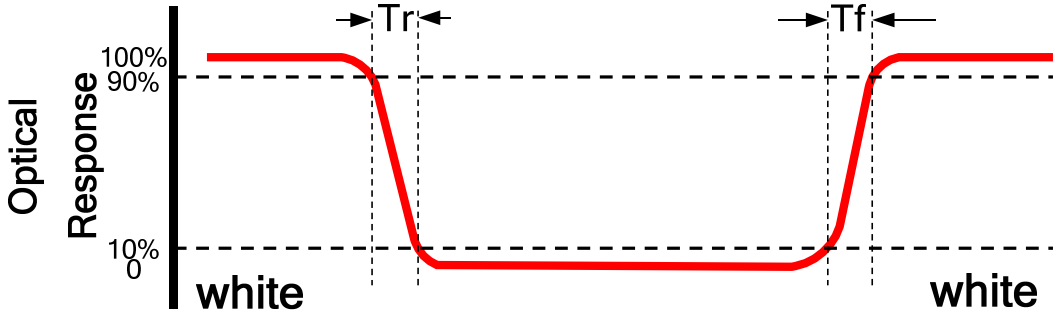



**FIG.2. Measuring method for contrast ratio, surface luminance, luminance uniformity, CIE (x,y) chromaticity**

Size : S≤5"(see Figure a) A : 5 mm B : 5 mm
H,V : Active area
Light spot size ∅=5mm(BM-5) or ∅=7.7mm (BM-7)50cm distance or compatible distance from the LCD surface to detector lens.
test spot position : see Figure a.
measurement instrument : TOPCON's luminance meter BM-5 or BM-7 or compatible (see Figure c).

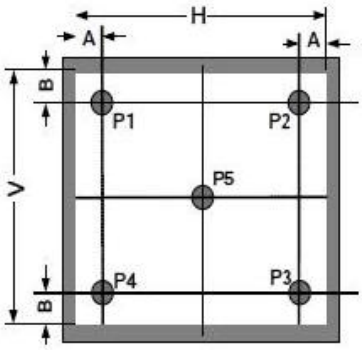



Figure a

Size : 5"＜S≤12.3"(see Figure b) H,V : Active area
Light spot size ∅=5mm(BM-5) or ∅=7.7mm (BM-7)50cm distance or compatible distance from the LCD surface to detector lens.
test spot position : see Figure b.
measurement instrument : TOPCON's luminance meter BM-5 or BM-7 or compatible (see Figure c).

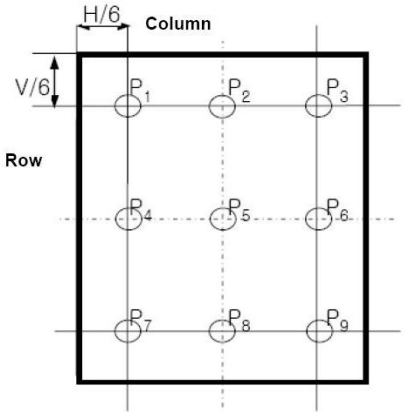



Figure b

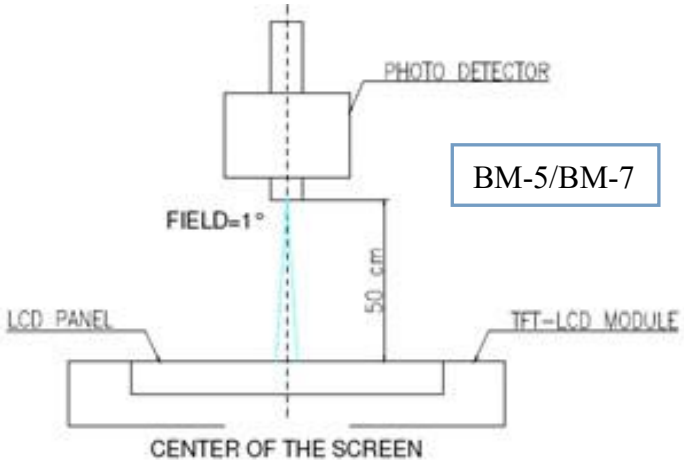
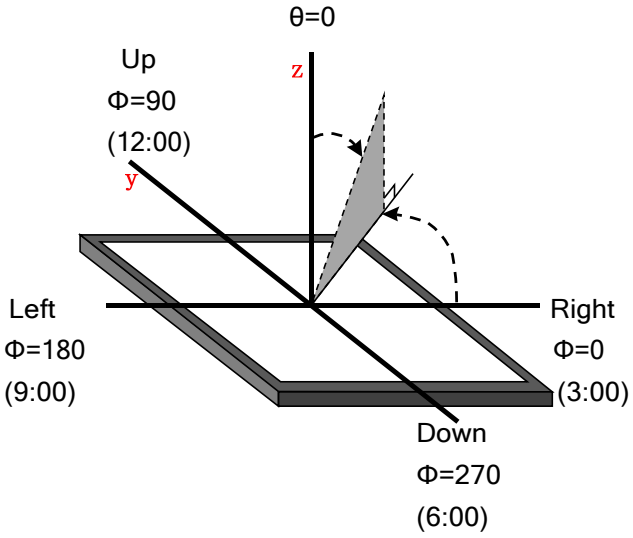



Figure c

**FIG.3.The definition of viewing angle**



## 8. Environmental / Reliability Tests

| Test Item | Test Conditions | |
|---|---|---|
| High Temperature Storage | Ta= +85℃ | 96hrs |
| Low Temperature Storage | Ta= -30℃ | 96hrs |
| High Temperature Operation | Ta= +85℃ | 96hrs |
| Low Temperature Operation | Ta= -30℃ | 96hrs |
| High Temperature and Humidity Operation | Ta= +60℃, 90% RH | 96hrs |
| Thermal Shock (Non-operation) | -30℃/30 min ~ +80℃/30 min for 20 cycles<br>Start with cold temperature,<br>end with high temperature | |
| Electro Static Discharge | Contact = ± 4 kV, class B<br>Air = ± 8 kV, class B<br>R=330Ω,C=150pF | |
| Vibration | Sweep: 10Hz~55Hz~10Hz<br>Stroke: 1.5mm<br>2 hrs for each direction of X .Y. Z. | |
| Mechanical Shock | 60G 6ms,±X,±Y,±Z<br>3 times for each direction | |
| Package Drop Test | Height: 60 cm,<br>1 corner, 3 edges, 6 surfaces | |

Notes:

1. The test result shall be evaluated after the sample has been left at room temperature and humidity for 2 hours without load. No condensation shall be accepted. The sample will not be accepted if appear these defects:

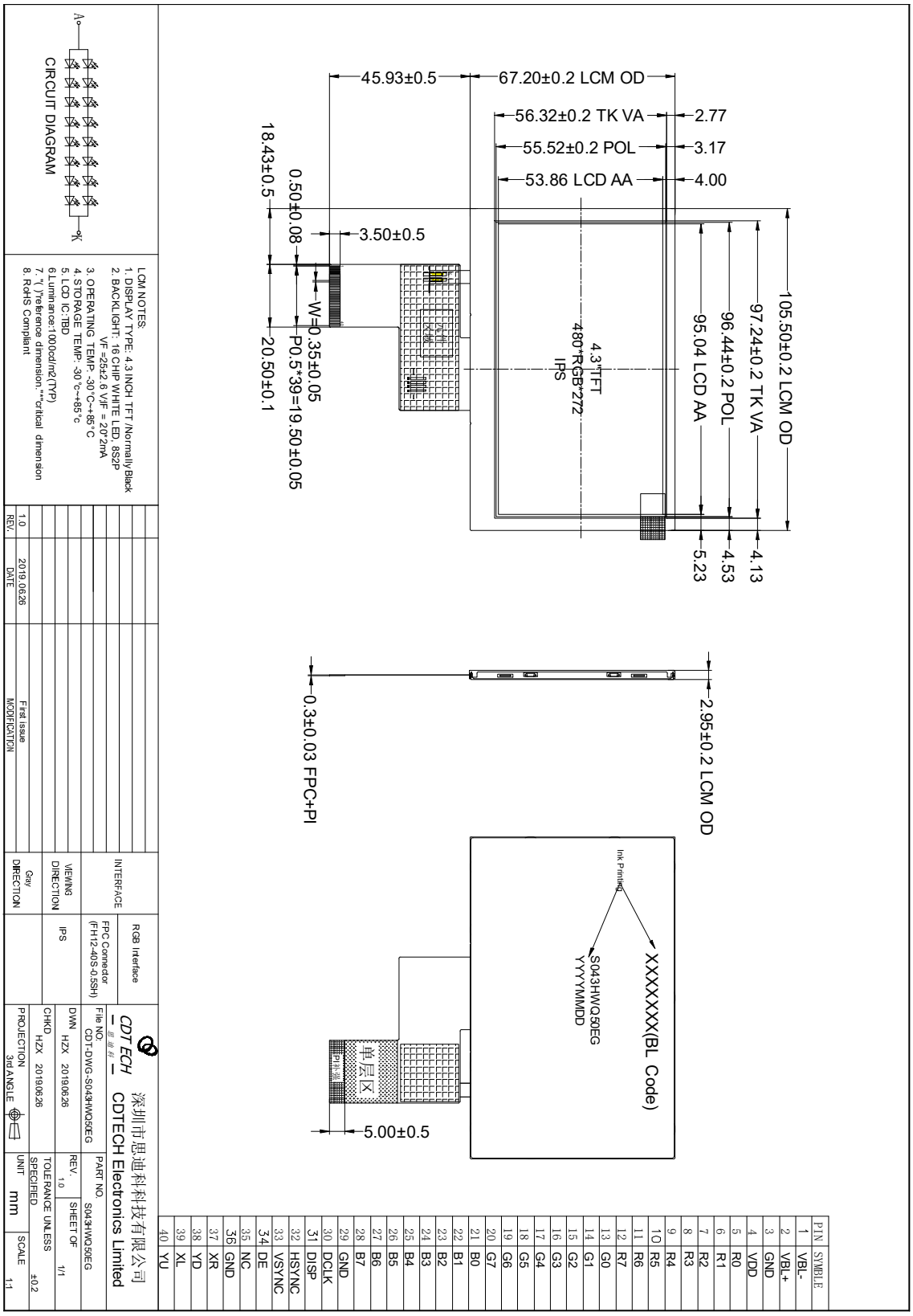
1).Air bubble in the LCD;

2).Seal leak or Glass crack

3).Non display or abnormal display

4).Brightness reduction >50%

# 9. Mechanical Drawing



# 10. Packing

**Packing Method**

**TBD**

# 11. Precautions for Use of LCD modules

## 11.1 Handling Precautions

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

11.1.2. 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.

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

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

11.1.5. 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
- Ketene
- Aromatic solvents

11.1.6. Do not attempt to disassemble the LCD Module.

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

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

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

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

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

11.1.8.4. 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.

## 11.2 Storage Precautions

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

11.2.2. 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℃ ～ 40℃ Relatively humidity: ≤80%

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

## 11.3 Transportation Precautions

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