



深圳市拓普微科技开发有限公司

SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

# LMT050DNCFWU-NJA

## LCD Module User Manual

|                                                              |                                  |                                   |
|--------------------------------------------------------------|----------------------------------|-----------------------------------|
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|--------------------------------------------------------------|----------------------------------|-----------------------------------|

| Rev. | Descriptions | Release Date |
|------|--------------|--------------|
| 0.1  | Preliminary  | 2016-06-08   |
|      |              |              |
|      |              |              |
|      |              |              |

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## 1. General Specification

|                         |                                                              |
|-------------------------|--------------------------------------------------------------|
| Signal Interface :      | 24 bits LVDS (VESA)                                          |
| Display Mode :          | Transmissive with Normally White                             |
| Screen Size :           | 5.0 inch                                                     |
| Outline Dimension :     | 143.5 x 95.5 x 21.8(mm)<br>(see outline drawing for details) |
| Active Area :           | 108.0x 64.8(mm)                                              |
| Number of dots :        | 800 x 480                                                    |
| Dot Pitch :             | 0.135x 0.135(mm)                                             |
| Pixel Configuration :   | R.G.B. Vertical Stripe                                       |
| Backlight :             | White LED                                                    |
| Viewing Direction :     | 6 o'clock ( Gray scale Inversion ) (*1)<br>12 o'clock (*2)   |
| Operating Temperature : | -20 ~ +70°C                                                  |
| Storage Temperature :   | -30 ~ +80°C                                                  |

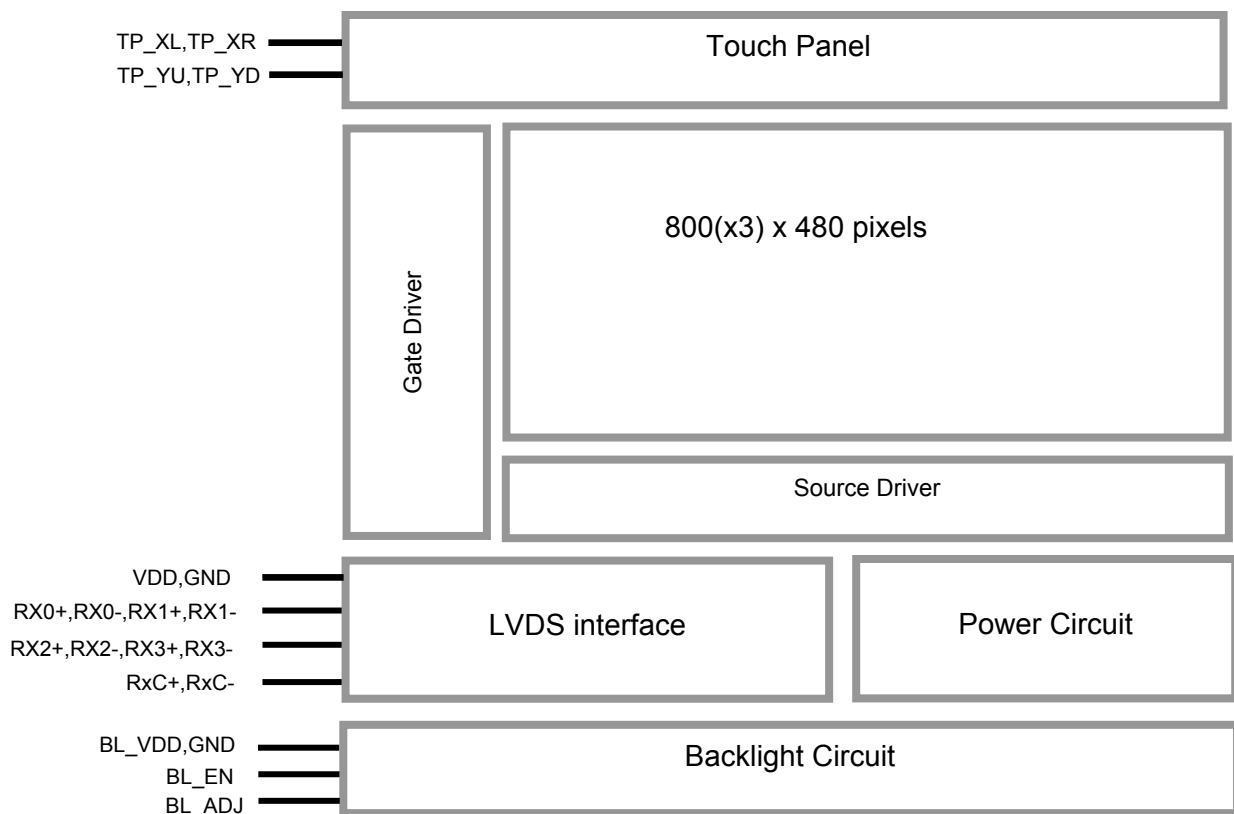
Note:

\*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.

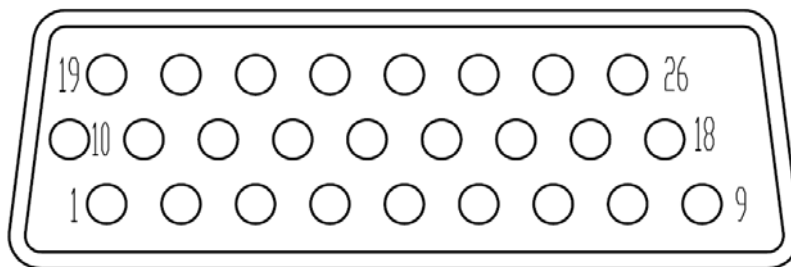
## 2. Block Diagram



### 3. Terminal Function

#### 3.1 K1 Terminal ( 26Pin D connector(F)or equivalent )

| K1 Pin No. | Pin Name | I/O     | Descriptions                                                                                                         |
|------------|----------|---------|----------------------------------------------------------------------------------------------------------------------|
| 1          | RX3+     | Input   | LVDS receiver positive signal channel 3                                                                              |
| 2          | RX3-     | Input   | LVDS receiver negative signal channel 3                                                                              |
| 3          | NC       | -       | No connection                                                                                                        |
| 4          | RXC+     | Input   | LVDS receiver positive signal Clock                                                                                  |
| 5          | RXC-     | Input   | LVDS receiver negative signal Clock                                                                                  |
| 6          | GND      | Power   | Power Supply GND (0V)                                                                                                |
| 7          | RX2+     | Input   | LVDS receiver positive signal channel 2                                                                              |
| 8          | RX2-     | Input   | LVDS receiver negative signal channel 2                                                                              |
| 9          | GND      | Power   | Power Supply GND (0V)                                                                                                |
| 10         | RX1+     | Input   | LVDS receiver positive signal channel 1                                                                              |
| 11         | RX1-     | Input   | LVDS receiver negative signal channel 1                                                                              |
| 12         | GND      | Power   | Power Supply GND (0V)                                                                                                |
| 13         | RX0+     | Input   | LVDS receiver positive signal channel 0                                                                              |
| 14         | RX0-     | Input   | LVDS receiver negative signal channel 0                                                                              |
| 15         | NC       | -       | No connection                                                                                                        |
| 16         | NC       | -       | No connection                                                                                                        |
| 17         | VDD      | Power   | Logic Positive Power Supply                                                                                          |
| 18         | VDD      |         |                                                                                                                      |
| 19         | BL_VDD   | Power   | Backlight Power Supply                                                                                               |
| 20         | BL_ADJ   | I/O     | Backlight dimming control(High actives)<br>PWM may be used to adjust the output brightness                           |
| 21         | BL_EN    | I/O     | Backlight Driver control<br>BL_EN=Hi,Backlight Driving Booster enable<br>BL_EN=Lo, Backlight Driving Booster disable |
| 22         | GND      | Power   | Power Supply GND (0V)                                                                                                |
| 23         | TP_XR    | Passive | Touch Screen XR terminal                                                                                             |
| 24         | TP_YU    | Passive | Touch Screen YU terminal                                                                                             |
| 25         | TP_XL    | Passive | Touch Screen XL terminal                                                                                             |
| 26         | TP_YD    | Passive | Touch Screen YD terminal                                                                                             |



## 4. Absolute Maximum Ratings

| Items                    | Symbol       | Min. | Max. | Unit | Condition       |
|--------------------------|--------------|------|------|------|-----------------|
| Power Supply voltage     | $V_{DD}$     | -0.3 | 3.6  | V    |                 |
| Backlight Supply voltage | $V_{DD\_BL}$ | -0.3 | 13.0 | 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 it 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,  $T_{OP}=25^{\circ}\text{C}$
- \*3. 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

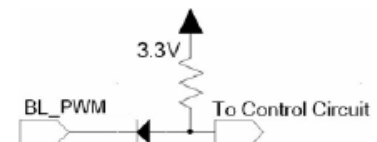
$V_{DD\_BL}=12\text{V}$  ,  $V_{DD}=3.3\text{V}$  ,  $GND=0\text{V}$  ,  $T_{OP}=25^{\circ}\text{C}$

| Items                                     | Symbol        | Min.        | Typ. | Max.        | Unit | Remark                    |
|-------------------------------------------|---------------|-------------|------|-------------|------|---------------------------|
| Power Supply Voltage                      | $V_{DD}$      | 3.0         | 3.3  | 3.6         | V    | *2                        |
| Backlight Supply voltage                  | $V_{DD\_BL}$  | 11.5        | 12.0 | 12.5        |      | *2, *3                    |
| Input logic high voltage                  | $V_{IH}$      | $0.8V_{DD}$ | -    | $V_{DD}$    | V    | *2, *3                    |
| Input logic low voltage                   | $V_{IL}$      | 0           | -    | $0.2V_{DD}$ | V    |                           |
| Logic Supply Current ( $V_{DD}$ )         | $I_{VDD}$     | -           | 100  |             | mA   |                           |
| Backlight Supply Current ( $V_{DD\_BL}$ ) | $I_{VDD\_BL}$ | -           | 100  |             | mA   | Backlight( 100%PWM)<br>*4 |

Note:

- \*1. Never apply logic signal before the  $V_{DD}$  and  $V_{DD\_BL}$ ;
- \*2.  $V_{DD}$  setting should match the signals voltage;
- \*3. For all the inputs signals;
- \*4.  $BL\_PWM=Hi$ ;
- \*5. Recommended  $BL\_PWM$  Freq. is 3kHz;

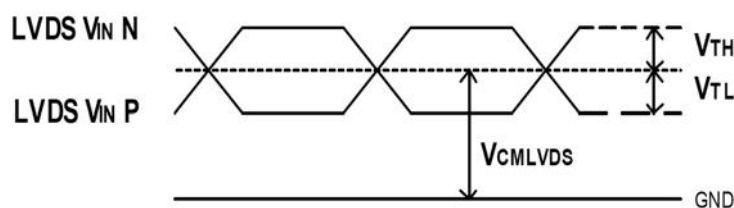
\*6. Terminal circuit.



### 5.2 DC Characteristics(LVDS)

$V_{DD}=3.3\text{V}$  ,  $GND=0\text{V}$  ,  $T_a=25^{\circ}\text{C}$

| Items                                  | Symbol       | MIN. | TYP. | MAX.     | Unit          | Note |
|----------------------------------------|--------------|------|------|----------|---------------|------|
| Differential Input High Threshold      | $V_{TH}$     | -    | -    | 100      | mV            |      |
| Differential Input Low Threshold       | $V_{TL}$     | -100 | -    | -        | mV            |      |
| Input Current                          | $I_{IN}$     |      |      | $\pm 10$ | $\mu\text{A}$ |      |
| Differential Input common Mode voltage | $V_{CMLVDS}$ | 1.65 | -    | 2.1      | V             |      |



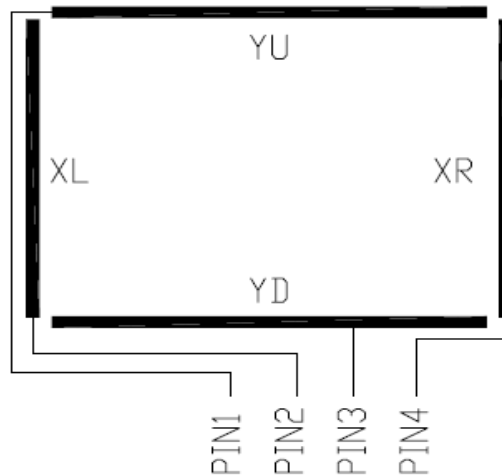
LVDS DC timing diagram

### 5.3 Touch panel Characteristics

| Items               | MIN. | TYP.      | MAX. | Unit  | Applicable Pin |
|---------------------|------|-----------|------|-------|----------------|
| Terminal resistance | 400  | -         | 1000 | Ω     | X- terminal    |
|                     | 100  | -         | 500  | Ω     | Y- terminal    |
| Operating Voltage   | -    | -         | 5    | V     | -              |
| Response time       | -    | -         | 10   | ms    | -              |
| Life Time           | -    | 1,000,000 | -    | times | -              |

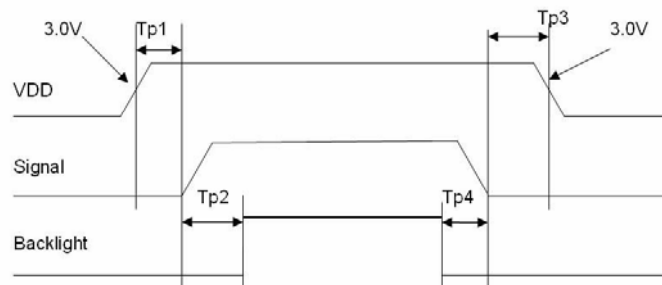
*Cautions:*

*Exceeding the recommended Condition could cause substantial damage to the touch panel and shorten its lifetime.*



### 5.4 POWER ON/OFF SEQUENCE

| Parameter                       | Symbol | MIN. | TYP. | MAX. | Unit | Note |
|---------------------------------|--------|------|------|------|------|------|
| VDD 3.0V to signal starting     | Tp1    | 0    | -    | 50   | ms   |      |
| Signal starting to backlight on | Tp2    | 150  | -    | -    | ms   |      |
| Signal off to VDD 3.0V          | Tp3    | 0    | -    | 50   | ms   |      |
| Backlight off to signal off     | Tp4    | 150  | -    | -    | ms   |      |



**Interface Power On/Off Sequence**

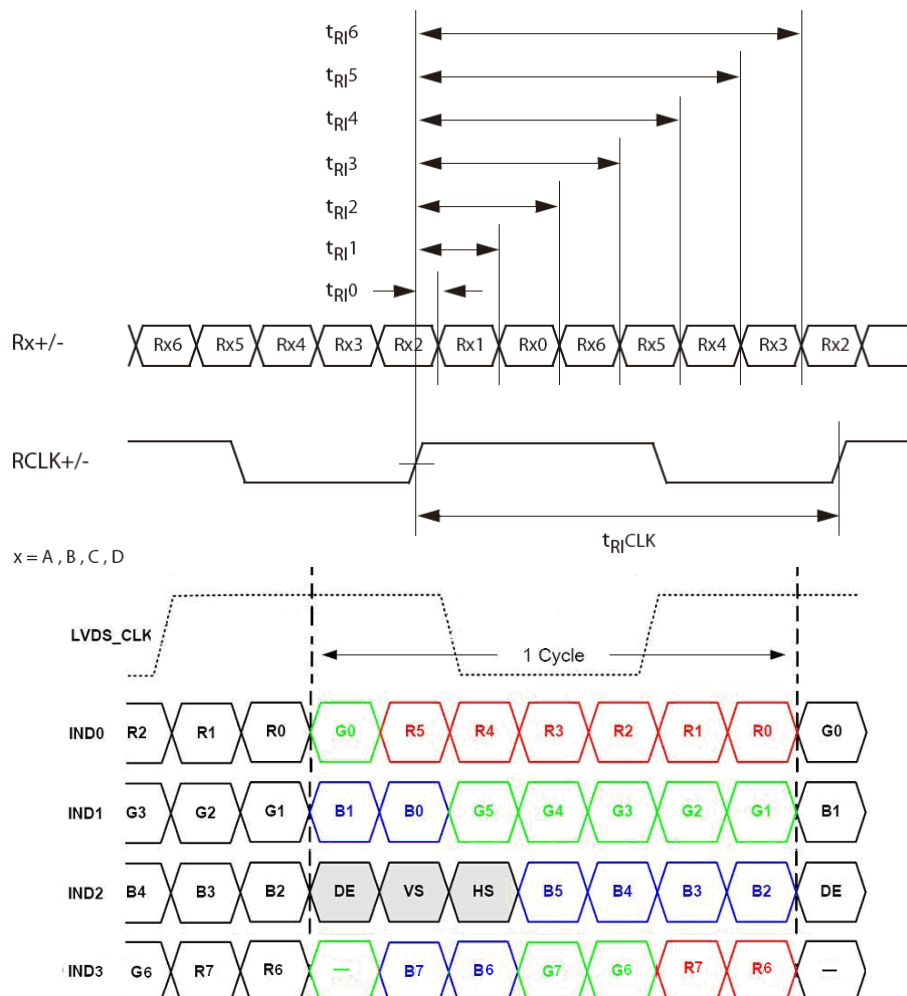
## 6. AC Characteristics

### 6.1 LVDS AC Characteristics

VDD=3.3V, GND=0V, T<sub>a</sub>=25°C

| Item                                                     | Symbol              | MIN.                       | TYP.                   | MAX.                       | Unit | Condition |
|----------------------------------------------------------|---------------------|----------------------------|------------------------|----------------------------|------|-----------|
| Input CLK period                                         | t <sub>RI</sub> CLK | 8.9                        | -                      | 50                         | ns   |           |
| Input Data Position 0<br>( t <sub>RI</sub> CLK = 8.9ns ) | t <sub>RI</sub> 0   | -0.3                       | -                      | +0.3                       | ns   |           |
| Input Data Position 1<br>(t <sub>RI</sub> CLK = 8.9ns )  | t <sub>RI</sub> 1   | t <sub>RI</sub> CLK/7-0.3  | t <sub>RI</sub> CLK/7  | t <sub>RI</sub> CLK/7+0.3  | ns   |           |
| Input Data Position 2<br>(t <sub>RI</sub> CLK = 8.9ns )  | t <sub>RI</sub> 2   | 2t <sub>RI</sub> CLK/7-0.3 | 2t <sub>RI</sub> CLK/7 | 2t <sub>RI</sub> CLK/7+0.3 | ns   |           |
| Input Data Position 3<br>(t <sub>RI</sub> CLK = 8.9ns )  | t <sub>RI</sub> 3   | 3t <sub>RI</sub> CLK/7-0.3 | 3t <sub>RI</sub> CLK/7 | 3t <sub>RI</sub> CLK/7+0.3 | ns   |           |
| Input Data Position 4<br>(t <sub>RI</sub> CLK = 8.9ns )  | t <sub>RI</sub> 4   | 4t <sub>RI</sub> CLK/7-0.3 | 4t <sub>RI</sub> CLK/7 | 4t <sub>RI</sub> CLK/7+0.3 | ns   |           |
| Input Data Position 5<br>(t <sub>RI</sub> CLK = 8.9ns )  | t <sub>RI</sub> 5   | 5t <sub>RI</sub> CLK/7-0.3 | 5t <sub>RI</sub> CLK/7 | 5t <sub>RI</sub> CLK/7+0.3 | ns   |           |
| Input Data Position 6<br>(t <sub>RI</sub> CLK = 8.9ns )  | t <sub>RI</sub> 6   | 6t <sub>RI</sub> CLK/7-0.3 | 6t <sub>RI</sub> CLK/7 | 6t <sub>RI</sub> CLK/7+0.3 | ns   |           |

#### Input Clock and Data timing Diagram:



## 6.2 TFT timing

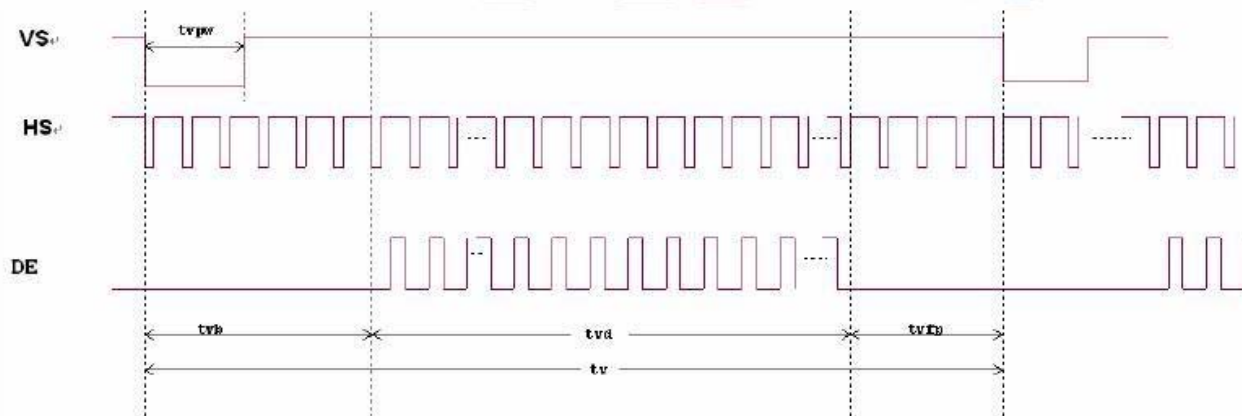
VDD=3.3V, GND=0V, T<sub>a</sub>=25°C

| 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 |        |

| Item                  | Symbol | Values |      |      | Unit | Remark |
|-----------------------|--------|--------|------|------|------|--------|
|                       |        | MIN.   | TYP. | MAX. |      |        |
| 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   |        |



1 Horizontal input timing diagram.



Vertical input timing diagram.

## 7. Optical Characteristics

| Item                            | Symbol     | Condition                  | MIN. | TYP. | MAX. | UNIT              | Note. |
|---------------------------------|------------|----------------------------|------|------|------|-------------------|-------|
| Viewing angle<br>(CR $\geq$ 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<br>$\theta=0^\circ$ | -    | 10   | 20   | msec              | *3    |
|                                 | $T_r$      |                            | -    | 15   | 30   | msec              |       |
| Contrast ratio                  | CR         |                            | 400  | 500  | -    | -                 | *1    |
| Color chromaticlty              | $W_X$      |                            | 0.26 | 0.31 | 0.26 | -                 |       |
|                                 | $W_Y$      |                            | 0.28 | 0.33 | 0.38 | -                 |       |
| Luminance                       | L          |                            | -    | 480  | -    | cd/m <sup>2</sup> | *4    |
| Luminance uniformity            | $Y_U$      |                            | 70   | 75   | -    | %                 | *4    |

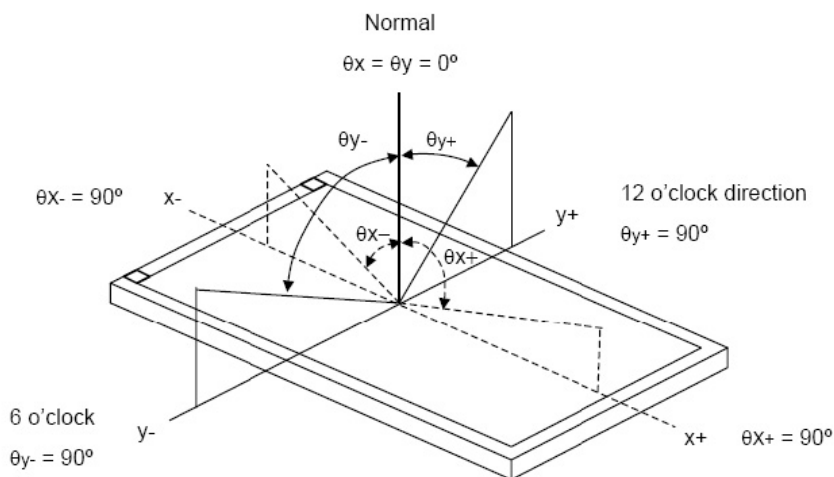
Note:

**\*1. Definition of Contrast Ratio**

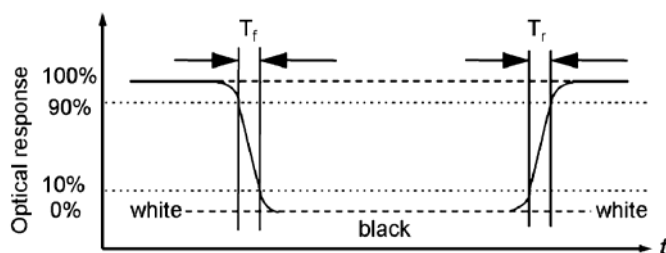
The contrast ratio could be calculate by the following expression:

Contrast Ratio (CR) = Luminanc with all pixels white / Luminance with all pixels black

**\*2 Definition of Viewing Angle**



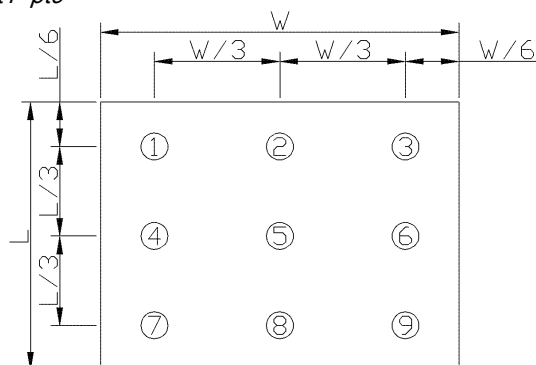
**\*3 Definition of response time**



**\*4 Definition of Luminance Uniformity**

Luminance uniformity (Lu)=

Min. Luminance form pt1~pt9 / Max Luminance form Pt1~pt9



## **8. Precautions for Use of LCD Modules**

### **8.1 Handling Precautions**

- 8.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- 8.1.2 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.
- 8.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- 8.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- 8.1.5 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 alcoholSolvents other than those mentioned above may damage the polarizer. Especially, do not use the following:
  - Water
  - Ketone
  - Aromatic solvents
- 8.1.6 Do not attempt to disassemble the LCD Module.
- 8.1.7 If the logic circuit power is off, do not apply the input signals.
- 8.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
  - 8.1.8.1 Be sure to ground the body when handling the LCD Modules.
  - 8.1.8.2 Tools required for assembly, such as soldering irons, must be properly ground.
  - 8.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
  - 8.1.8.4 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.

### **8.2 Storage precautions**

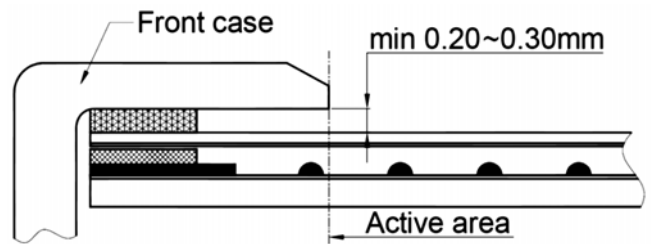
- 8.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.
- 8.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:  
Temperature : 0°C ~ 40°C Relatively humidity: ≤80%
- 8.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

### **8.3 Transportation Precautions**

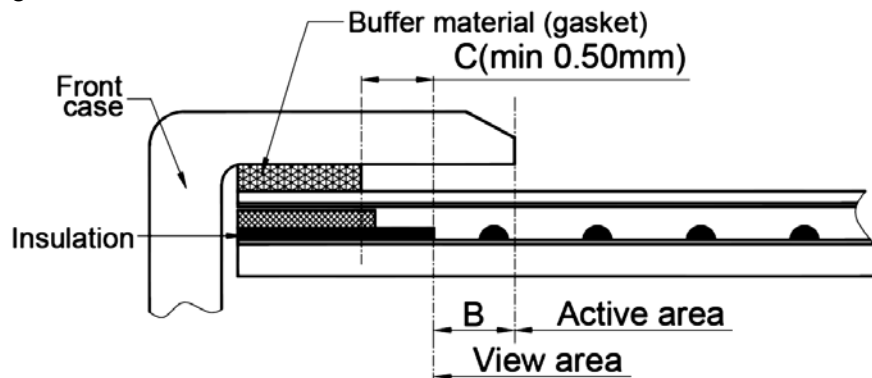
The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

### 附录: Touch panel Design Precautions

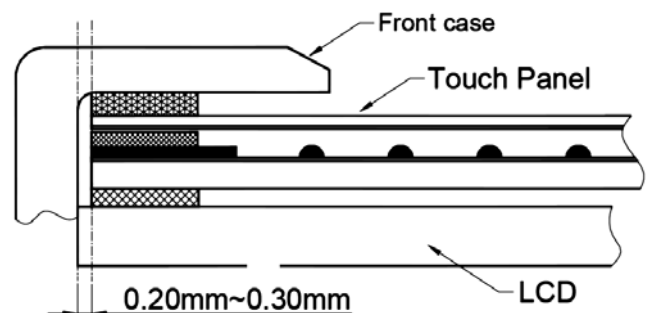
1. It should prevent front case touching the touch panel Active Area (A.A.) to prevent abnormal touch.  
It should left gab (e.g. 0.2~0.3mm) in between.



2. Outer case design should take care about the area outside the A.A.  
Those areas contain circuit wires which is having different thickness. Touching those areas could deform the ITO film. As a result case the ITO cold be damaged and shorten its lifetime.  
It is suggested to protect those areas with gasket (between the front case and the touch panel).  
The suggested figures are  $B \geq 0.50\text{mm}$ ;  $C \geq 0.50\text{mm}$ .



3. The front case side wall should keep space (e.g. 0.2 ~ 0.3mm) from the touch panel.



4. In general design,  
touch panel V.A. should be bigger than the LCD V.A.  
and touch panel A.A. should be bigger than the LCD A.A.

