

## Approval sheet

**Customer:** \_\_\_\_\_  
**Modelname:**           JT500MINI-02P            
**Spec NO:** \_\_\_\_\_  
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- Preliminary Specification**  
 **Final Specification**

### For Customer's Acceptance

Approved by	Content

Approved by	Reviewed by	Prepared by

## Record of Reversion

Version	Revise date	Page	Content
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## 1. General Specification

No.	Item	Specification	Remark
1	LCD size	5.0 inch(Diagonal)	
2	Driver element	a-Si TFT active matrix	
3	Resolution	480 X 3(RGB) X 272	
4	Display mode	Normally White, Transmissive	
5	Active area	110.88(W) X 62.83(H) mm	
6	Module size	120.70(W) X 75.80(H) X 4.1(D) mm	Note1
7	Surface treatment	Anti-Glare	
8	Color arrangement	RGB-stripe	
9	Viewing direction	12 o' clock	
10	Gray scale viewing direction	6 o' clock	
11	Interface	24Bit RGB	
12	Backlight power consumption	TBD	
13	Weight	TBD	

Note 1: Refer to Mechanical Drawing.

## 2. Pin Assignment

### 2.1 TFT LCD Panel Driving Section

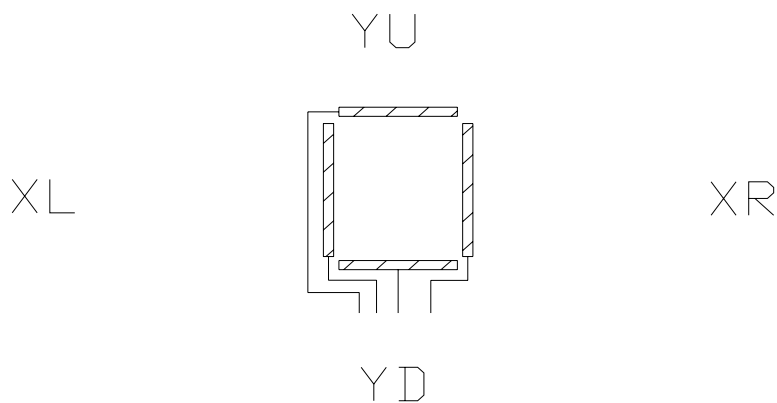
Pin No.	Symbol	I/O	Function	Remark
1	VLED-	P	Power for LED backlight (Cathode)	
2	VLED+	P	Power for LED backlight (Anode)	
3	GND	P	Power ground	
4	VDD	P	Power supply	
5	R0	I	Data bus	
6	R1	I	Data bus	
7	R2	I	Data bus	
8	R3	I	Data bus	
9	R4	I	Data bus	
10	R5	I	Data bus	
11	R6	I	Data bus	
12	R7	I	Data bus	
13	G0	I	Data bus	
14	G1	I	Data bus	
15	G2	I	Data bus	
16	G3	I	Data bus	
17	G4	I	Data bus	
18	G5	I	Data bus	
19	G6	I	Data bus	
20	G7	I	Data bus	
21	B0	I	Data bus	
22	B1	I	Data bus	
23	B2	I	Data bus	
24	B3	I	Data bus	
25	B4	I	Data bus	
26	B5	I	Data bus	
27	B6	I	Data bus	
28	B7	I	Data bus	
29	GND	P	Power ground	

30	DCLK	I	Dot clock	
31	DISP	I	Display on/off	
32	HSYNC	I	Horizontal signal YNC	
33	VSYNC	I	Vertical signal YNC	
34	DE	I	Data enable	
35	NC	-	No connect	
36	GND	P	Power Ground	
37	XR	I	TP pin	
38	YD	I	TP pin	
39	XL	I	TP pin	
40	YU	I	TP pin	

## 2.2. Touch Screen Panel Section

Symbol	I/O	Function	Remark
YU	Top	Top electrode – differential analog	
XL	Left	Left electrode – differential analog	
YD	Bottom	Bottom electrode – differential analog	
XR	Right	Right electrode – differential analog	

Note: Touch screen panel block



### 3. Operation Specifications

#### 3.1. Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Supply voltage for logic	VDD	-0.3	3.6	V
Input voltage for logic	V <sub>IN</sub>	-0.5	VDD +0.3	V
Supply current (One LED)	I <sub>LED</sub>		30	mA
Operating temperature	T <sub>OP</sub>	-20	+70	°C
Storage temperature	T <sub>ST</sub>	-30	+80	°C

#### 3.1.1. Typical Operation Conditions

Item	Symbol	Min	Typ	Max	Unit	Applicable terminal
Supply voltage for logic	VDD	3	3.3	3.6	V	V <sub>DD</sub>
Input voltage	V <sub>IL</sub>	-0.3	-	0.2 VDD	V	
	V <sub>IH</sub>	0.8 VDD	-	VDD	V	
Input leakage current	I <sub>LKG</sub>				μA	
LED Forward voltage	V <sub>f</sub>	3.0	3.2	3.4	V	With One LED
Input backlight current	I <sub>LED</sub>	-	20	25	mA	With One LED

## 3.1.2. Backlight Driving Conditions

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Voltage for LED backlight	$V_L$	15	16	17	V	Note 1
Current for LED backlight	$I_L$	-	40	50	mA	
LED life time	-	30,000	-	-	Hr	Note 2

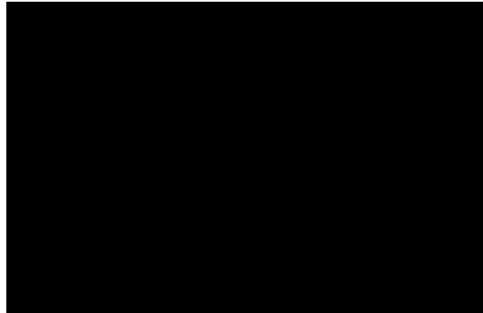
Note 1: The LED Supply Voltage is defined by the number of LED at  $T_a=25^{\circ}\text{C}$  and  $I_L=40\text{mA}$ .

Note 2: The “LED life time” is defined as the module brightness decrease to 50% original brightness at  $T_a=25^{\circ}\text{C}$  and  $I_L=40\text{mA}$ . The LED lifetime could be decreased if operating  $I_L$  is larger than 50 mA.

Note 3: Typ.specification: Gray-level test pattern; Max.specification: Black-level test pattern.



(a) Gray-level test pattern

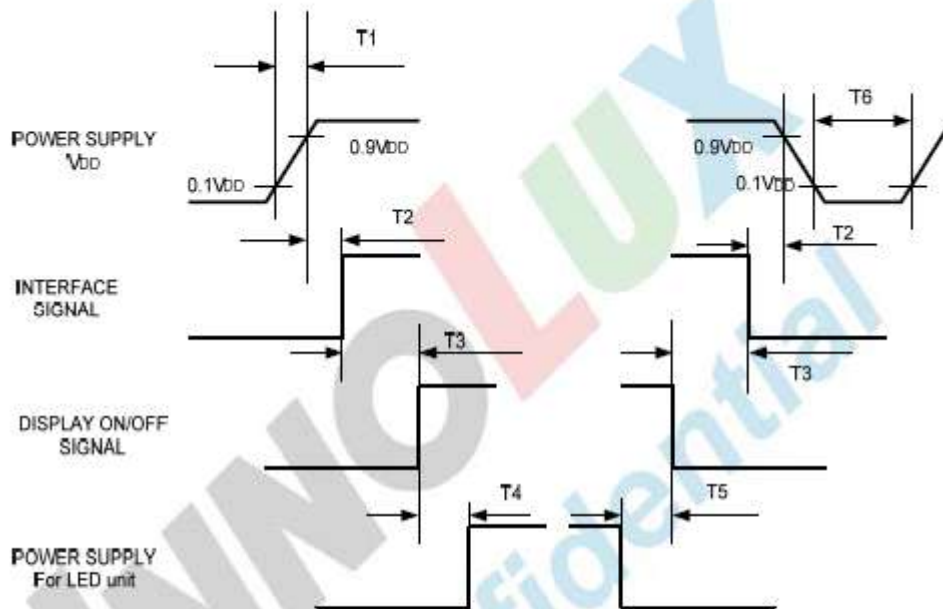


(b) Black-level test pattern



### 3.2. Power Sequence

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence should be as the diagram below.



Symbol	Specification	Symbol	Specification
T1	$0 \leq T1 \leq 10 \text{ msec}$	T4	$160 \text{ msec} \leq T4$
T2	$0 \leq T2 \leq 100 \text{ msec}$	T5	$160 \text{ msec} \leq T5$
T3	$0 \leq T3 \leq 200 \text{ msec}$	T6	$1 \text{ msec} \leq T6$

## 3.3. Timing Characteristics

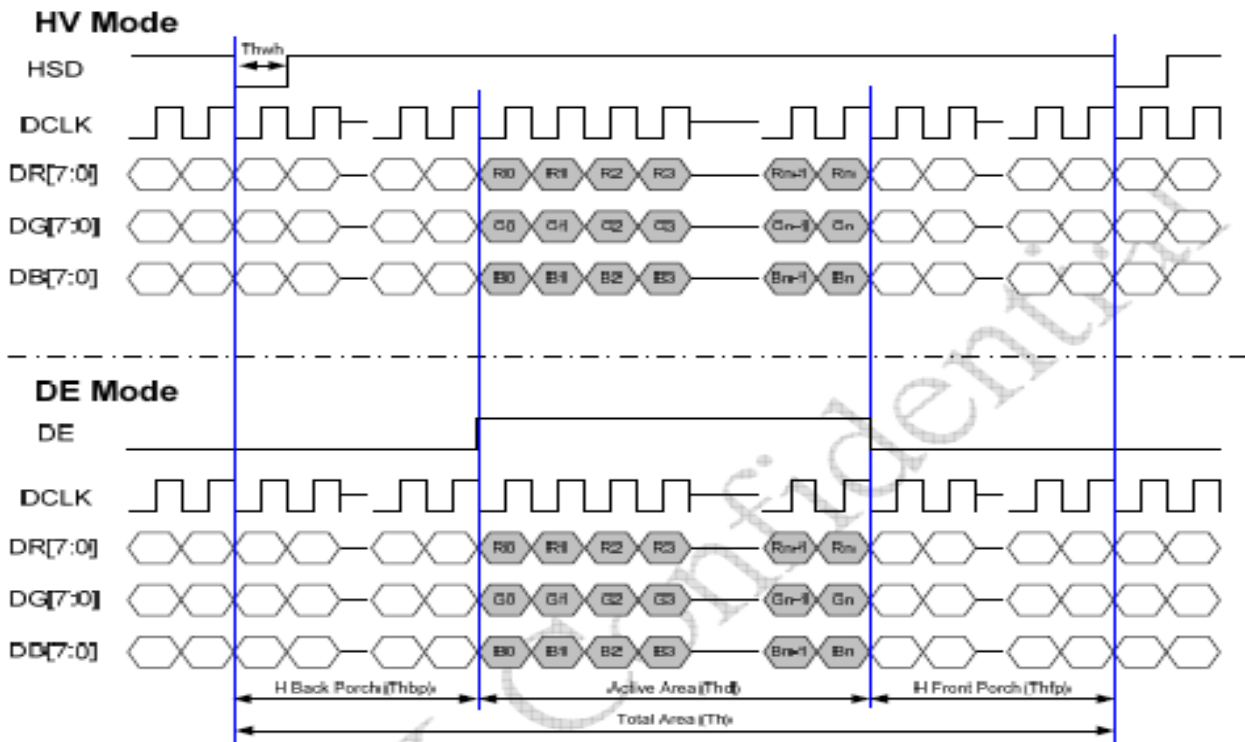
## Parallel RGB input timign table

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
DCLK frequency	fclk	5	9	12	MHz
VSD period time	Tv	277	288	400	H
VSD display area	Tvd	272			H
VSD back porch	Tvb	3	8	31	H
VSD front porch	Tvfp	2	8	97	H
HSD period time	Th	520	525	800	DCLK
HSD display area	Thd	480			DCLK
HSD back porch	Thbp	36	40	255	DCLK
HSD front porch	Thfp	4	5	65	DCLK

Parameters	Symbol	Min.	Typ.	Max.	Unit	Conditions
DCLK frequency	Fclk	24	27	30	MHz	
DCLK cycle time	Tclk	83	110	200	ns	
DCLK pulse duty	Tcwh	40	50	60	%	
Time from HSD to source output	Thso	-	13	-	DCLK	
Time from HSD to gate output	Thgo	-	27	-	DCLK	
Time from HSD to gate output off	Thgz	-	3	-	DCLK	
Time from HSD to VCOM	Thvc	-	12	-	DCLK	

Data Input Format

Parallel RGB mode data format



## 4. Touch Screen Panel Specifications

### 4.1. Electrical Characteristics

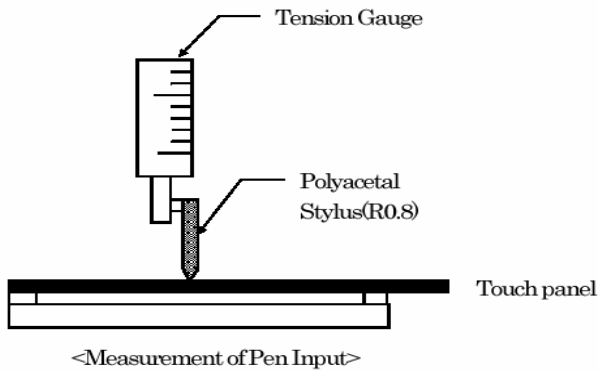
Item	Value			Unit	Remark
	Min.	Typ.	Max.		
Linearity	--	--	1.5	%	Analog X and Y directions
Terminal Resistance	400	-	1050	$\Omega$	X(Film side)
	100	-	450	$\Omega$	Y(Glass side)
Insulation resistance	25	-	-	M $\Omega$	DC 25V
Voltage	-	-	10	V	DC
Chattering	-	-	10	ms	100k $\Omega$ pull-up
Transparency	80	-	-	%	

### 4.2. Mechanical & Reliability Characteristics

Item	Value			Unit	Remark
	Min.	Typ.	Max.		
Active force	10	-	100	g	Note 1
Durability-surface scratching	Write 100,000	-	-	characters	Note 2
Durability-surface pitting	1,000,000	-	-	touches	Note 3
Surface hardness	3	-	-	H	

Note 1: Active force test condition

- (1) Input DC 5V on X direction, Drop off Polyacetal Stylus (R0.8), until output voltage stabilize ,then get the activation force.
- (2) R8.0mm Silicon rubber for finger Activation force test
- (3) Test point: 9 points



Note 2: Measurement for surface area.

-Scratch 100,000 times straight line on the film with a stylus change every 20,000 times.

-Force: 250gf.

-Speed: 60mm/sec.

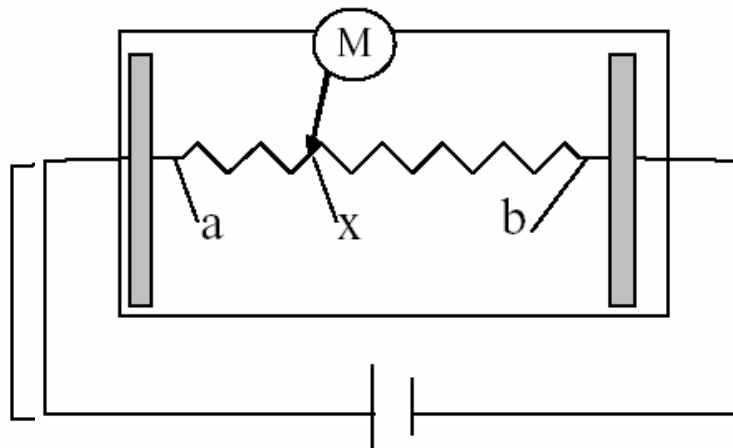
-Stylus: R0.8 polyacetal tip.

Note 3: Pit 1,000,000 times on the film with a R0.8 silicon rubber.

-Force: 250gf.

-Speed: 2times/sec.

### 4.3. Linearity Definition

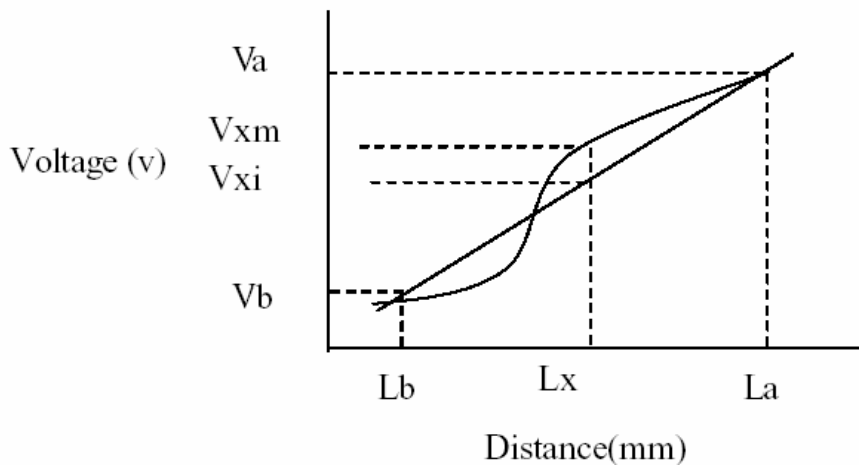


Va: maximum voltage in the active area of touch panel

Vb: minimum voltage in the active area of touch panel X: random measuring point

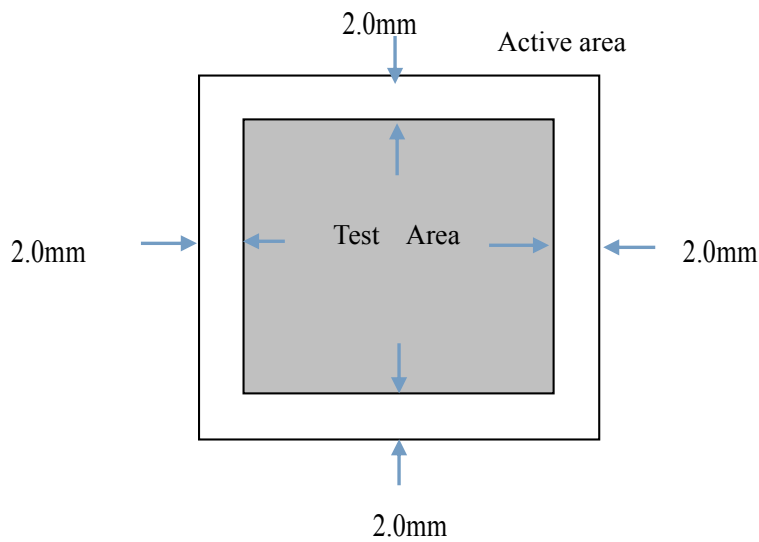
Vxm: actual voltage of Lx point

Vxi: theoretical voltage of Lx point



$$\text{Linearity} = \left[ \frac{|V_{xi} - V_{xm}|}{(V_a - V_b)} \right] * 100\%$$

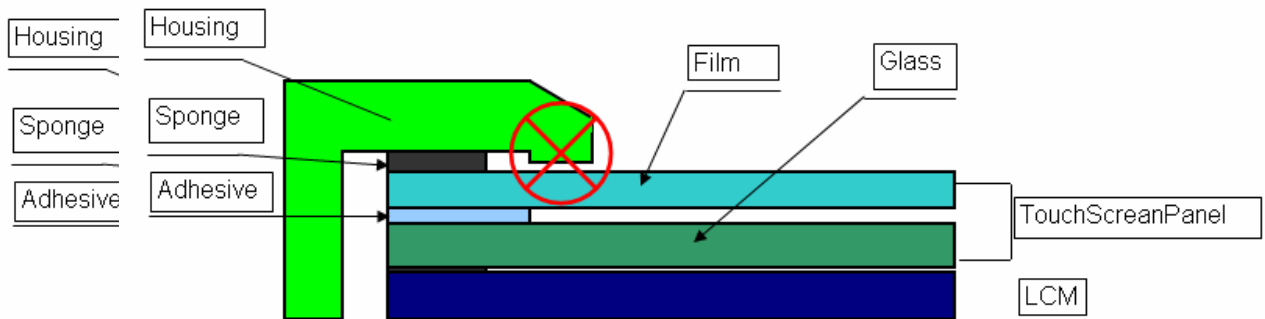
Note: Test area is as follows and operation force is 150gf



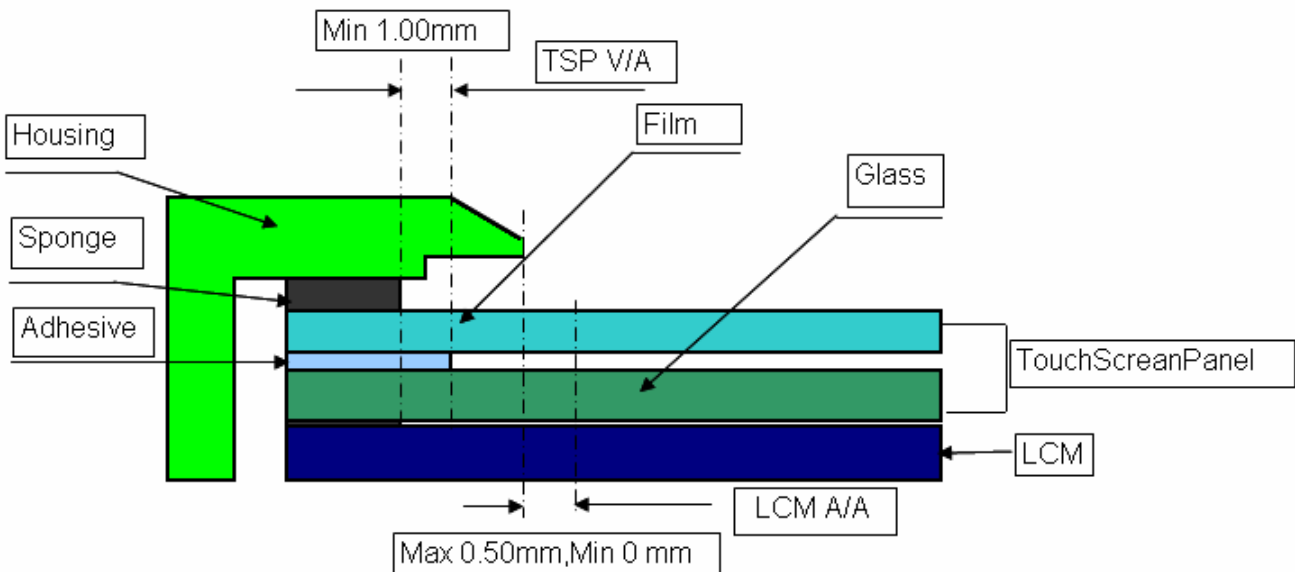
### 4.4. Housing Design Guide

Housing design follow as below.

- 1) Avoid the design that housing overlap and press on the active area of the LCM.
- 2) Give enough gap(over 0.5mm at compressed) between the housing and TSP to protect wrong operating.



- 3) Use a buffer material(Gasket) between the TSP and housing to protect damage and wrong operating.area.overlap and press on the inside of TSP view



## 5. Optical Specifications

ITEM		SYMBOL	CONDITIONS	SPECIFICATIONS			UNIT	NOTE
				MIN.	TYP.	MAX		
Brightness		B	Viewing normal angle	-	200	-	Cd/m <sup>2</sup>	All left side data are referenced only
Contrast Ratio		CR		400	500	--	--	
Response Time		Tr+Tf		--	35		ms	
CIE Color coordinate	Red	X <sub>R</sub>		--	0.608			
		Y <sub>R</sub>			0.316			
	Green	X <sub>G</sub>		--	0.305			
		Y <sub>G</sub>			0.556			
	Blue	X <sub>B</sub>		--	0.135			
		Y <sub>B</sub>			0.137			
White	X <sub>W</sub>	--		0.270				
	Y <sub>W</sub>		0.290					
Viewing Angle	Hor.	$\theta_{x+}$	Center CR>=10	60	70	--	Deg.	
		$\theta_{x-}$		60	70	--		
	Ver.	$\theta_{y+}$		40	50	--		
		$\theta_{y-}$		60	70			
Uniformity	Un		70	75		%		



Note 1: Definition of viewing angle range

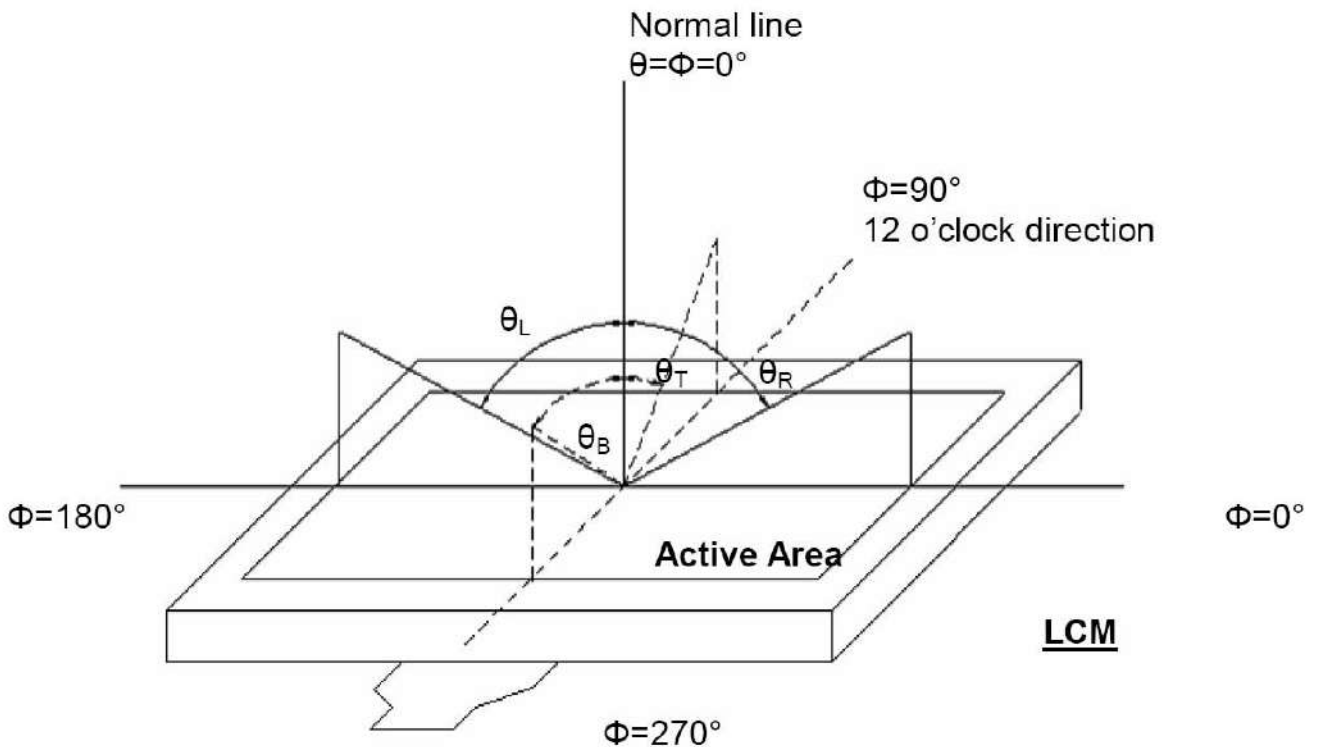


Fig. 4-1 Definition of viewing angle

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:  $1^\circ$  /Height: 500mm.)

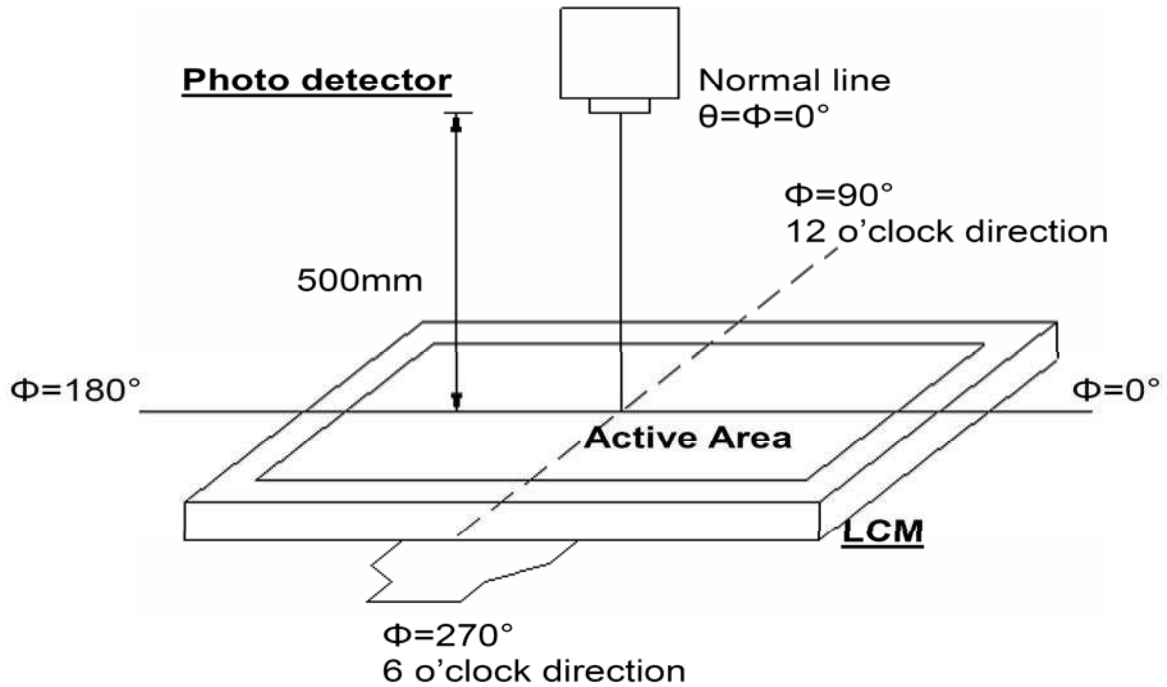


Figure 4-2 Optical measurement system setup

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%.

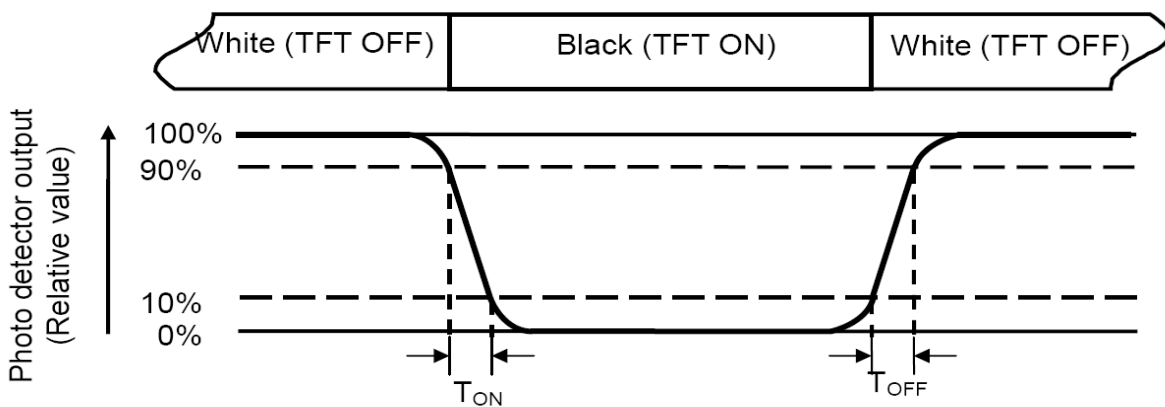


Figure 4-3 Definition of response time

Note 4: Definition of contrast ratio

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

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  $I_L=180\text{mA}$ .

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

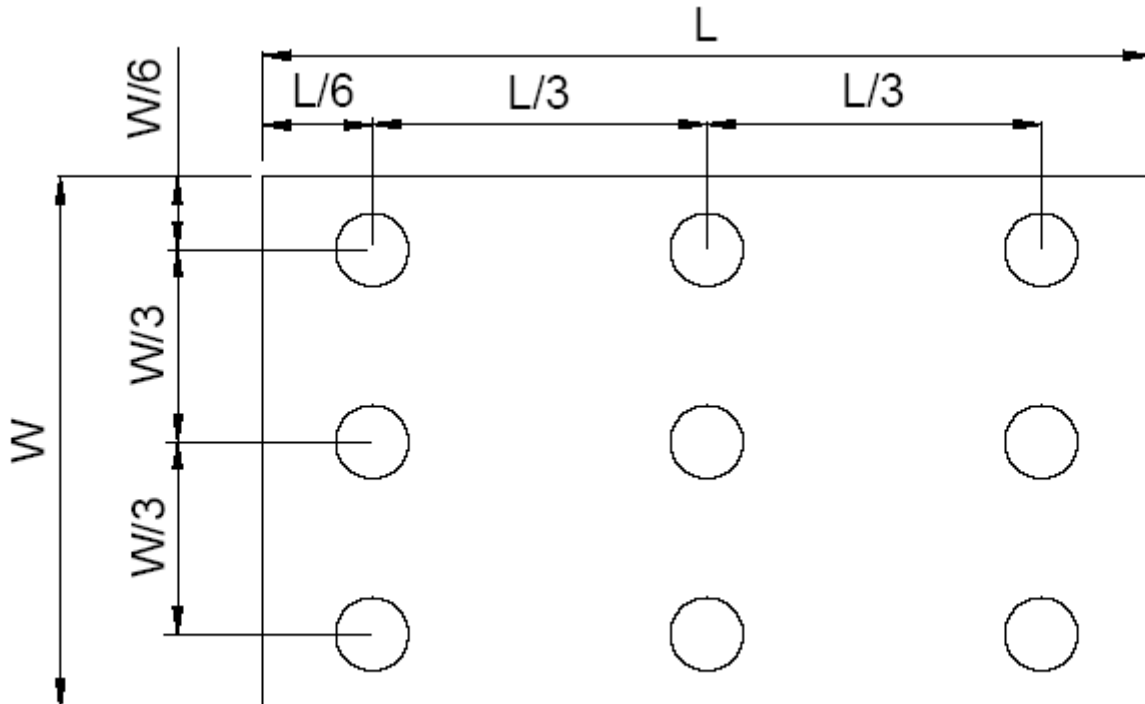


Fig. 4-4 Definition of measuring points

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

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

**6. Reliability Test Items**

(NOTE 3)

Item	Test Conditions	Remark
High temperature storage	Ta=80℃ 240hrs	NOTE1 , NOTE4
Low temperature storage	Ta=-30℃ 240hrs	NOTE1 , NOTE4
High temperature operation	Ta=70℃ 240hrs	NOTE2 , NOTE4
Low temperature operation	Ta=-20℃ 240hrs	NOTE2 , NOTE4
Operate at high temperature and humidity	+60℃, 90%RH 240hrs	NOTE4
Thermal Shock	-30℃/30min~+80℃/30min for a total 100 cycles ,start with cold temperature and end with high temperature .	NOTE4
Vibration Test	Frequency range:10~55HZ Stroke:1.5mm Swap:10HZ~55HZ~10HZ 2 hours of each direction of X.Y. Z (6 hours for total)	
Mechanical shock	100G 6ms, ± X, ± Y, ± Z 3 times for each direction	
Package vibration test	Random vibration :0.15G*G/HZ from 5-200 HZ,-6dB/Octave from 200-500HZ of each direction of X.Y. Z (6 hours for total)	
Low temperature storage	Height:60cm 1 corner ,3 edges ,6 surfaces	
Low temperature storage	± 2KV ,Human Body Mode, 100pF/1500 Ω	

Note 1: Ta is the ambient temperature of samples.

Note 2: Ts is the temperature of panel' s surface.

Note 3: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don' t guarantee all of the cosmetic specification.

Note 4: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

## 7. General Precautions

### 7.1. 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.

### 7.2. 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.

### 7.3. 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.

### 7.4. 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.

### 7.5. Cleaning

1. Do not wipe the polarizer with dry cloth. It might cause scratch.

2. Only use a soft cloth with IPA to wipe the polarizer, other chemicals might permanent damage to the polarizer .



## 9. Package Drawing

