深圳市拓普微科技开发有限公司
SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

# LMT050DICFWD-NNC

LCD Module User Manual

| Prepared by: | Checked by: | Approved by: |
|---|---|---|
| **LUJIANHUI** | | |
| Date: 2017-10-26 | Date: | Date: |

| Rev. | Descriptions | Release Date |
|---|---|---|
| 0.1 | Preliminary release | 2017-10-26 |
| | | |
| | | |
| | | |

# Table of Content

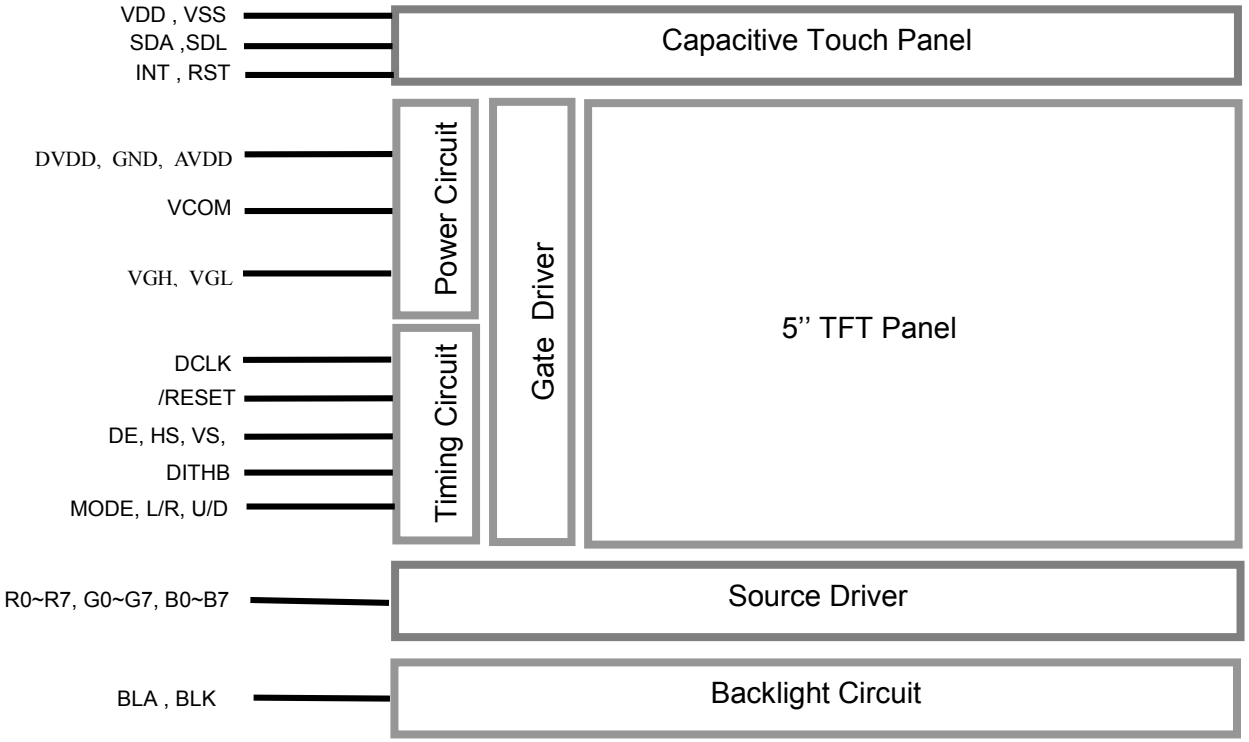
# 1. General Specification

| | |
|---|---|
| Signal Interface : | Digital 24-bits RGB |
| CTP Interface: | $I^2C$ |
| Display Technology : | a-Si TFT active matrix |
| Display Mode : | Normal White, Transmissive |
| Screen Size(Diagonal) : | 5.0” |
| Outline Dimension : | 120.7 x 76.3 x 4.75 (mm)<br>(see attached drawing for details) |
| Active Area : | 108 x 64.8 (mm) |
| Number of dots : | 800 x 3(RGB) x 480 |
| Pixel Pitch : | 0.045 x 0.135 (mm) |
| Pixel Configuration : | RGB Stripe |
| Backlight : | LED |
| Surface Treatment : | Anti-Glare Treatment |
| Viewing Direction : | 6 o’clock(Gray scale Inversion) (*1)<br>12 o’clock (*2) |
| Operating Temperature : | -20 ~ +70°C |
| Storage Temperature : | -30 ~ +80°C |
| Touch Panel Type : | Capacitive Touch Panel(*4) |
| Touch points: | 5 points touch |

Note:

*1. For saturated color display content (eg. pure-red, pure-green, pure-blue or pure-colors-combinations).
*2. For “color scales” display content.
*3. Color tone may slightly change by temperature and driving condition.
*4. Applicable cover panel/cover glass thickness = 1.80MAX.(Without air gap)

# 2. Block Diagram



# 3. Terminal Function (Input Terminal)

## 3.1 K1 TFT Input Terminal

| Pin No. | Pin Name | I/O | Descriptions |
|---|---|---|---|
| 1 | BLA | Power | Positive Backlight Power Supply |
| 2 | BLA | | |
| 3 | BLK | Power | Negative Backlight Power Supply |
| 4 | BLK | | |
| 5 | GND | Power | Power GND (0V) |
| 6 | VCOM | Power | Common voltage |
| 7 | DVDD | Power | Power for Digital Circuit |
| 8 | MODE | Input | DE/SYNC mode select (*1) |
| 9 | DE | Input | Data input enable |
| 10 | VS | Input | Vertical Sync Input |
| 11 | HS | Input | Horizontal Sync Input |
| 12 | B7 | Input | 8bit Data for Blue |
| : | : | | |
| 19 | B0 | | |
| 20 | G7 | Input | 8bit Data for Green |
| : | : | | |
| 27 | G0 | | |
| 28 | R7 | Input | 8bit Data for Red |
| : | : | | |
| 35 | R0 | | |
| 36 | GND | Power | Power GND (0V) |
| 37 | DCLK | Input | Sample clock(*2) |
| 38 | GND | Power | Power GND (0V) |
| 39 | L/R | Input | Left / right selection (*3) |
| 40 | U/D | Input | Up/down selection (*3) |
| 41 | VGH | Power | Gate ON Voltage |
| 42 | VGL | Power | Gate OFF Voltage |
| 43 | AVDD | Power | Power for Analog Circuit |
| 44 | /RESET | Input | Global reset pin (*4) |
| 45 | NC | - | No connection |
| 46 | VCOM | Power | Common Voltage |
| 47 | DITHB | Input | Dithering function (*5) |
| 48 | GND | Power | Power GND (0V) |
| 49 | NC | - | No connection |
| 50 | NC | | |

Note:

* 1: DE/SYNC mode select. Normally pull high.
  When select DE mode, MODE="1", VS and HS must pull high.
  When select SYNC mode, MODE= "0", DE must be grounded.
* 2: Data shall be latched at the falling edge of DCLK.
* 3: Selection of scanning mode

| Setting of scan control input | | Scanning direction |
|---|---|---|
| U/D | L/R | |
| DVDD | DVDD | Up to down, left to right (normal) |
| GND | GND | Down to up, right to left |
| DVDD | GND | Up to down, right to left |
| GND | DVDD | Down to up, left to right |

*4: Global reset pin. Active low to enter reset state. Suggest to connect with an RC reset circuit for stability. Normally pull high.
*5: Dithering function enable control, normally pull high.
When DITHB=" 1",Disable internal dithering function.
When DITHB=" 0",Enable internal dithering function.

### 3.2 K2 CTP Input Terminal

| Pin No | Pin Name | I/O | Descriptions |
|---|---|---|---|
| 1 | /RST | P | Global reset pin, active low reset |
| 2 | VDD | P | Power supply |
| 3 | VSS | P | Ground |
| 4 | /INT | I | Interrupt signal, active low Interrupt |
| 5 | SDA | I/O | $I^2C$ data |
| 6 | SDL | I | $I^2C$ clock |

Note

*1.Note:The capacitance touch drive IC is GT911.

## 4. Absolute Maximum Ratings

| Items | Symbol | Min. | Max. | Unit | Condition |
|---|---|---|---|---|---|
| Power voltage | VDD | -0.3 | 3.6 | V | |
| | DVDD | -0.3 | 3.6 | V | |
| | AVDD | -0.5 | 13.5 | V | |
| | VGH | -0.3 | 42.0 | V | |
| | VGL | -20.0 | 0.3 | V | |
| | VGH-VGL | - | 40.0 | V | |
| Operating Temperature | $T_{OP}$ | -20 | 70 | °C | No Condensation |
| Storage Temperature | $T_{ST}$ | -30 | 80 | °C | No Condensation |

Note:

*1. This rating applies to all parts of the module. And should not be exceeded.

*2. The operating temperature only guarantees operation of the circuit. The contrast, response speed, and the other specification related to electro-optical display quality is determined at the room temperature, $T_{OP}$=25.

*3. Ambient temperature when the backlight is lit (reference value)

*4. Any Stresses exceeding the Absolute Maximum Ratings may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

# 5. Electrical Characteristics

## 5.1 DC Characteristics

GND=0V, Ta = 25℃

| Items | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Power voltage | VDD | 3.0 | 3.3 | 3.6 | V | |
| | DVDD | 3.0 | 3.3 | 3.6 | V | *2 |
| | AVDD | 10.2 | 10.4 | 10.6 | V | |
| | VGH | 15.3 | 16.0 | 16.7 | V | |
| | VGL | -6.7 | -6.0 | -5.3 | V | |
| Input signal voltage | VCOM | 3.09 | 4.09 | 5.09 | V | *4 |
| Input logic high voltage | $V_{IH}$ | 0.7 DVDD | - | DVDD | V | *3 |
| Input logic low voltage | $V_{IL}$ | 0 | - | $0.3DV_{DD}$ | V | |

Note:

*1. Be sure to apply DVDD and VGL to the LCD first, and then apply VGH.
*2: DVDD setting should match the signals output voltage (refer to Note 3) of customer's system board.
*3: DCLK,HS,VS,RESET,U/D, L/R,DE,R0~R7,G0~G7,B0~B7,MODE,DITHB.
*4: Typical Vcom is only a reference value.It must be optimized according to each LCM.Please use VR and base on below application circuit.

## 5.2 Current Consumption

GND=0V, Ta = 25℃

| Items | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Current for Driver | $I_{VDD}$ | - | 20 | 40 | mA | VDD=3.3V |
| | $I_{GH}$ | - | 0.50 | 1.0 | mA | VGH = 16.0V |
| | $I_{GL}$ | - | 0.54 | 1.0 | mA | VGL= -6.0V |
| | $I_{DVDD}$ | - | 4.2 | 10 | mA | DVDD=3.3V |
| | $I_{AVDD}$ | - | 19 | 50 | mA | AVDD=10.4V |

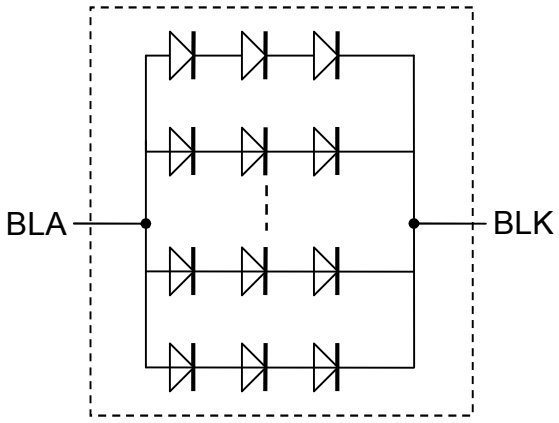
## 5.3 LED Backlight Circuit Characteristics

Top=25℃

| Items | Symbol | MIN. | TYP. | MAX. | Unit | Note |
|---|---|---|---|---|---|---|
| Forward Voltage | $V_F$ | 8.6 | 9.6 | 10.2 | V | If=120mA |
| Forward Current | $I_F$ | - | 120.0 | - | mA | |

Note:

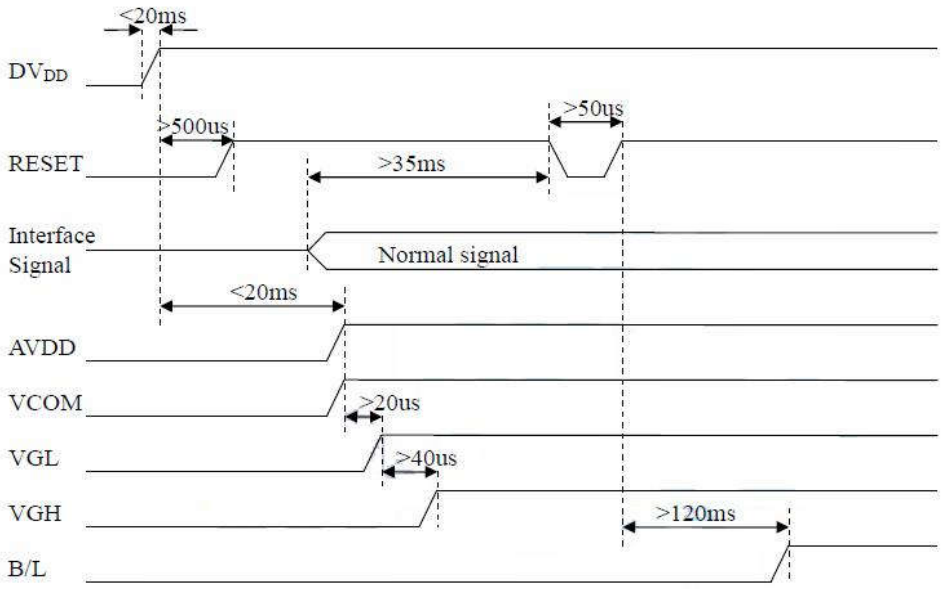
*1. The LED driving condition is defined for total backlight consumption, and which depend on Forward Current setting.



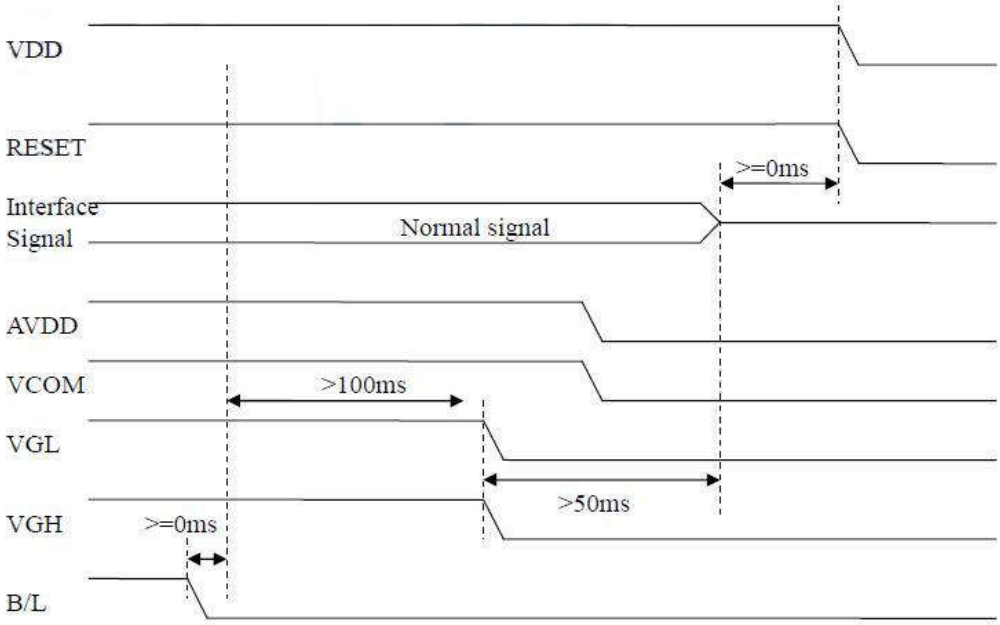

No. of LED = 6x3=18 pcs

## 5.4 Power Sequence

POWER ON




POWER OFF



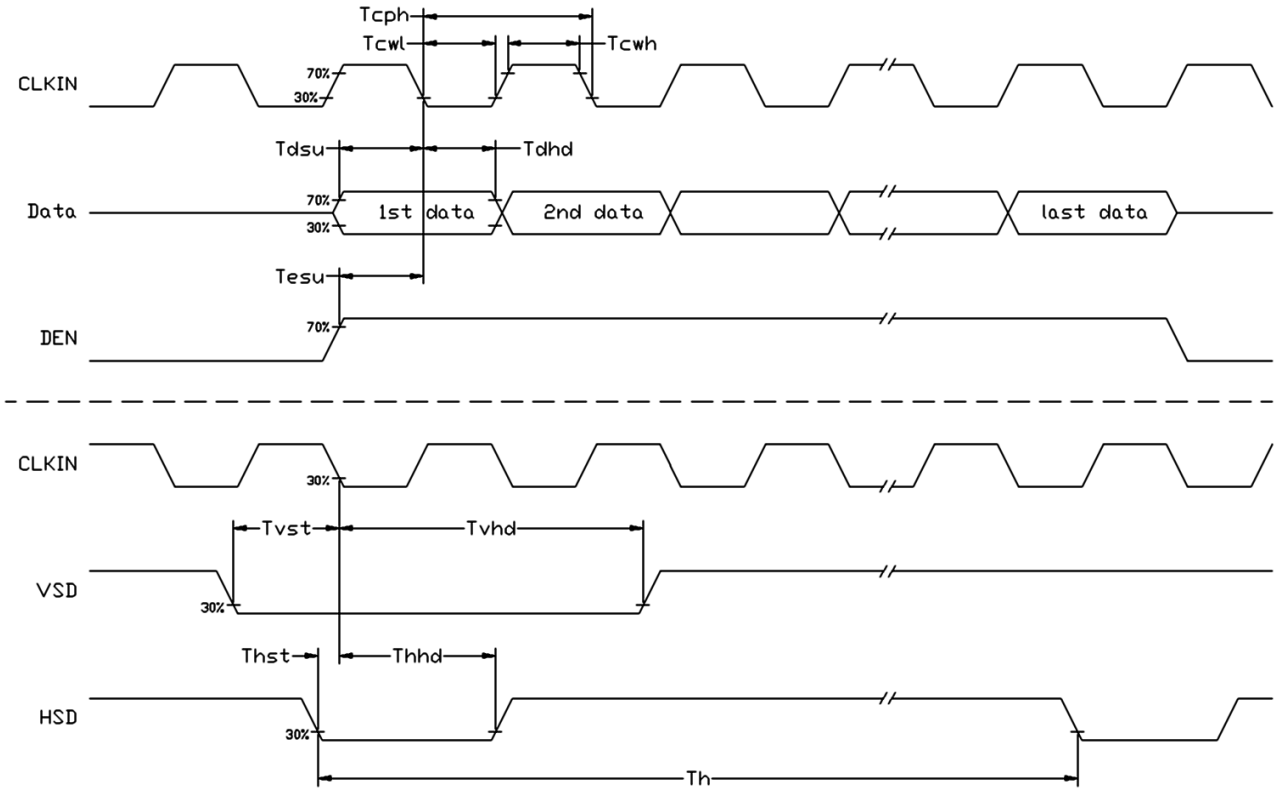
# 6. AC Characteristics

## 6.1 Timing Characteristics

| Item | Symbol | MIN. | TYP. | MAX. | Unit | Remark |
|---|---|---|---|---|---|---|
| HS setup time | Thst | 8 | - | - | ns | |
| HS hold time | Thhd | 8 | - | - | ns | |
| VS setup time | Tvst | 8 | - | - | ns | |
| VS hold time | Tvhd | 8 | - | - | ns | |
| Data setup time | Tdsu | 8 | - | - | ns | |
| Data hole time | Tdhd | 8 | - | - | ns | |
| DE setup time | Tesu | 8 | - | - | ns | |
| DVDD Power On Slew rate | TPOR | - | - | 20 | ms | From 0 to 90% DVDD |
| DCLK cycle time | Tcph | 20 | - | - | ns | |
| DCLK pulse duty | Tcwh | 40 | 50 | 60 | % | |

Note: For the details of the timing, please see the Driver IC data sheet.

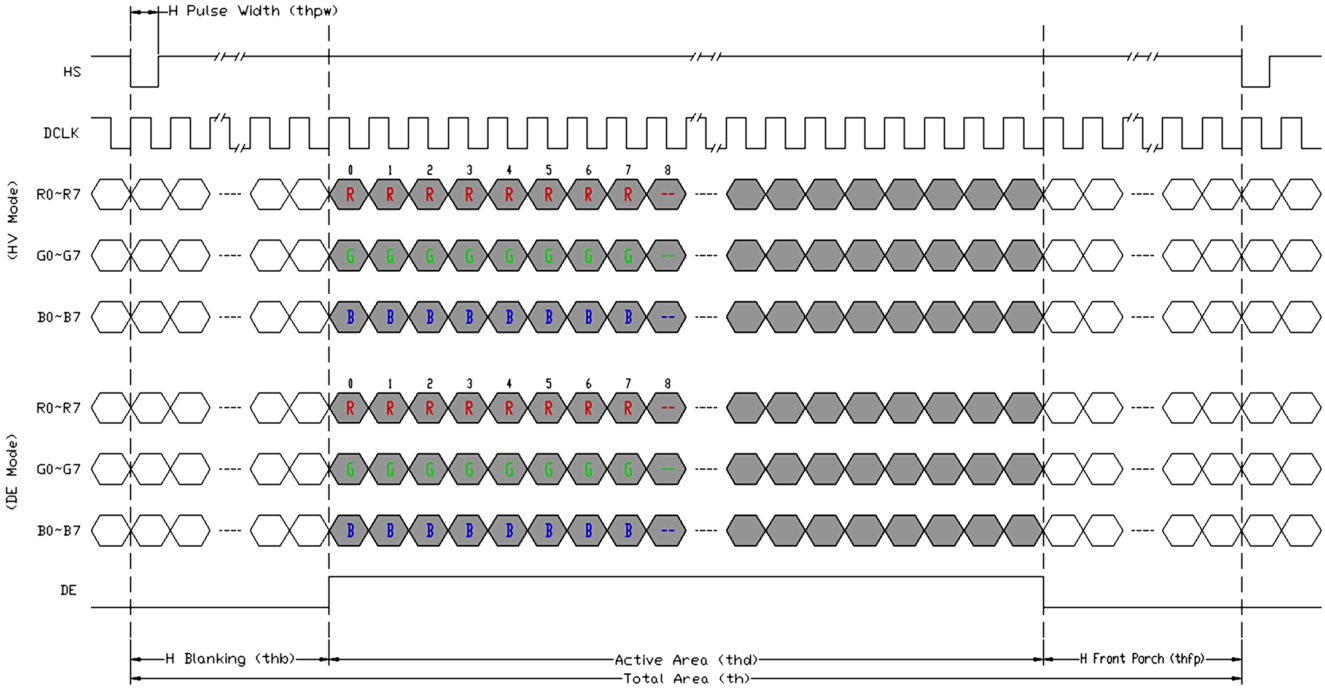
## 6.2 Input Clock and Data Timing Diagram



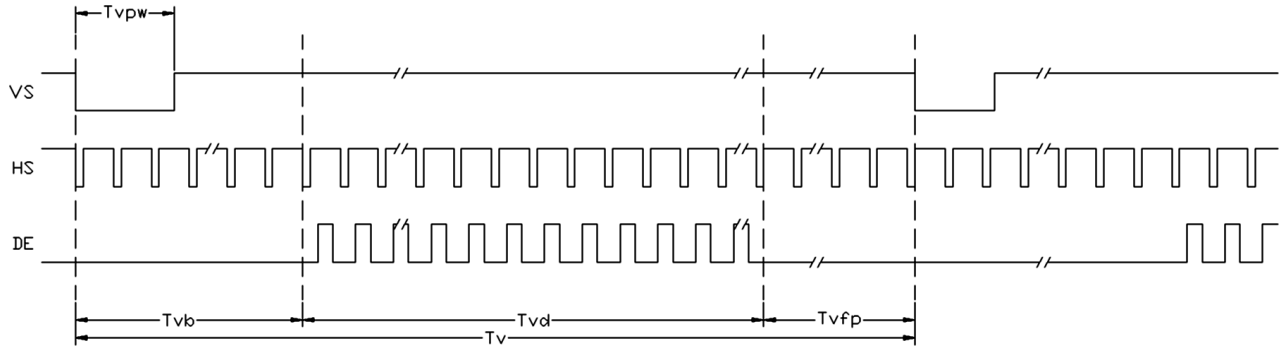
## 6.3 Timing

| Item | Symbol | MIN. | TYP. | MAX. | Unit | Remark |
|---|---|---|---|---|---|---|
| Horizontal Display Area | thd | - | 800 | - | DCLK | |
| DCLK Frequency | fclk | 26.4 | 33.3 | 46.8 | MHz | |
| One Horizontal Line | th | 862 | 1056 | 1200 | DCLK | |
| HS pulse width | thpw | 1 | - | 40 | DCLK | |
| HS Blanking | thb | 46 | 46 | 46 | DCLK | |
| HS Front Porch | thfp | 16 | 210 | 354 | DCLK | |
| Vertical Display Area | tvd | - | 480 | - | TH | |
| VS period time | tv | 510 | 525 | 650 | TH | |
| VS pulse width | tvpw | 1 | - | 20 | TH | |
| VS Blanking | tvb | 23 | 23 | 23 | TH | |
| VS Front Porch | tvfp | 7 | 22 | 147 | TH | |

## 6.4 Data Input Format




**Horizontal input timing diagram.**

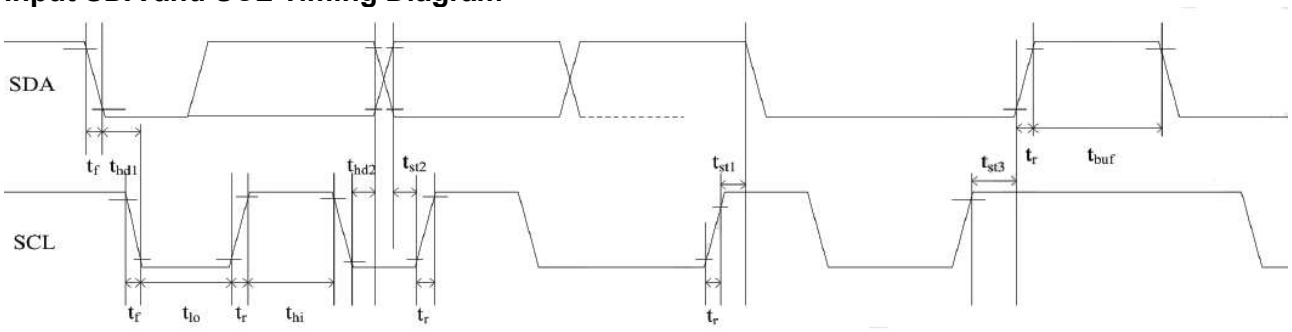



Vertical input timing diagram.

### 6.5 I²C Timing Characteristics(CTP)

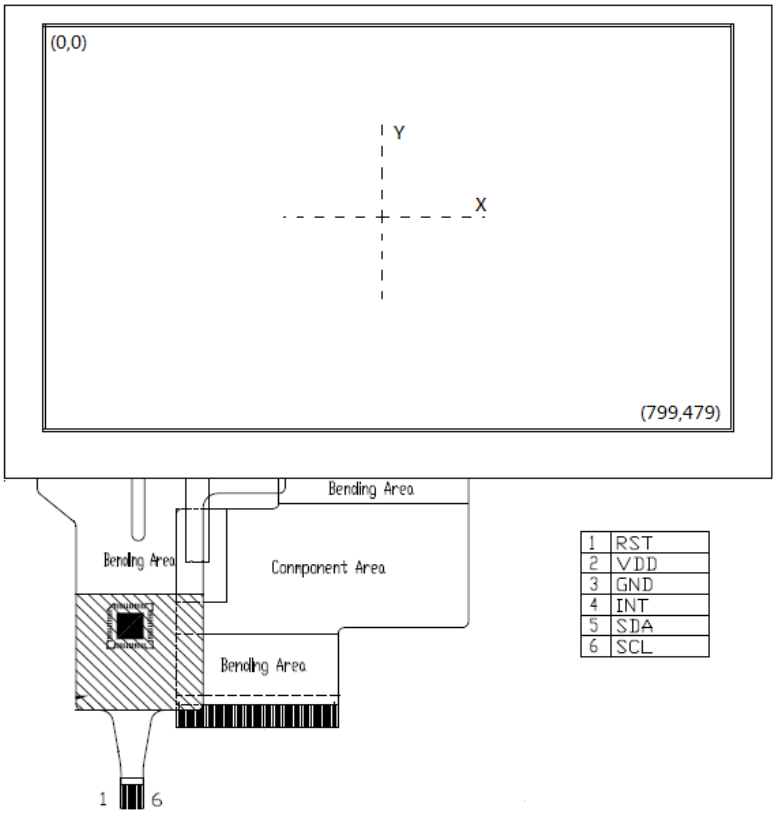
| Item | Symbol | MIN. | MAX. | Unit | Remark |
|---|---|---|---|---|---|
| SCL low period | tlo | 1.3 | - | us | |
| SCL high period | thi | 0.6 | - | us | |
| SCL setup time for Start condition | tst1 | 0.6 | - | us | |
| SCL setup time for Stop condition | tst3 | 0.6 | - | us | |
| SCL hold time for Start condition | thd1 | 0.6 | - | us | |
| SDA setup time | tst2 | 0.1 | - | us | |
| SDA hold time | thd2 | 0 | - | us | |

**Input SDA and SCL Timing Diagram**




# 7. CTP Functional Characteristics

### 7.1 CTP Coordinate

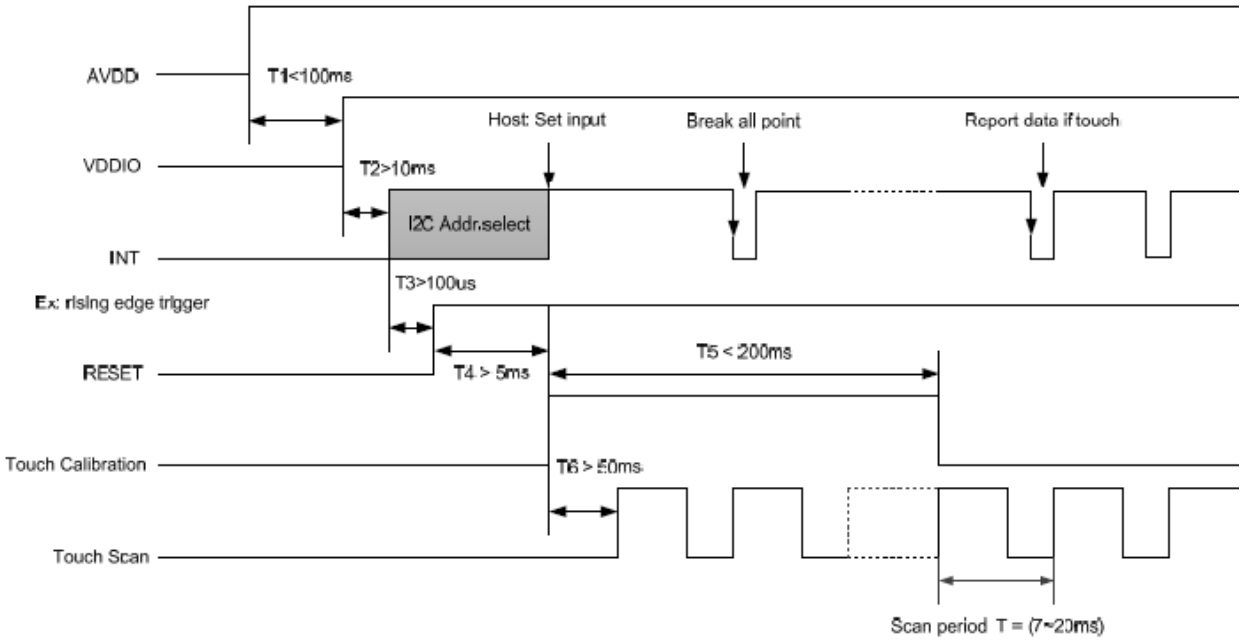



Note: *1: Top left corner is the origin.
* 2: Default resolution 800*480.

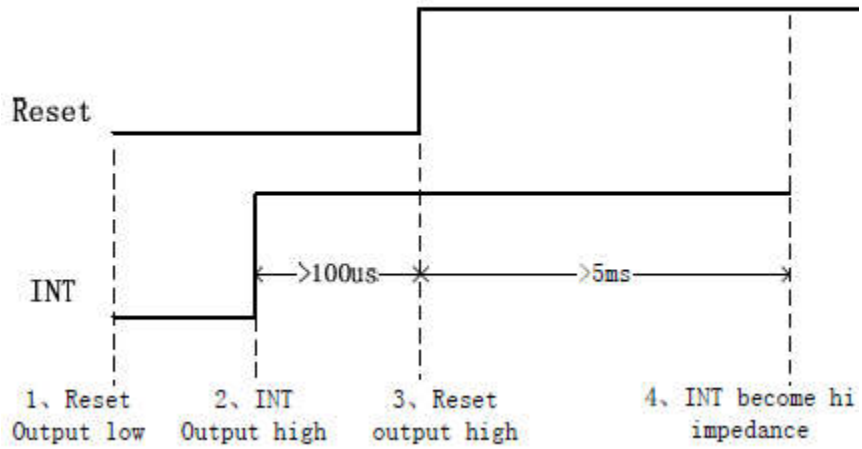
## 7.2 I²C Slave Addresses

CTP has 2 sets of slave address 0xBA/0xBB & 0x28/29. Master can control Reset & INT pin to configure the slave address in power on initial state like following:

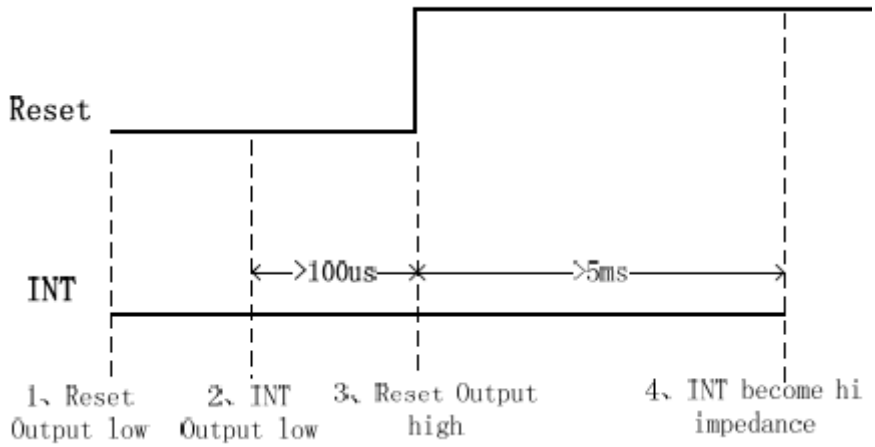
**Power on diagram:**




**Timing for setting slave address to 0x28/0x29:**




**Timing for setting slave address to 0xBA/0xBB:**



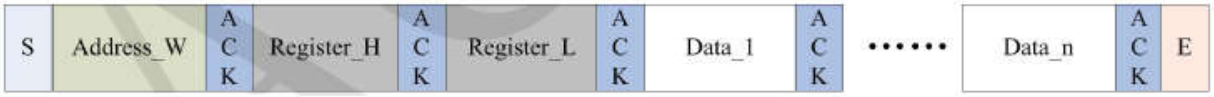
### 7.3 I²C Data Transmission

(For example：device address is 0xBA/0xBB)

1. Communication is always initiated by the host. Valid Start condition is signaled by pulling SDA linefrom "high" to "low" when SCL line is "high". Data flow or address is transmitted after the Startcondition.
2. All slave devices connected to I2C bus should detect the 8-bit address issued after Start condition and send the correct ACK. After receiving matching address, GT911 acknowledges by configuring SDA line as output port and pulling SDA line low during the ninth SCL cycle. When receiving unmatchedaddress, namely, not 0XBA or 0XBB, GT911 will stay in an idle state.
3. For data bytes on SDA, each of 9 serial bits will be sent on nine SCL cycles. Each data byte consists.of 8 valid data bits and one ACK or NACK bit sent by the recipient. The data transmission is valid when SCL line is "high".
4. When communication is completed, the host will issue the STOP condition. Stop condition implies the.transition of SDA line from "low" to "high" when SCL line is "high".

**CTP I²C Data Write**

(For example：device address is 0xBA/0xBB)

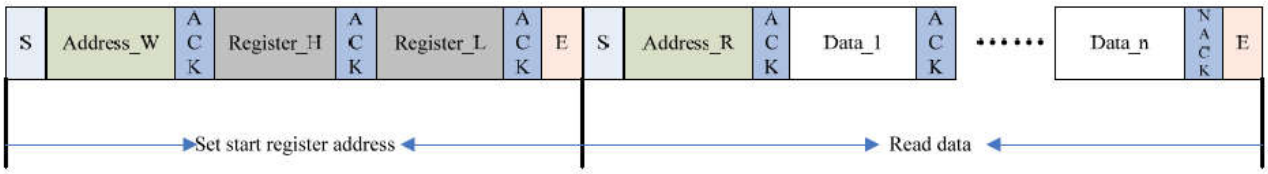



**Timing for Write Operation**

1. The diagram above displays the timing sequence of the host writing data onto GT911. First, the host issues a Start condition. Then, the host sends 0XBA (address bits and R/W bit; R/W bit as 0 indicates Write operation) to the slave device.
2. After receiving ACK, the host sends the 16-bit register address (where writing starts) and the 8-bit data bytes (to be written onto the register).
3. The location of the register address pointer will automatically add 1 after every Write Operation. Therefore, when the host needs to perform Write Operations on a group of registers of continuous addresses, it is able to write continuously. The Write Operation is terminated when the host issues the Stop condition.

**CTP I²C Data Read**

(For example：device address is 0xBA/0xBB)




**Read operations**

1. The diagram above is the timing sequence of the host reading data from GT911. First, the host issues.a Start condition and sends 0XBA (address bits and R/W bit; R/W bit as 0 indicates Write operation) to the slave device.
2. After receiving ACK, the host sends the 16-bit register address (where reading starts) to the slave device. Then the host sets register addresses which need to be read.
3. Also after receiving ACK, the host issues the Start condition once again and sends 0XBB (Read Operation). After receiving ACK, the host starts to read data.
4. GT911 also supports continuous Read Operation and, by default, reads data continuously. Whenever.receiving a byte of data, the host sends an ACK signal indicating successful reception. After receiving.the last byte of data, the host sends a NACK signal followed by a STOP condition which terminates communication.

### 7.4 CTP Register Data Transmission

**Register Table**

| Register | Access | Descriptions |
|---|---|---|
| 0x8140 | R | Product ID ( first byte，ASCII ) |
| 0x8141 | R | Product ID ( second byte，ASCII ) |
| 0x8142 | R | Product ID ( third byte，ASCII ) |
| 0x8143 | R | Product ID ( forth byte，ASCII ) |
| 0x8144 | R | Firmware version ( HEX.low byte ) |
| 0x8145 | R | Firmware version ( HEX.high byte ) |
| 0x8146 | R | x coordinate resolution ( low byte ) |
| 0x8147 | R | x coordinate resolution ( high byte ) |
| 0x8148 | R | y coordinate resolution ( low byte ) |
| 0x8149 | R | y coordinate resolution ( high byte ) |
| 0x814A | R | Vendor_id ( current module option information ) |
| 0x814B | R | Reserved |
| 0x814C | R | Reserved |
| 0x814D | R | Reserved |
| 0x814E | R/W | D[7,6]: buffer status<br>D[5,4]: large detect<br>D[3,2]: reserved<br>D[1,0]: number of touch points |
| 0x814F | R | track id |
| 0x8150 | R | point 1 x coordinate (low byte) |
| 0x8151 | R | point 1 x coordinate (high byte) |
| 0x8152 | R | point 1 y coordinate (low byte) |
| 0x8153 | R | point 1 y coordinate (high byte) |
| 0x8154 | R | Point 1 size (low byte) |
| 0x8155 | R | point 1 size (high byte) |
| 0x8156 | R | Reserved |
| 0x8157 | R | track id |
| 0x8158 | R | point 2 x coordinate (low byte) |
| 0x8159 | R | point 2 x coordinate (high byte) |
| 0x815A | R | point 2 y coordinate (low byte) |
| 0x815B | R | point 2 y coordinate (high byte) |
| 0x815C | R | point 2 size (low byte) |
| 0x815D | R | point 2 size (high byte) |
| 0x815E | R | Reserved |
| 0x815F | R | track id |
| 0x8160 | R | point 3 x coordinate (low byte) |
| 0x8161 | R | point 3 x coordinate (high byte) |
| 0x8162 | R | point 3 y coordinate (low byte) |
| 0x8163 | R | point 3 y coordinate (high byte) |
| 0x8164 | R | point 3 size (low byte) |
| 0x8165 | R | point 3 size (high byte) |

| Register | Access | Descriptions |
|---|---|---|
| 0x8166 | R | Reserved |
| 0x8167 | R | track id |
| 0x8168 | R | point 4 x coordinate (low byte) |
| 0x8169 | R | point 4 x coordinate (high byte) |
| 0x816A | R | point 4 y coordinate (low byte) |
| 0x816B | R | point 4 y coordinate (high byte) |
| 0x816C | R | point 4 size (low byte) |
| 0x816D | R | point 4 size (high byte) |
| 0x816E | R | Reserved |
| 0x816F | R | track id |
| 0x8170 | R | point 5 x coordinate (low byte) |
| 0x8171 | R | point 5 x coordinate (high byte) |
| 0x8172 | R | point 5 y coordinate (low byte) |
| 0x8173 | R | point 5 y coordinate (high byte) |
| 0x8174 | R | point 5 size (low byte) |
| 0x8175 | R | point 5 size (high byte) |
| 0x8176 | R | Reserved |
| 0x8177 | R | Reserved |

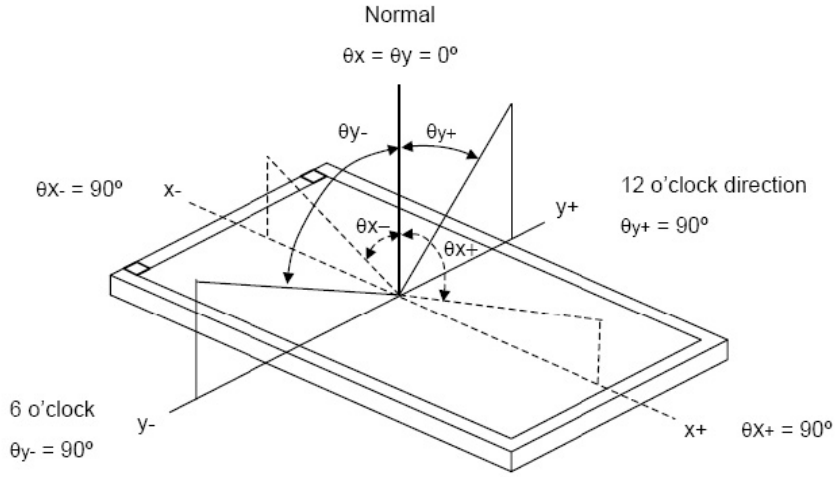
Note:Please refer to C911 IC datasheet for detail

# 8. Optical Characteristics

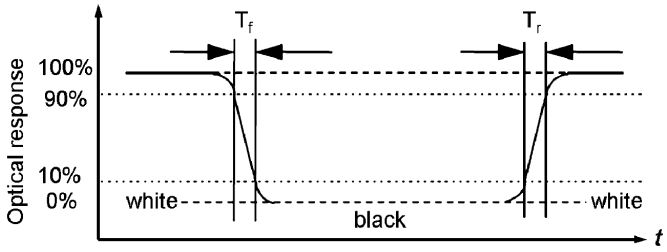
| Item | Symbol | Condition | MIN. | TYP. | MAX. | UNIT | Note. |
|---|---|---|---|---|---|---|---|
| Viewing angle (CR⩾10) | $\theta_L$ | 9 o'clock | 60 | 70 | - | degree | *2 |
| | $\theta_R$ | 3 o'clock | 60 | 70 | - | | |
| | $\theta_T$ | 12 o'clock | 40 | 50 | - | | |
| | $\theta_B$ | 6 o'clock | 60 | 70 | - | | |
| Response Time | $T_f$ | Normal θ=0° | - | 10 | 20 | msec | *3 |
| | $T_r$ | | - | 15 | 30 | msec | |
| Contrast ratio | CR | | 400 | 500 | - | - | *1 |
| Color chromaticity | $W_X$ | | 0.26 | 0.31 | 0.36 | - | |
| | $W_Y$ | | 0.28 | 0.33 | 0.38 | - | |
| Luminance | L | | - | 650 | - | cd/m$^2$ | *4 |
| Luminance uniformity | $Y_U$ | | 70 | 75 | - | % | *4 |

Note:
*1. Definition of Contrast Ratio
The contrast ratio could be calculate by the following expression:
Contrast Ratio (CR) = Luminance with all pixels white / Luminance with all pixels black

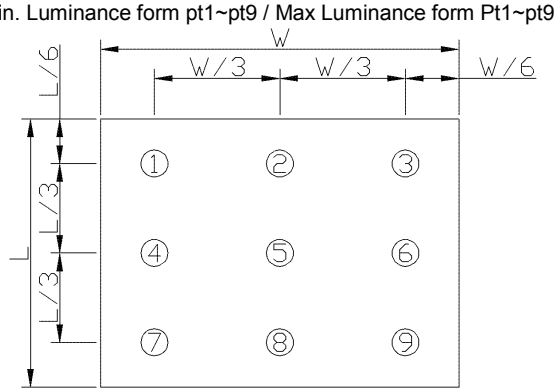
*2 Definition of Viewing Angle




*3 Definition of response time




*4 Definition of Luminance Uniformity
Luminance uniformity (Lu)=
Min. Luminance form pt1~pt9 / Max Luminance form Pt1~pt9



# 9. Precautions of using LCD Modules

**Mounting**

- Mounting must use holes arranged in four corners or four sides.
- The mounting structure so provide even force on to LCD module. Uneven force (ex. Twisted stress) should not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- It is suggested to attach a transparent protective plate to the surface in order to protect the polarizer. It should have sufficient strength in order to the resist external force.
- The housing should adopt radiation structure to satisfy the temperature specification.
- Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. Never rub with dust clothes with chemical treatment. Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics deteriorate the polarizer.)
- When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzine. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer

**Operating**

- The spike noise causes the mis-operation of circuits. It should be within the ±200mV level (Over and under shoot voltage)
- Response time depends on the temperature.(In lower temperature, it becomes longer.)
- Brightness depends on the temperature. (In lower temperature, it becomes lower.) And in lower temperature, response time(required time that brightness is stable after turned on) becomes longer.
- Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- When fixed patterns are displayed for a long time, remnant image is likely to occur.
- Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference

**Electrostatic Discharge Control**

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

**Strong Light Exposure**

Strong light exposure causes degradation of polarizer and color filter.

**Storage**

When storing modules as spares for a long time, the following precautions are necessary.

- Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
- The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.

**Protection Film**

- When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
- The protection film is attached to the polarizer with a small amount of glue. If some stress is applied to rub the protection film against the polarizer during the time you peel off the film, the glue is apt tore main on the polarizer. Please carefully peel off the protection film without rubbing it against the polarizer.
- When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the polarizer after the protection film is peeled off.
- You can remove the glue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.

**Transportation**

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

附录一：

# CTP Application Precautions

## 1. CTP Mounting Precaution

**1.1** Bezel Mounting (Figure 1)

- The bezel window should be bigger than the CTP active area. It should be≥0.5mm each side.
- Gasket should be installed between the bezel and the CTP surface. The final gap should be about 0.5~1.0mm.
- It is recommended to provide an additional support bracket for backside support when necessary (e.g. slim type TFT module without mounding structure). They should only provide appropriate support and keep the module in place.
- The mounting structure should be strong enough to prevent external uneven force or twist act onto the module.

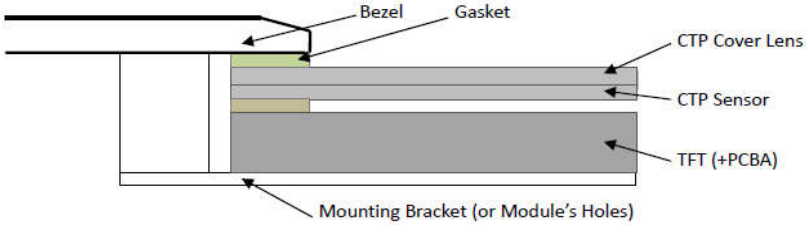



Figure 1

**1.2** Surface Mounting (Figure 2)

- As the CTP assembling on the countersink area with double side adhesive. The countersink area should be flat and clean to ensure the double side adhesive installation result.
- The Bezel is recommend to keep a gap (≥0.3mm each side) around the cover lens for tolerance.
- It is recommended to provide an additional support bracket with gasket for backside support when necessary (e.g. TFT module without mounding structure). They should only provide appropriate support and keep the module in place.
- The mounting structure should be strong enough to prevent external uneven force or twist act onto the module.

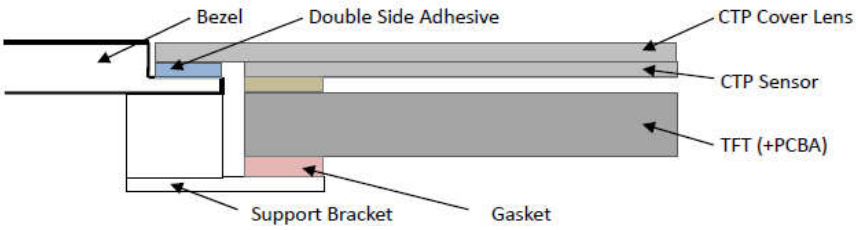



Figure 2

**1.3** Additional Cover Lens Mounting (Figure 3)

- For the case of additional cover Lens mounting, it is necessary to recheck with the CTP specification about the material and thickness to ensure the functionality.
- It should keep a 0.2~0.3mm gap between the cover lens and the CTP surface..
- The cover lens window should be bigger than the active area of the CTP. It should be≥0.5mm each side.
- It is recommended to provide an additional support bracket for backside support when necessary (e.g. slim type TFT module without mounding structure). They should only provide appropriate support and keep the module in place.
- The mounting structure should be strong enough to prevent external uneven force or twist act onto the module.

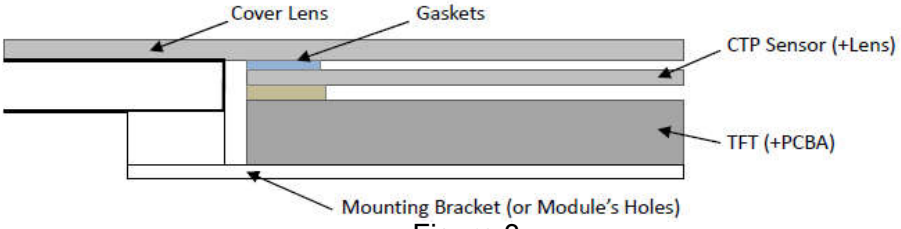



Figure 3

## 2. Handling Precautions

**2.1** The product made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

**2.2** Do not apply excessive or uneven force to the product since this may damage to the performance.

**2.3** 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 Isopropyl alcohol or Ethyl alcohol solvents. Solvents other than those mentioned above may damage the product. Especially, do not use Water, Ketone, Aromatic solvents.

**2.4** Do not attempt to disassemble the CTP Module.

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

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

a. Be sure to ground the body when handling the CTP Modules.

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

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

d. The CTP 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.

## 3. Storage and Transportation Precautions

**3.1** When storing the CTP modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

**3.2** The CTP modules should be stored the required temperature range. If the CTP modules will be stored for a long time, the recommend condition is the temperature of 0~40 ℃ and relative humidity of ≤80%.

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

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