

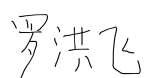
## PRODUCT SPECIFICATION

CDTECH Model: **S035CHV54NS-DR24**

CUSTOMER Model: **-**

Description: **3.5" TFT-LCD Module with RTP**

Version: **1.0**

| CDTECH    | PREPARED BY                                                                         | CHECKED BY                                                                           | APPROVED BY                                                                           |
|-----------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| SIGNATURE |  |  |  |
| DATE      | 2022.8.26                                                                           | 2022.8.26                                                                            | 2022.8.26                                                                             |

| CUSTOMER<br>APPROVAL | SIGNATURE | DATE |
|----------------------|-----------|------|
|                      |           |      |



## Record of Revisions

[illegible]



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# 1. General Specifications

## 1.1 LCM General Information

| Item                  | Specification                | Unit     |
|-----------------------|------------------------------|----------|
| LCD Size              | 3.5                          | inch     |
| Number of Pixels      | 320(H) RGB x 480(V)          | pixels   |
| Display Mode          | Normally Black               | -        |
| Viewing Direction     | Free                         | o' clock |
| Interface             | RGB                          | -        |
| Display Colors        | 16.7M                        | colors   |
| Outline Dimension     | 54.76(H) x 83.58(V) x 3.7(D) | mm       |
| Active Area           | 48.96(H) x 73.44 (V)         | mm       |
| Pixel Pitch           | 0.153(H) x 0.153(V)          | mm       |
| Driver IC             | ILI9488                      | -        |
| Operation Temperature | -20~70                       | °C       |
| Storage Temperature   | -30~80                       | °C       |

Note1:Requirements on environmental protection RoHS compliant.

# 2. Absolute Maximum Ratings

| Item                   | Symbol | MIN. | MAX. | Unit | Note   |
|------------------------|--------|------|------|------|--------|
| Analog Supply voltage  | VDD    | -0.3 | 5.0  | V    | Note 1 |
| Digital supply voltage | IOVCC  | -0.3 | 3.6  | V    | Note 1 |

Note 1:Permanent damage may occur to the LCD module if beyond this specification.

Functional operation should be restricted to the conditions described under normal operating conditions.

### 3. Electrical Characteristics

#### 3.1 Recommended Operating Condition for TFT LCD

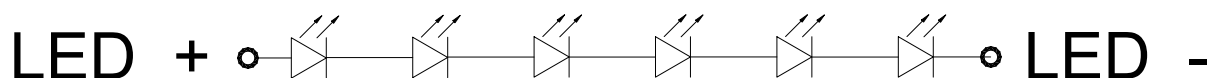
| Item                  | Symbol             | Min.      | Typ. | Max.      | Unit | Note       |
|-----------------------|--------------------|-----------|------|-----------|------|------------|
| Analog Supply voltage | VCC                | 3.0       | 3.3  | 3.6       | V    |            |
| Analog supply current | I <sub>VCC</sub>   | -         | TBD  | -         | mA   | VCC=3.3V   |
| Logic supply voltage  | IOVCC              | 1.65      | 1.8  | 3.3       | V    |            |
| Logic supply current  | I <sub>IOVCC</sub> | -         | TBD  | -         | mA   | IOVCC=1.8V |
| Logic input voltage   | VIH                | 0.7*IOVCC | -    | IOVCC     | V    |            |
|                       | VIL                | GND       | -    | 0.3*IOVCC | V    |            |

#### 3.2 Recommended Driving Condition for Backlight

| Item              | Symbol          | Min.   | Typ. | Max.  | Unit  | Note             |
|-------------------|-----------------|--------|------|-------|-------|------------------|
| Driving Current   | I <sub>F</sub>  | -      | 20   | -     | mA    |                  |
| Driving Voltage   | V <sub>F</sub>  | 16.2   | -    | 20.4  | V     |                  |
| Power consumption | W <sub>BL</sub> | 0.324  | -    | 0.408 | W     |                  |
| LED Life-Time     | N/A             | 30,000 | -    | -     | Hours | Ta=25℃<br>Note 1 |

Note 1:LED lifetime is defined as the module brightness decay 50% of original brightness at Ta=25 degree, typical current.

Note 2:LED circuit :



## 4. Interface Pin Assignment

### 4.1 LCM Pin Assignment

Recommended connector: FH26-45S-0.3SHW manufactured by HIROSE

| No.   | Symbol  | Description                                     |
|-------|---------|-------------------------------------------------|
| 1     | GND     | Ground                                          |
| 2     | LEDA    | Power for LED backlight (Anode)                 |
| 3     | LEDK    | Power for LED backlight (Cathode)               |
| 4     | VCC     | A supply voltage to the analog circuit          |
| 5     | IOVCC   | A supply voltage to the digital circuit         |
| 6     | SDO     | Serial data output                              |
| 7     | SDI     | Serial data input/output                        |
| 8     | GND     | Ground                                          |
| 9     | SCL_WR  | SCL pin as serial clock                         |
| 10    | CS      | Chip select input signal                        |
| 11    | NC      | No connection                                   |
| 12    | RESET   | Reset signal                                    |
| 13-20 | R0-R7   | Data bus                                        |
| 21-28 | G0-G7   | Data bus                                        |
| 29-36 | B0-B7   | Data bus                                        |
| 37    | DE      | Data enable input                               |
| 38    | GND     | Ground                                          |
| 39    | PCLK    | Dot clock signal input                          |
| 40    | GND     | Ground                                          |
| 41    | HS      | Horizontal sync input. Negative polarity        |
| 42    | VS      | Vertical sync input. Negative polarity          |
| 43    | IC_ID   | No connection                                   |
| 44    | LED_PWM | The PWM frequency output for LED driver control |
| 45    | GND     | Ground                                          |

### 4.2 RTP Pin Assignment

|   |    |                             |
|---|----|-----------------------------|
| 1 | YU | The up side signal of TP    |
| 2 | XL | The left side signal of TP  |
| 3 | YD | The down side signal of TP  |
| 4 | XR | The right side signal of TP |

## 5. Interface Characteristics

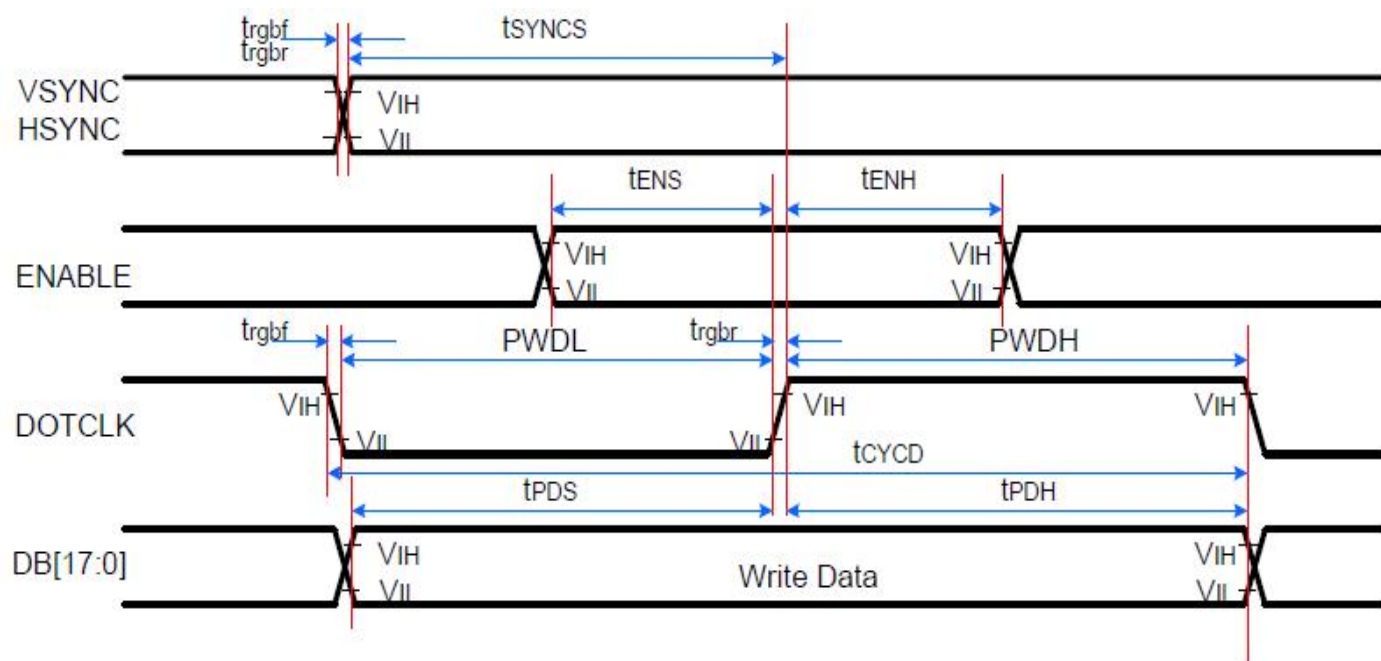
### 5.1 DC Characteristics for Panel Driving

| Item                                                                         | Symbol     | Condition                | Min.      | Typ. | Max.         | Unit | Note      |
|------------------------------------------------------------------------------|------------|--------------------------|-----------|------|--------------|------|-----------|
| <b>Power &amp; Operation Voltage</b>                                         |            |                          |           |      |              |      |           |
| Analog operating voltage                                                     | VCI        | -                        | 2.5       | 2.8  | 3.3          | V    |           |
| Logic operating voltage                                                      | IOVCC      | -                        | 1.65      | 1.8  | 3.3          | V    | Note 1, 2 |
| OTP Supply voltage                                                           | DDVDH      | -                        | -         | 7    | -            | V    | Note 1    |
| Logic High level input voltage                                               | VIH        | -                        | 0.7*IOVCC |      | IOVCC        | V    | Note 1    |
| Logic Low level input voltage                                                | VIL        | -                        | -0.3      |      | 0.3*IOVCC    | V    | Note 1    |
| Logic High level output voltage<br>TE, SDO (SDA), CABC PWM OUT               | VOH        | IOH = -1.0mA             | 0.8*IOVCC |      | IOVCC        | V    | Note 1    |
| Logic Low level output voltage<br>TE, SDO (SDA), CABC PWM OUT                | VOL        | IOL = +1.0mA             | 0         |      | 0.2*IOVCC    | V    | Note 1    |
| 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    |           |
| <b>Input and Output</b>                                                      |            |                          |           |      |              |      |           |
| Logic High Level Input Voltage                                               | VIH        | -                        | 0.7*IOVCC | -    | IOVCC        | V    |           |
| Logic Low Level Input Voltage                                                | VIL        | -                        | DGND      | -    | 0.3*IOVCC    | V    |           |
| <b>VCOM Operation</b>                                                        |            |                          |           |      |              |      |           |
| DC VCOM Amplitude Voltage                                                    | VCOM       | -                        | -2.0      | -    | -0.06        | V    | Note 3    |
| <b>Source Driver</b>                                                         |            |                          |           |      |              |      |           |
| Source Output Range                                                          | VSOUT      | -                        | 0.1       | -    | VREG1OUT-0.1 | V    | Note 4    |
| Positive Gamma Reference Voltage                                             | VREG1OUT   | -                        | 3.625     | -    | 5.5          | V    |           |
| Negative Gamma Reference Voltage                                             | VREG2OUT   | -                        | -5.5      | -    | -3.625       | V    |           |
| Source Output Setting Time                                                   | Tr         | Below with 99% precision | -         | 10   | -            | uS   | Note 3, 4 |
| Output Deviation Voltage<br>(Source Output channel)                          | Vdev       | Sout>=4.2V               | -         | -    | 20           | mV   | Note 3    |
|                                                                              |            | Sout<=0.8V               | -         | -    | 15           | mV   | -         |
| Output Offset Voltage                                                        | VOFFSET    | -                        | -         | -    | 35           | mV   | Note 3    |
| <b>Booster Operation</b>                                                     |            |                          |           |      |              |      |           |
| Booster (VCIx2) Voltage                                                      | DDVDH      | -                        |           |      | 6            | V    |           |
| Booster (VCIx2) Voltage                                                      | DDVDL      | -                        | -6        |      |              | V    |           |
| Booster (VCIx2 Drop Voltage)                                                 | VCIx2 drop | loading=1mA              | -         | -    | 5            | %    |           |
| Gate Driver High Voltage                                                     | VGH        | -                        | 10.0      | -    | 20           | V    |           |
| Gate Driver Low Voltage                                                      | VGL        | -                        | -15.0     | -    | -6.0         | V    |           |
| <b>Standby mode current consumption (Ta = 25 °C, Interface: DBI and DPI)</b> |            |                          |           |      |              |      |           |
| Sleep in mode                                                                | VCI        | VCI=2.8V                 | -         | 100  | -            | uA   |           |
| Deep Standby mode                                                            | VCI        | IOVCC=1.8V               | -         | 1    | -            | uA   |           |

#### Notes:

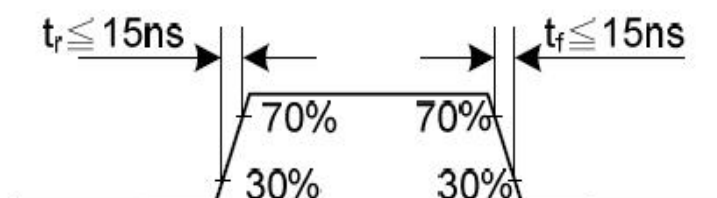
1. Ta = -30 to 70 °C (no damage up to 85°C (at maximum)), IOVCC=1.65V to 3.3V, VCI=2.5V to 3.3V, DGND=0V.
2. Supply the digital IOVCC voltage equal to or less than the analog VCI voltage.
3. Source channel loading = 10KΩ, 30pF/channel
4. The maximum value is between 10KΩ, 30pF/channel and Gamma setting value.

## 5.2 DPI Parallel Interface (RGB Interface) Characteristics



| Signal          | Symbol         | Parameter                           | min | max | Unit | Description                              |
|-----------------|----------------|-------------------------------------|-----|-----|------|------------------------------------------|
| VSYNC/<br>HSYNC | $t_{SYNCS}$    | VSYNC/HSYNC setup time              | 15  | -   | ns   | 16-/18-/24-bit bus<br>RGB interface mode |
|                 | $t_{SYNCH}$    | VSYNC/HSYNC hold time               | 15  | -   | ns   |                                          |
| ENABLE          | $t_{ENS}$      | ENABLE setup time                   | 15  | -   | ns   |                                          |
|                 | $t_{ENH}$      | ENABLE hold time                    | 15  | -   | ns   |                                          |
| DB [23:0]       | $t_{POS}$      | Data setup time                     | 15  | -   | ns   |                                          |
|                 | $t_{PDH}$      | Data hold time                      | 15  | -   | ns   |                                          |
| DOTCLK          | $PWDH$         | DOTCLK high-level period            | 20  | -   | ns   |                                          |
|                 | $PWDL$         | DOTCLK low-level period             | 20  | -   | ns   |                                          |
|                 | $t_{CYCD}$     | DOTCLK cycle time                   | 50  | -   | ns   |                                          |
|                 | $t_{r}, t_{f}$ | DOTCLK, HSYNC, VSYNC rise/fall time | -   | 15  | ns   |                                          |

Note:  $T_a = -30$  to  $70$  °C,  $IOVCC = 1.65V$  to  $3.3V$ ,  $VCI = 2.5V$  to  $3.3V$ ,  $AGND = DGND = 0V$



### 5.3 DPI Parallel Interface (RGB Interface) Timing

The DPI can display moving pictures by two ways: rewrite into the GRAM and transmit directly to the shift register. The selection is set by the register BPGRAM (bypass GRAM) and RM bit. The RM bit selects an interface for the access operation of the Frame Memory. For the DPI, RM should be set as 1.

| BPGRAM | Display Data Path        |
|--------|--------------------------|
| 1      | Direct to shift register |
| 0      | Write into Memory        |
| RM     | Interface for RAM access |
| 0      | System interface         |
| 1      | RGB interface            |

The DM bit selects the clock operation mode. It allows switching between display operations in synchronization with the internal oscillation clock. If DM = 1, the external DOTCLK cannot be stopped unless it enters the Sleep-In mode.

| DM | RGB Interface Operating Clock Selection |
|----|-----------------------------------------|
| 0  | Internal system clock                   |
| 1  | RGB interface (DOTCLK)                  |

#### 4.5.1. RGB Interface Selection

The DPI can be selected by the RCM bit. When the RCM is set to 0, the DE mode is selected by VSYNC, HSYNC, DOTCLK, ENABLE, and DB [23:0] pins. When RCM is set to 1, the SYNC mode is selected by VSYNC, HSYNC, DOTCLK, and DB [23:0] pins. It supports several pixel formats that can be selected by DPI [2:0] bits in Pixel Format Set (R3Ah) command. The selection of a given interface is done by DPI [2:0], as shown in Table 6 and Figure 17.

Table 6: DPI Interface Selection

| RCM | DPI [2:0] |   |   | RGB Interface Mode                  | RGB Mode                                                                                                     | Used Pins                               |
|-----|-----------|---|---|-------------------------------------|--------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| 0   | 1         | 1 | 1 | 24-bit RGB interface (16.7M colors) | <b>DE Mode</b><br>Valid data is determined by the ENABLE signal.                                             | VSYNC, HSYNC, ENABLE, DOTCLK, DB [23:0] |
| 0   | 1         | 1 | 0 | 18-bit RGB interface (262K colors)  |                                                                                                              | VSYNC, HSYNC, ENABLE, DOTCLK, DB [17:0] |
| 0   | 1         | 0 | 1 | 16-bit RGB interface (65K colors)   |                                                                                                              | VSYNC, HSYNC, ENABLE, DOTCLK, DB [15:0] |
| 1   | 1         | 1 | 1 | 24-bit RGB interface (16.7M colors) | <b>SYNC Mode</b><br>In the SYNC mode, ENABLE signal is ignored; blanking porch is determined by B5h command. | VSYNC, HSYNC, DOTCLK, DB [23:0]         |
| 1   | 1         | 1 | 0 | 18-bit RGB interface (262K colors)  |                                                                                                              | VSYNC, HSYNC, DOTCLK, DB [17:0]         |
| 1   | 1         | 0 | 1 | 16-bit RGB interface (65K colors)   |                                                                                                              | VSYNC, HSYNC, DOTCLK, DB [15:0]         |

24-bit DPI interface connection (DB [23:0] is used): set pixel format DPI [2:0] = 3'h7

|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| DB23 | DB22 | DB21 | DB20 | DB19 | DB18 | DB17 | DB16 | DB15 | DB14 | DB13 | DB12 | DB11 | DB10 | DB9  | DB8  | DB7  | DB6  | DB5  | DB4  | DB3  | DB2  | DB1  | DB0  |
| R[7] | R[6] | R[5] | R[4] | R[3] | R[2] | R[1] | R[0] | G[7] | G[6] | G[5] | G[4] | G[3] | G[2] | G[1] | G[0] | B[7] | B[6] | B[5] | B[4] | B[3] | B[2] | B[1] | B[0] |

18-bit DPI interface connection (DB [17:0] is used): set pixel format DPI [2:0] = 3'h6

|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| DB23 | DB22 | DB21 | DB20 | DB19 | DB18 | DB17 | DB16 | DB15 | DB14 | DB13 | DB12 | DB11 | DB10 | DB9  | DB8  | DB7  | DB6  | DB5  | DB4  | DB3  | DB2  | DB1  | DB0  |
|      |      |      |      |      |      | 4[5] | 4[4] | 4[3] | 4[2] | 4[1] | 4[0] | 4[5] | 4[4] | 4[3] | 4[2] | 4[1] | 4[0] | 5[5] | 4[4] | 4[3] | 4[2] | 4[1] | 4[0] |

16-bit DPI interface connection (DB [15:0] is used): set pixel format DPI [2:0] = 3'h5

|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| DB23 | DB22 | DB21 | DB20 | DB19 | DB18 | DB17 | DB16 | DB15 | DB14 | DB13 | DB12 | DB11 | DB10 | DB9  | DB8  | DB7  | DB6  | DB5  | DB4  | DB3  | DB2  | DB1  | DB0  |
|      |      |      |      |      |      |      |      | R[4] | R[3] | R[2] | R[1] | R[0] | G[5] | G[4] | G[3] | G[2] | G[1] | G[0] | B[4] | B[3] | B[2] | B[1] | B[0] |

**Figure 17: DPI Interface 24/18/16 Pixel Format Selection**

The Pixel clock (DOTCLK) runs all the time without stop. It is used to enter VSYNC, HSYNC, ENABLE and DB [23:0] states when there is a rising edge of the DOTCLK. The DOTCLK cannot be used as the internal clock for other functions of the display module.

Vertical synchronization (VSYNC) is used to indicate when a new frame of the display is received. This is low enable and its state is read to the display module by a rising edge of the DOTCLK signal.

Horizontal synchronization (HSYNC) is used to indicate when a new line of the frame is received. This is low enable and its state is read to the display module by a rising edge of the DOTCLK signal.

Data Enable (ENABLE) is used to indicate when the RGB information that should be transferred in the display is received. This is a high enable, and its state is read to the display module by a rising edge of the DOTCLK signal.

DB [23:0] is used to indicate what is the information of the image that is transferred on the display (when ENABLE = 0 (low) and there is a rising edge of DOTCLK). DB [23:0] can be 0 (low) or 1 (high). These lines are read by a rising edge of the DOTCLK signal. In RGB interface modes, the input display data is written to GRAM first then outputs the corresponding source voltage according to the gray data from GRAM.

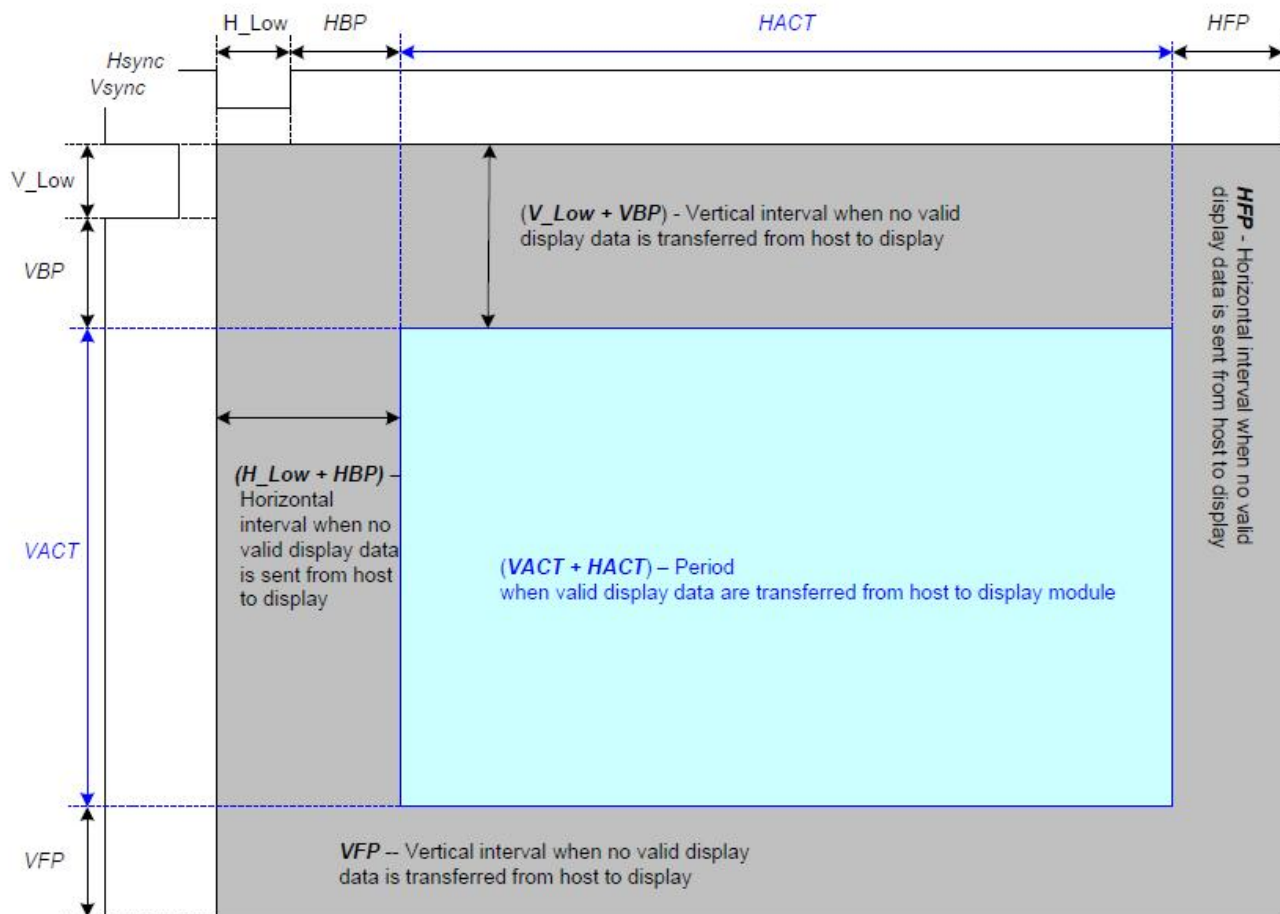


Figure 18: General DPI Timing Diagram

| Parameters                 | Symbols | Min. | Typ. | Max. | Units  |
|----------------------------|---------|------|------|------|--------|
| Horizontal Synchronization | H_Low   | 3    | -    | -    | DOTCLK |
| Horizontal Back Porch      | HBP     | 3    | -    | -    | DOTCLK |
| Horizontal Address         | HACT    | -    | 320  | -    | DOTCLK |
| Horizontal Front Porch     | HFP     | 3    | -    | -    | DOTCLK |
| Horizontal Frequency       |         | -    | -    | 33   | KHz    |
| Vertical Synchronization   | V_Low   | 1    | -    | -    | Line   |
| Vertical Back Porch        | VBP     | 2    | -    | -    | Line   |
| Vertical Address           | VACT    | -    | 480  | -    | Line   |
| Vertical Front Porch       | VFP     | 2    | -    | -    | Line   |
| Vertical Frequency         |         | 60   | -    | 70   | Hz     |
| DOTCLK cycle               |         | 100  | -    | 50   | ns     |
| DOTCLK Frequency           |         | 10   | -    | 20   | MHz    |

Example : DOTCLK = 20Mhz, TE=70Hz, V\_Low+VBP=2, VFP=2, H\_Low+HBP=100, HFP=170.

The timing chart of 16-/18-/24-bit DPI interface mode is illustrated in Figure 19.

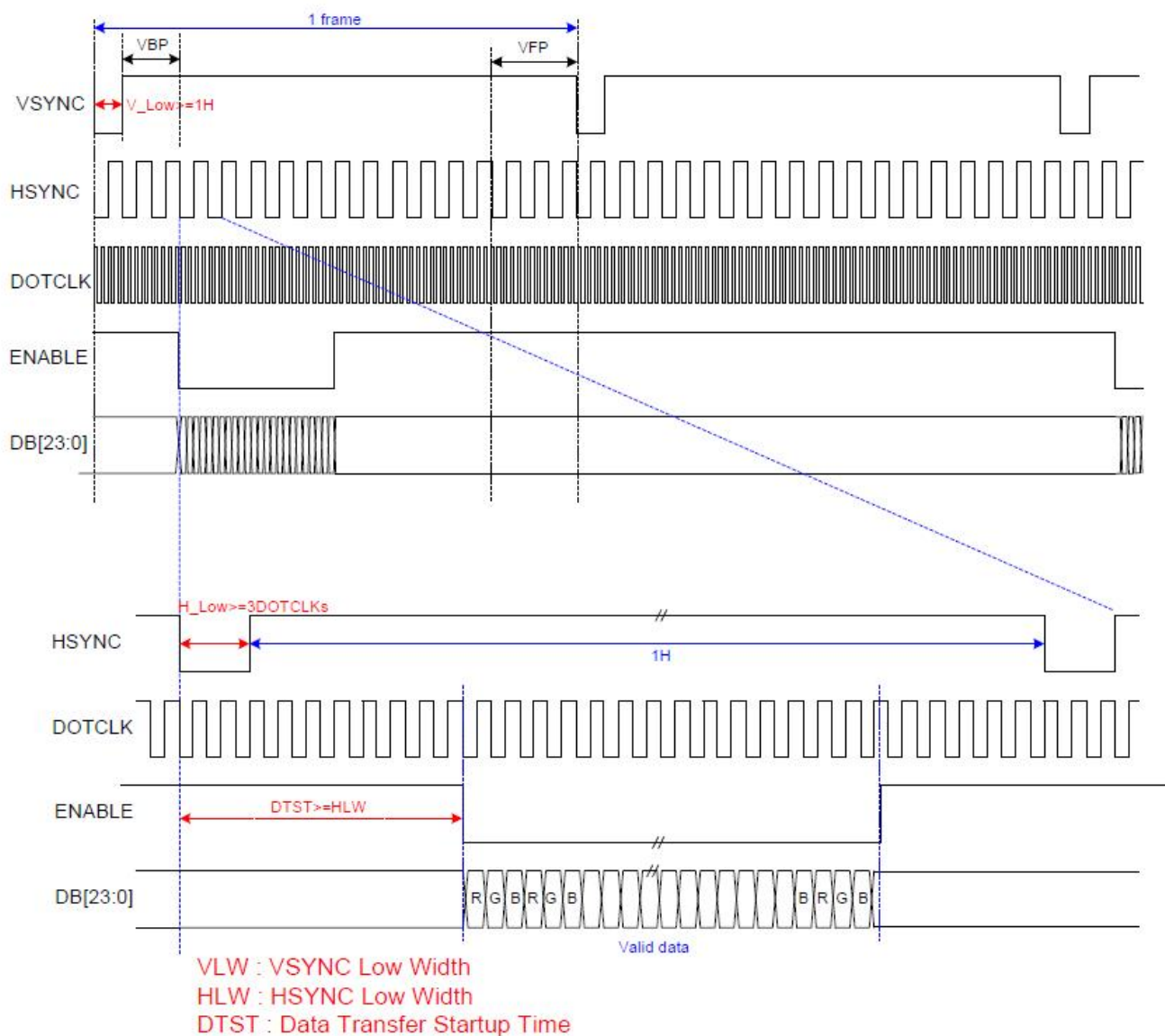


**Figure 19: DPI Interface Timing Diagram**

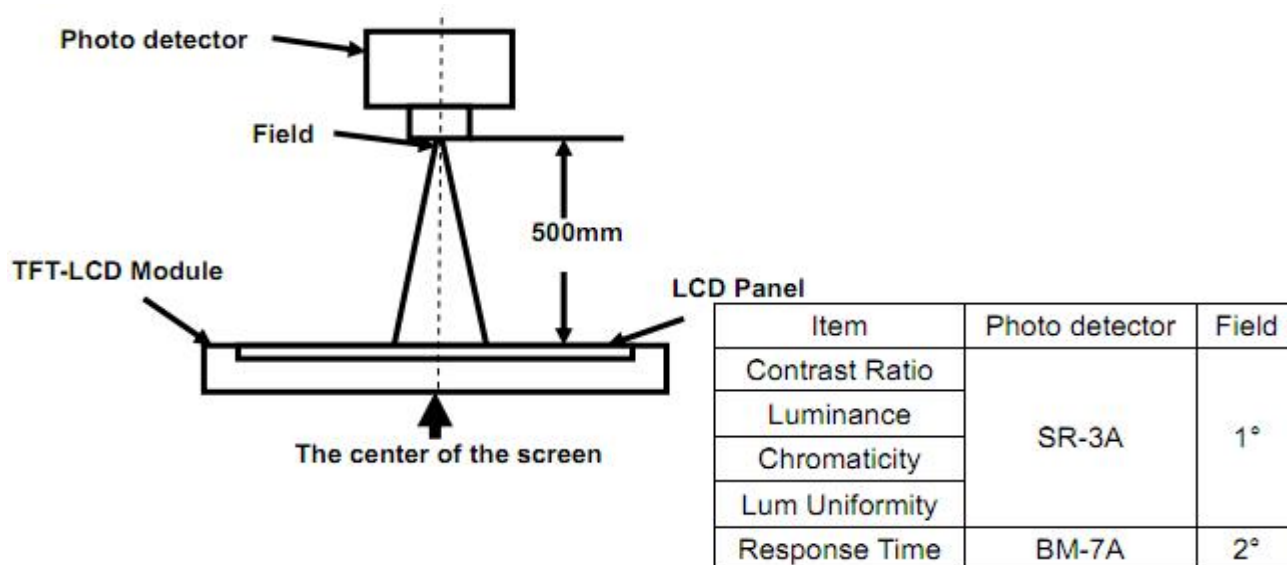
**Note:** VSPL = 0, HSPL = 0, DPL = 0 and EPL = 0 of Interface Mode Control B0h command.

## 6. Optical Specifications

| Item                               | Symbol     | Condition                    | Min. | Typ.  | Max. | Unit              | Note           |
|------------------------------------|------------|------------------------------|------|-------|------|-------------------|----------------|
| Viewing Angle<br>(CR≥10)<br>B/L ON | $\theta_T$ | $\Phi=90^\circ$ (12 o'clock) | -    | 80    | -    | deg               | Note2          |
|                                    | $\theta_B$ | $\Phi=270^\circ$ (6 o'clock) | -    | 80    | -    | deg               | Note2          |
|                                    | $\theta_L$ | $\Phi=180^\circ$ (9 o'clock) | -    | 80    | -    | deg               | Note2          |
|                                    | $\theta_R$ | $\Phi=0^\circ$ (3 o'clock)   | -    | 80    | -    | deg               | Note2          |
| Response Time                      | $T_{ON}$   | Normal $\theta=\Phi=0^\circ$ | -    | 15    | -    | msec              | Note4          |
|                                    | $T_{OFF}$  |                              | -    | 15    | -    | msec              | Note4          |
| Contrast Ratio                     | CR         |                              | -    | 700   | -    | -                 | Note1<br>Note3 |
| Color Chromaticity                 | $W_X$      |                              | -    | 0.309 | -    | -                 | Note1<br>Note5 |
|                                    | $W_Y$      |                              | -    | 0.332 | -    | -                 | Note1<br>Note5 |
| Luminance                          | L          |                              | 200  | 250   | -    | cd/m <sup>2</sup> | Note1<br>Note7 |
| Luminance<br>Uniformity            | $Y_U$      |                              | 75   | 80    | -    | %                 | Note1<br>Note6 |
| NTSC                               | -          |                              | -    | 50    | -    | %                 | -              |

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.



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).

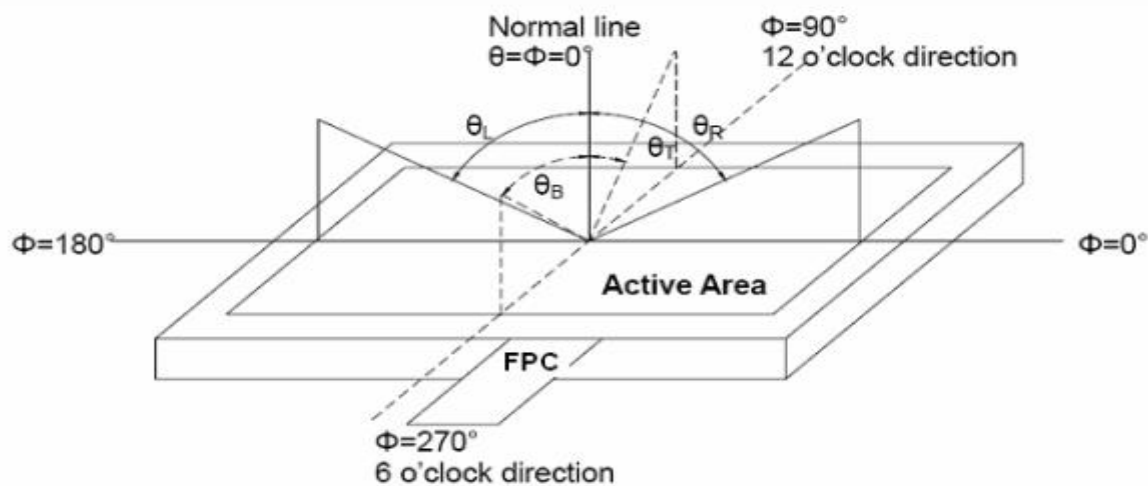


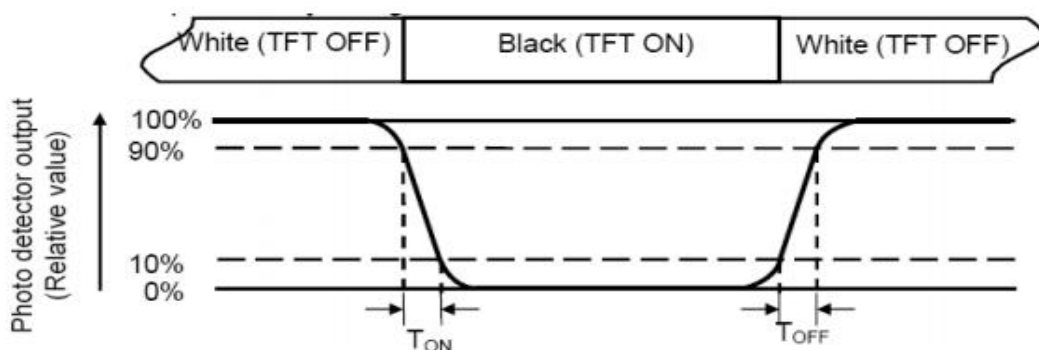
Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

### 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

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.

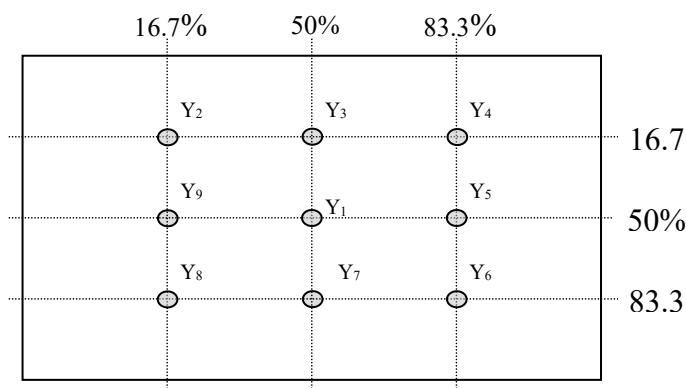


Fig. 2 Definition of points

### Note 7: Definition of Luminance (Refer Fig. 2)

Surface luminance is the luminance with all pixels displaying white.

$L_v$  = Average Surface Luminance with all white pixels( $P_1, P_2, P_3, \dots, P_n$ ).

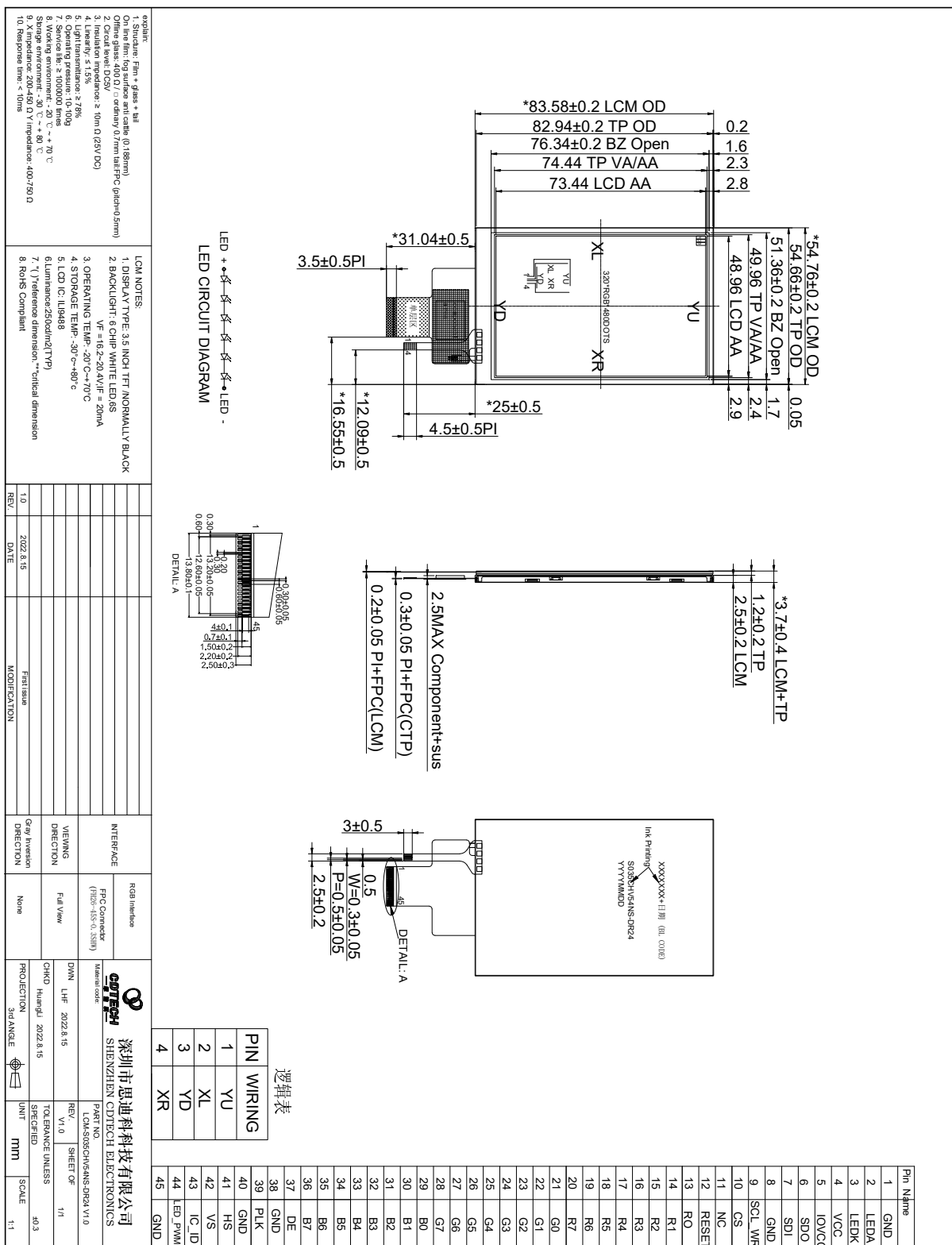
## 7. Reliability Test Items

| Test Item                             | Test Conditions                                                                                     |
|---------------------------------------|-----------------------------------------------------------------------------------------------------|
| High Temperature Storage              | Ta= +80℃ 96hrs                                                                                      |
| Low Temperature Storage               | Ta= -30℃ 96hrs                                                                                      |
| High Temperature Operation            | Ta= +70℃ 96hrs                                                                                      |
| Low Temperature Operation             | Ta= -20℃ 96hrs                                                                                      |
| High Temperature and Humidity Storage | Ta= +60℃, 90% RH 96hrs                                                                              |
| Thermal Shock<br>(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: 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:

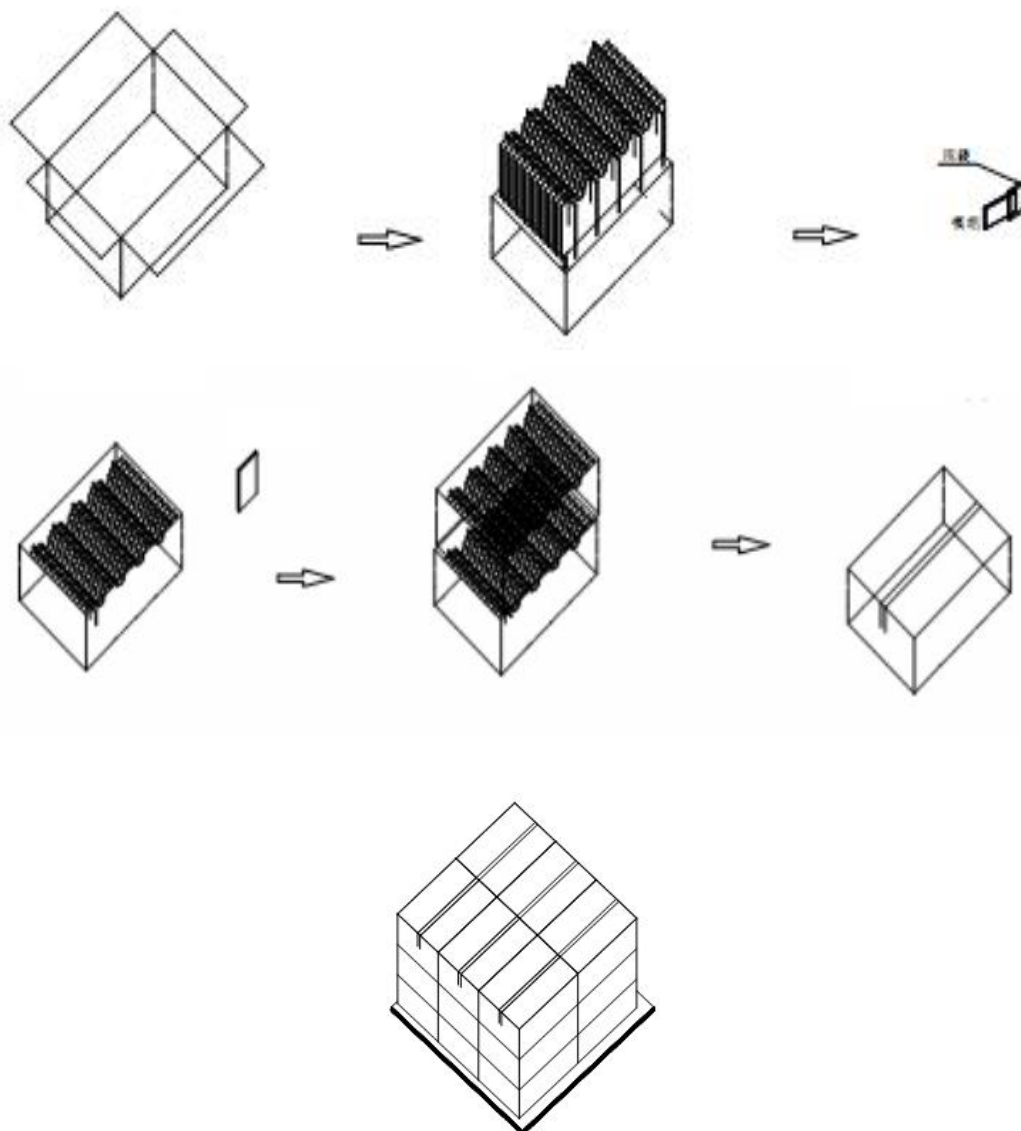
- 1). Air bubble in the LCD
- 2). Seal leak or Glass crack
- 3). Non display or abnormal display
- 4). Brightness reduction >50%

## 8. Mechanical Drawing



## 9. Packing

### Packing Method



#### Steps:

1. Put module into tray cavity
2. Tray stacking
3. Put 1 cardboard under the tray stack and 1 cardboard above
4. Fix the cardboard to the tray stack with adhesive tape
5. Put the tray stack into carton
6. Carton sealing with adhesive tape

## 10. TFT-LCD Module Inspection Criteria

### 10.1 Scope

The incoming inspection standards shall be applied to TFT –LCD Modules (hereinafter called "Modules") that supplied by CDTech.

### 10.2 Incoming Inspection

The customer shall inspect the modules within twenty calendar days of the delivery date (the "inspection period") at its own cost. The result of the inspection (acceptance or rejection) shall be recorded in writing, and a copy of this writing will be promptly sent to the seller, If the results of the inspecting from buyer does not send to the seller within twenty calendar days of the delivery date. The modules shall be regards as acceptance. Should the customer fail to notify the seller within the inspection period, the buyers right to reject the modules shall be lapsed and the modules shall be deemed to have been accepted by the buyer.

### 10.3 Inspection Sampling

10.3.1. Lot size: Quantity per shipment lot per model

10.3.2. Sampling type: Normal inspection, Single sampling

10.3.3. Inspection level: II

10.3.4. Sampling table: MIL-STD-105E

10.3.5. Acceptable quality level (AQL )

Major defect: AQL=0.65

Minor defect: AQL=1.00

### 10.4 Inspection Conditions

10.4.1 Ambient conditions:

a. Temperature: Room temperature  $25\pm 5^{\circ}\text{C}$

b. Humidity:  $(60\pm 10)\% \text{RH}$

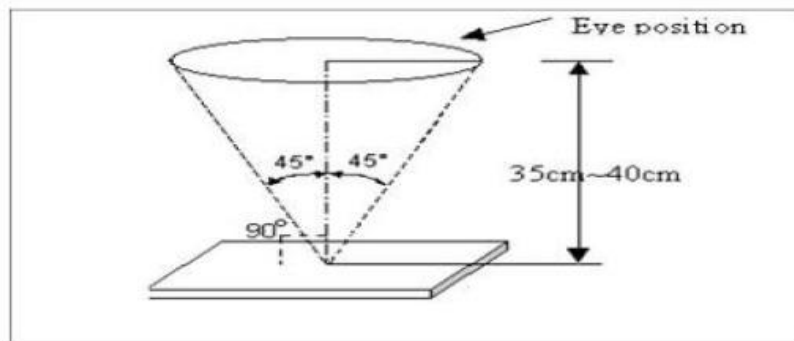
c. Illumination: Single fluorescent lamp non-directive (300 to 700 Lux)

10.4.2 Viewing distance

The distance between the LCD and the inspector's eyes shall be at least  $35\pm 5\text{ cm}$ .

10.4.3 Viewing Angle

U/D:  $45^{\circ}/45^{\circ}$ , L/R:  $45^{\circ}/45^{\circ}$



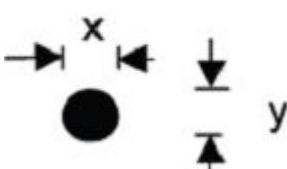
### 10.5 Inspection Criteria

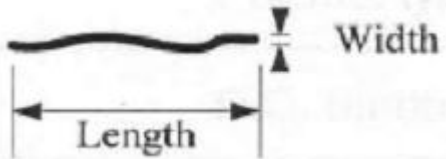
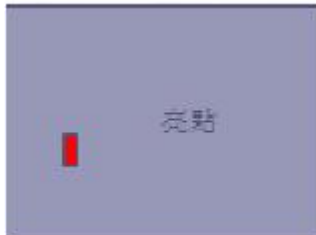
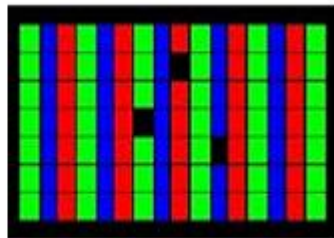
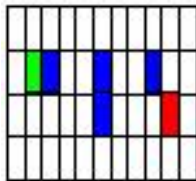
Defects are classified as major defects and minor defects according to the degree of defectiveness defined here in.

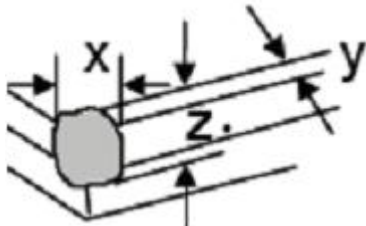
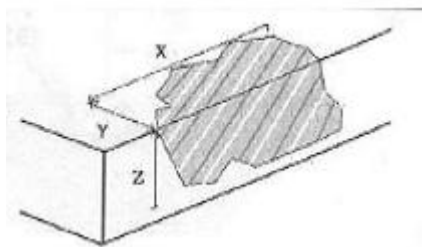
#### 10.5.1. Major defect

| Item No | Items to be inspected  | Inspection Standard                                                          |
|---------|------------------------|------------------------------------------------------------------------------|
| 5.1.1   | All functional defects | 1) No display<br>2) Display abnormally<br>3) Short circuit<br>4) line defect |
| 5.1.2   | Missing                | Missing function component                                                   |
| 5.1.3   | Crack                  | Glass Crack                                                                  |

#### 10.5.2. Minor defect

| Item No | Items to be inspected                                                                           | Inspection standard                                                                                                                             |                     |
|---------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| 5.2.1   | Spot Defect<br>Including Black spot White spot<br>Pinhole<br>Foreign particle<br>Polarizer dirt | For dark/white spot is defined<br><br>$\varphi = (x+y) / 2$  |                     |
|         |                                                                                                 | Size $\varphi(\text{mm})$                                                                                                                       | Acceptable Quantity |
|         |                                                                                                 | $\varphi \leq 0.1$                                                                                                                              | Ignore              |
|         |                                                                                                 | $0.1 < \varphi \leq 0.2$                                                                                                                        | 2                   |
|         |                                                                                                 | $0.2 < \varphi$                                                                                                                                 | Not allowed         |
| 5.2.2   | Polarizer dirt, particle                                                                        | Size $\varphi(\text{mm})$                                                                                                                       | Acceptable Quantity |
|         |                                                                                                 | $\varphi \leq 0.2$                                                                                                                              | 1                   |
|         |                                                                                                 | $\varphi > 0.2$                                                                                                                                 | Not allowed         |

|           |                                                              |                                                                                                                                                                                                                                                                                                                         |  |                     |
|-----------|--------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------|
| 5.2.3     | Line Defect<br>Including Black<br>line White line<br>Scratch | Define:<br>                                                                                                                                                                                                                           |  |                     |
|           |                                                              | Width(mm)<br>Length(mm)                                                                                                                                                                                                                                                                                                 |  | Acceptable Quantity |
|           |                                                              | W≤0.05                                                                                                                                                                                                                                                                                                                  |  | Ignore              |
|           |                                                              | 0.05 < W≤0.1<br>L≤1.5                                                                                                                                                                                                                                                                                                   |  | 1                   |
|           |                                                              | 0.1 < W,or L>1.5                                                                                                                                                                                                                                                                                                        |  | Not allowed         |
| 5.2.4     | Polarizer<br>Dent/Bubble                                     | Not allowed                                                                                                                                                                                                                                                                                                             |  |                     |
| 5.2.5     | Electrical Dot<br>Defect                                     | Bright and Black dot define:<br> and <br><br>Two Adjacent Dot |  |                     |
|           |                                                              | Inspection pattern: Full white,Full black,Red,green and blue screens                                                                                                                                                                                                                                                    |  |                     |
|           |                                                              | Item                                                                                                                                                                                                                                                                                                                    |  | Acceptable Quantity |
|           |                                                              | Black dot defect                                                                                                                                                                                                                                                                                                        |  | 1                   |
|           |                                                              | Bright dot defect                                                                                                                                                                                                                                                                                                       |  | 1                   |
|           |                                                              | Two Adjacent Dot                                                                                                                                                                                                                                                                                                        |  | Not allow           |
|           |                                                              | There or more Adjacent Dot                                                                                                                                                                                                                                                                                              |  | Not allowed         |
| Total Dot |                                                              | 2                                                                                                                                                                                                                                                                                                                       |  |                     |

|       |              |                                                                                     |                                                                       |
|-------|--------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| 5.2.6 | Glass defect |   |                                                                       |
|       |              | 1. Corner Fragment:                                                                 |                                                                       |
|       |              | Size(mm)                                                                            | Acceptable Quantity                                                   |
|       |              | $X \leq 2\text{mm}$<br>$Y \leq 1\text{mm}$<br>$Z \leq T$                            | Ignore<br>T: Glass thickness<br>X: Length<br>Y: Width<br>Z: thickness |
|       |              |  |                                                                       |
|       |              | 2. Side Fragment:                                                                   |                                                                       |
|       |              | Size(mm)                                                                            | Acceptable Quantity                                                   |
|       |              | $X \leq 5\text{mm}$<br>$Y \leq 1\text{mm}$<br>$Z \leq T$                            | Ignore<br>T: Glass thickness<br>X: Length<br>Y: Width<br>Z: thickness |

- Note:
- 1). Dot defect is defined as the defective area of the dot area is larger than 50% of the dot area.
  - 2). The distance between two bright dot defects (red, green, blue, and white) should be larger than 15mm.
  - 3). The distance between black dot defects or black and bright dot defects should be more than 5mm apart.
  - 4). Polarizer bubble is defined as the bubble appears on active display area. The defect of polarizer bubble shall be ignored if the polarizer bubble appears on the outside of active display area.

## 10.6 Mechanics specification

As for the outside dimension, weight of the modules, please refer to product specification for more details.

## 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.