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## 1 General Specifications

|                                   | Feature                         | Spec                   |
|-----------------------------------|---------------------------------|------------------------|
| <b>Display Spec</b>               | Size                            | 2.4 inch               |
|                                   | Resolution                      | 240(RGB) x 320         |
|                                   | Interface                       | CPU 8/16 bits          |
|                                   | Color Depth                     | 262K                   |
|                                   | Technology Type                 | a-Si                   |
|                                   | Pixel Pitch (mm)                | 0.153x0.153            |
|                                   | Pixel Configuration             | R.G.B. Vertical Stripe |
|                                   | Display Mode                    | TM with Normally White |
|                                   | Surface Treatment(Up Polarizer) | Clear Type (3H)        |
|                                   | Surface Treatment(Up TSP)       | Clear Type (3H)        |
|                                   | Viewing Direction               | 6 o'clock              |
|                                   | Gray Scale Inversion Direction  | 12 o'clock             |
| <b>Mechanical Characteristics</b> | LCM (W x H x D) (mm)            | 42.72×60.26×3.55       |
|                                   | Active Area(mm)                 | 36.72x48.96            |
|                                   | With /Without TSP               | With TSP               |
|                                   | Weight (g)                      | 16.8                   |
|                                   | LED Numbers                     | 4 LEDs                 |
| <b>Electronic</b>                 | Driver IC                       | ILI 9328               |

Note 1: Viewing direction for best image quality is different from TFT definition, there is a 180 degree shift.

Note 2: Requirements on Environmental Protection: RoHS

Note 3: LCM weight tolerance: +/- 5%



## 2 Input/Output Terminals

### 2.1 TFT LCD Panel

| No | Symbol  | I/O | Description                      | Remark   |
|----|---------|-----|----------------------------------|----------|
| 1  | DB0     | I   | Data input                       | Note2-1  |
| 2  | DB1     | I   | Data input                       |          |
| 3  | DB2     | I   | Data input                       |          |
| 4  | DB3     | I   | Data input                       |          |
| 5  | GND     | P   | Power ground                     |          |
| 6  | VCC     | P   | Power supply                     |          |
| 7  | /CS     | I   | Chip select                      |          |
| 8  | RS      | I   | Register select                  |          |
| 9  | /WR     | I   | Write strobe                     |          |
| 10 | /RD     | I   | Read strobe                      |          |
| 11 | IM0     | I   | Select the MPU system input mode | Note 2-2 |
| 12 | X+ (XL) | P   | Touch panel left pin             |          |
| 13 | Y+ (YU) | P   | Touch panel up pin               |          |
| 14 | X- (XR) | P   | Touch panel right pin            |          |
| 15 | Y- (YD) | P   | Touch panel down pin             |          |
| 16 | LED-A   | P   | LED anode                        |          |
| 17 | LED-1   | P   | LED cathode                      |          |
| 18 | LED-2   | P   | LED cathode                      |          |
| 19 | LED-3   | P   | LED cathode                      |          |
| 20 | LED-4   | P   | LED cathode                      |          |
| 21 | IM3     | I   | Select the MPU system input mode | Note 2-2 |
| 22 | DB4     | I   | Data Input                       |          |
| 23 | DB10    | I   | Data Input                       |          |
| 24 | DB11    | I   | Data Input                       |          |
| 25 | DB12    | I   | Data Input                       |          |
| 26 | DB13    | I   | Data Input                       |          |
| 27 | DB14    | I   | Data Input                       |          |
| 28 | DB15    | I   | Data Input                       |          |
| 29 | DB16    | I   | Data Input                       |          |
| 30 | DB17    | I   | Data Input                       |          |
| 31 | /RESET  | I   | Reset signal                     |          |
| 32 | VCI     | P   | Power supply                     |          |
| 33 | VCC     | P   | Power supply                     |          |
| 34 | GND     | P   | Power ground                     |          |
| 35 | DB5     | I   | Data Input                       |          |
| 36 | DB6     | I   | Data Input                       |          |
| 37 | DB7     | I   | Data Input                       |          |



Note2-1: I/O definition:

I----Input O----Output P----Power/Ground

Note2-2: Data bits selection reference:

| IM3 | IM0 | Interface Mode              | DB Pin             |
|-----|-----|-----------------------------|--------------------|
| 0   | 0   | i80-system 16-bit interface | DB[17:10], DB[7:0] |
| 0   | 1   | i80-system 8-bit interface  | DB[17:10]          |

### 3 Absolute Maximum Ratings

#### 3.1 Driving TFT LCD Panel

GND=0V, Ta=25°C

| Item                       | Symbol   | Min  | Max     | Unit | Remark       |
|----------------------------|--|------|---------|------|--------------|
| Analog Supply Voltage      | VCI  | -0.3 | 4.6     | V    |              |
| Logic Supply Voltage       | VCC  | -0.3 | 4.6     | V    |              |
| Input Signal Voltage       | DB0~DB7, DB10~DB17,<br>/RESET,/CS,RS,/WR,/RD,<br>IM0,IM3 | -0.3 | VCC+0.3 | V    |              |
| Touch Panel Pin Voltage    | X+(XL), Y+(YU),<br>X-(XR), Y-(YD)                        | --   | 7       | V    |              |
| Back Light Forward Current | I <sub>LED</sub>   | --   | 25      | mA   | For each LED |
| Operating Temperature      | T <sub>OPR</sub>   | -20  | 60      | °C   |              |
| Storage Temperature        | T <sub>STG</sub>   | -30  | 70      | °C   |              |



## 4 Electrical Characteristics

### 4.1 Driving TFT LCD Panel

GND=0V, Ta=25°C

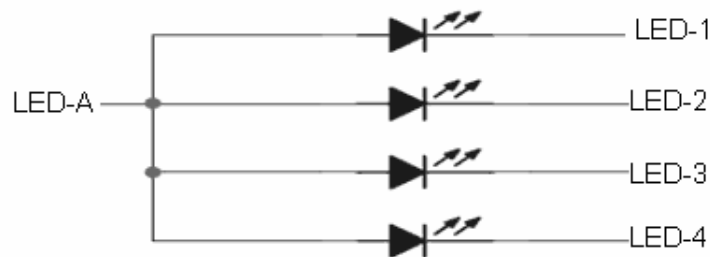
| Item                              | Symbol          | Min             | Typ                 | Max | Unit                | Remark          |  |
|-----------------------------------|-----------------|-----------------|---------------------|-----|---------------------|-----------------|--|
| Analog Supply Voltage             | V <sub>CI</sub> | 2.5             | 2.8                 | 3.3 | V                   |                 |  |
| Logic Supply Voltage              | V <sub>CC</sub> | 1.65            | 2.8                 | 3.3 | V                   |                 |  |
| Input Signal Voltage              | Low Level       | V <sub>IL</sub> | 0                   | --  | 0.2xV <sub>CC</sub> | V               | DB0~DB7, DB10~DB17, /RESET,/CS,RS,/WR,/RD, IM0,IM3 |
|                                   | High Level      | V <sub>IH</sub> | 0.8xV <sub>DD</sub> | --  | V <sub>CC</sub>     |                 |  |
| Output Signal Voltage             | Low Level       | V <sub>OL</sub> | 0                   | --  | 0.2xV <sub>CC</sub> | V               |  |
|                                   | High Level      | V <sub>OH</sub> | 0.8xV <sub>DD</sub> | --  | V <sub>CC</sub>     | V               |  |
| (Panel+ LSI)<br>Power Consumption | Black Mode      | --              | 5.0                 | 7.0 | mA                  | Frame Rate 60Hz |  |
|                                   | Sleeping Mode   | --              | 60                  | 100 | uA                  |                 |  |

### 4.2 Driving Backlight

Ta=25°C

| Item              | Symbol          | Min | Typ | Max | Unit | Remark                   |
|-------------------|-----------------|-----|-----|-----|------|--------------------------|
| Forward Current   | I <sub>F</sub>  | --  | 20  | --  | mA   | For each LED             |
| Forward Voltage   | V <sub>F</sub>  | --  | 3.2 | --  | V    | 4 LEDs<br>( in parallel) |
| Power Consumption | W <sub>BL</sub> | --  | 256 | --  | mW   |                          |

Note1: Figure below shows the connection of backlight LED.

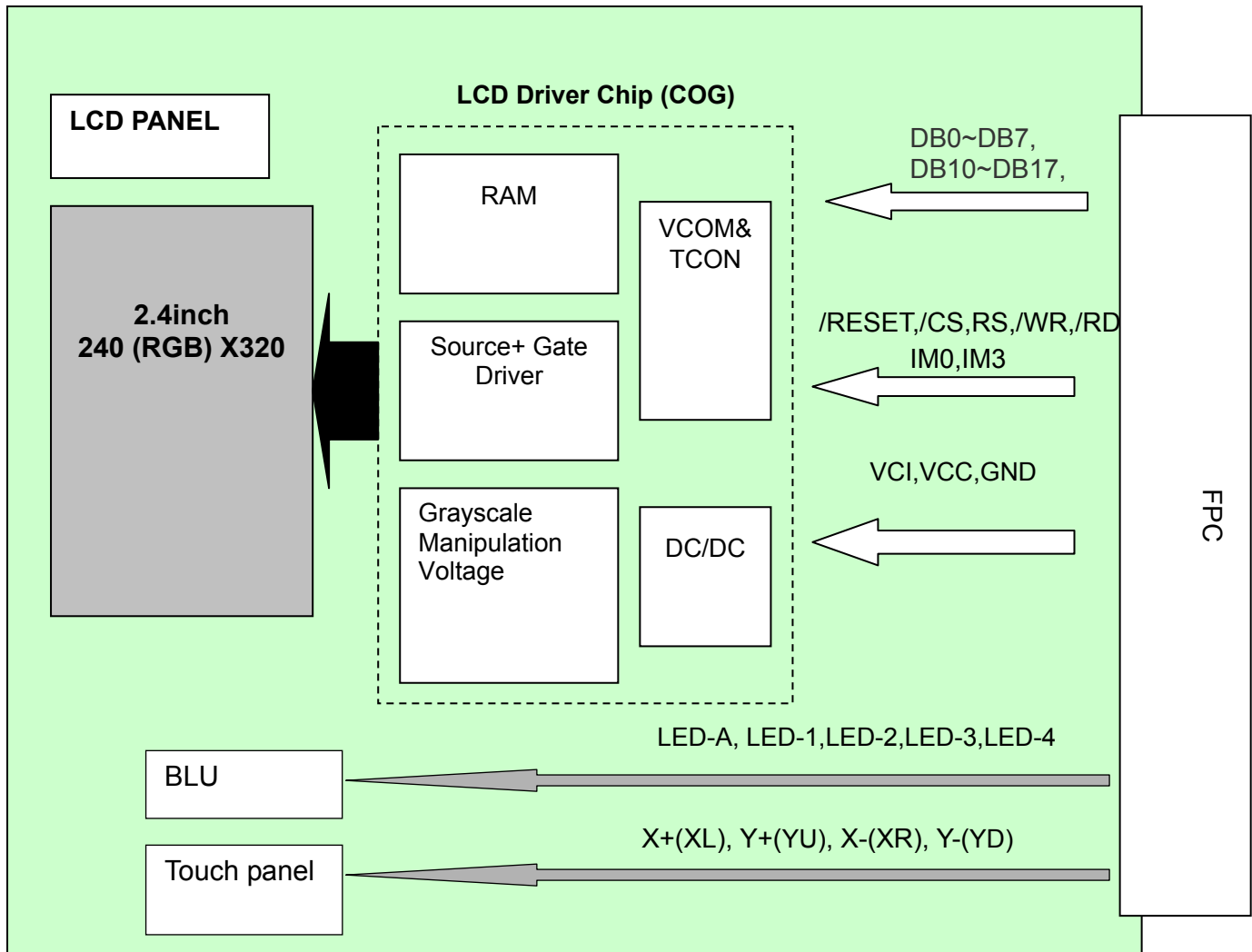


Note 2: One LED: I<sub>F</sub> =20 mA, V<sub>F</sub> =3.2V

Note 3: The Minimum Life of LED : 20,000 hours



4.3 Block Diagram





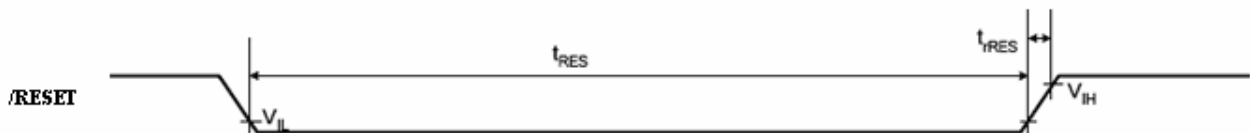
## 5 Timing Chart

### 5.1 Timing Parameter

| Item                          |                            | Symbol            | Unit | Min | Typ | Max | Remark |
|-------------------------------|----------------------------|-------------------|------|-----|-----|-----|--------|
| Bus cycle time                | Write                      | $t_{CYCW}$        | ns   | 100 | -   | -   |        |
|                               | Read                       | $t_{CYCR}$        | ns   | 300 | -   | -   |        |
| Write low-level pulse width   |                            | $PW_{LW}$         | ns   | 50  | -   | 500 |        |
| Write high-level pulse width  |                            | $PW_{HW}$         | ns   | 50  | -   | -   |        |
| Read low-level pulse width    |                            | $PW_{LR}$         | ns   | 150 | -   | -   |        |
| Read high-level pulse width   |                            | $PW_{HR}$         | ns   | 150 | -   | -   |        |
| Write / Read rise / fall time |                            | $t_{WRr}/t_{WRf}$ | ns   | -   | -   | 25  |        |
| Setup time                    | Write ( RS to nCS, E/nWR ) | $t_{AS}$          | ns   | 10  | -   | -   |        |
|                               | Read ( RS to nCS, RW/nRD ) |                   |      | 5   | -   | -   |        |
| Address hold time             |                            | $t_{AH}$          | ns   | 5   | -   | -   |        |
| Write data set up time        |                            | $t_{DSW}$         | ns   | 10  | -   | -   |        |
| Write data hold time          |                            | $t_H$             | ns   | 15  | -   | -   |        |
| Read data delay time          |                            | $t_{DDR}$         | ns   | -   | -   | 100 |        |
| Read data hold time           |                            | $t_{DHR}$         | ns   | 5   | -   | -   |        |

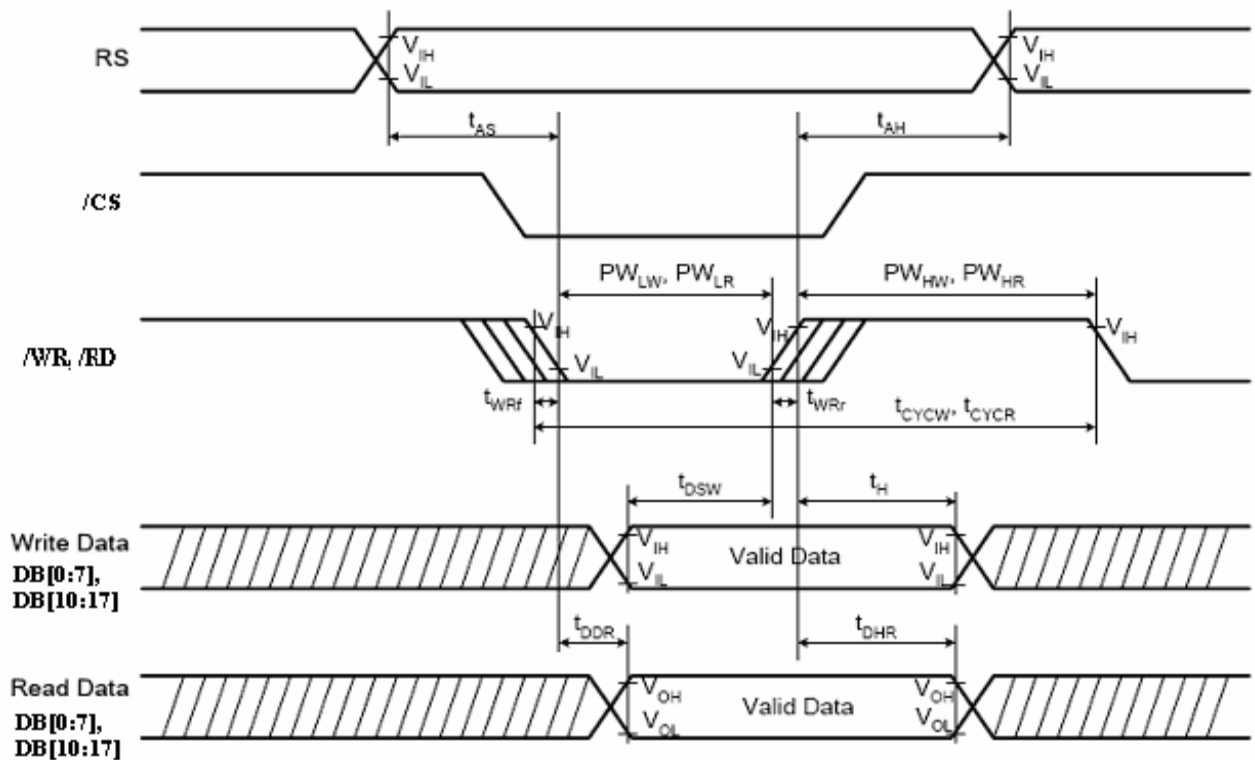
### Reset timing characteristics

| Item                  | Symbol     | Unit    | Min | Typ | Max |
|-----------------------|------------|---------|-----|-----|-----|
| Reset low-level width | $t_{RES}$  | ms      | 1   | -   | -   |
| Reset rise time       | $t_{rRES}$ | $\mu s$ | -   | -   | 10  |





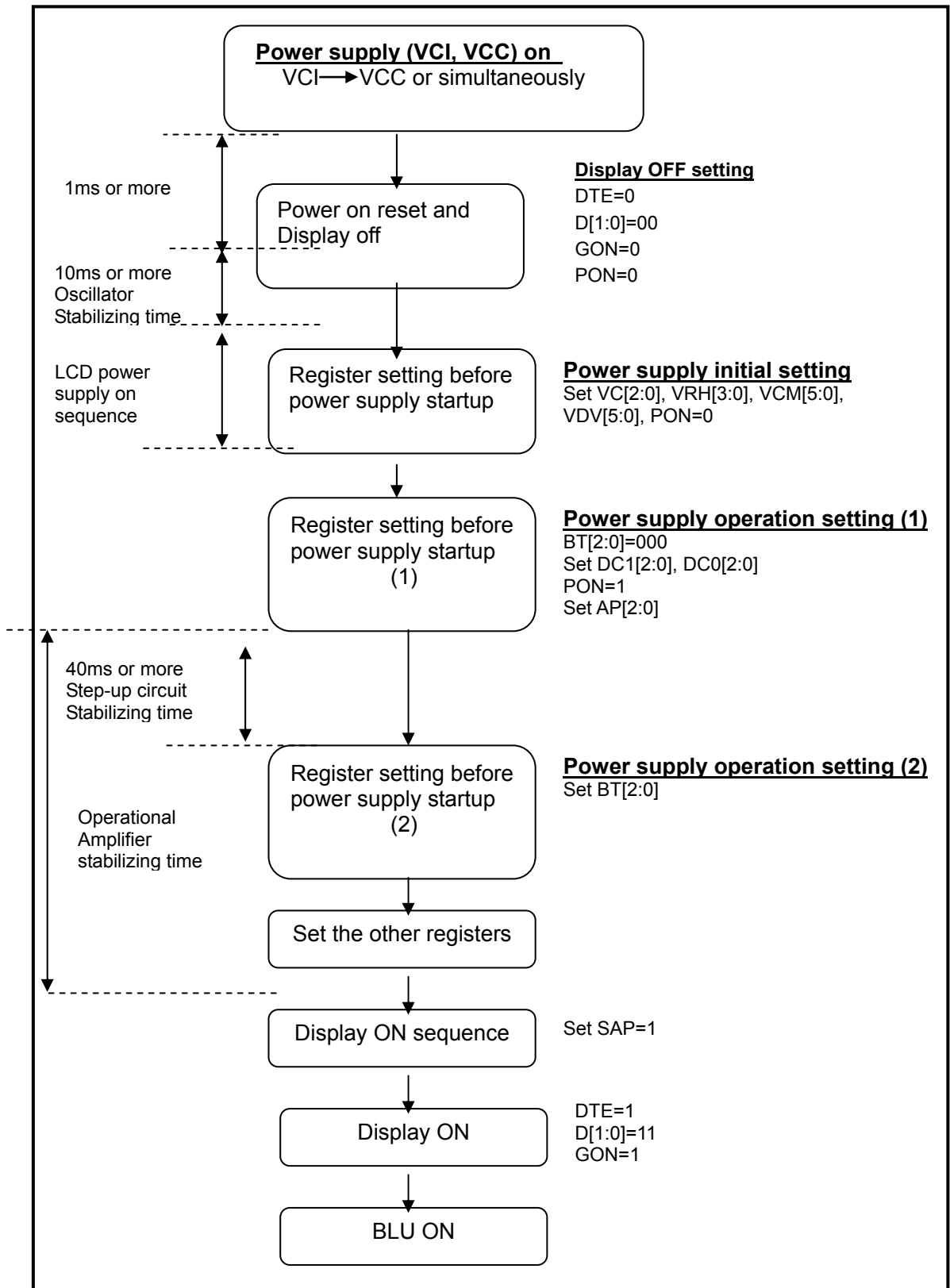
5.2 Register Write/Read Timing





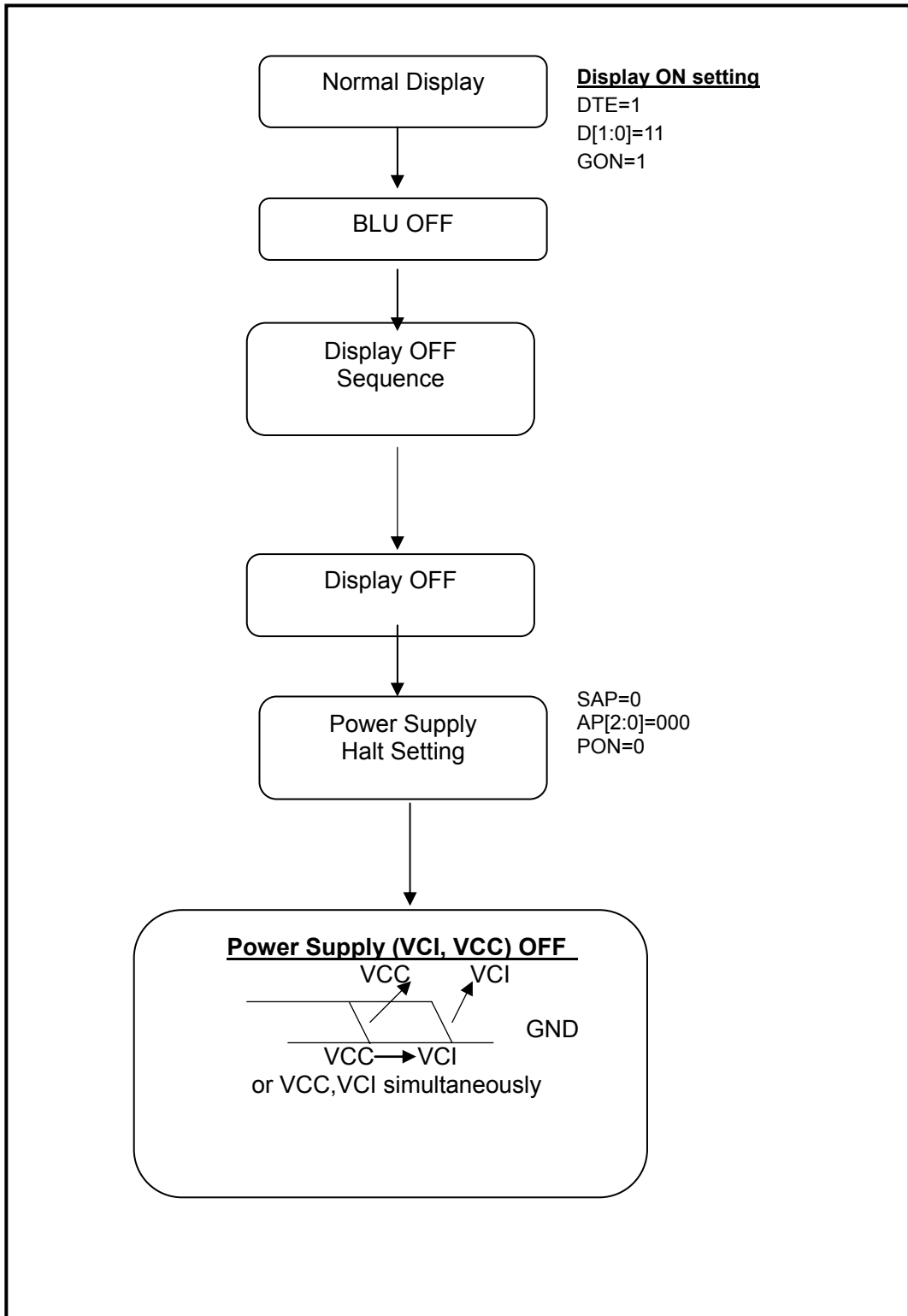
5.3 Power on /Off Sequence

5.3.1 Power on Sequence





5.3.2 Power off Sequence





## 6 Optical Characteristics

### 6.1 Optical Specification

Ta=25°C

| Item           | Symbol           | Condition        | Min             | Typ   | Max   | Unit              | Remark          |
|----------------|------------------|------------------|-----------------|-------|-------|-------------------|-----------------|
| View Angles    | $\theta T$       | $CR \geq 10$     | 35              | 40    | -     | Degree            | Note 2          |
|                | $\theta B$       |                  | 15              | 20    | -     |                   |                 |
|                | $\theta L$       |                  | 40              | 45    | -     |                   |                 |
|                | $\theta R$       |                  | 40              | 45    | -     |                   |                 |
| Contrast Ratio | CR               | $\theta=0^\circ$ | 200             | 350   | -     |                   | Note1<br>Note3  |
| Response Time  | T <sub>ON</sub>  | 25°C             | -               | 25    | 40    | ms                | Note1           |
|                | T <sub>OFF</sub> |                  |                 |       |       |                   | Note4           |
| Chromaticity   | White            | x                | Backlight is on | 0.260 | 0.310 | 0.360             | Note5,<br>Note1 |
|                |                  | y                |                 | 0.285 | 0.335 | 0.385             |                 |
|                | Red              | x                |                 | 0.567 | 0.617 | 0.667             |                 |
|                |                  | y                |                 | 0.282 | 0.332 | 0.382             |                 |
|                | Green            | x                |                 | 0.285 | 0.335 | 0.385             |                 |
|                |                  | y                |                 | 0.517 | 0.567 | 0.617             |                 |
|                | Blue             | x                |                 | 0.100 | 0.150 | 0.200             |                 |
|                |                  | y                |                 | 0.022 | 0.072 | 0.122             |                 |
| Uniformity     | U                |                  | 75              | 80    | -     | %                 | Note1<br>Note6  |
| NTSC           |                  |                  | -               | 55    | -     | %                 | Note 5          |
| Luminance(TSP) | L                |                  | 200             | 250   | -     | cd/m <sup>2</sup> | Note1<br>Note7  |

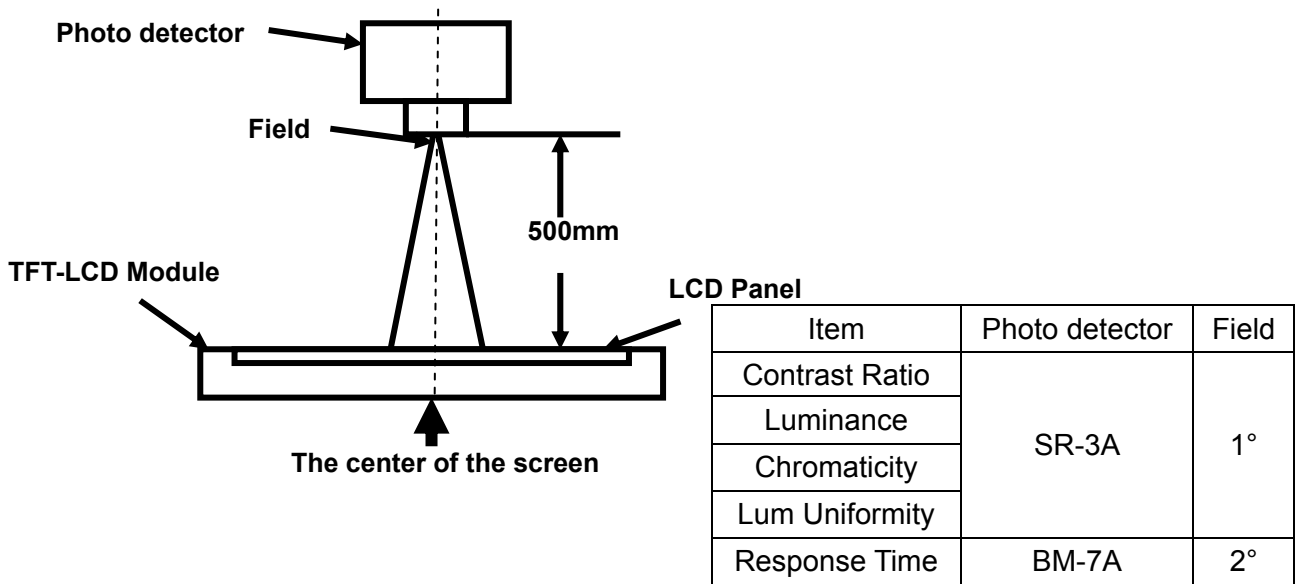
Test Conditions:

1.  $V_F=3.2V$ ,  $I_L=20mA$ (LED current), the ambient temperature is 25°C.
2. The test systems refer to Note 1 and Note 2.



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).

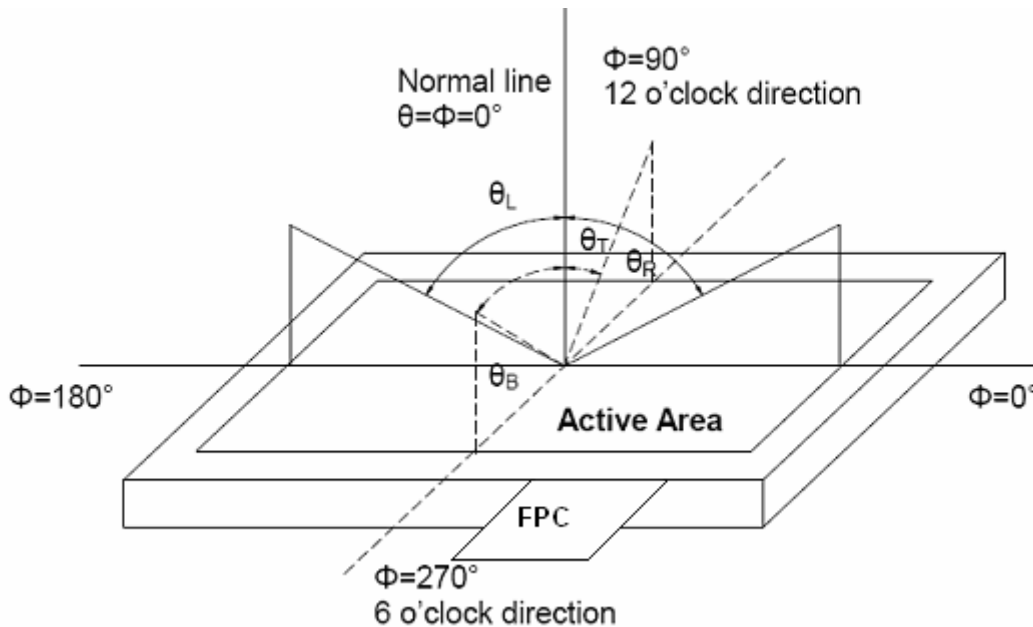


Fig. 1 Definition of viewing angle

**Note 3: Definition of contrast ratio**

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

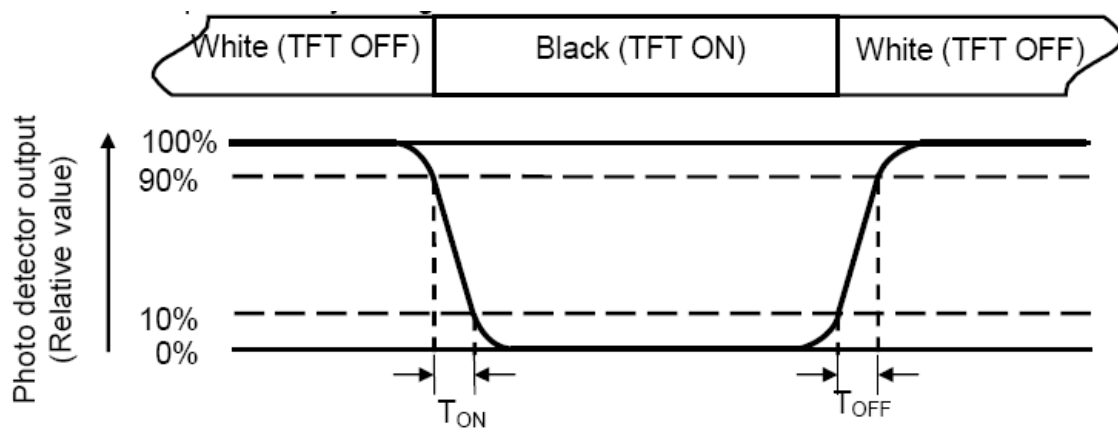
“White state “:The state is that the LCD should driven by  $V_{\text{white}}$ .

“Black state”: The state is that the LCD should driven by  $V_{\text{black}}$ .

$V_{\text{white}}$ : To be determined     $V_{\text{black}}$ : To be determined.

**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 ( $T_{\text{ON}}$ ) is the time between photo detector output intensity changed from 90% to 10%. And fall time ( $T_{\text{OFF}}$ ) 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

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity}(U) = L_{\min} / L_{\max}$$

L-----Active area length W----- Active area width

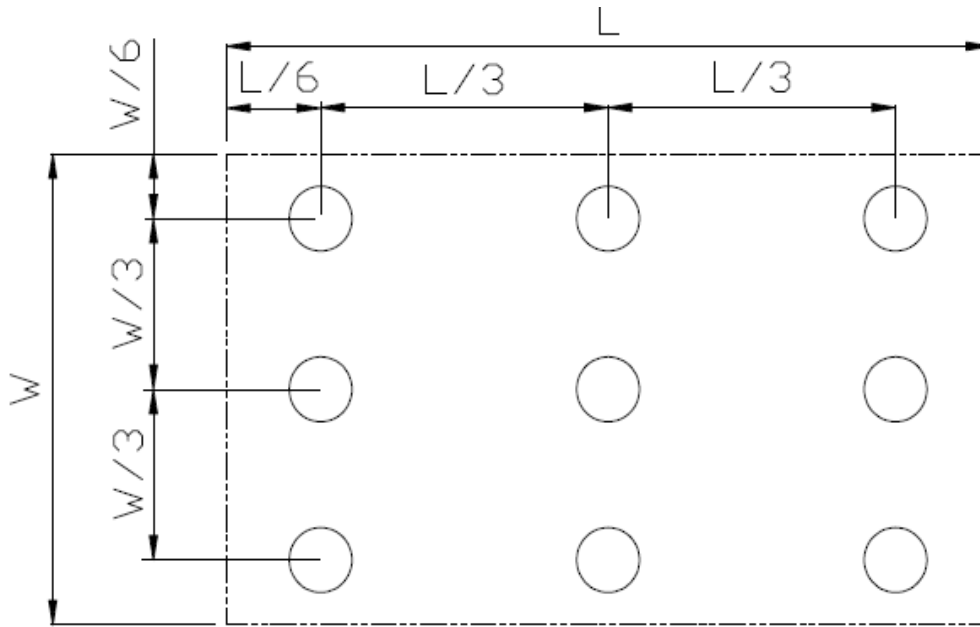


Fig. 2 Definition of uniformity

$L_{\max}$ : The measured maximum luminance of all measurement position.

$L_{\min}$ : The measured minimum luminance of all measurement position.

### Note 7: Definition of Luminance:

Measure the luminance of white state at center point.



## 7 Environmental / Reliability Test

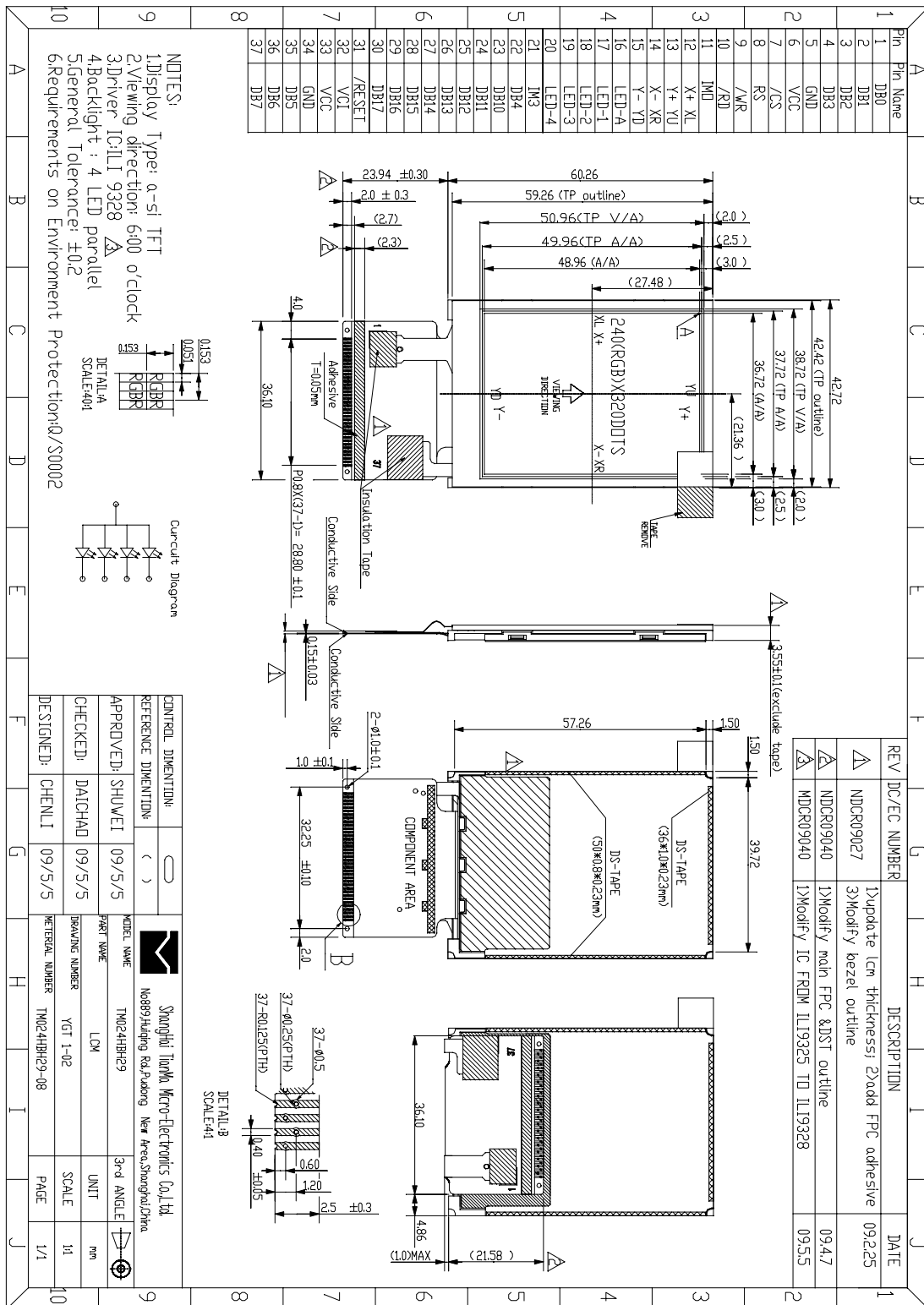
| No | Test Item                                | Condition  | Remark   |
|----|--|--|--|
| 1  | High Temperature Operation               | Ts=+60°C, 240hrs   | Note1<br>IEC60068-2-2,GB2423.2—89  |
| 2  | Low Temperature Operation                | Ta=-20°C, 240hrs   | IEC60068-2-1<br>GB2423.1—89  |
| 3  | High Temperature Storage                 | Ta=+70°C, 240hrs   | IEC60068-2-2,<br>GB2423.2—89   |
| 4  | Low Temperature Storage                  | Ta=-30°C, 240hrs   | IEC60068-2-1<br>GB2423.1—89  |
| 5  | High Temperature & High Humidity Storage | Ta=+60°C, 90% RH<br>240 hours  | Note2<br>IEC60068-2-3,<br>GB/T2423.3—2006  |
| 6  | Thermal Shock (Non-operation)            | -30°C 30 min~+70°C 30 min,<br>Change time:5min, 20 Cycles  | Start with cold temperature,<br>End with high temperature,<br>IEC60068-2-14,GB2423.22—87 |
| 7  | Electro Static Discharge (Operation)     | C=150pF, R=330Ω,5points/panel<br>Air:±8KV, 5times;<br>Contact:±4KV, 5 times;<br>(Environment: 15°C~35°C,<br>30%~60%, 86Kpa~106Kpa)                 | IEC61000-4-2<br>GB/T17626.2—1998   |
| 8  | Vibration (Non-operation)                | Frequency range:10~55Hz,<br>Stroke:1.5mm<br>Sweep:10Hz~55Hz~10Hz 2 hours<br>for each direction of X.Y.Z.<br>(6 hours for total)(Package condition) | IEC60068-2-6<br>GB/T2423.10—1995   |
| 9  | Shock (Non-operation)                    | 60G 6ms, ±X,±Y,±Z 3times,<br>for each direction  | IEC60068-2-27<br>GB/T2423.5—1995   |
| 10 | Package Drop Test                        | Height:80 cm,<br>1 corner, 3 edges, 6 surfaces   | IEC60068-2-32<br>GB/T2423.8—1995   |

Note1: Ts is the temperature of panel's surface.

Note2: Ta is the ambient temperature of sample.



8 Mechanical Drawing



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## 9 Packing Drawing

### 9.1 Packaging Material Table

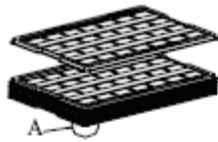
| No | Item             | Model (Material) | Dimensions(mm)   | Unit Weight(Kg) | Quantity | Remark      |
|----|------------------|------------------|------------------|-----------------|----------|-------------|
| 1  | LCM module       | TM024HBH29       | 42.72×60.26×3.55 | 0.0168          | 288      |             |
| 2  | Tray             | PET(Transmit)    | 315.0x247.0x11.8 | 0.079           | 42       | Anti-static |
| 3  | EPE              | EPE              | 315x247x5        | 0.009           | 12       |             |
| 4  | DUST-PROOF Bag   | PE               | 700x545          | 0.046           | 1        |             |
| 5  | Anti-static Bag  | PE               | 327×440          | 0.021           | 6        |             |
| 6  | Box              | Corrugated Paper | 345x260x70       | 0.227           | 6        |             |
| 7  | Carton           | Corrugated Paper | 544x365x250      | 1.01            | 1        |             |
| 8  | Total Weight(Kg) | 10.9             |                  |                 |          |             |

### 9.2 Packaging Drawing

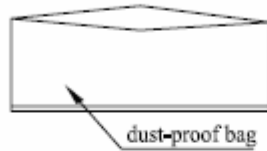
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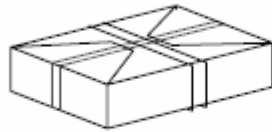
Use empty tray  
+  
Put products into  
the trays



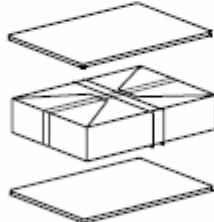
Use package bag



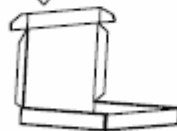
Use strop



EPE  
+  
dust-proof bag  
+  
EPE



Box



6 Box



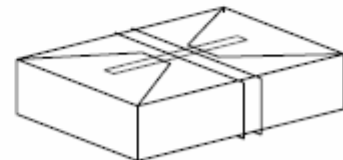
Use the tape to seal Carton



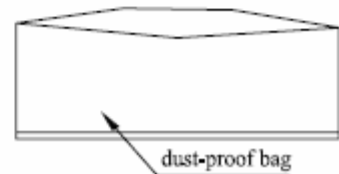
Put into Carton



Use strop



Use package bag





## 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
- Ketone
- 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°C ~ 40°C      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.