

**INNOLUX DISPLAY CORPORATION**  
**LCD MODULE**  
**SPECIFICATION**

Customer: \_\_\_\_\_  
 Model Name: AT056TN52 V.3  
 SPEC NO.: A056-52-TT-31  
 Date: 2009/03/25  
 Version: 01

- Preliminary Specification  
 Final Specification

For Customer's Acceptance

| Approved by | Comment |
|-------------|---------|
| KTTIC       |         |

| Approved by               | Reviewed by  | Prepared by                 |
|---------------------------|--|-----------------------------|
| Joe Lin<br><br>2009/03/31 | Jack Huang<br>Charlie Chou<br>James Yu<br>2009/03/30 | David Lee<br><br>2009/03/26 |

### Record of Revision

| Version     | Revise Date | Page | Content         |
|-------------|-------------|------|-----------------|
| Pre-spec.01 | 2009/03/25  |      | Initial Release |

Contents:

|   |    |
|---|----|
| 1.General Specifications .....          | 1  |
| 2.Pin Assignment .....                  | 2  |
| 3.Operation Specifications .....        | 5  |
| 3.1.Absolute Maximum Ratings .....      | 5  |
| 3.2.Typical Operation Conditions.....   | 6  |
| 3.2.1 Typical Operation Conditions..... | 6  |
| 3.2.2 Current Consumption .....         | 6  |
| 3.2.3 Backlight Driving Conditions..... | 7  |
| 3.3.Power Sequence .....                | 8  |
| 3.4.Timing Characteristics .....        | 9  |
| 3.4.1.Timing Conditions .....           | 9  |
| 3.4.2.Timing Diagram.....               | 11 |
| 4.Optical Specifications .....          | 14 |
| 5.Reliability Test.....                 | 18 |
| 6.General Precautions .....             | 19 |
| 6.1.Safety .....                        | 19 |
| 6.2.Handling .....                      | 19 |
| 6.3.Static Electricity.....             | 19 |
| 6.4.Storage .....                       | 19 |
| 6.5.Cleaning .....                      | 19 |
| 7.Mechanical Drawing.....               | 20 |
| 8.Package Drawing .....                 | 21 |
| 8.1.Packaging Material Table.....       | 21 |
| 8.2.Packaging Quantity.....             | 21 |
| 8.3.Packaging Drawing.....              | 22 |

## 1.General Specifications

| No. | Item                        | Specification                 | Remark |
|-----|-----------------------------|-------------------------------|--------|
| 1   | LCD size                    | 5.6 inch(Diagonal)            |        |
| 2   | Driver element              | a-Si TFT active matrix        |        |
| 3   | Resolution                  | 640 × (RGB) × 480             |        |
| 4   | Display mode                | Normally White, Transmissive  |        |
| 5   | Dot pitch                   | 0.0588(W) × 0.1764(H) mm      |        |
| 6   | Active area                 | 112.896 (W) × 84.672(H) mm    |        |
| 7   | Module size                 | 126.5(W) × 100(H) × 5.7(D) mm | Note 1 |
| 8   | Surface treatment           | Anti-Glare                    |        |
| 9   | Color arrangement           | RGB-stripe                    |        |
| 10  | Interface                   | Digital                       |        |
| 11  | Backlight Power consumption | 0.930W                        |        |
| 12  | Panel Power consumption     | 117mW                         |        |
| 13  | Weight                      | 132g                          |        |

Note 1: Refer to Mechanical Drawing.

## 2.Pin Assignment

### TFT LCD Panel Driving Section

FPC connector is used for the module electronics interface. The recommended model is FH12S-50S-0.5SH manufactured by HiRose.

| Pin No. | Symbol            | I/O | Function                        | Remark |
|---------|-------------------|-----|---------------------------------|--------|
| 1       | V <sub>LED+</sub> | P   | Power for LED backlight anode   |        |
| 2       | V <sub>LED+</sub> | P   | Power for LED backlight anode   |        |
| 3       | V <sub>LED-</sub> | P   | Power for LED backlight cathode |        |
| 4       | V <sub>LED-</sub> | P   | Power for LED backlight cathode |        |
| 5       | GND               | P   | Power ground                    |        |
| 6       | V <sub>COM</sub>  | I   | V <sub>COM</sub> input          |        |
| 7       | V <sub>CC</sub>   | P   | Digital power supply(+3.3V)     |        |
| 8       | MODE              | I   | DE or HV mode control           | Note 1 |
| 9       | DE                | I   | Data Enable                     |        |
| 10      | VS                | I   | Vsync signal input              |        |
| 11      | HS                | I   | Hsync signal input              |        |
| 12      | B7                | I   | Blue data input (MSB)           |        |
| 13      | B6                | I   | Blue data input                 |        |
| 14      | B5                | I   | Blue data input                 |        |
| 15      | B4                | I   | Blue data input                 |        |
| 16      | B3                | I   | Blue data input                 |        |
| 17      | B2                | I   | Blue data input                 |        |
| 18      | B1                | I   | Blue data input                 |        |
| 19      | B0                | I   | Blue data input(LSB)            |        |
| 20      | G7                | I   | Green data input(MSB)           |        |
| 21      | G6                | I   | Green data input                |        |
| 22      | G5                | I   | Green data input                |        |
| 23      | G4                | I   | Green data input                |        |
| 24      | G3                | I   | Green data input                |        |
| 25      | G2                | I   | Green data input                |        |
| 26      | G1                | I   | Green data input                |        |
| 27      | G0                | I   | Green data input(LSB)           |        |
| 28      | R7                | I   | Red data input(MSB)             |        |
| 29      | R6                | I   | Red data input                  |        |

|    |                  |   |   |          |
|----|------------------|---|---|----------|
| 30 | R5               | I | Red data input  |          |
| 31 | R4               | I | Red data input  |          |
| 32 | R3               | I | Red data input  |          |
| 33 | R2               | I | Red data input  |          |
| 34 | R1               | I | Red data input  |          |
| 35 | R0               | I | Red data input(LSB)                                   |          |
| 36 | GND              | P | Power ground  |          |
| 37 | DCLK             | I | Sample clock  |          |
| 38 | GND              | P | Power ground  |          |
| 39 | L/R              | I | Select left to right scanning direction               | Note 2,3 |
| 40 | U/D              | I | Select up or down scanning direction                  | Note 2,3 |
| 41 | VGH              | I | Positive power for scan driver                        |          |
| 42 | VGL              | I | Negative power for scan driver                        |          |
| 43 | AV <sub>DD</sub> | P | Power supply for analog circuit                       |          |
| 44 | RESET            | I | Reset   |          |
| 45 | POL              | O | Polarity select for the line inversion control signal |          |
| 46 | V <sub>COM</sub> | I | V <sub>COM</sub> input                                |          |
| 47 | NC               | - | No Connector  |          |
| 48 | NC               | - | No Connector  |          |
| 49 | NC               | - | No Connector  |          |
| 50 | NC               | - | No Connector  |          |

Note: I: input, O: output t, P: Power , R: Reserve

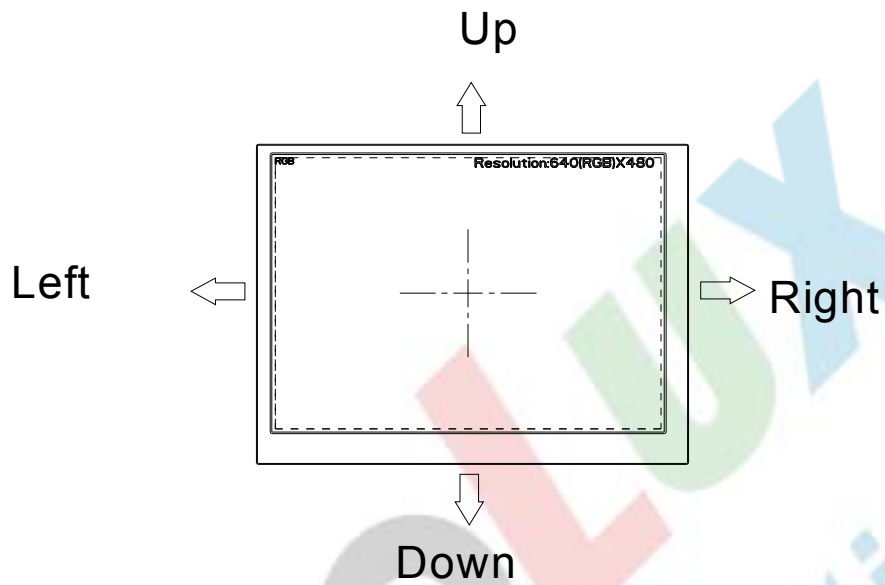
Note 1: DE Mode, Mode="H",HS floating and VS floating  
HV Mode, Mode="L" and DE floating

Note 2: Selection of scanning mode

| Setting of scan control input |                 | Scanning direction        |
|-------------------------------|-----------------|---------------------------|
| U/D                           | L/R             |                           |
| GND                           | V <sub>CC</sub> | Up to down, left to right |
| V <sub>CC</sub>               | GND             | Down to up, right to left |
| GND                           | GND             | Up to down, right to left |
| V <sub>CC</sub>               | V <sub>CC</sub> | Down to up, left to right |

版權屬於群創所有，禁止任何未經授權的使用

Note 3: Definition of scanning direction.  
Refer to the figure as below:



KTTIC

版權屬於群創所有，禁止任何未經授權的使用

### 3.Operation Specifications

#### 3.1. Absolute Maximum Ratings

(Note 1)

| Item                  | Symbol          | Values |      | Unit | Remark |
|-----------------------|-----------------|--------|------|------|--------|
|                       |                 | Min.   | Max. |      |        |
| Power voltage         | $V_{CC}$        | -0.3   | 6.5  | V    |        |
|                       | AVDD            | -0.3   | 6.5  | V    |        |
|                       | $V_{GH}$        | -0.3   | 18   | V    |        |
|                       | $V_{GL}$        | -15    | 0.3  | V    |        |
|                       | $V_{GH}-V_{GL}$ | -      | 33   | V    |        |
| Operation temperature | $T_{OP}$        | -20    | 70   | °C   |        |
| Storage temperature   | $T_{ST}$        | -30    | 80   | °C   |        |

Note 1: The absolute maximum rating values of the module should not be exceeded. Once exceeded absolute maximum rating values, the characteristics of the module may not be recovered. Even in an extreme condition, may result in module permanently destroyed.



### 3.2. Typical Operation Conditions

#### 3.2.1 Typical Operation Conditions

| Item                     | Symbol    | Values      |       |             | Unit | Remark |
|--------------------------|-----------|-------------|-------|-------------|------|--------|
|                          |           | Min.        | Typ.  | Max.        |      |        |
| Power voltage            | $V_{CC}$  | 3.0         | 3.3   | 3.6         | V    | Note 1 |
|                          | $AV_{DD}$ | 4.8         | 5.0   | 5.2         | V    |        |
|                          | $V_{GH}$  | 14.3        | 15.0  | 15.7        | V    |        |
|                          | $V_{GL}$  | -10.5       | -10.0 | -9.5        | V    |        |
| $V_{COM}$                | $V_{CAC}$ | -           | 5.50  | -           | V    |        |
|                          | $V_{CDC}$ | 0.72        | 0.92  | 1.12        | V    |        |
| Input logic high voltage | $V_{IH}$  | $0.7V_{CC}$ | -     | $1V_{CC}$   | V    | Note 2 |
| Input logic low voltage  | $V_{IL}$  | 0           | -     | $0.3V_{CC}$ | V    |        |

Note 1:  $V_{CC}$  setting should match the signals output voltage (refer to Note 2) of customer's system board.

Note 2: DCLK, DE, HS, VS, R0~ R7, G0~ G7, B0~ B7.

#### 3.2.2 Current Consumption

(GND =0V)

| Item               | Symbol   | Values |      |      | Unit | Remark          |
|--------------------|----------|--------|------|------|------|-----------------|
|                    |          | Min.   | Typ. | Max. |      |                 |
| Current for Driver | $I_{GH}$ | -      | 120  | 240  | uA   | $V_{GH} = +15V$ |
|                    | $I_{GL}$ | -      | 130  | 260  | uA   | $V_{GL} = -10V$ |
|                    | $I_{CC}$ | -      | 10   | 15   | mA   | $V_{CC} = 3.3V$ |
|                    | $I_{DD}$ | -      | 16   | 24   | mA   | $AV_{DD} = 5V$  |

### 3.2.3 Backlight Driving Conditions

| Item                      | Symbol | Values |      |      | Unit | Remark |
|---------------------------|--------|--------|------|------|------|--------|
|                           |        | Min.   | Typ. | Max. |      |        |
| Voltage for LED Backlight | $V_L$  | 8.4    | 9.3  | 10.5 | V    | Note 1 |
| Current for LED Backlight | $I_L$  | 90     | 100  | 110  | mA   |        |
| LED life time             | -      | 20,000 | -    | -    | Hr   | Note 2 |

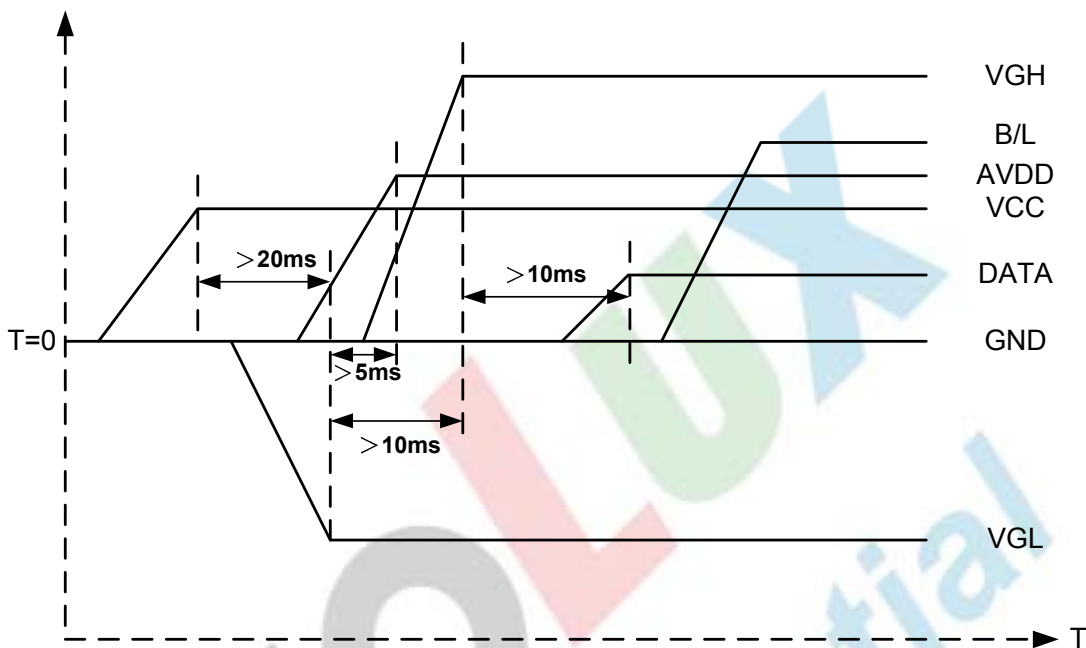
Note 1: The Voltage for LED Backlight is defined at  $T_a=25^{\circ}\text{C}$  and  $I_L=100\text{mA}$ .

Note 2: The "LED life time" is defined as the module brightness decrease to 50% original brightness that the ambient temperature is  $25^{\circ}\text{C}$  and  $I_L=100\text{mA}$ . The LED lifetime could be decreased if operating  $I_L$  is larger than 100 mA.

KTTIC

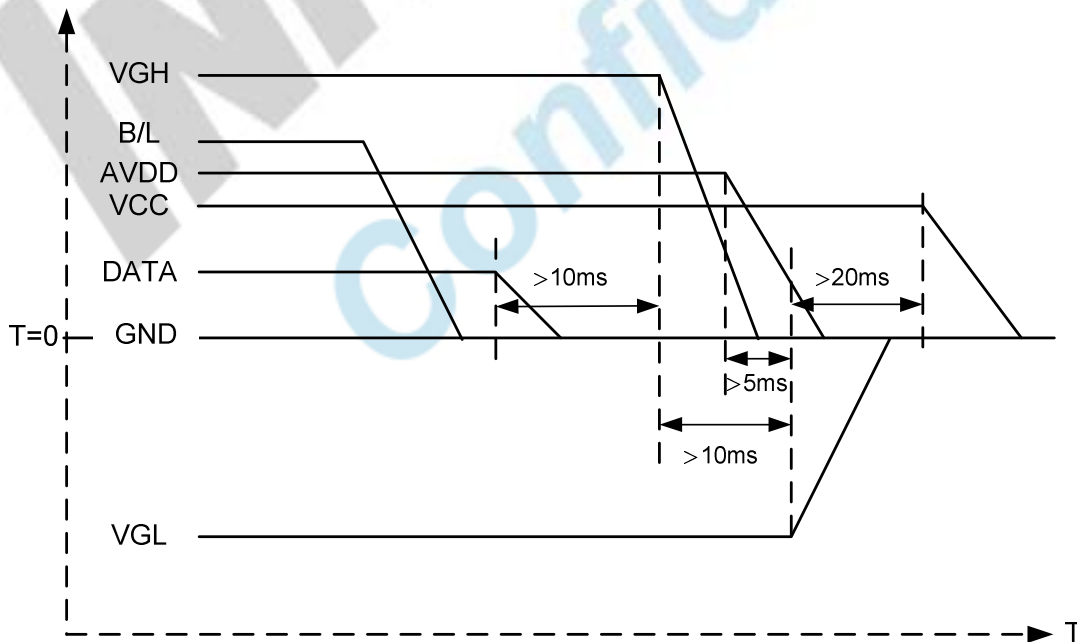
### 3.3. Power Sequence

#### 3.3.1 Power on:



VCC → VGL → VGH → Data → B/L

#### 3.3.2 Power off:



B/L → Data → VGH → VGL → VCC

Note: Data includes DE, VS, HS, B0~B7, G0~G7, R0~R7, DCLK.

版權屬於群創所有，禁止任何未經授權的使用

### 3.4. Timing Characteristics

#### 3.4.1. Timing Conditions

Input/Output Timing

| Item              | Symbol | Values |       |      | Unit. | Remark         |
|-------------------|--------|--------|-------|------|-------|----------------|
|                   |        | Min.   | Typ.  | Max. |       |                |
| PXLCLK clock time | Tclk   | 33.3   | 39.7  | -    | ns    |                |
| PXLCLK pulse duty | Tcwh   | 40     | 50    | 60   | %     | Tclk           |
| DATA set-up time  | Tdsu   | 12     | -     | -    | ns    | DATA to PXLCLK |
| DATA hold time    | Tdhd   | 12     | -     | -    | ns    | DATA to PXLCLK |
| DE setup time     | Tesu   | 12     | -     | -    | ns    | DE to PXLCLK   |
| VSYNC setup time  | Tvst   | 12     | -     | -    | ns    |                |
| VSYNC hold time   | Tvhd   | 12     | -     | -    | ns    |                |
| HSYNC setup time  | Thst   | 12     | -     | -    | ns    |                |
| HSYNC hold time   | Thhd   | 12     | -     | -    | ns    |                |
| HSYNC period time | Th     | 22.91  | 31.76 | -    | us    |                |
| HSYNC width       | Thwh   | 1      | -     | -    | Tclk  |                |
| VSYNC width       | Tvwh   | 1      | -     | -    | Th    |                |
| HSYNC to CLKIN    | Thc    | -      | -     | 1    | Tclk  |                |

DE Mode input Timing Limitation

| DE Mode | Values |      |      | Unit | Remark     |
|---------|--------|------|------|------|------------|
|         | Min.   | Typ. | Max. |      |            |
| THC     | 48     | 160  | 765  | tclk |            |
| THD     | 640    | 640  | 640  | tclk |            |
| TH      | 688    | 800  | 1405 | tclk | 1TH=1line  |
| TVC     | 6      | 45   | 255  | line |            |
| TVD     | 480    | 480  | 480  | line |            |
| TV      | 486    | 525  | 735  | line | 1TV=1field |

版權屬於群創所有，禁止任何未經授權的使用

HV Mode input Timing Limitation

| HV Mode | Values |      |      | Unit | Remark      |
|---------|--------|------|------|------|-------------|
|         | Min.   | Typ. | Max. |      |             |
| Thwh    | -      | 10   | -    | tclk |             |
| Thbp    | -      | 134  | -    | tclk |             |
| Thfp    | -      | 16   | -    | tclk |             |
| THD     | -      | 640  | -    | tclk |             |
| TH      | -      | 800  | -    | tclk | 1TH=1 line  |
| Tvwh    | -      | 2    | -    | line |             |
| Tvbp    | -      | 11   | -    | line |             |
| Tvfp    | -      | 32   | -    | line |             |
| TVD     | -      | 480  | -    | line |             |
| TV      | -      | 525  | -    | line | 1TV=1 field |

KTTIC

版權屬於群創所有, 禁止任何未經授權的使用

3.4.2. Timing Diagram

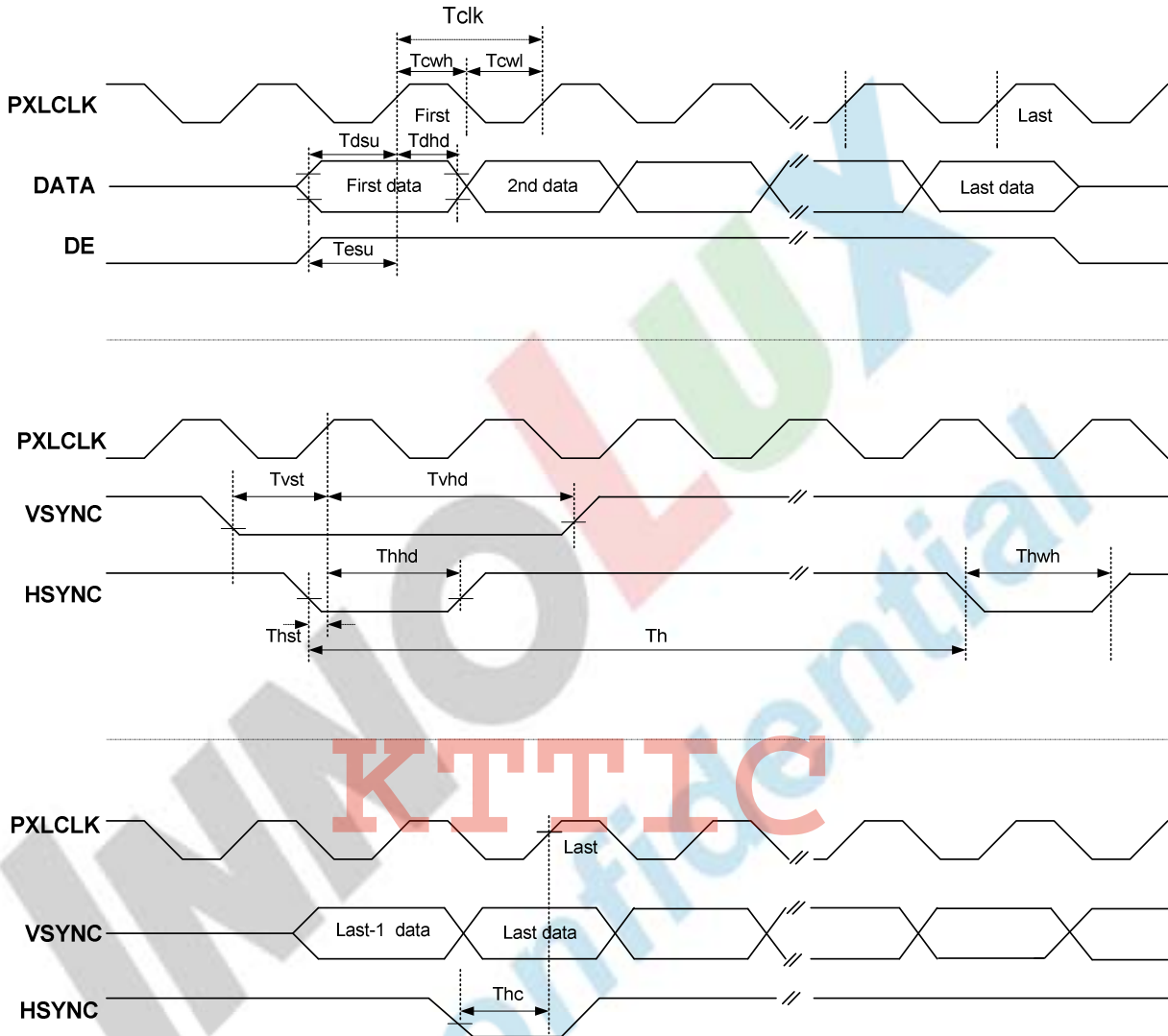


Fig.3-1 Clock and Data Input Timing Diagram

版權屬於群創所有，禁止任何未經授權的使用

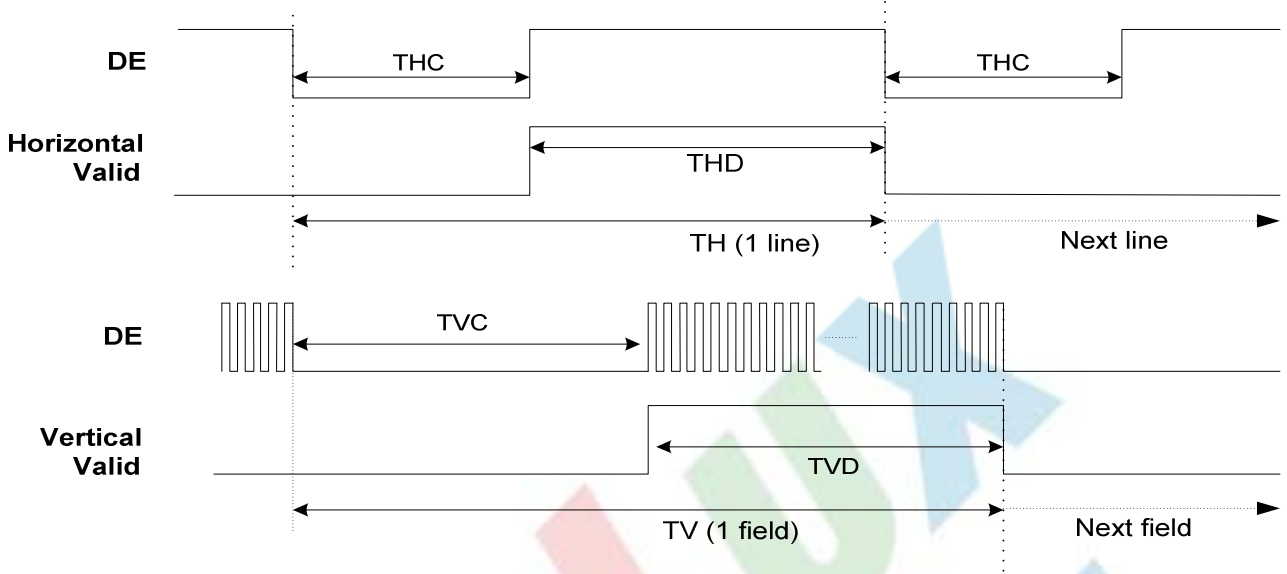


Fig.3-2 DE Mode Input Timing

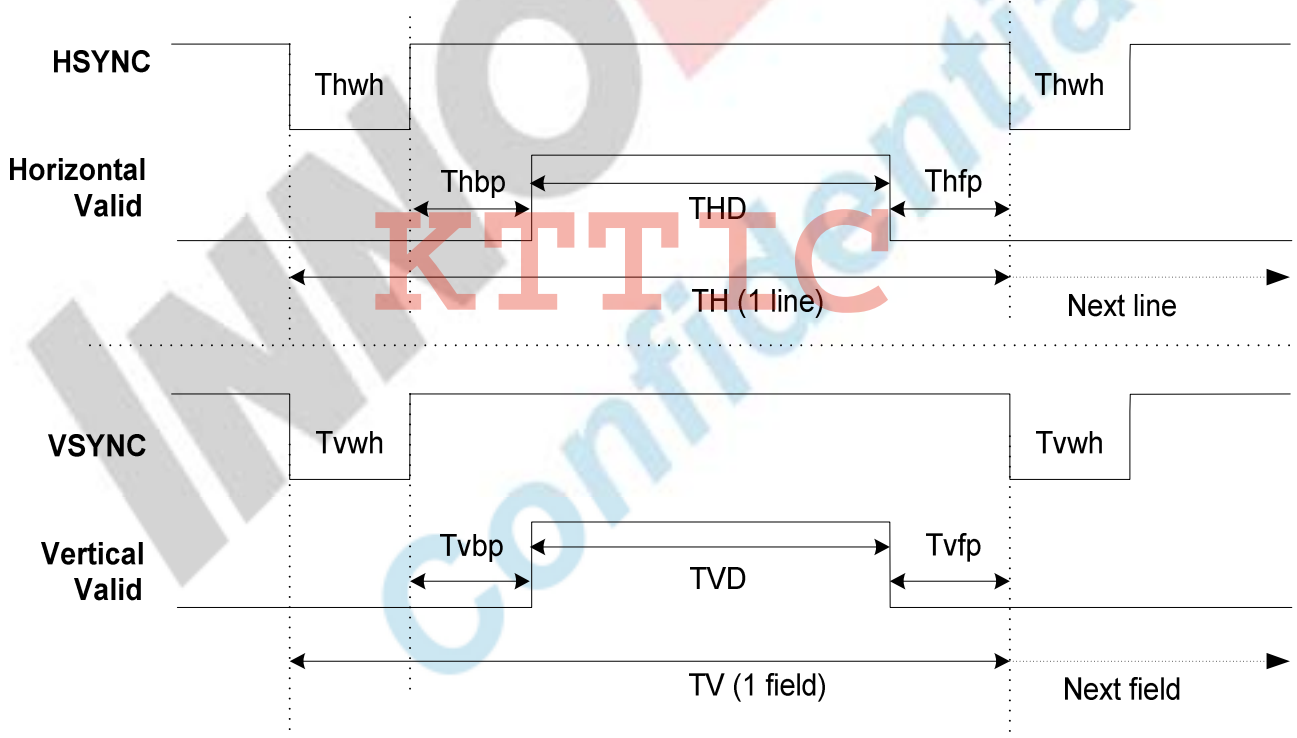


Fig.3-3 HV Mode Input Timing

版權屬於群創所有，禁止任何未經授權的使用

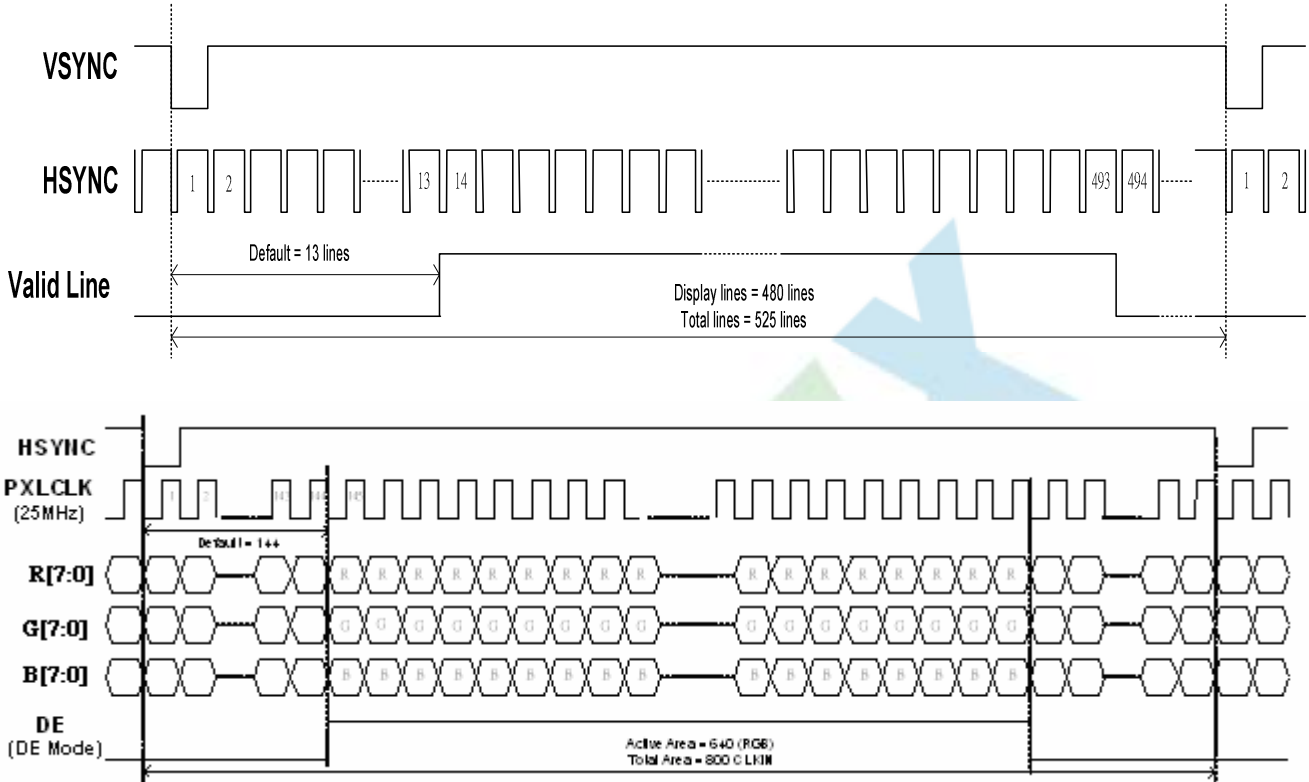


Fig. 3-4 24 bit RGB mode for 640 x (RGB) x 480

KTTIC



## 4. Optical Specifications

| Item                     | Symbol     | Condition                       | Values |      |      | Unit              | Remark           |
|--------------------------|------------|---------------------------------|--------|------|------|-------------------|------------------|
|                          |            |                                 | Min.   | Typ. | Max. |                   |                  |
| Viewing angle<br>(CR≥10) | $\theta_L$ | $\Phi=180^\circ$ (9 o'clock)    | 60     | 70   | -    | degree            | Note 1           |
|                          | $\theta_R$ | $\Phi=0^\circ$ (3 o'clock)      | 60     | 70   | -    |                   |                  |
|                          | $\theta_T$ | $\Phi=90^\circ$ (12 o'clock)    | 40     | 50   | -    |                   |                  |
|                          | $\theta_B$ | $\Phi=270^\circ$ (6 o'clock)    | 60     | 70   | -    |                   |                  |
| Response time            | $T_{ON}$   | Normal<br>$\theta=\Phi=0^\circ$ | -      | 10   | 20   | msec              | Note 3           |
|                          | $T_{OFF}$  |                                 | -      | 15   | 30   | msec              | Note 3           |
| Contrast ratio           | CR         |                                 | 400    | 500  | -    | -                 | Note 4           |
| Color chromaticity       | $W_X$      | Normal<br>$\theta=\Phi=0^\circ$ | 0.26   | 0.31 | 0.36 | -                 | Note 2<br>Note 5 |
|                          | $W_Y$      |                                 | 0.28   | 0.33 | 0.38 | -                 | Note 6           |
| Luminance                | L          |                                 | 150    | 200  | -    | cd/m <sup>2</sup> | Note 6           |
| Luminance uniformity     | $Y_U$      |                                 | 70     | 75   | -    | %                 | Note 6,7         |

Test Conditions:

1.  $V_{CC}=3.3V$ ,  $I_L=100mA$ , the ambient temperature is  $25^\circ C$ .
2. The test systems refer to Note 2.

Note 1: Definition of viewing angle range

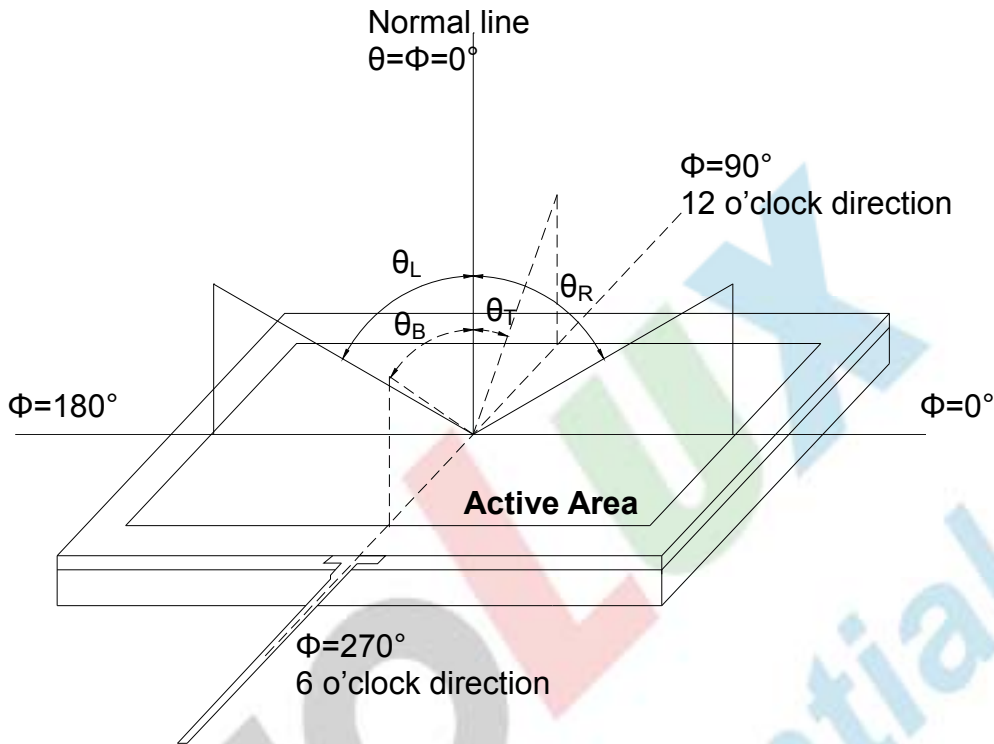


Fig. 4-1 Definition of viewing angle

Note 2: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Response time is measured by Photo detector TOPCON BM-7, other items are measured by BM-5A/Field of view: 1° /Height: 500mm.)

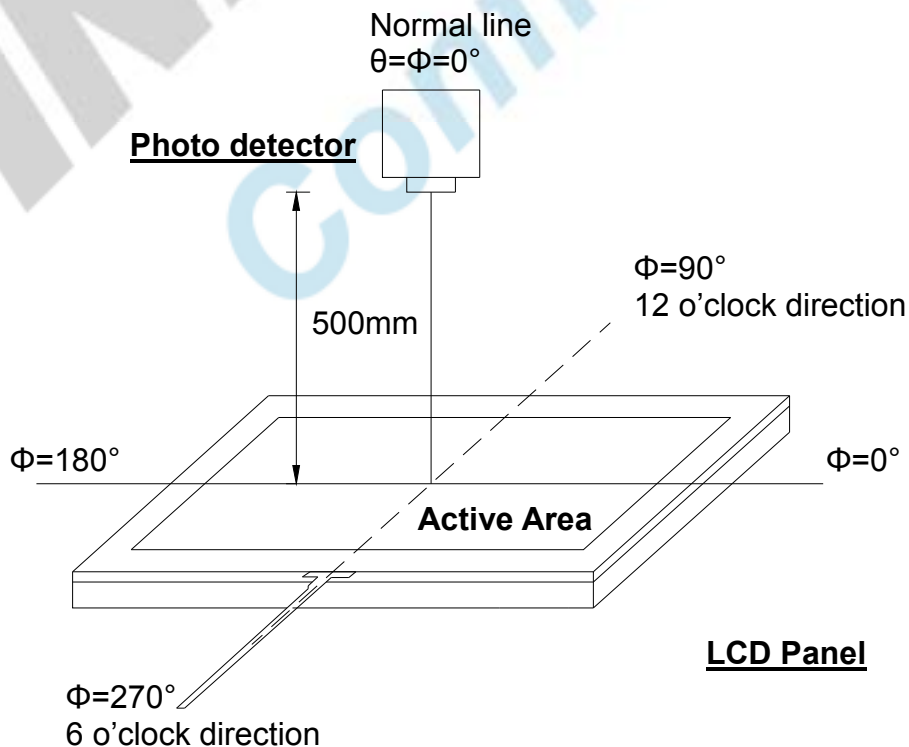


Fig. 4-2 Optical measurement system setup

Note 3: Definition of Response time

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time ( $T_{ON}$ ) is the time between photo detector output intensity changed from 90% to 10%. And fall time ( $T_{OFF}$ ) is the time between photo detector output intensity changed from 10% to 90%.

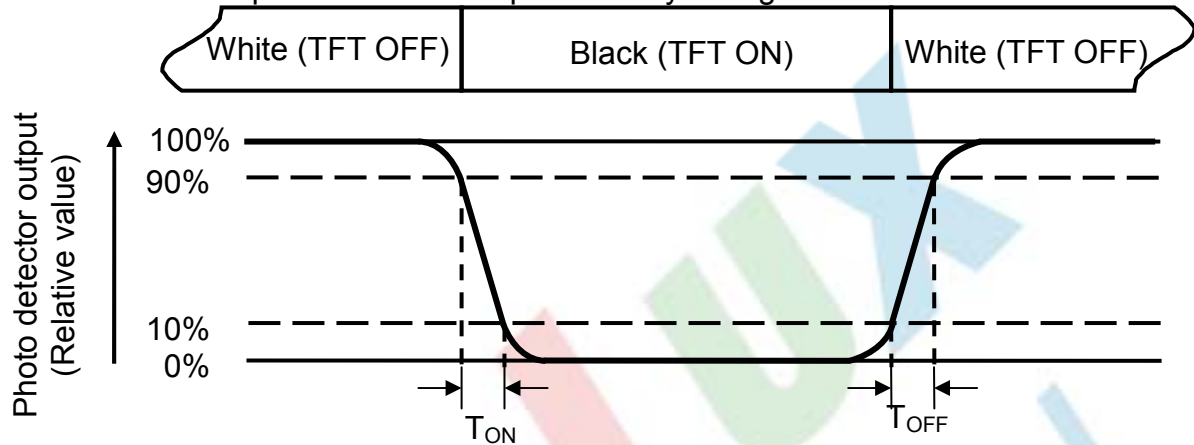


Fig. 4-3 Definition of response time

Note 4: Definition of contrast ratio

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

Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: All input terminals LCD panel must be ground while measuring the center area of the panel. The LED driving condition is  $I_L=100\text{mA}$ .

Note 7: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer to Fig. 4-4 ).Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (Yu)} = \frac{B_{min}}{B_{max}}$$

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

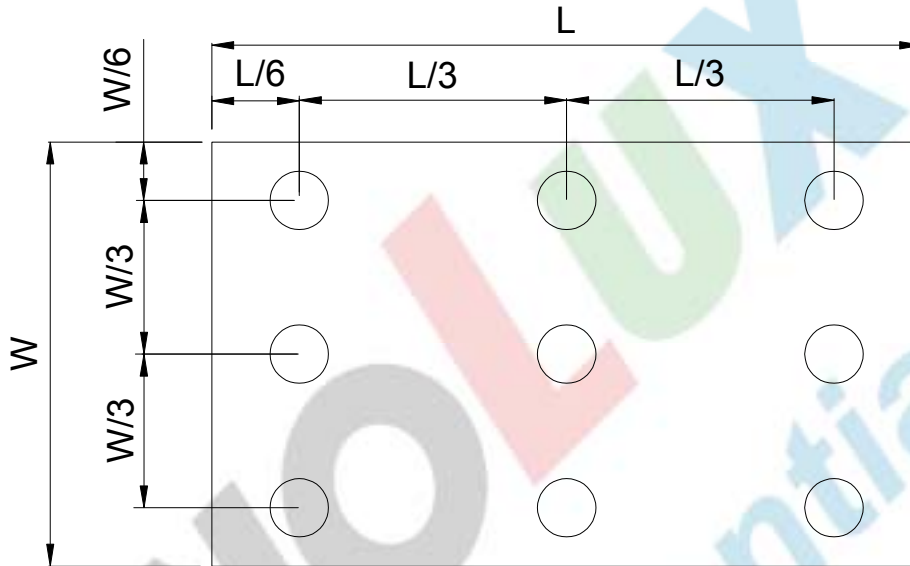


Fig. 4-4 Definition of measuring points

**B<sub>max</sub>**: The measured maximum luminance of all measurement position.

**B<sub>min</sub>**: The measured minimum luminance of all measurement position.



## 6. General Precautions

### 6.1. Safety

Liquid crystal is poisonous. Do not put it in your mouth. If liquid crystal touches your skin or clothes, wash it off immediately by using soap and water.

### 6.2. Handling

1. The LCD panel is plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.
2. The polarizer attached to the display is easily damaged. Please handle it carefully to avoid scratch or other damages.
3. To avoid contamination on the display surface, do not touch the module surface with bare hands.
4. Keep a space so that the LCD panels do not touch other components.
5. Put cover board such as acrylic board on the surface of LCD panel to protect panel from damages.
6. Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where the condensation of dew occurs.
7. Do not leave module in direct sunlight to avoid malfunction of the ICs.

### 6.3. Static Electricity

1. Be sure to ground module before turning on power or operating module.
2. Do not apply voltage which exceeds the absolute maximum rating value.

### 6.4. Storage

1. Store the module in a dark room where must keep at  $+25\pm 10^{\circ}\text{C}$  and 65%RH or less.
2. Do not store the module in surroundings containing organic solvent or corrosive gas.
3. Store the module in an anti-electrostatic container or bag.

### 6.5. Cleaning

1. Do not wipe the polarizer with dry cloth. It might cause scratch.
2. Only use a soft sloth with IPA to wipe the polarizer, other chemicals might permanent damage to the polarizer.



## 8.Package Drawing

### 8.1.Packaging Material Table

| No. | Item             | Model (Material)    | Dimensions(mm)    | Unit Weight (kg) | Quantity | Remark |
|-----|------------------|---------------------|-------------------|------------------|----------|--------|
| 1   | LCM Module       | AT056TN52 V.3       | 126.5 × 100 × 5.7 | 0.132            | 60pcs    |        |
| 2   | Partition        | B Corrugated paper  | 105 × 349         | 0.031            | 8pcs     |        |
| 3   | Corrugated Board | B Corrugated paper  | 510 × 350         | 0.074            | 2pcs     |        |
| 4   | Partition Paper  | BC Corrugated paper | 512 × 226 × 349   | 1.000            | 1set     |        |
| 5   | Dust-Proof Bag   | PE                  | 700 × 530         | 0.060            | 1pcs     |        |
| 6   | A/S Bag          | PE                  | 170 × 110 × 0.2   | 0.002            | 60pcs    |        |
| 7   | Carton           | Corrugated paper    | 530 × 355 × 255   | 0.810            | 1 pcs    |        |
| 8   | Total Weight     |                     |                   | 10.306 ± 5% kg   |          |        |

### 8.2.Packaging Quantity

|  |                                  |
|--|----------------------------------|
| Total LCM quantity in Carton: no. of Partition | 4 Rows x quantity per Row 15= 60 |
|--|----------------------------------|



