# CDTech(H.K.)Electronics Limited

## Product Specification

| | |
|---|---|
| **Model Name** | S035GV09HSO |
| **Description** | TFT LCD Module<br>3.5" VGA<br>480(RGB)x640 Dots |
| **Date** | 2019/5/31 |
| **Version** | 1.0 |

| **Approved by/Date** | **Check by/Date** | **Prepared by/Date** |
|---|---|---|
| ZHP 2019/5/31 | HZX 2019/5/31 | Yigui.Han 2019/5/31 |

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

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## 1. Record of Revision

| Rev | Issued Date | Description | Editor |
|---|---|---|---|
| 1.0 | 2019/5/31 | First Release. | Yigui.Han |
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## 2. General Specifications

| Feature | | Spec |
|---|---|---|
| Characteristics | Size | 3.5 inch |
| | Resolution | 480(horizontal)*640(Vertical) |
| | Interface | 18bit-RGB |
| | Connect type | Connector |
| | Color Depth | 16.7M |
| | Technology type | a-Si |
| | Pixel pitch (mm) | 0.111*0.111 |
| | Pixel Configuration | R.G.B.-Stripe |
| | Display Mode | Normally White |
| | Driver IC | TBD |
| | Viewing Direction | 6 O'clock |
| | Gray Inversion Direction | 12 O'clock |
| Mechanical | LCM (W x H x D) (mm) | 64.00*85.00*2.9 |
| | Active Area(mm) | 53.27*71.04 |
| | With /Without TSP | Without TSP |
| | Weight (g) | TBD |
| | LED Numbers | 8 LEDs |

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

## 3. Input/Output Terminals

### LCD PIN-MAP

| No. | Symbol | Description |
|---|---|---|
| 1~2 | GND | System Ground |
| 3~4 | VDD | Power supply. |
| 5 | NC | - |
| 6 | RESETB | Reset signal. |
| 7 | HSYNC | Horizontal sync. |
| 8 | VSYNC | Vertical sync. |
| 9 | CLK | Dot clock signal. |
| 10 | VSS | System Ground |
| 11 | D0(B2) | 6bits Blue Data |
| 12 | D1(B3) | 6bits Blue Data |
| 13 | D2(B4) | 6bits Blue Data |
| 14 | D3(B5) | 6bits Blue Data |
| 15 | D4(B6) | 6bits Blue Data |
| 16 | D5(B7) | 6bits Blue Data |
| 17 | D10(G2) | 6bits Green Data |
| 18 | D11(G3) | 6bits Green Data |
| 19 | D12(G4) | 6bits Green Data |
| 20 | D13(G5) | 6bits Green Data |
| 21 | D14(G6) | 6bits Green Data |
| 22 | D15(G7) | 6bits Green Data |
| 23 | D20(R2) | 6bits Red Data |
| 24 | D21(R3) | 6bits Red Data |
| 25 | D22(R4) | 6bits Red Data |
| 26 | D23(R5) | 6bits Red Data |
| 27 | D24(R6) | 6bits Red Data |
| 28 | D25(R7) | 6bits Red Data |
| 29 | VSS | System Ground |
| 30 | DE | Data enable signal. |
| 31 | STBYB | Standby signal(Hi:Normal operation,LO: Standby operation) |
| 32 | TEST1 | No connection |
| 33 | XL(NC) | No connection |
| 34 | YD(NC) | No connection |
| 35 | XR(NC) | No connection |

| | | |
|---|---|---|
| 36 | YU(NC) | No connection |
| 37 | TEST2 | No connection |
| 38 | BLH | LED Anode |
| 39 | BLL | LED Cathode. |

## 4. Absolute Maximum Rating

| Item | Symbol | MIN | Typ | MAX | Unit | Remark |
|---|---|---|---|---|---|---|
| Supply Voltage | $V_{DD}$ | -0.3 | - | 5.5 | V | - |
| Operating Temperature | $T_{OPR}$ | -20 | - | 70 | ℃ | - |
| Storage Temperature | $T_{STG}$ | -30 | - | 80 | ℃ | |

## 5. Timing characteristics

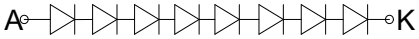
### 5.1 ELECTRICAL CHARACTERISTICS

| Item | | Symbol | MIN | TYP | MAX | Unit | Remark |
|---|---|---|---|---|---|---|---|
| Supply Voltage | | $V_{cc}$ | 2.3 | 2.8 | 3.3 | V | |
| | | IOVCC | 1.65 | 1.8 | 3.3 | | |
| Input Signal Voltage | Low Leve | $V_{IL}$ | VSS | - | 0.3VDDI | V | |
| | High Level | $V_{IH}$ | 0.7VDDI | - | VDDI | V | |
| Output Signal Voltage | Low Leve | $V_{OL}$ | VSS | - | 0.2VDDI | V | |
| | High Level | $V_{OH}$ | 0.8VDDI | - | VDDI | V | |
| Supply current | | $I_{DD}$ | - | 33 | 50 | mA | |

### 5.3 LED Driving Conditions

| Item | Symbol | MIN | TYP | MAX | Unit | Remark |
|---|---|---|---|---|---|---|
| Forward Current | $I_F$ | - | 20 | - | mA | |
| Forward Voltage | $V_F$ | 24.6 | 25.6 | 26.6 | V | |
| Backlight Power consumption | $W_{BL}$ | - | 0.512 | - | W | |
| LED Lifetime | | - | 30000 | - | Hrs | |

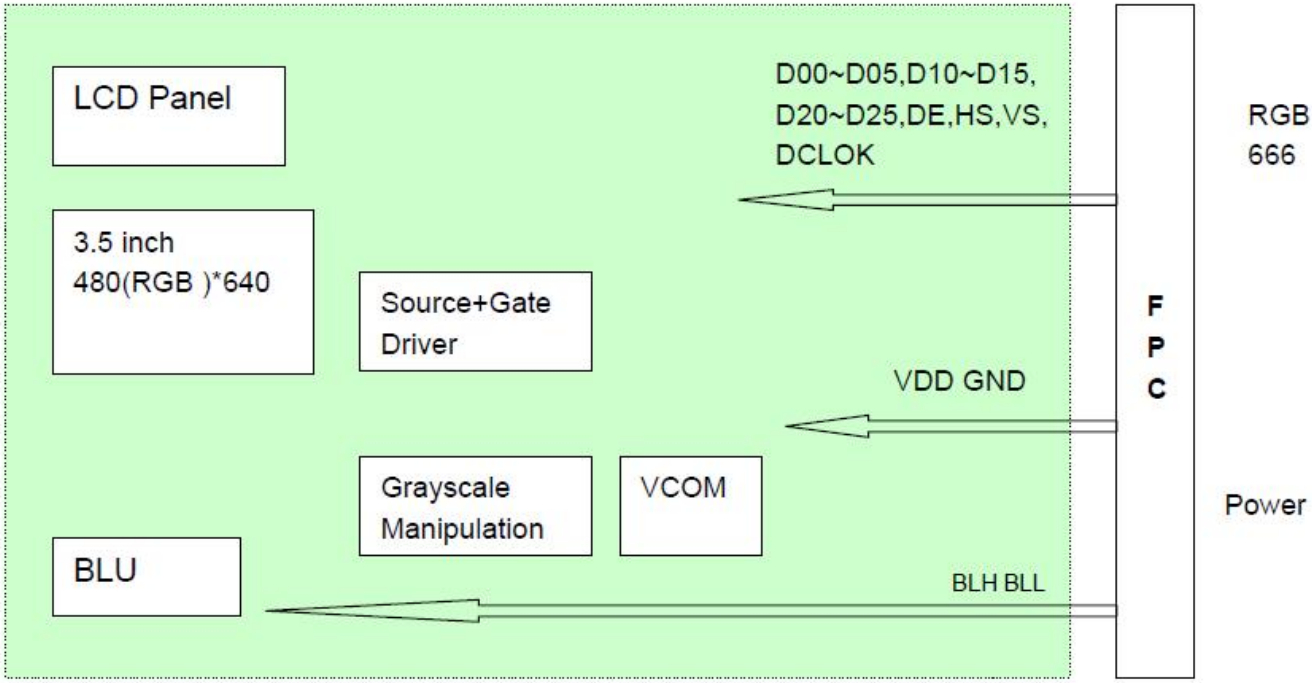
Note 1: Each LED: IF =20 mA, VF =3.2+/0.2V.
Note 2: Optical performance should be evaluated at Ta=25℃ only.
Note 3: If LED is driven by high current, high ambient temperature & humidity condition. The life Time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.




BL CIRCUIT DIAGRAM

Figure: LED connection of backlight(Constant Current)

## 5.4 Block Diagram



# 6. Interface Timing

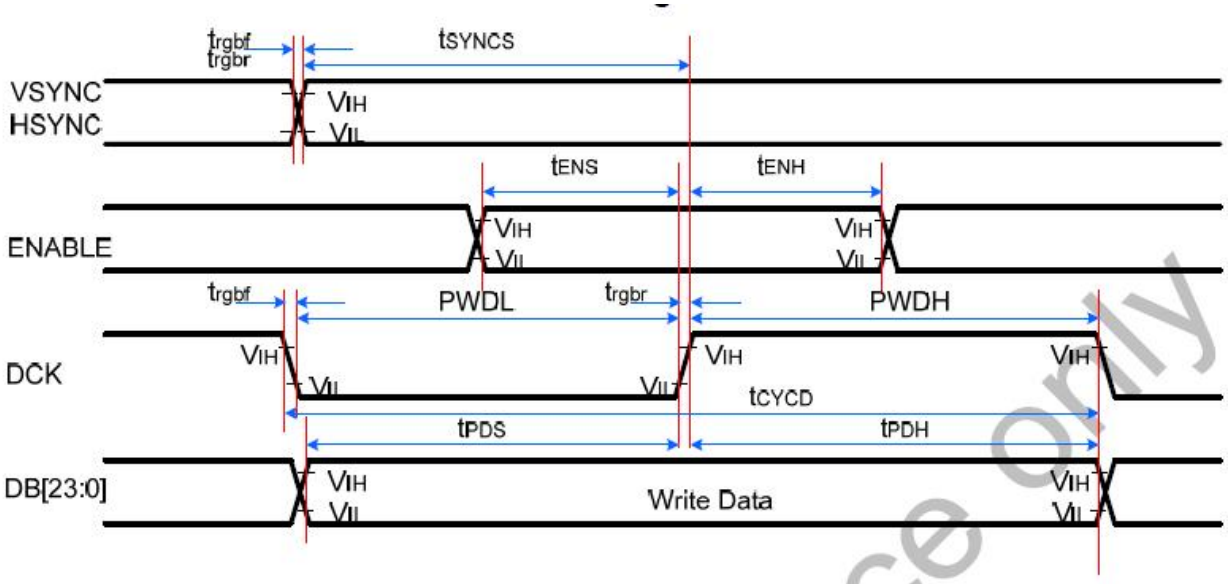
## 6.1 DC characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| **Power & Operation Voltage** | | | | | | | |
| Analog operating voltage | VCI | - | 2.6 | 2.8 | 3.6 | V | |
| Logic operating voltage | HS_VCC | - | 1.65 | 2.8 | 3.3 | V | |
| Logic operating voltage | IOVCC | - | 1.65 | 1.8 | 3.3 | V | Note1,2 |
| OTP Supply voltage | VPP_OTP | - | 4.5 | 5 | 6.6 | V | Note1 |
| Logic High level input voltage | $V_{IH}$ | - | 0.7*IOVCC | | IOVCC | V | Note1 |
| Logic Low level input voltage | $V_{IL}$ | - | -0.3 | | 0.3*IOVCC | V | Note1 |
| Logic High level output voltage TE, SDO (SDA) , CABC_PWM_OUT | $V_{OH}$ | IOH = -1.0mA | 0.8*IOVCC | | IOVCC | V | Note1 |
| Logic Low level output voltage TE, SDO (SDA) , CABC PWM OUT | $V_{OL}$ | IOL = +1.0mA | 0 | | 0.2*IOVCC | V | Note1 |
| Gate Driver High Voltage | VGH | - | 10.0 | - | 20 | V | |
| Gate Driver Low Voltage | VGL | - | -15.0 | - | -6.0 | V | |
| Driver Supply Voltage | - | \|VGH-VGL\| | 16 | - | 32 | V | |
| **VCOM Operation** | | | | | | | |
| DC VCOM Amplitude Voltage | VCOM | - | -3.0 | - | -0.06 | V | Note3 |
| Source Driver | | | | | | | |
| Source Output Range | $V_{SOUT}$ | - | 0.1 | - | VREG1OUT-0.1 | V | Note4 |
| Positive Gamma Reference Voltage | VREG1OUT | - | 3.687 | - | 5.5 | V | |
| Negative Gamma Reference Voltage | VREG2OUT | - | -5.5 | - | -3.687 | V | |
| Source Output Setting Time | Tr | Below with 99% precision | - | 10 | - | uS | Note3.4 |
| Output Deviation Voltage (Source Output channel) | Vdev | Sout>=4.2V Sout<=0.8V | - | - | (TBD) | mV | Note3 |
| | | 4.2V>Sout>0.8V | - | - | (TBD) | mV | |
| Output Offset Voltage | $V_{OFFSET}$ | - | - | - | (TBD) | mV | Note3 |
| **Booster Operation** | | | | | | | |
| Booster (VCIx2) Voltage | DDVDH | - | | | 6 | V | |
| Booster (VCIx2) Voltage | DDVDL | - | -6 | | | V | |
| Booster (VCIx2 Drop Voltage) | VCI1x2 drop | loading=1mA | - | - | 5 | % | |
| Gate Driver High Voltage | VGH | - | 10.0 | - | 20 | V | |
| Gate Driver Low Voltage | VGL | - | -15.0 | - | -6.0 | V | |
| **Standby mode current consumption** | | | | | | | |
| Sleep In mode | $I_{(IOVCC\ SLP\ IN)}$ | Ta = 25 °C VCI=2.8V IOVCC=1.8V | - | 0 | - | uA | |
| | $I_{(VCI\ SLP\ IN)}$ | | - | (TBD) | (TBD) | uA | |
| Deep Standby mode | $I_{(IOVCC\ DSTB)}$ | | - | 1 | - | uA | |
| | $I_{(VCI\ DSTB)}$ | | - | 1 | - | uA | |

**Notes:**

1. Ta = -30 to 70 °C (to 85 °C no damage), IOVCC = 1.65V to 3.3V, VCI = 2.6V to 3.6V, HS_VSS = DGND = 0V.
2. Supply digital IOVCC voltage equal or less than analog VCI voltage.
3. Source channel loading = 10KΩ, 40pF/channel
4. The maximum value is between with 10KΩ, 40pF/channel and Gamma setting value

## 6.2 RGB InterfaceTiming:




| Signal | Symbol | Parameter | min | max | Unit | Description |
|---|---|---|---|---|---|---|
| VSYNC/ HSYNC | $t_{SYNCS}$ | VSYNC/HSYNC setup time | 5 | - | ns | 24/18/16-bit bus RGB interface mode |
| | $t_{SYNCH}$ | VSYNC/HSYNC hold time | 5 | - | ns | |
| ENABLE | $t_{ENS}$ | ENABLE setup time | 5 | - | ns | |
| | $t_{ENH}$ | ENABLE hold time | 5 | - | ns | |
| DB [17:0] | $t_{POS}$ | Data setup time | 5 | - | ns | |
| | $t_{PDH}$ | Data hold time | 5 | - | ns | |
| DCK | PWDH | DCK high-level period | 13 | - | ns | |
| | PWDL | DCK low-level period | 13 | - | ns | |
| | $t_{CYCD}$ | DCK cycle time | 28 | - | ns | |
| | $t_{rgbr}$, $t_{rgbf}$ | DCK,HSYNC,VSYNC rise/fall time | - | 15 | ns | |

**Note:** Ta = -30 to 70 °C, IOVCC = 1.65V to 3.3V, VCI = 2.6V to 3.6V, HS_VSS = DGND = 0V

## 7.Optical Characteristics

| Items | | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark | Note |
|---|---|---|---|---|---|---|---|---|---|
| Response time | | Tr+Tf | - | - | 30 | - | ms | FIG.1 | Note4 |
| Contrast Ratio | | CR | | 400 | - | - | - | FIG.2 | Note1 |
| Surface luminance | | LV | θ =0° | - | 450 | - | cd/m2 | FIG.2 | Note2 |
| Luminance uniformity | | Yu | θ =0° | - | - | - | % | FIG.2 | Note3 |
| NTSC | | - | θ =0° | - | 50 | - | % | FIG.2 | Note5 |
| Viewing angle | | θ Cr>10 | $\theta_T$ | - | 70 | - | 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° | TBD | TBD | TBD | - | FIG.2 CIE1931 | Note5 |
| | | $R_Y$ | | TBD | TBD | TBD | - | | |
| | Green | $G_X$ | | TBD | TBD | TBD | - | | |
| | | $G_Y$ | | TBD | TBD | TBD | - | | |
| | Blue | $B_X$ | | TBD | TBD | TBD | - | | |
| | | $B_Y$ | | TBD | TBD | TBD | - | | |
| | White | $W_X$ | | TBD | TBD | TBD | - | | |
| | | $W_Y$ | | TBD | TBD | TBD | - | | |

**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**

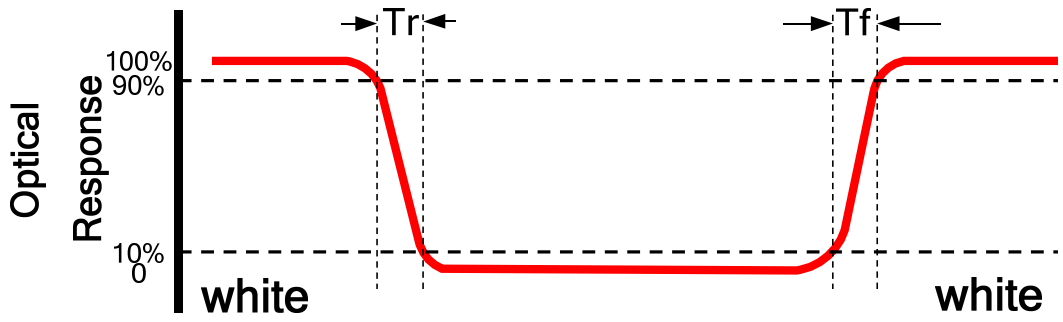



**FIG.2. Measuring method for contrast ratio, surface luminance, luminance uniformity, CIE (x,y) chromaticity**

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).

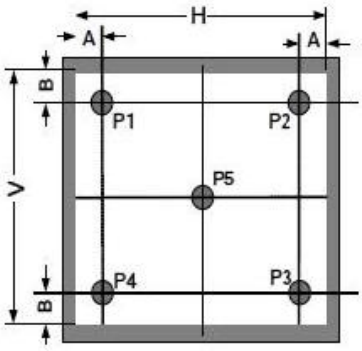


Figure a

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).

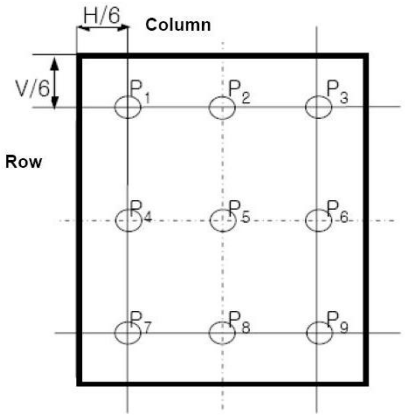



Figure b

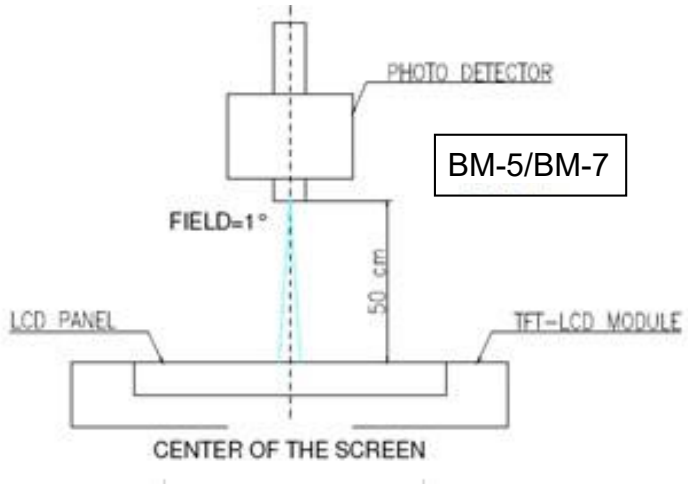
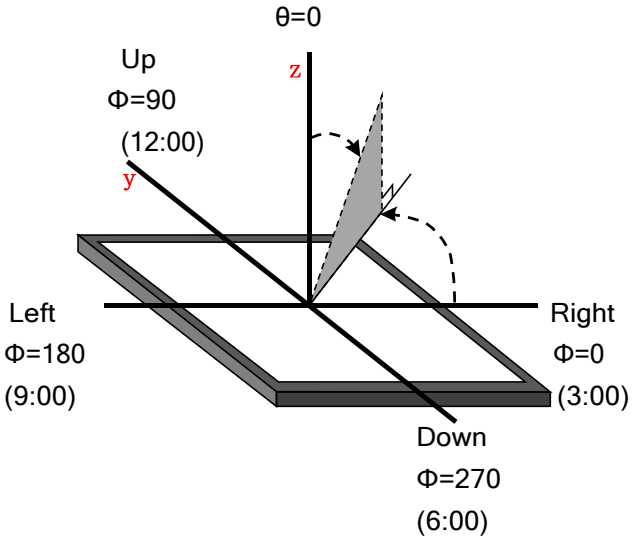



Figure c

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

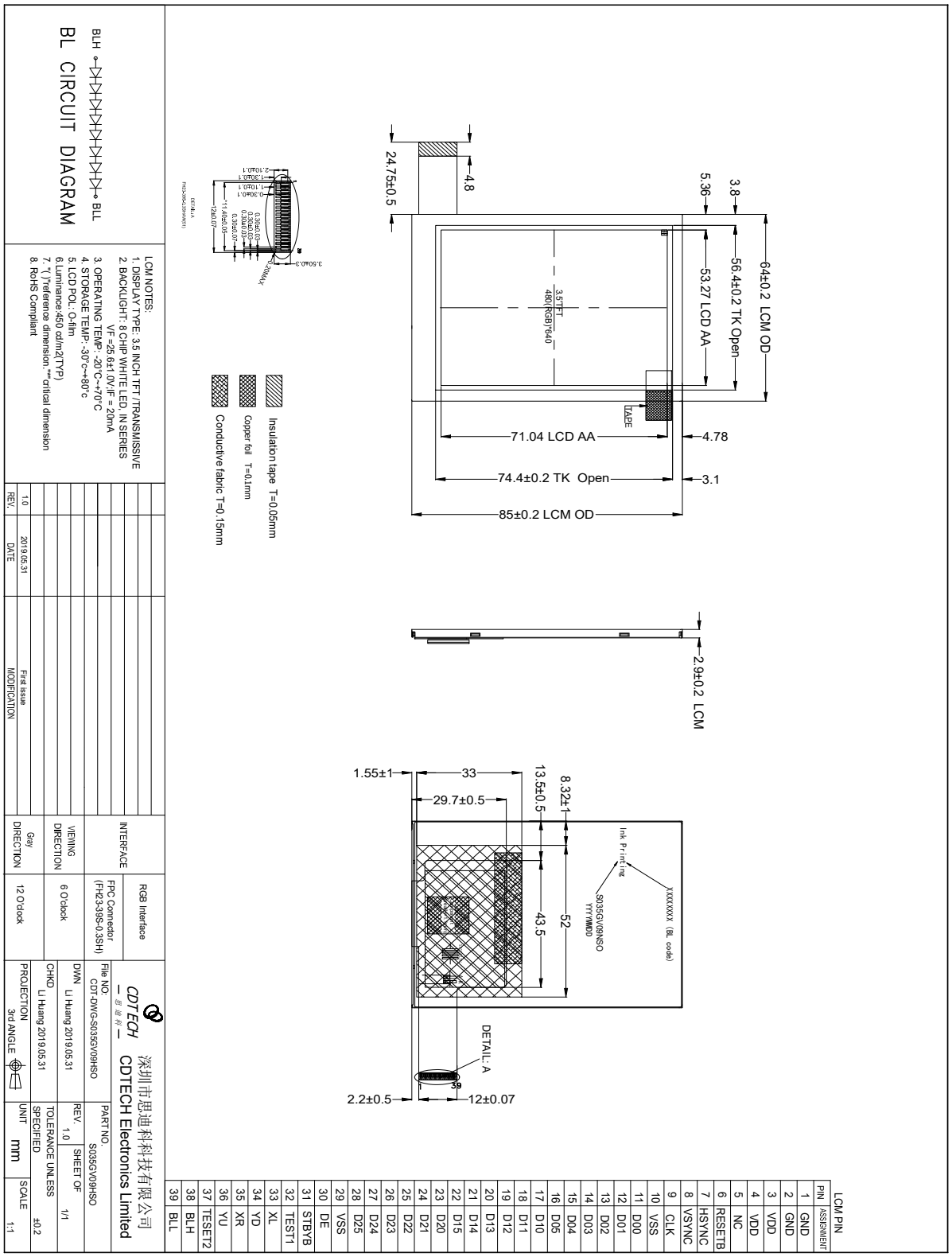


## 8. Environmental / Reliability Tests

| No | Test Item | Condition | Remarks |
|---|---|---|---|
| 1 | High Temperature Operation | Ts= +70℃, 96hrs | Note 1 IEC60068-2-2, GB2423. 2-89 |
| 2 | Low Temperature Operation | Ta= -20℃, 96hrs | Note 2 IEC60068-2-1 GB2423.1-89 |
| 3 | High Temperature Storage | Ta= +80℃, 120hrs | IEC60068-2-2 GB2423. 2-89 |
| 4 | Low Temperature Storage | Ta= -30℃, 120hrs | IEC60068-2-1 GB/T2423.1-89 |
| 5 | High Temperature & Humidity Storage | Ta= +70℃, 90% RH max,120 hours | IEC60068-2-3 GB/T2423.3-2006 |
| 6 | Thermal Shock (Non-operation) | -20℃ 30 min ~ +70℃ 30 min Change time: 5min, 30 Cycle | Start with cold temperature, end with high temperature IEC60068-2-14, GB2423.22-87 |
| 7 | Electro Static Discharge (Operation) | C=150pF, R=330 Ω, 5 points/panel Air:±8KV, 5 times; Contact: ±4KV, 5 times; (Environment: 15℃ ~ 35℃, 30% ~ 60%, 86Kpa ~ 106Kpa) | IEC61000-4-2 GB/T17626.2-1998 |
| 8 | Vibration (Non-operation) | Frequency range: 10~55Hz, Stroke: 1.mm Sweep: 10Hz~55Hz~10Hz 2 hours for each direction of X .Y. Z. (package condition) | IEC60068-2-6 GB/T2423.5-1995 |
| 9 | Shock (Non-operation) | 60G 6ms, ± X, ±Y , ± Z 3 times for each direction | IEC60068-2-27 GB/T2423.5-1995 |
| 10 | Package Drop Test | Height: 80 cm, 1 corner, 3 edges, 6 surfaces | IEC60068-2-32 GB/T2423.8-1995 |

Note:1. Ts is the temperature of panel's surface.
2. Ta is the ambient temperature of sample.
3. The size of sample is 5pcs.

# 9. Mechanical Drawing



## 10. Packing

**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.