

CREDIT DISPLAY CORPORATION

Tel: 0755-82730276

Web: www.crddisplay.com

SPECIFICATION FOR LCD MODULE

Customer : _____

Product Model: _____ CRD043TN01-40TM02

Sample code: _____

Designed by	Checked by	Approved by

Final Approval by Customer

<input type="checkbox"/> LCM Machinery OK Checked By _____ <input type="checkbox"/> LCM Display OK Checked By _____	<input type="checkbox"/> LCM OK <input type="checkbox"/> NG , Problem survey: Approved By _____
--	---

※The specification of “TBD” should refer to the measured value of sample . If there is difference between the design specification and measured value, we naturally shall negotiate and agree to solution with customer.

Revision History

[illegible]

CREDIT DISPLAY CORPORATION

Contents

1. General Specifications	1
2. Pin Assignment	2
2.1. TFT LCD Panel Driving Section.....	2
2.2. Touch Screen Panel Section.....	4
3. Operation Specifications	5
3.1. Absolute Maximum Ratings	5
3.2. Typical operation conditions	6
3.3. Backlight Driving Conditions	6
3.4. Power Sequence	7
3.5. Timing Characteristics	8
3.5.1. Timing Conditions	8
3.5.2. Timing Diagram	9
4. Touch Screen Panel Specifications	10
4.1. Electrical Characteristics	10
4.2. Mechanical & Reliability Characteristics	11
4.3. Linearity Definition	12
4.4. Housing design guide	13
5. Optical Specifications	14
6. Reliability Test Items	18
7. General Precautions	19
7.1. Safety	19
7.2. Handling	19
7.3. Static Electricity.....	19
7.4. Storage	19
7.5. Cleaning	19
8. Mechanical Drawing	20

1. General Specifications

No.	Item	Specification	Remark
1	LCD size	4.3 inch(Diagonal)	
2	Driver element	a-Si TFT active matrix	
3	Resolution	480×3(RGB)×272	
4	Display mode	Normally White, Transmissive	
5	Dot pitch	198(W)×198(H) um	
6	Active area	95.04(W)×53.86 (H) mm	
7	Module size	105.5(W)×67.2(H)×4.05(D) mm	Note 1
8	Surface treatment	Anti-Glare	
9	Color arrangement	RGB-stripe	
10	Interface	Digital	
11	Backlight power consumption	TBD	
12	Panel power consumption	TBD	
13	Weight	TBD	

Note 1: Refer to Mechanical Drawing.

2. Pin Assignment

2.1.TFT LCD Panel Driving Section

1	GLED	GND for LED
2	VLED	Power for LED
3	GND	Ground
4	VDD	Digital power supply(+3.3V)
5	R0	Red data(LSB)
6	R1	Red data
7	R2	Red data
8	R3	Red data
9	R4	Red data
10	R5	Red data
11	R6	Red data
12	R7	Red data(MSB)
13	G0	Green data(LSB)
14	G1	Green data
15	G2	Green data
16	G3	Green data
17	G4	Green data
18	G5	Green data
19	G6	Green data
20	G7	Green data(MSB)
21	B0	Blue data(LSB)
22	B1	Blue data
23	B2	Blue data
24	B3	Blue data
25	B4	Blue data
26	B5	Blue data
27	B6	Blue data
28	B7	Blue data(MSB)

CREDIT DISPLAY CORPORATION

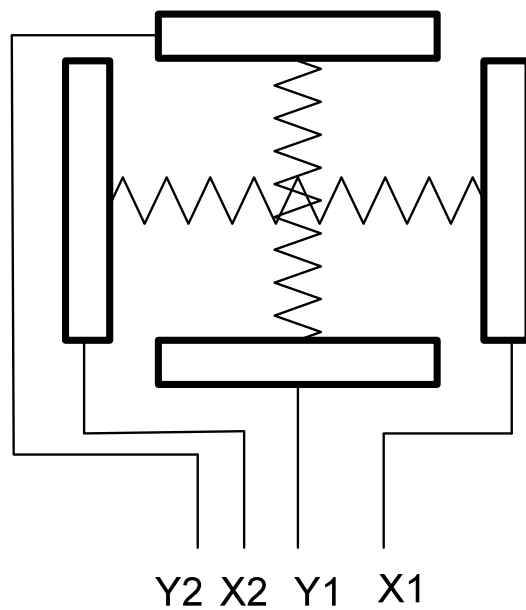
Page:3/20

29	GND	Ground
30	DCLK	Data clk
31	DISP	Display ON/OFF control. Internally pulled high
32	NC	No connection
33	NC	No connection
34	DE	Data Enable
35	NC	No connection
36	GND	Ground
37	XR	T/p X-Right
38	YD	T/p Y-Bottom
39	XL	T/p X-Left
40	YU	T/p Y-Up

2.2. Touch Screen Panel Section

Symbol	I/O	Function	Remark
X1	Right	Right electrode – differential analog	
Y1	Bottom	Bottom electrode – differential analog	
X2	Left	Left electrode – differential analog	
Y2	Top	Top electrode – differential analog	

Note: Touch Screen Panel Block



Top View

3. Operation Specifications

3.1. Absolute Maximum Ratings

(Note 1)

Item	Symbol	Values		Unit	Remark
		Min.	Max.		
Supply voltage	V_{DD}	-0.3	4.5	V	
Operation Temperature	T_{OP}	-20	60	°C	
Storage Temperature	T_{ST}	-30	70	°C	
LED Reverse Voltage	VR	-	5	V	Each LED Note 2
LED Forward Current	IF	-	25	mA	Each LED

Note 1: The absolute maximum rating values of this product are not allowed to be exceeded at any times. Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed.

Note 2: VR Conditions: Zener Diode 20mA

3.1.1. Typical Operation Conditions

Item	Symbol	Values			Unit	Remark
		Min.	Typ	Max.		
Power voltage	V_{DD}	3.0	3.3	3.6	V	Note 2
Current for Driver	$I_{V_{DD}}$	-	17	25	mA	
Input logic high voltage	V_{IH}	$0.8 V_{DD}$	-	V_{DD}	V	Note 3
Input logic low voltage	V_{IL}	0	-	$0.2 V_{DD}$	V	

3.1.2. Backlight Driving Conditions

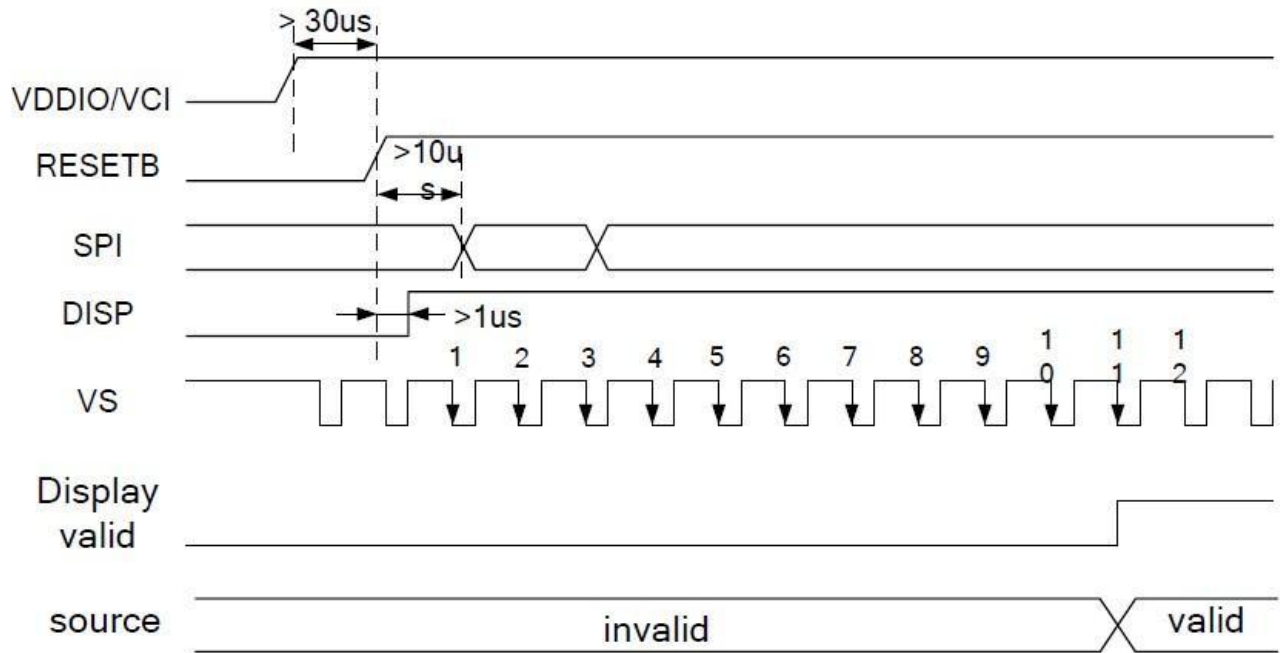
Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Voltage for LED backlight	V_L	20.2	22.9	24.5	V	Note 1
Current for LED backlight	I_L	18	20	25	mA	
LED life time	-	-	20,000	-	Hr	Note 2

Note 1: The LED Supply Voltage is defined by the number of LED at $T_a=25^{\circ}\text{C}$ and $I_L=20\text{mA}$.

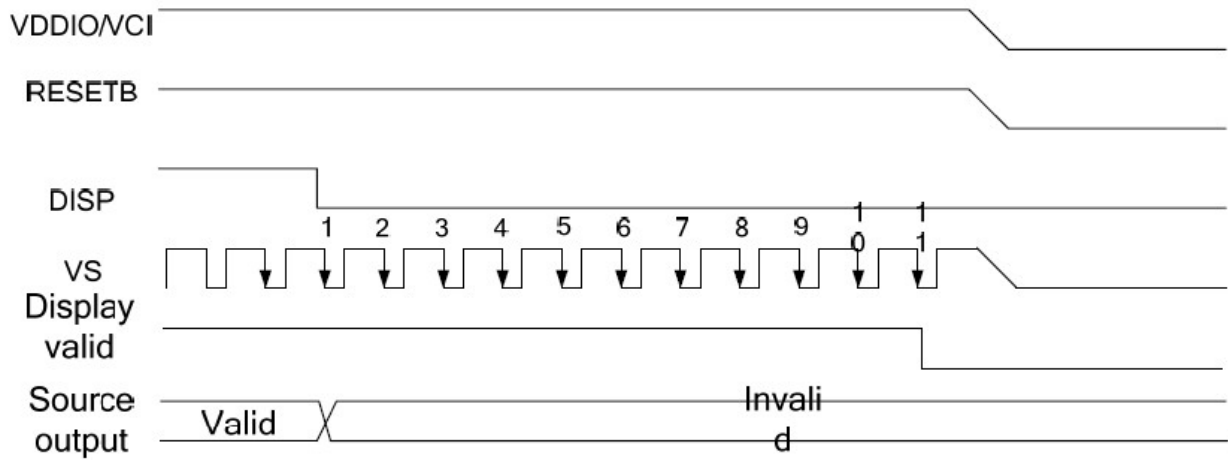
Note 2: The “LED life time” is defined as the module brightness decrease to 50% original brightness at $T_a=25^{\circ}\text{C}$ and $I_L=20\text{mA}$. The LED lifetime could be decreased if operating I_L is larger than 40mA.

3.2. Power Sequence

Power on sequence



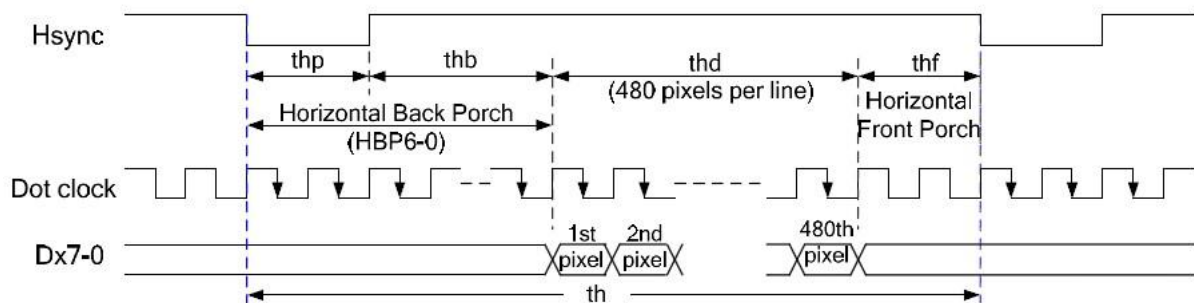
Power off sequence



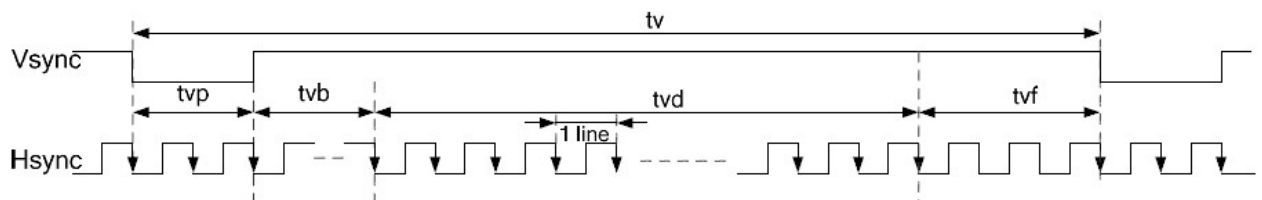
3.3. Timing Characteristics

3.3.1. Sync Mode

Horizontal timing



Vertical timing

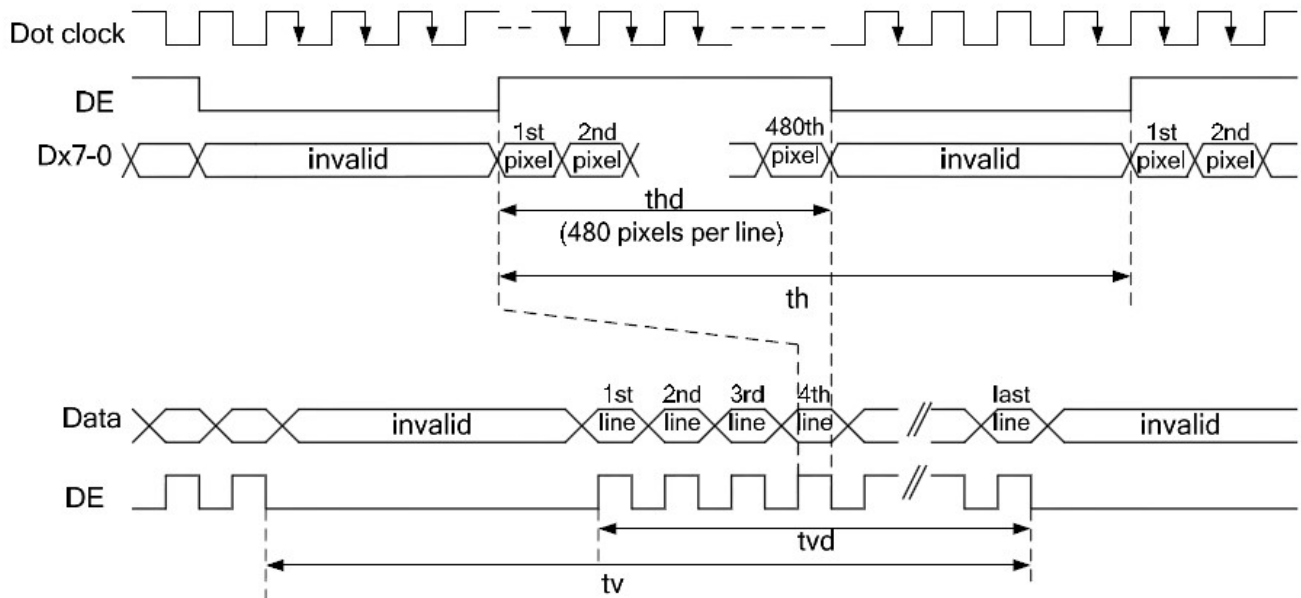


Timing Table

Parameter	Symbol	Min	Typ.	Max	Unit
Clock frequency	$1/t_{CLK}$	-	9	15	MHz
Hsync frequency	$1/t_h$	-	17.14	-	KHz
Vsync frequency	$1/t_v$	-	59.94	-	Hz
Horizontal timing					
Horizontal cycle	th	525	525	605	CLK
Horizontal display period	thd	480	480	480	CLK
Horizontal front porch	thf	2	2	82	CLK
Horizontal pulse width	thp ⁽¹⁾	2	41	41	CLK
Horizontal back porch	thb ⁽¹⁾	2	2	41	CLK
Vertical timing					
Vertical cycle	tv	285	286	511	H
Vertical display period	tvd	272	272	272	H
Vertical front porch	tvf	1	2	227	H
Vertical pulse width	tvp ⁽¹⁾	1	10	11	H
Vertical back porch	tvb ⁽¹⁾	1	2	11	H

Note (1) it is necessary to keep $tvp + tvb = 12$ and $thp + thb = 43$.

3.3.2. De Mode


Timing Table

Parameter	Symbol	Min	Typ.	Max	Unit
Clock frequency	$1/t_{CLK}$	-	9	15	MHz
Hsync frequency ⁽³⁾	$1/t_h$	-	17.14	-	KHz
Vsync frequency ⁽³⁾	$1/t_v$	-	59.94	-	Hz
Horizontal timing					
Horizontal cycle	t_h	525	525	605	CLK
Horizontal display period	t_{hd}	480	480	480	CLK
Vertical timing					
Vertical cycle	t_v	285	286	511	H ⁽⁴⁾
Vertical display period	t_{vd}	272	272	272	H ⁽⁴⁾

Note (3) HSYNC is not necessary in DE mode. VSYNC is not necessary in DE mode when DEO=0.

Note (4) 1 H=1 t_h .

3.3.3. Input Setup Timing Requirement

Parameter	Symbol	Spec.			Unit
		Min	Typ.	Max	
DISP setup time	t_{diss}	10	-	-	ns
DISP hold time	t_{dish}	10	-	-	ns
Clock period	PW_{CLK}	66.7	-	-	ns
Clock pulse high period	PWH	26.7	-	-	ns
Clock pulse low period	PWL	26.7	-	-	ns
Hsync setup time	t_{hs}	10	-	-	ns
Hsync hold time	t_{hh}	10	-	-	ns
Data setup time	t_{ds}	10	-	-	ns
Data hold time	t_{dh}	10	-	-	ns
DE setup time	t_{des}	10	-	-	ns
DE hold time	t_{deh}	10	-	-	ns
Vsync setup time	t_{vhs}	10	-	-	ns
Vsync hold time	t_{vhh}	10	-	-	ns

4. Touch Screen Panel Specifications

4.1. Electrical Characteristics

Item	Value			Unit	Remark
	Min.	Typ.	Max.		
Terminal Resistance	100	-	550	Ω	X(Film side)
	450	-	1150	Ω	Y(Glass side)
Insulation resistance	20	-	-	M Ω	DC 25V
Voltage	-	5	6	V	DC
Chattering	-	-	10	ms	100k Ω pull-up
Transparency	72	-	-	%	JIS K7105

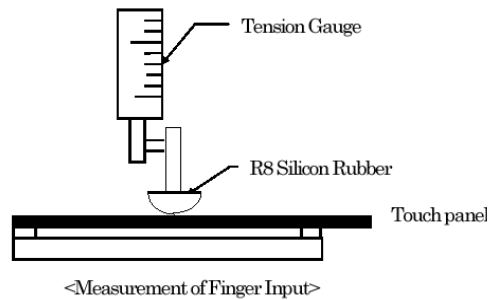
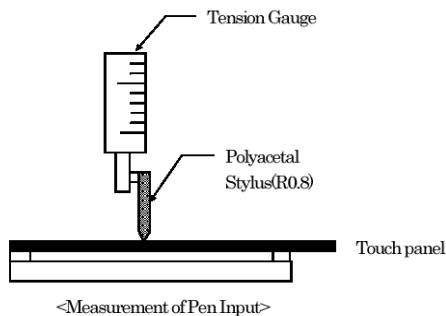
Note: Avoid operating with hard or sharp material such as a ball point pen or a mechanical pencil except a polyacetal pen (tip R0.8mm or less) or a finger.

4.2. Mechanical & Reliability Characteristics

Item	Value			Unit	Remark
	Min.	Typ.	Max.		
Activation force	80	-	-	gf	Note 1
Durability-surface scratching	Write 100,000	-	-	characters	Note 2
Durability-surface pitting	500,000	-	-	touches	Note 3
Surface hardness	3	-	-	H	JIS K5400

Note 1: Activation 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



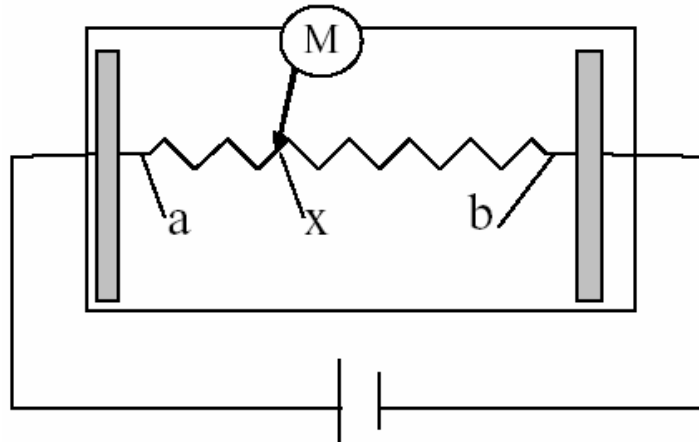
Note 2: Measurement for surface area.

- Scratch 100,000 times straight line on the film with a stylus change every 20,000 times.
- Force: 110gf.
- 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: 110gf.
- Speed: 2times/sec.

4.3. Linearity Definition



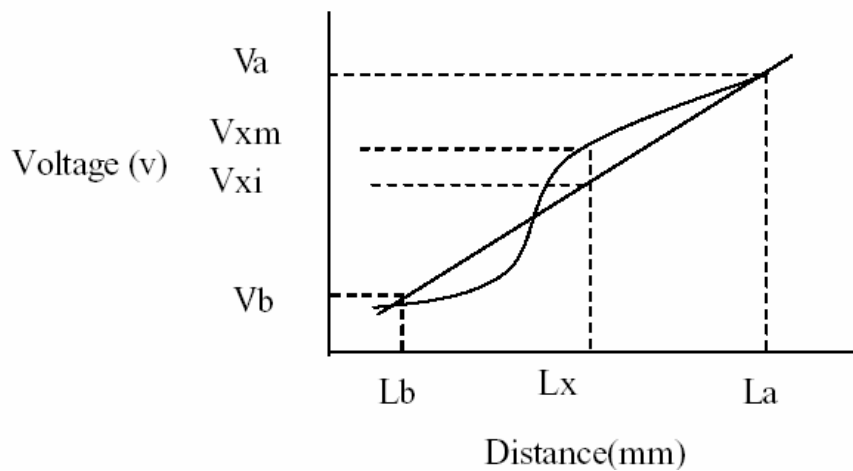
Va: maximum voltage in the active area of touch panel

Vb: minimum voltage in the active area of touch panel

X: random measuring point

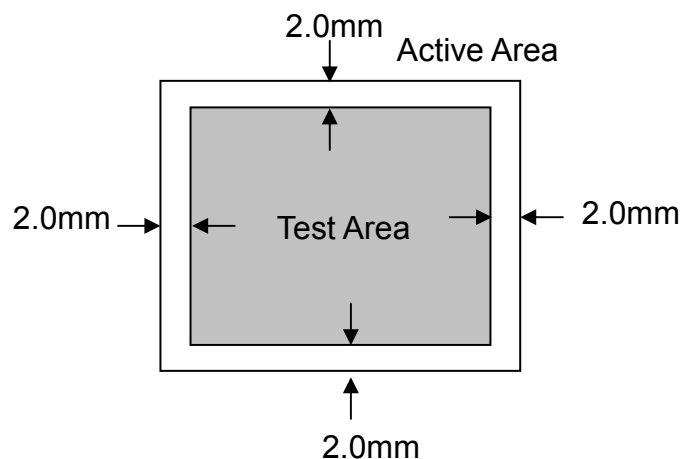
Vxm: actual voltage of Lx point

Vxi: theoretical voltage of Lx point



$$\text{Linearity} = \frac{|V_{xi} - V_{xm}|}{(V_a - V_b)} \times 100\% < 2\%$$

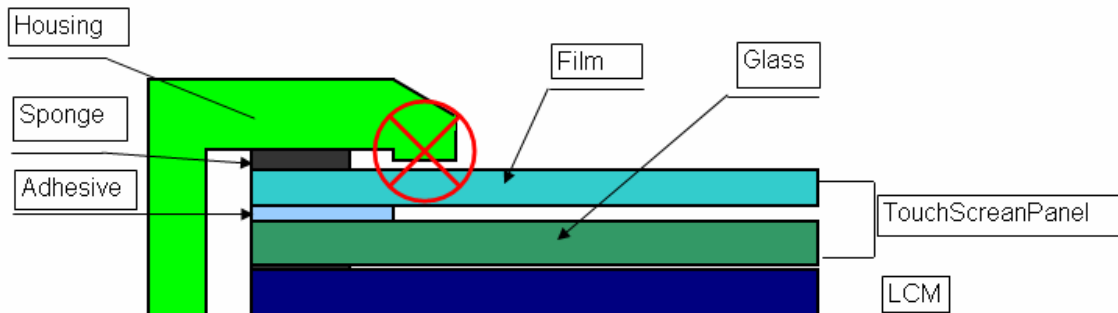
Note: Test area is as follows and operation force is 150gf.



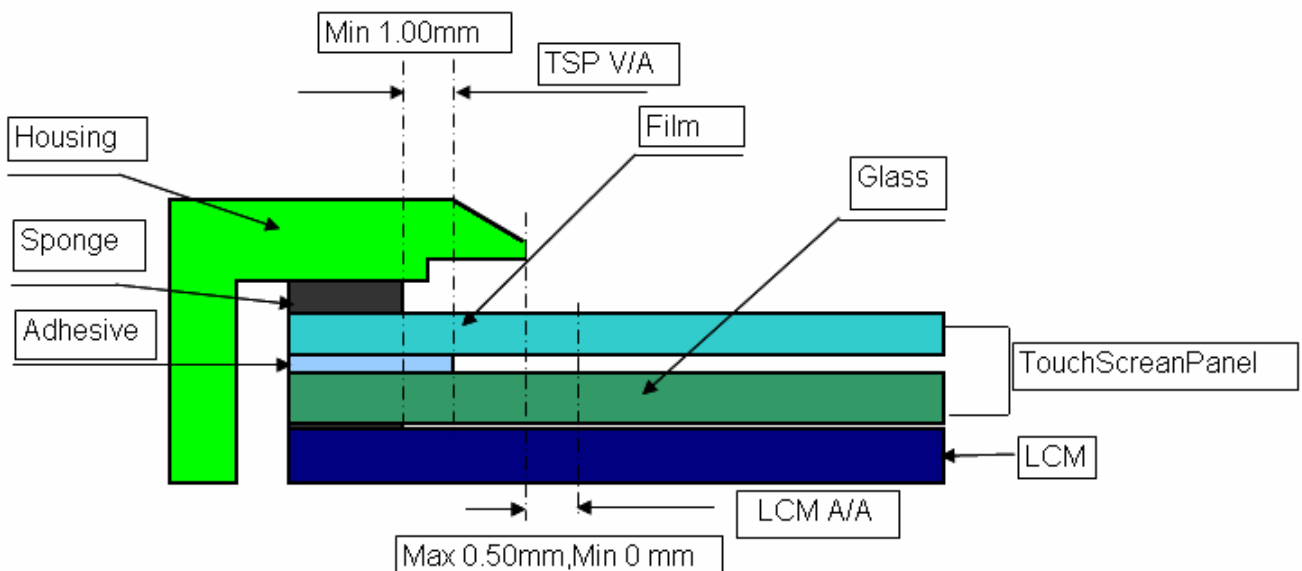
4.4. Housing design guide

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
- 4) Avoid the design that buffer material overlap and press on the inside of TSP view area



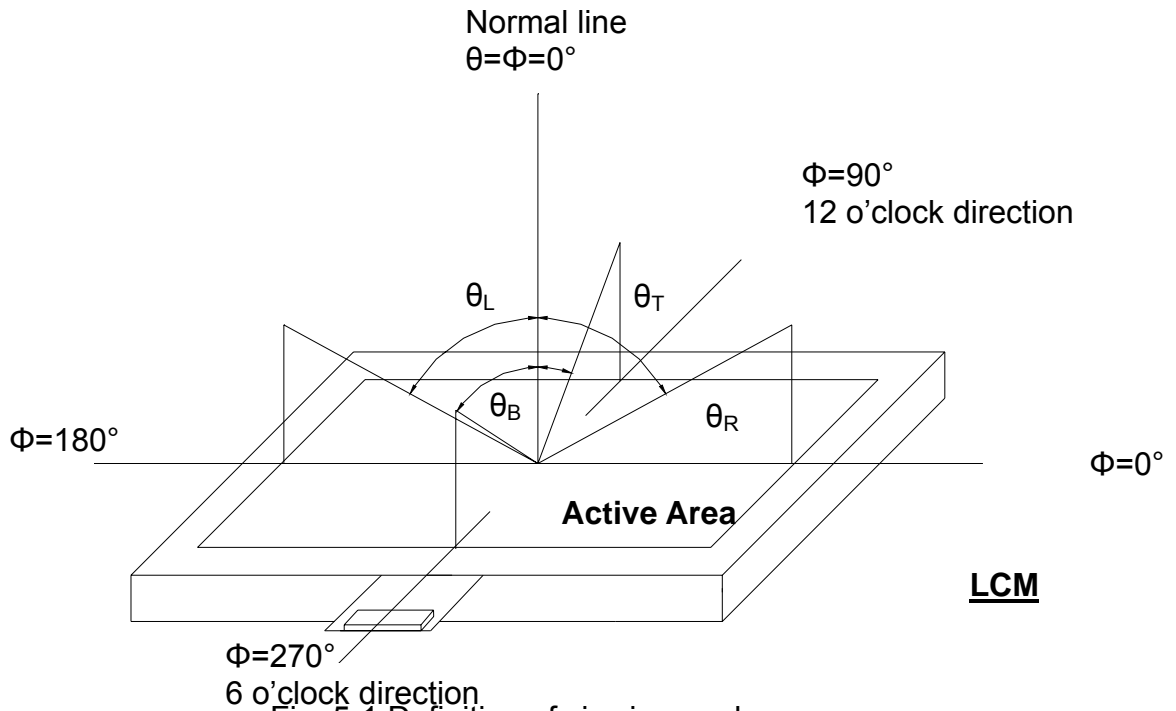
5. Optical Specifications

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Viewing angle (CR≥ 10)	θ_L	$\Phi=180^\circ$ (9 o'clock)	-	75	-	degree	Note 1
	θ_R	$\Phi=0^\circ$ (3 o'clock)	-	75	-		
	θ_T	$\Phi=90^\circ$ (12 o'clock)	-	70	-		
	θ_B	$\Phi=270^\circ$ (6 o'clock)	-	75	-		
Response time	T_{ON}	Normal $\theta=\Phi=0^\circ$	-	10	20	msec	Note 3
	T_{OFF}		-	10	20	msec	Note 3
Contrast ratio	CR		500	700	-	-	Note 4
Color chromaticity	W_X		0.26	0.31	0.36	-	Note 2
	W_Y		0.28	0.33	0.38	-	Note 5 Note 6
Luminance	L		150	200	-	cd/m ²	Note 6
Luminance uniformity	Y_U		70	75	-	%	Note 7

Test Conditions:

1. $V_{DD}=3.3V$, $I_L=20mA$ (Backlight current), the ambient temperature is 25℃.
2. The test systems refer to Note 2.

Note 1: Definition of viewing angle range



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.)

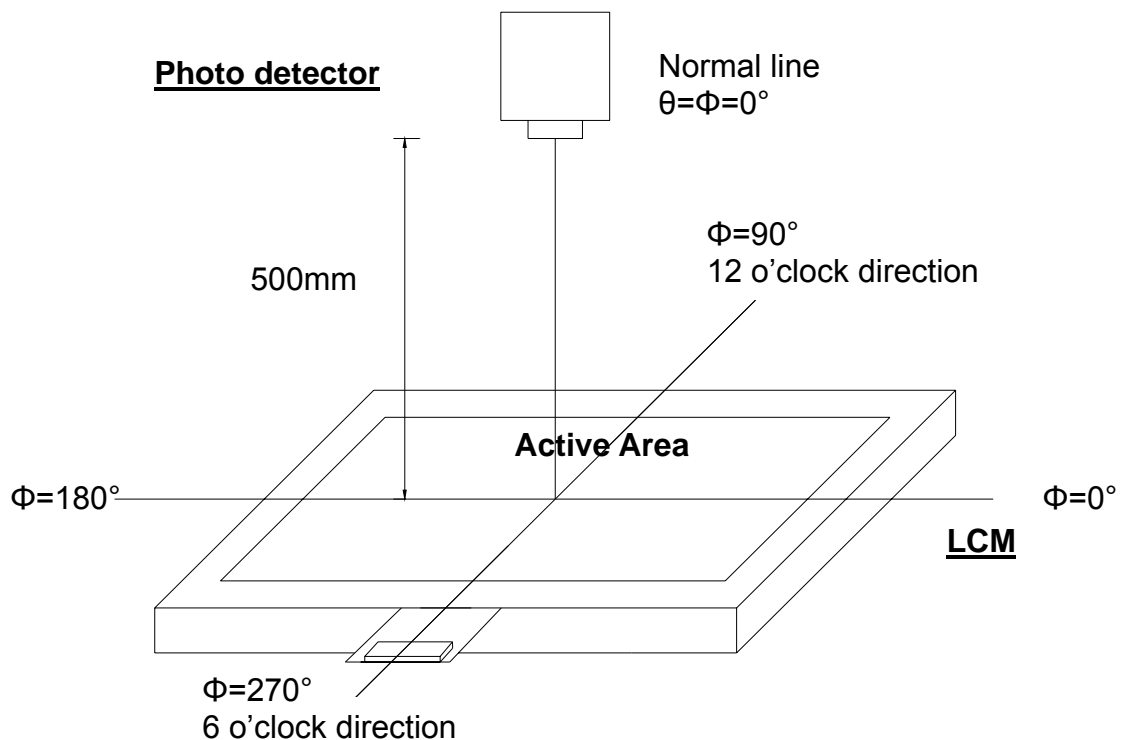


Fig. 5-2 Optical measurement system setup

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%.

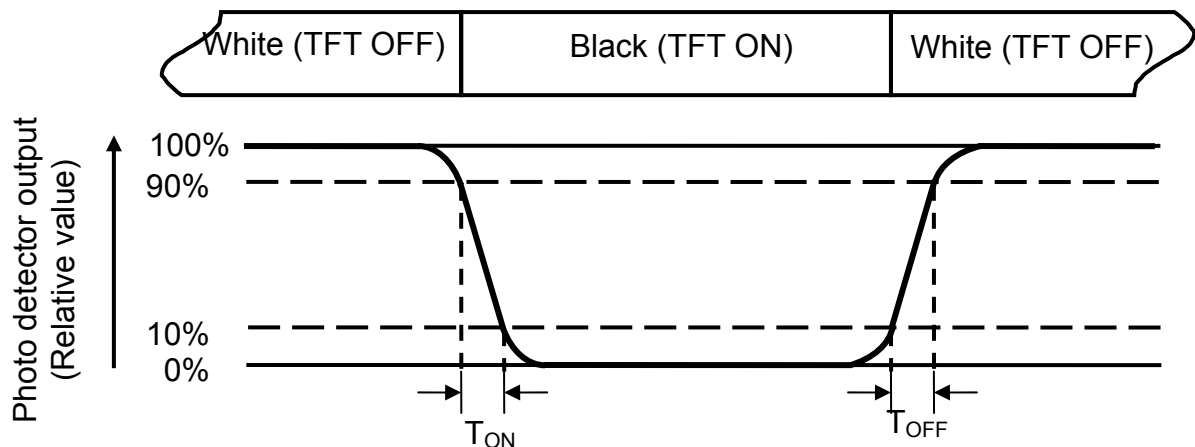


Fig. 5-3 Definition of response time

Note 4: Definition of contrast ratio

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

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 $I_L=20\text{mA}$.

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

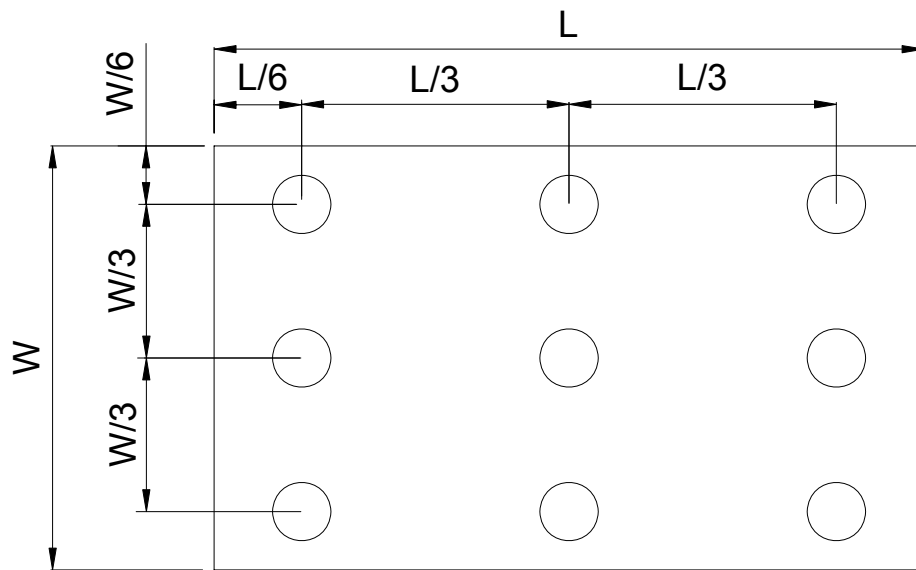


Fig. 5-4 Definition of measuring points

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

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

6. Reliability Test Items

(Note3)

Item	Test Conditions	Remark
High Temperature Storage	Ta = 70℃ 240hrs	Note 1, Note 4
Low Temperature Storage	Ta = -30℃ 240hrs	Note 1, Note 4
High Temperature Operation	Ts = 60℃ 240hrs	Note 2, Note 4
Low Temperature Operation	Ta = -20℃ 240hrs	Note 1, Note 4
Operate at High Temperature and Humidity	+40℃, 90%RH 240hrs	Note 4
Thermal Shock	-30℃/30 min ~ +70℃/30 min for a total 100 cycles, Start with cold temperature and end with high temperature.	Note 4
Vibration Test	Frequency range:10~55Hz Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for 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 : 0.015G*G/Hz from 5-200HZ, -6dB/Octave from 200-500HZ 2 hours for each direction of X. Y. Z. (6 hours for total)	
Package Drop Test	Height:60 cm 1 corner, 3 edges, 6 surfaces	
Electro Static Discharge	± 2KV, Human Body Mode, 100pF/1500Ω	

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 $25\pm10^{\circ}\text{C}$ 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 sloth with IPA to wipe the polarizer, other chemicals might permanent damage to the polarizer.

8. Mechanical Drawing

[illegible]