# PRODUCT SPECIFICATION

**CDTECH Model:** **S024HQ58EN-1**

**CUSTOMER Model:** -

**Description:** **2.4 ” TFT-LCD Module**

**Version:** **3.0**

| CDTECH | PREPARED BY | CHECKED BY | APPROVED BY |
|---|---|---|---|
| SIGNATURE | | | |
| DATE | 2024.11.12 | 2024.11.12 | 2024.11.12 |

| CUSTOMER APPROVAL | SIGNATURE | DATE |
|---|---|---|
| | | |

## Record of Revisions

| Version | Revise Date | Description | Page |
|---|---|---|---|
| 1.0 | 2024-8-9 | First Release | - |
| 2.0 | 2024-8-30 | Double crystal lamp changed to single crystal lamp, using brightening film | 18 |
| 3.0 | 2024-10-08 | Update FPC | 18 |
| | 2024-10-15 | Update backlight drive current to 90MA | 5 |
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# Contents

# 1. General Specifications

## 1.1 LCM General Information

| Item | Specification | Unit |
|---|---|---|
| LCD Size | 2.4 | inch |
| Number of Pixels | 240 (H) RGB x 320 (V) | pixels |
| Display Mode | Normally Black | - |
| Viewing Direction | Free | - |
| Interface | RGB | - |
| Display Colors | 262K | colors |
| Outline Dimension | 42.72 (H) x 60.26 (V) x 2.2 (D) | mm |
| Active Area | 36.72 (H) x 48.96 (V) | mm |
| Pixel Pitch | 0.153 (H) x 0.153 (V) | mm |
| Driver IC | ILI9340X | - |
| Operation Temperature | -20~70 | ℃ |
| Storage Temperature | -30~80 | ℃ |

Note1:Requirements on environmental protection RoHS compliant.

# 2. Absolute Maximum Ratings

| Item | Symbol | MIN. | MAX. | Unit | Note |
|---|---|---|---|---|---|
| Analog Supply voltage | VDD_2.8-3.3V | -0.3 | 4.0 | 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. Elecrical Characteristics

### 3.1 Recommended Operating Condition for TFT LCD

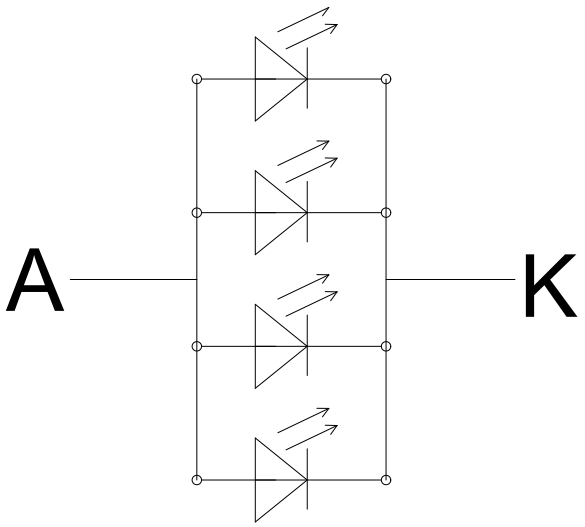
| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Analog Supply voltage | VDD_2.8-3.3V | 2.5 | 2.8 | 3.3 | V | |
| Analog supply current | $I_{VDD\_2.8-3.3V}$ | - | TBD | - | mA | VDD_2.8-3.3V =2.8V |
| Logic input voltage | VIH | 0.7*VDD_2.8-3.3V | - | VDD_2.8-3.3V | V | |
| | VIL | GND | - | 0.3*VDD_2.8-3.3V | V | |

### 3.2 Recommended Driving Condition for Backlight

| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Driving Current | $I_F$ | - | 90 | - | mA | |
| Driving Voltage | $V_F$ | 2.7 | - | 3.4 | V | |
| Power consumption | $W_{BL}$ | 0.243 | - | 0.306 | W | |
| LED Life-Time | N/A | - | 50,000 | - | Hours | Ta=25℃ 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

| No. | Symbol | Description |
|---|---|---|
| 1 | LEDK | Power for LED backlight (Cathode) |
| 2 | LEDA | Power for LED backlight (Anode) |
| 3 | GND | Ground |
| 4 | VDD_2.8-3.3V | Power supply(2.8-3.3V) |
| 5 | NC | No connection |
| 6 | NC | No connection |
| 7-12 | R0-R5 | Data bus |
| 13 | NC | No connection |
| 14 | NC | No connection |
| 15-20 | G0-G5 | Data bus |
| 21 | NC | No connection |
| 22 | NC | No connection |
| 23-28 | B0-B5 | Data bus |
| 29 | GND | Ground |
| 30 | DCLK | Dot clock signal for RGB interface operation. |
| 31 | VPP(NC) | No connection |
| 32 | HSYNC | Line synchronizing signal for RGB interface operation. |
| 33 | VSYNC | Frame synchronizing signal for RGB interface operation. |
| 34 | DE | Data enable signal for RGB interface operation. |
| 35 | NC | No connection |
| 36 | GND | Ground |
| 37 | SPI-CLK | Select Date or Command |
| 38 | SPI-DATA | Serial in/out signal |
| 39 | SPI-CS | Chip select input pin |
| 40 | SPI-RST | Global reset pin |

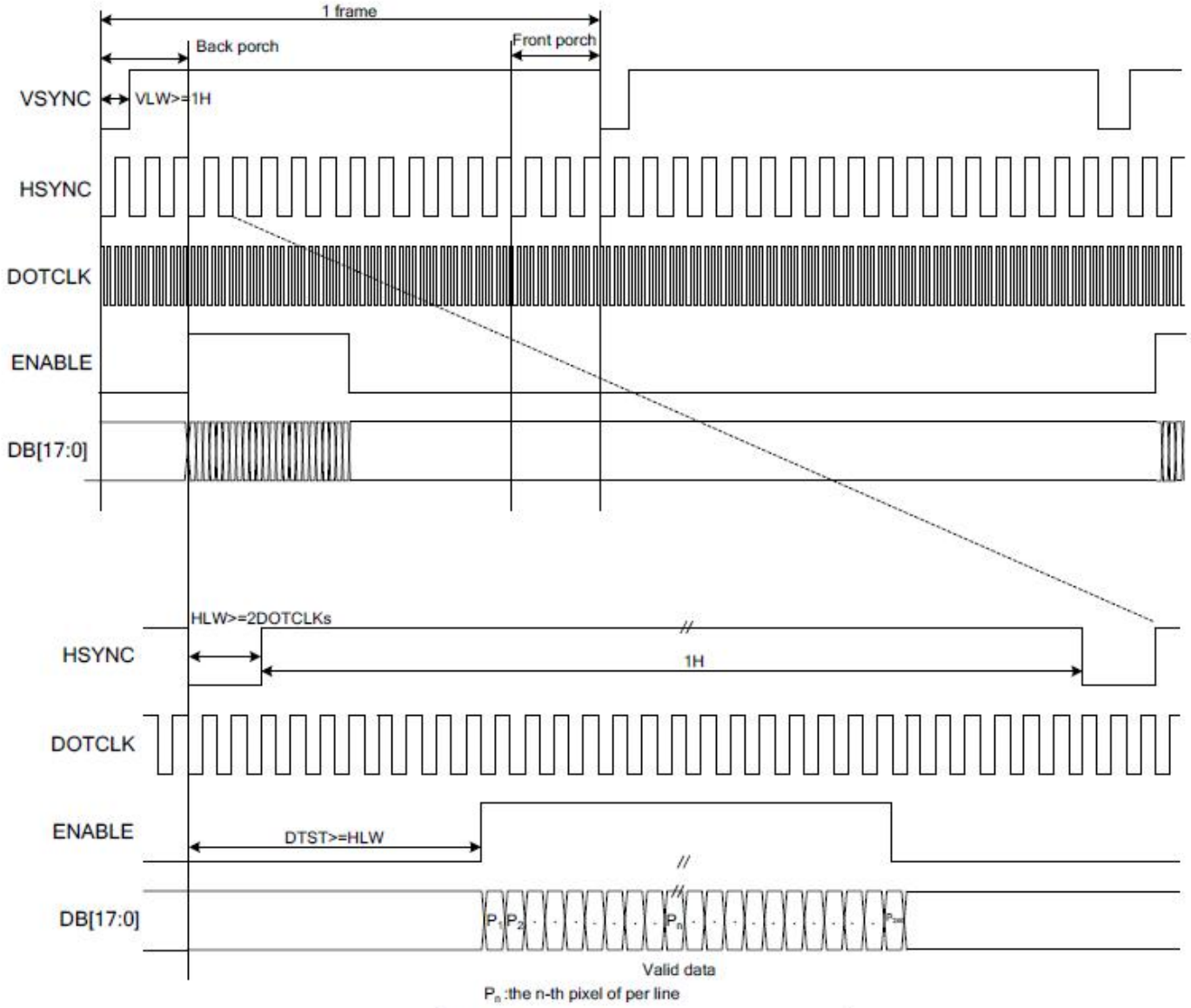
# 5. Interface Characteristics

## 5.1 RGB Interface

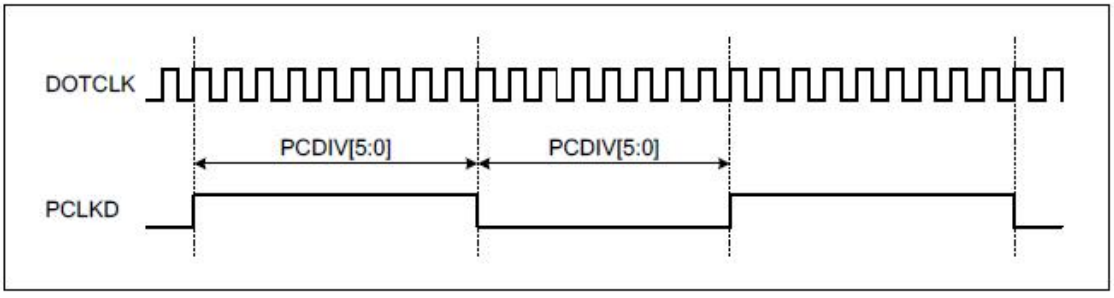
| Parameters | Symbols | Condition | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Horizontal Synchronization | Hsync | | 2 | 10 | 16 | DOTCLK |
| Horizontal Back Porch | HBP | | 2 | 20 | 24 | DOTCLK |
| Horizontal Back Porch(ByPass mode)* | HBP(BP) | | 58 | 64 | 200 | DOTCLK |
| Horizontal Address | HAdr | | - | 240 | - | DOTCLK |
| Horizontal Front Porch | HFP | | 2 | 10 | 16 | DOTCLK |
| Vertical Synchronization | Vsync | | 1 | 2 | 4 | Line |
| Vertical Back Porch | VBP | | 1 | 2 | - | Line |
| Vertical Address | VAdr | | - | 320 | - | Line |
| Vertical Front Porch | VFP | | 3 | 4 | - | Line |

## 5.2 RGB Interface Timing

The timing chart of 18-/16-bit RGB interface mode is shown as below.

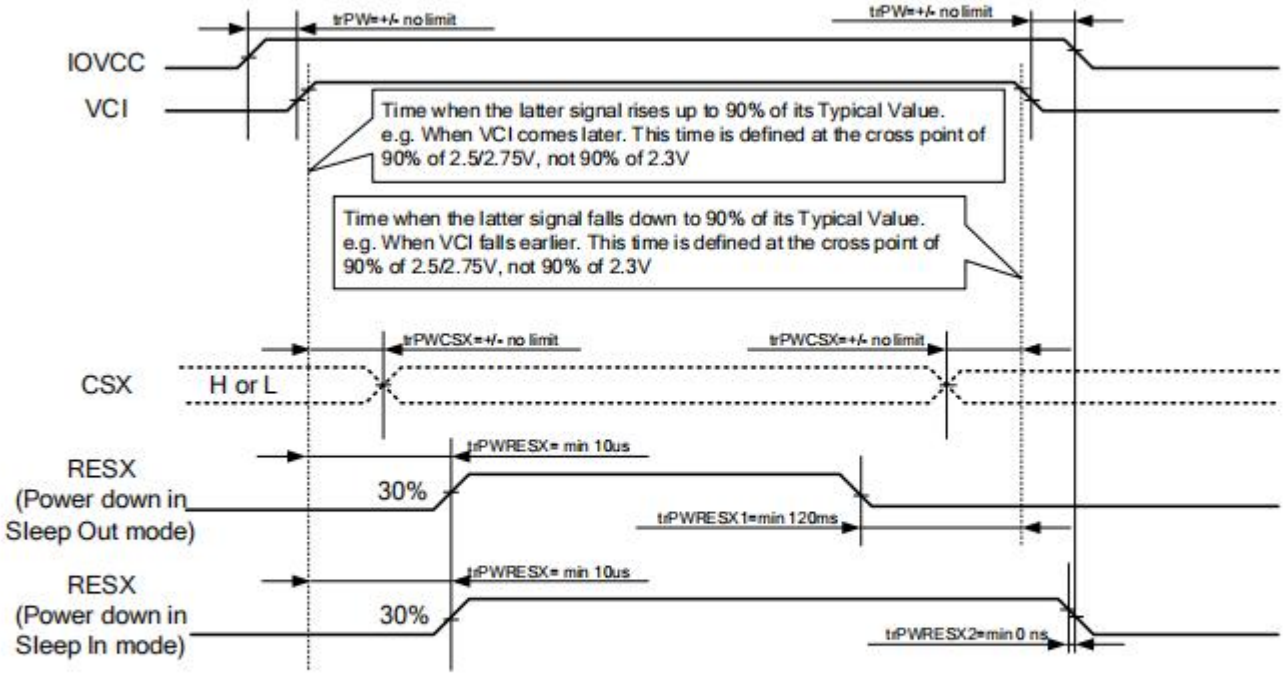



VLW : VSYNC Low Width
HLW : HSYNC Low Width
DTST : Data Transfer Startup Time



## 5.3 Power On/Off Sequence

If RESX line is held Low (and stable) by the host during Power On, then the RESX must be held low for minimum 10µsec after both VCI and IOVCC have been applied.

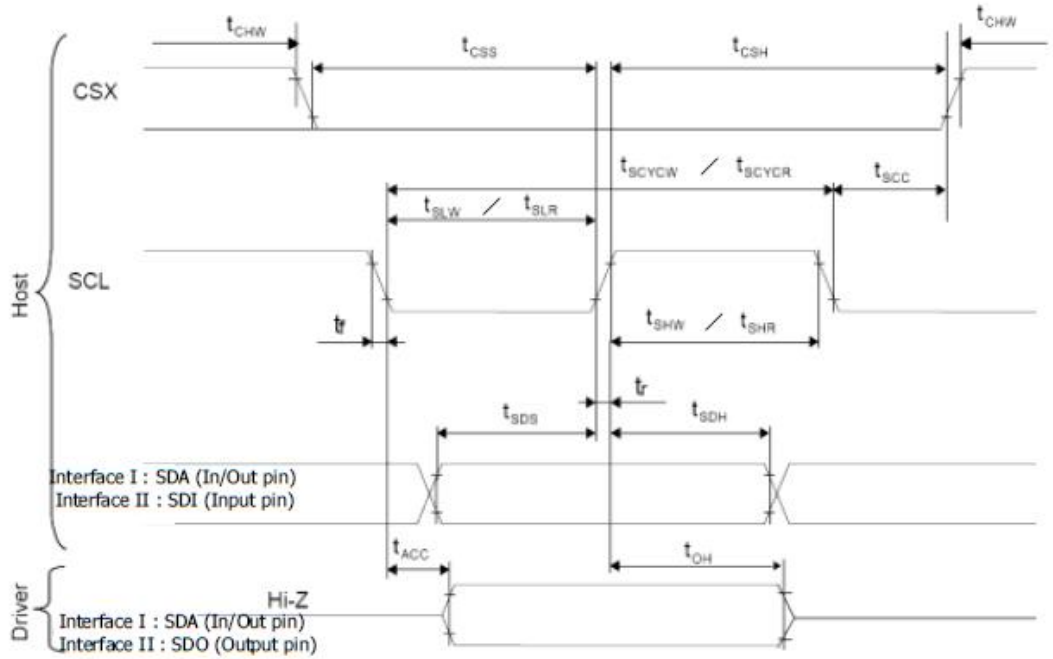



trPWRESX1 is applied to RESX falling in the Sleep Out Mode
trPWRESX2 is applied to RESX falling in the Sleep In Mode

*Note 1: Unless otherwise specified, timings herein show cross point at 50% of signal power level.*

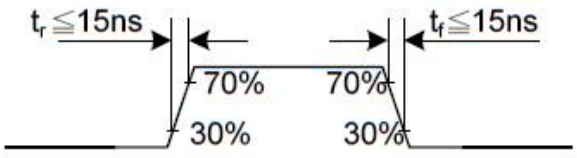
## 5.4 AC Characteristics

### Display Serial Interface Timing Characteristics (3-line SPI system)

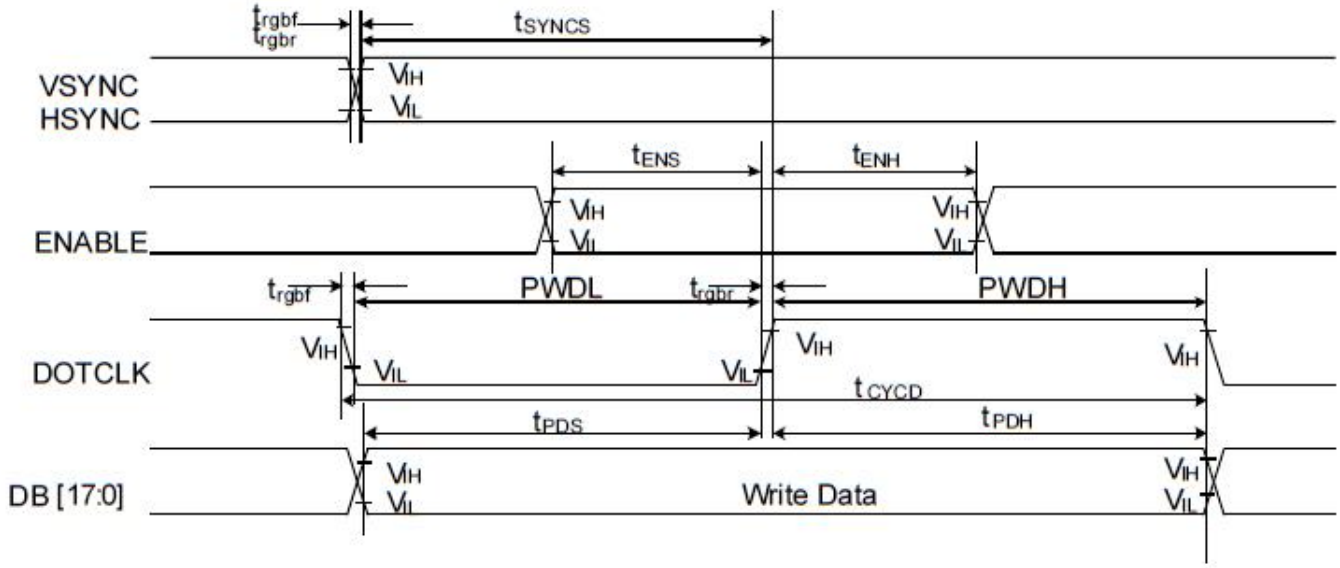



| Signal | Symbol | Parameter | min | max | Unit | Description |
|---|---|---|---|---|---|---|
| SCL | $t_{SCYCW}$ | Serial Clock Cycle (Write) | 66 | - | ns | |
| | $t_{SHW}$ | SCL "H" Pulse Width (Write) | 33 | - | ns | |
| | $t_{SLW}$ | SCL "L" Pulse Width (Write) | 33 | - | ns | |
| | $t_{SCYCW}$ | Serial Clock Cycle (Write RGB data ) | 15 | - | ns | MTK-2 lane mode only |
| | $t_{SHW}$ | SCL "H" Pulse Width (Write RGB data) | 4 | - | ns | MTK-2 lane mode only |
| | $t_{SLW}$ | SCL "L" Pulse Width (Write RGB data) | 4 | - | ns | MTK-2 lane mode only |
| | $t_{SCYCR}$ | Serial Clock Cycle (Read) | 150 | - | ns | |
| | $t_{SHR}$ | SCL "H" Pulse Width (Read) | 75 | - | ns | |
| | $t_{SLR}$ | SCL "L" Pulse Width (Read) | 75 | - | ns | |
| SDA / SDI (Input) | $t_{SDS}$ | Data setup time (Write) | 30 | - | ns | |
| | $t_{SDH}$ | Data hold time (Write) | 30 | - | ns | |
| SDA / SDO (Output) | $t_{ACC}$ | Access time (Read) | 10 | - | ns | |
| | $t_{OH}$ | Output disable time (Read) | 10 | 70 | ns | |
| CSX | $t_{SCC}$ | SCL-CSX | 20 | - | ns | |
| | $t_{CHW}$ | CSX "H" Pulse Width | 40 | - | ns | |
| | $t_{CSS}$ | CSX-SCL Time(write) | 15 | - | ns | |
| | $t_{CSH}$ | | 15 | - | ns | |

*Note: Ta = 25 °C, IOVCC=1.65V to 3.3V, VCI=2.5V to 3.3V, AGND=GND=0V*



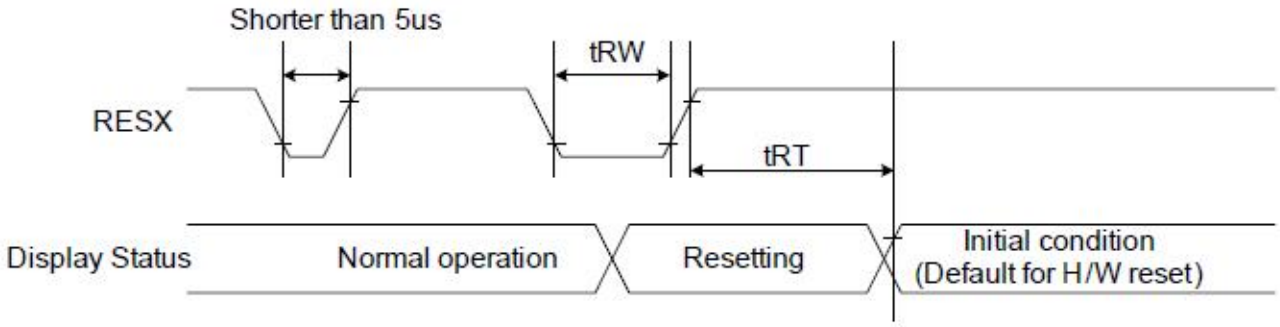
## Parallel 18/16/6-bit RGB Interface Timing Characteristics




| Signal | Symbol | Parameter | min | max | Unit | Description |
|---|---|---|---|---|---|---|
| VSYNC / HSYNC | $t_{SYNCS}$ | VSYNC/HSYNC setup time | 15 | - | ns | 18/16-bit bus 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[17:0] | $t_{PDS}$ | Data setup time | 15 | - | ns | |
| | $t_{PDH}$ | Data hold time | 15 | - | ns | |
| DOTCLK | PWDH | DOTCLK high-level period | 33 | - | ns | |
| | PWDL | DOTCLK low-level period | 33 | - | ns | |
| | $t_{CYCD}$ | DOTCLK cycle time(18 bit) | 66 | - | ns | |
| | $t_{rgbr}$, $t_{rgbf}$ | DOTCLK,HSYNC,VSYNC rise/fall time | - | 15 | ns | |
| VSYNC / HSYNC | $t_{SYNCS}$ | VSYNC/HSYNC setup time | 15 | - | ns | 6-bit bus 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[17:0] | $t_{PDS}$ | Data setup time | 15 | - | ns | |
| | $t_{PDH}$ | Data hold time | 15 | - | ns | |
| DOTCLK | PWDH | DOTCLK high-level pulse period | 25 | - | ns | |
| | PWDL | DOTCLK low-level pulse period | 25 | - | ns | |
| | $t_{CYCD}$ | DOTCLK cycle time (6 bit) | 50 | - | ns | |
| | $t_{rgbr}$, $t_{rgbf}$ | DOTCLK,HSYNC,VSYNC rise/fall time | | 15 | ns | |

*Note: Ta = -30 to 80 °C, IOVCC=1.65V to 3.3V, VCI=2.5V to 3.3V, AGND=GND=0V*

## 5.5 Reset Timing




| Signal | Symbol | Parameter | Min | Max | Unit |
|---|---|---|---|---|---|
| RESX | tRW | Reset pulse duration | 10 | | uS |
| | tRT | Reset cancel | | 5 (note 1,5) | mS |
| | | | | 120 (note 1,6,7) | mS |

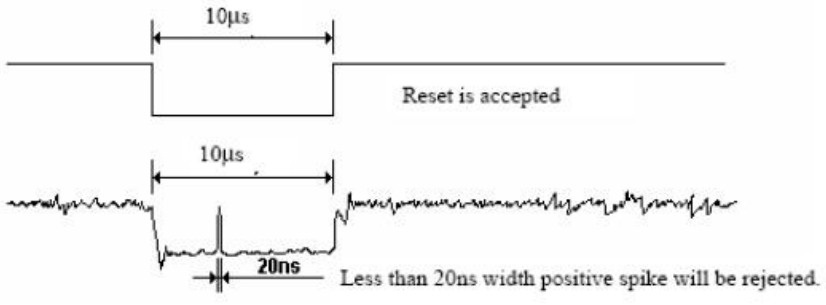
*Note 1: The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NV memory to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.*

*Note 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 5us | Reset Rejected |
| Longer than 10us | Reset |
| Between 5us and 10us | Reset starts |

*Note 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 return to Default condition for Hardware Reset.*

*Note 4: Spike Rejection also applies during a valid reset pulse as shown below:*




*Note 5: When Reset applied during Sleep In Mode.*

*Note 6: When Reset applied during Sleep Out Mode.*

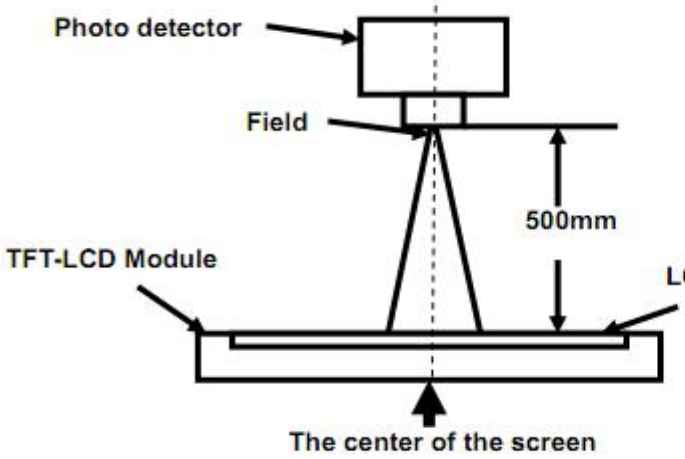
Note 7: It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

# 6. Optical Specifications

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| Viewing Angle (CR≥10) B/L ON | $\theta_T$ | Φ=90°(12 o'clock) | - | 80 | - | deg | Note2 |
| | $\theta_B$ | Φ=270°(6 o'clock) | - | 80 | - | deg | Note2 |
| | $\theta_L$ | Φ=180°(9 o'clock) | - | 80 | - | deg | Note2 |
| | $\theta_R$ | Φ=0°(3 o'clock) | - | 80 | - | deg | Note2 |
| Response Time | $T_{ON}$ | Normal θ=Φ=0° | - | 16 | 21 | msec | Note4 |
| | $T_{OFF}$ | | - | 19 | 24 | msec | Note4 |
| Contrast Ratio | CR | | 640 | 800 | - | - | Note1 Note3 |
| Color Chromaticity | $W_X$ | | 0.305 | 0.335 | 0.365 | - | Note1 Note5 |
| | $W_Y$ | | 0.326 | 0.356 | 0.386 | - | Note1 Note5 |
| Luminance | L | | 700 | 800 | - | cd/m² | Note1 Note7 |
| Luminance Uniformity | $Y_U$ | | 75 | 80 | - | % | Note1 Note6 |
| NTSC | - | | - | 70 | - | % | - |

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.




| Item | Photo detector | Field |
|---|---|---|
| Contrast Ratio | SR-3A | 1° |
| Luminance | | |
| Chromaticity | | |
| Lum Uniformity | | |
| Response Time | BM-7A | 2° |

**Fig 1**

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).

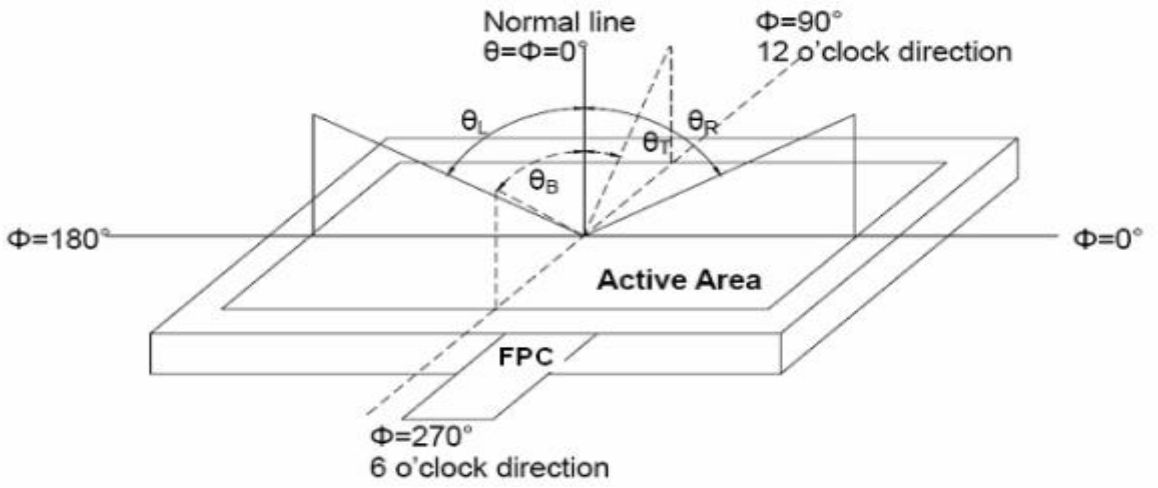


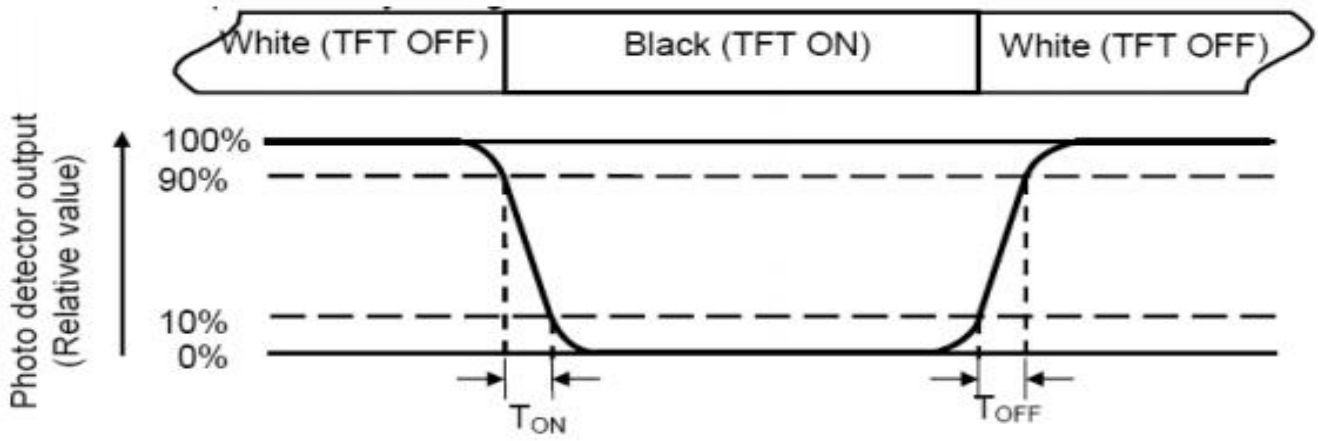

**Fig 2 Definition of viewing angle**

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.3-a/b

Note 7:Surface luminance is the luminance with all pixels displaying white.

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

For more information see FIG.3-a/b

Note 8:Size : S≤5”(see Figure a)  H,V : Active area
Light spot size ∅ =5mm(BM-5) or ∅=7.7mm (BM-7)50cm distance or test spot position : see Figure a.
measurement instrument : TOPCON’s luminance meter SR-3A or BM-7 or compatible (see Figure 1).

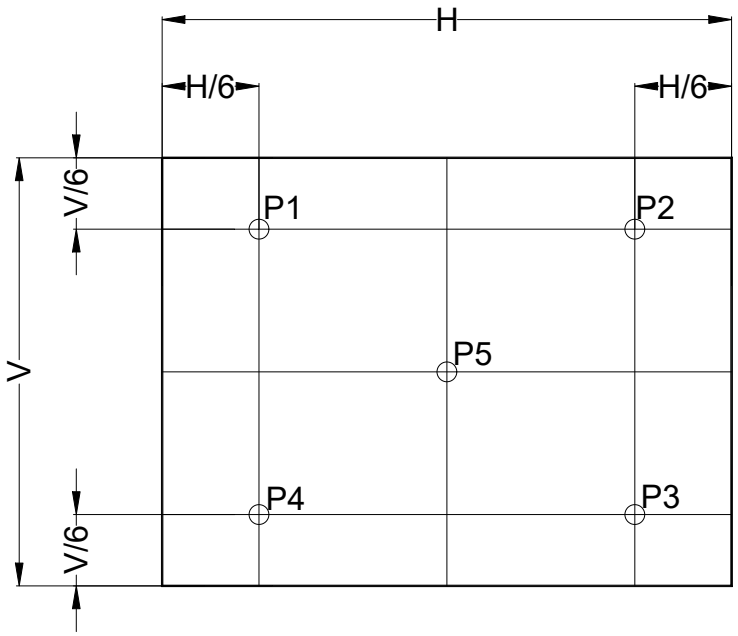



**Fig. 3-a Definition of points**

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 SR-3A or BM-7 or compatible (see Figure 1).

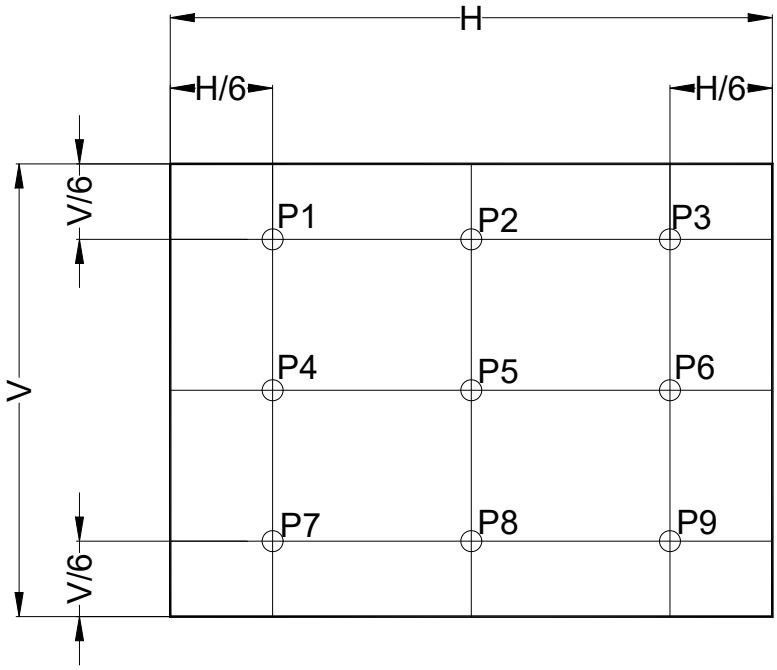



**Fig. 3-b Definition of points**

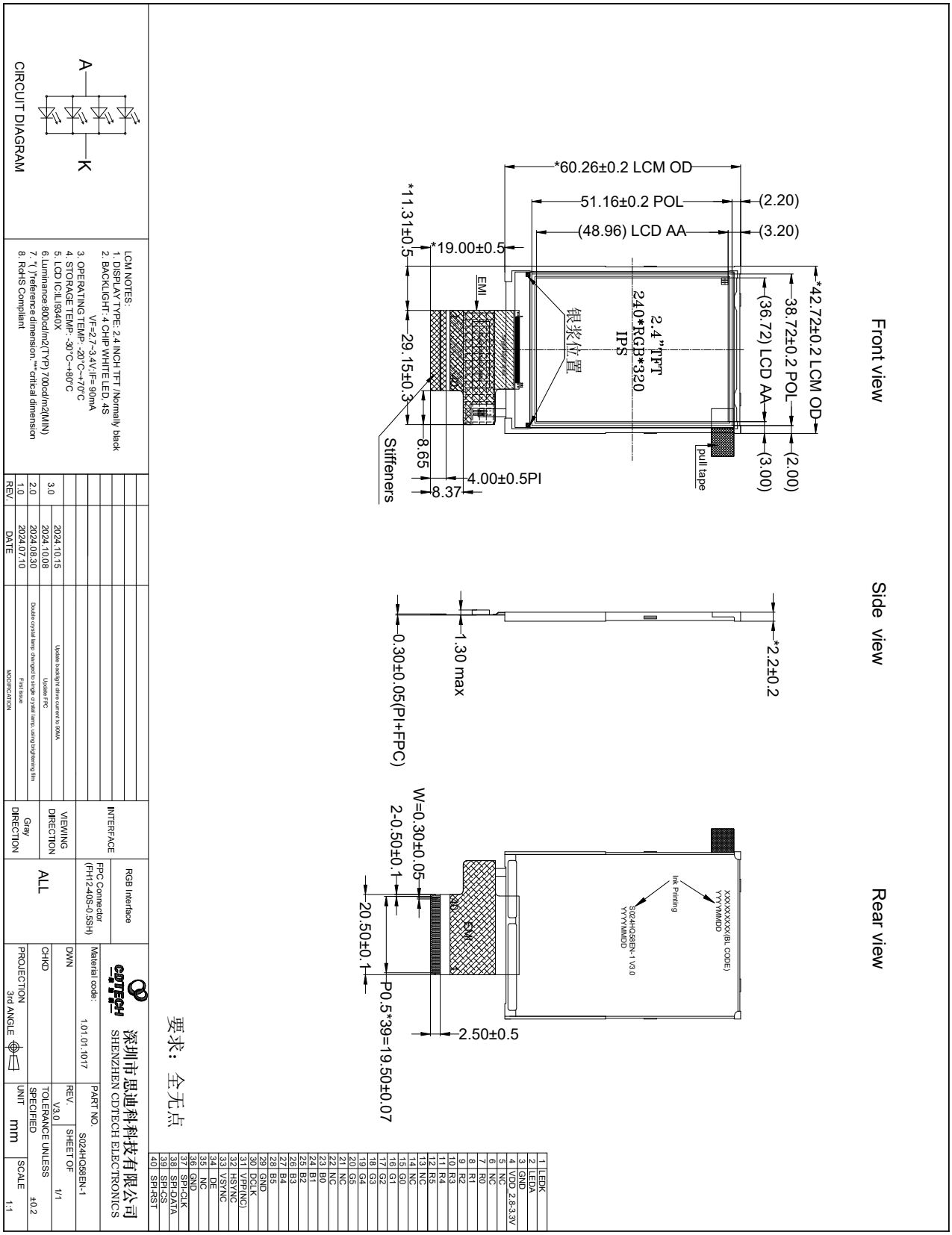
# 7. Reliability Test Items

| 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 (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:

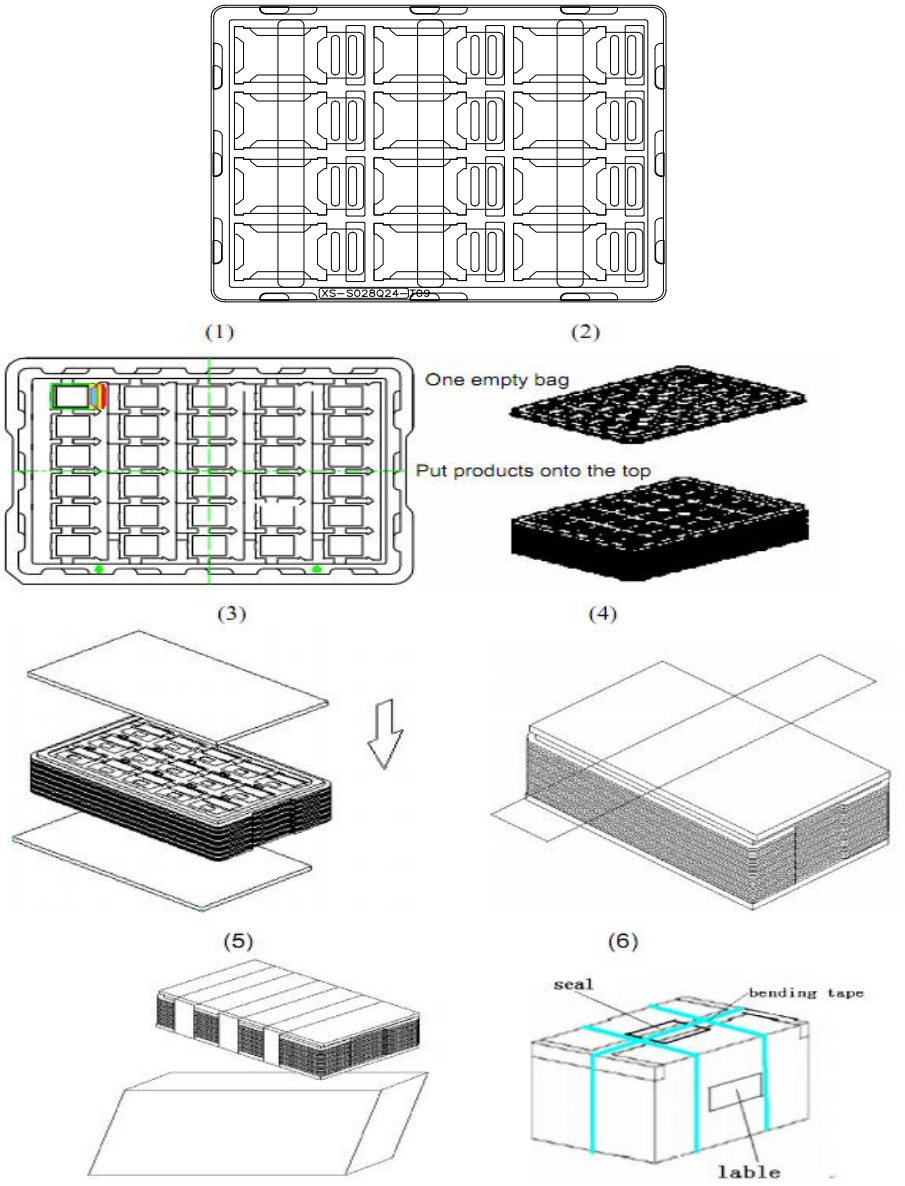
1). Air bubble in the LCD
2). Seal leak or Glass crack
3). Non display or abnormal display
4). Brightness reduction >50%

# 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. Precautions for Use of LCD modules

## 10.1 Handling Precautions

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

10.1.2. 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.

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

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

10.1.5. 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

10.1.6. Do not attempt to disassemble the LCD Module.

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

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

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

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

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

10.1.8.4. 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.

## 10.2 Storage Precautions

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

10.2.2.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%

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

## 10.3 Transportation Precautions

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