深圳市拓普微科技开发有限公司
SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

LMT070TN83-NNA

LCD Module User Manual

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Date: 2016-04-05	Date:	Date:

Rev.	Descriptions	Release Date
0.1	Preliminary release	2012-03-19
0.2	Typing correction	2016-4-5

Table of Content

1. Applications

This Module is designed for portable DVD, GPS car TV & PMP(portable multimedia player) application which require high quality flat panel displays. It is also a good substitute for many outmoded CSTN module in the industrial application.

This product is composed of a TFT-LCD panel, driver ICs and LED backlight unit.

2. General Specification

Signal Interface :	Digital 18-bits RGB
Display Technology :	a-Si TFT active matrix
Display Mode :	Transmissive / Normal White
Screen Size(Diagonal) :	7.0”
Outline Dimension :	165 x 104.0 x 7.0 (mm) (see attached drawing for details)
Active Area :	152.4 x 91.44 (mm)
Number of dots :	800 x 3 (RGB) x 480
Pixel Pitch :	0.0635 x 0.1905 (mm)
Pixel Configuration :	RGB Stripe
Backlight :	LED
Surface Treatment :	Anti-Glare Treatment
Viewing Direction :	6 o’clock
Operating Temperature :	-20 ~ +60°C
Storage Temperature :	-30 ~ +70°C

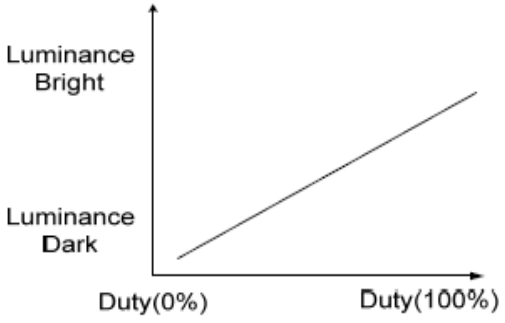
3. Terminal Function (Input Terminal)

3.1 TFT Terminal

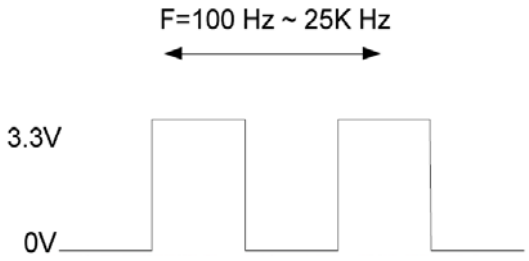
Pin No.	Pin Name	I/O	Descriptions
1,2	VLED	Power	Positive Supply for LED Driver
3	ADJ	Input	Adjust the led brightness with PWM Pulse (*1,2)
4,5	GLED	Power	Ground for LED Circuit
6,7	VCC	Power	Power supply for digital circuit
8	MODE	Input	DE or HV mode control (*3)
9	DE	Input	Data input enable
10	VS	Input	Vertical Sync Input
11	HS	Input	Horizontal Sync Input
12	GND	Power	Power Ground
13	B5	Input	Blue data input
14	B4		
15	B3		
16	GND	Power	Power Ground
17	B2	Input	Blue data input
18	B1		
19	B0		
20	GND	Power	Power Ground
21	G5	Input	Green data input
22	G4		
23	G3		
24	GND	Power	Power Ground
25	G2	Input	Green data input
26	G1		
27	G0		
28	GND	Power	Power Ground
29	R5	Input	Green data input
30	R4		
31	R3		
32	GND	Power	Power Ground
33	R2	Input	Red data input
34	R1		
35	R0		
36	GND	Power	Power Ground
37	DCLK	Input	Sample clock
38	GND	Power	Power Ground
39	L/R	Input	Left / right selection (*4,5)
40	U/D	Input	Up/down selection (*4,5)

Note:

* 1: Pin3. is used to adjust brightness.



* 2: ADJ signal=0 ~3.3V; Operating frequency:100~25KHz

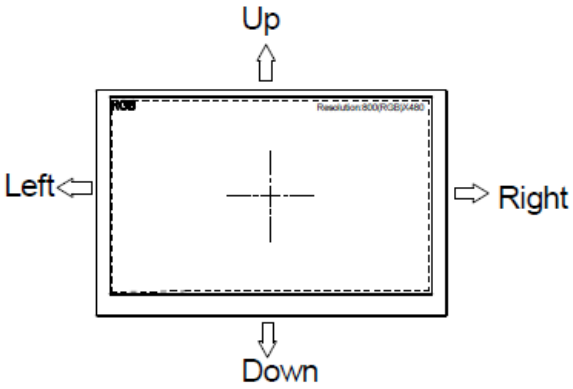


* 3: DE Mode: Mode=”H”, HS floating and VS floating.
HV Mode: Mode=”L” and DE floating.

*4: Selection of scanning mode

Setting of scan control input		Scanning direction
U/D	L/R	
GND	VCC	Up to down, left to right
VCC	GND	Down to up, right to left
GND	GND	Up to down, right to left
VCC	VCC	Down to up, left to right

*5: Scanning direction refer to the figure below.



3.2 Touch Panel Terminal

Pin No.	Pin Name	I/O	Descriptions
1	YU	Passive	y-axis upper side
2	XL	Passive	x-axis left side
3	YD	Passive	y-axis down side
4	XR	Passive	x-axis right side

4. Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit	Condition
Power voltage	VCC	-0.3	6.0	V	
	VLED	-	13.5	V	
Input signal voltage	VI	-0.3	6.3	V	
Operating Temperature	T_{OP}	-20	60	°C	No Condensation
Storage Temperature	T_{ST}	-30	70	°C	No Condensation

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

5. Electrical Characteristics

5.1 DC Characteristics

Items	Symbol	Min.	Typ.	Max.	Unit	Remark
Power voltage	VCC	3.1	3.3	3.5	V	Note1
	VLED	4.8	5.0	5.2	V	Note 2
Current consumption	Icc	-	250	300	mA	
	I_{LED}	-	500	550	mA	Note 3
Input logic high voltage	VIH	0.7VCC	-	VCC	V	Note 4
Input logic low voltage	VIL	0	-	0.3VCC	V	
LED life time	-	20,000	-	-	Hr	Note 5

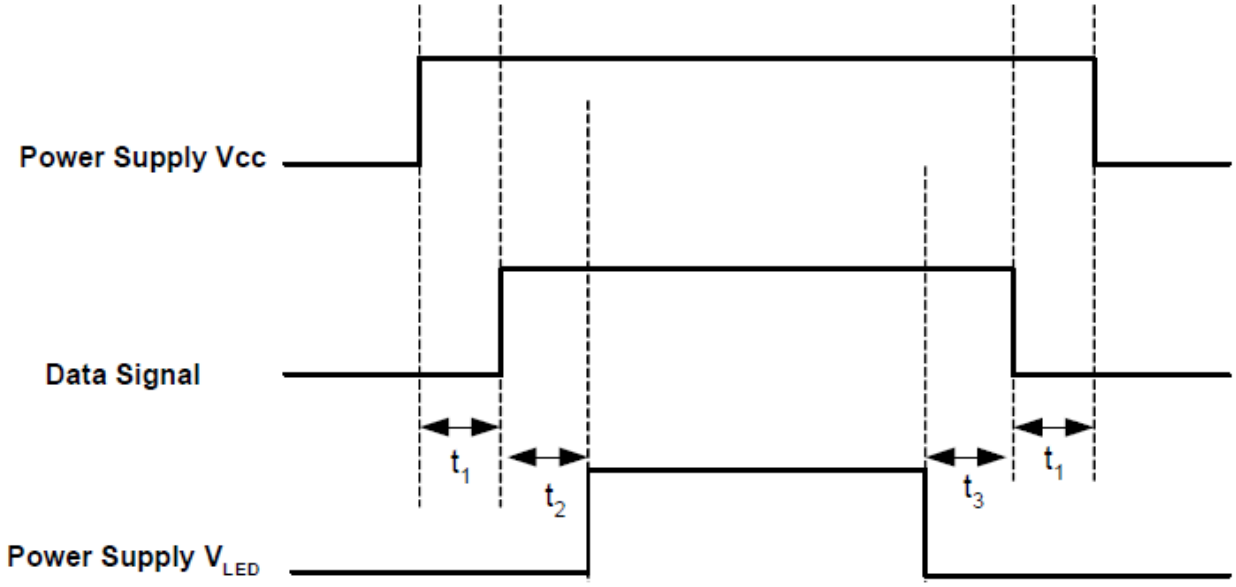
Note1: VCC setting should match the signals output voltage (refer to Note 4) of customer's system board.
Note 2: LED driving voltage.
Note 3: LED driving current.
Note 4: DCLK, DE, HS, VS, R0~ R5,,G0~ G5,B0~ B5.
Note 5: The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and VLED=5.0V. The LED lifetime could be decreased if operating VLED is larger than 5.0V.

5.2 Touch Panel Characteristics

T_{OP}=25°C

Items	MIN.	TYP.	MAX.	Unit	Note
Operating Voltage	-	5.0	-	V	XL, XR, YU, YD
Operating Pressure	30	-	70	g	XL, XR, YU, YD
Life time	-	1000000	-	times	XL, XR, YU, YD
Response Time	-	-	10	ms	XL, XR, YU, YD
Linearity	-	-	±1.5	%	XL, XR, YU, YD

5.3 Power Sequence



$t_1 > 50$ mSec
$t_2 \geqq 200$ mSec
$t_3 \geqq 200$ mSec

Note: Data Signal includes DCLK, DE, HS, VS, R0~ R5, G0~ G5, B0~ B5.

6. AC Characteristics

6.1 Timing Conditions

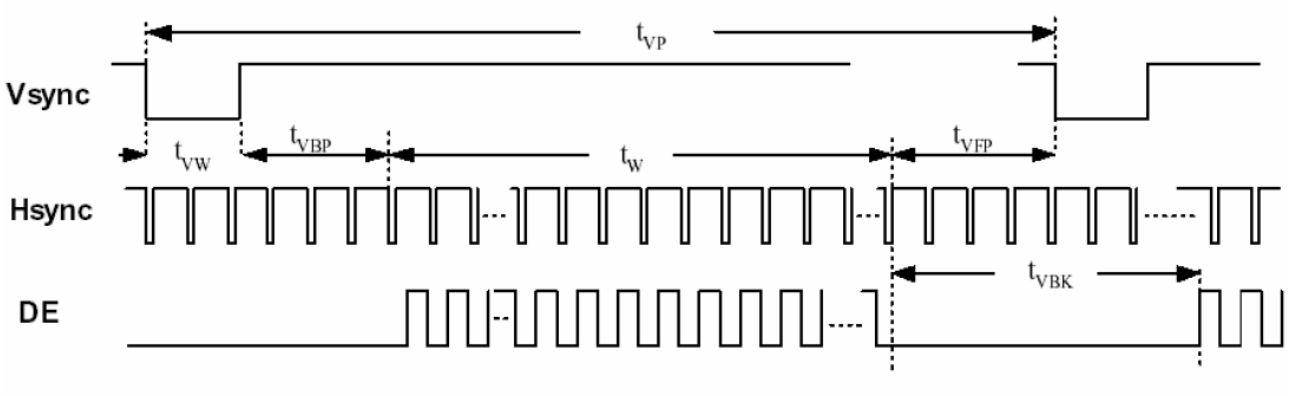
Input signal characteristics of SYNC mode.

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Clock Period	t_{CLK}	23.2	25.0	30.7	ns	
Clock Frequency	f_{CLK}	32.4	40	43	MHz	
Clock Low Level Width	t_{WCL}	8	-	-	ns	
Clock High Level Width	t_{WCH}	8	-	-		
Clock Rise/Fall Time	t_{CLKr}, t_{CLKf}	-	-	3		
HSYNC Period	t_{HP}	862	1056	1100	t_{CLK}	
HSYNC Pulse Width	t_{HW}	-	1	-	t_{CLK}	
HSYNC Back Porch	t_{HBP}	-	45	-	t_{CLK}	
HSYNC Width + Back Porch	$t_{hw} + t_{HBP}$	46			t_{CLK}	
Horizontal valid data width	t_{HV}	800			t_{CLK}	
HSYNC Front Porch	t_{HFP}	$t_{HP} - t_{HW} - t_{HBP} - t_{HV}$			t_{CLK}	
Horizontal Blank	t_{HBK}	$t_{HP} - t_{HV}$			t_{CLK}	
VSYNC Period	t_{VP}	628	635	650	t_{HP}	
VSYNC Pulse Width	t_{VW}	-	1	-	t_{HP}	
VSYNC Back Porch	t_{VBP}	22			t_{HP}	
Vertical valid data width	t_{w}	480			t_{HP}	
Vertical Front Porch	t_{VFP}	$t_{VP} - t_{VW} - t_{VBP} - t_{w}$			t_{HP}	
Vertical Blank	t_{VBK}	$t_{VP} - t_{w}$			t_{HP}	
Data Setup Time	t_{DS}	5	-	-	ns	
Data Hold Time	t_{DH}	10	-	-	ns	

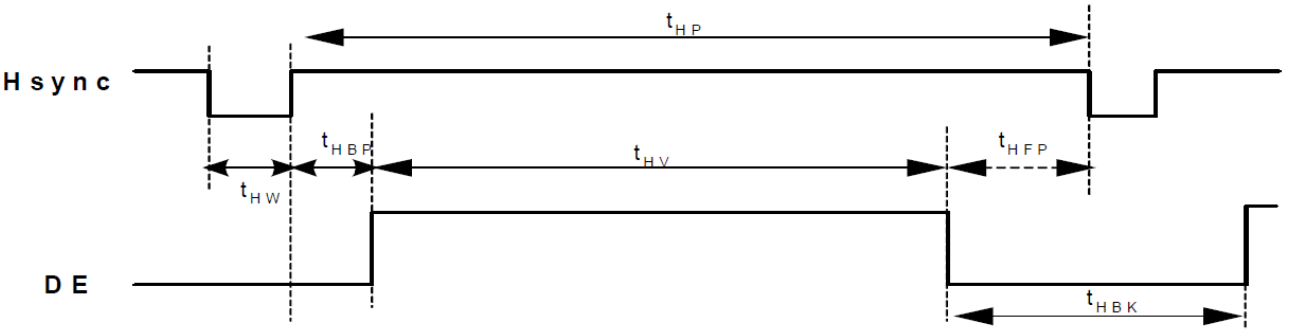
Input signal characteristics of DE mode.

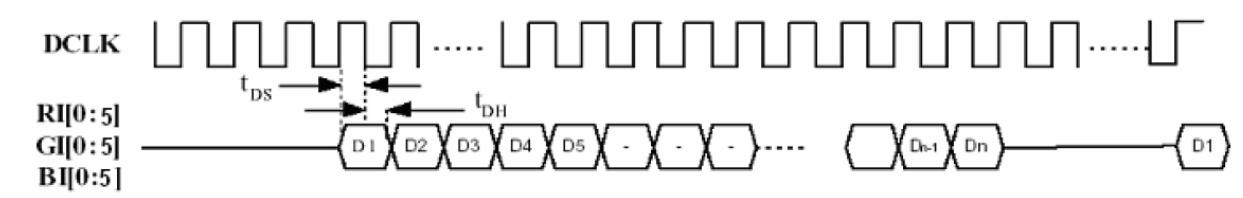
Item		Symbol	Values			Unit	Remark
			Min.	Typ.	Max.		
DCLK	Period	t_{CLK}	23.2	25.0	30.7	ns	
	Frequency	f_{CLK}	32.4	40	43	MHz	
	Low Level Width	t_{WCL}	6	-	-	ns	
	High Level Width	t_{WCH}	6	-	-		
	Rise/Fall Time	t_{CLKr}, t_{CLKf}	-	-	3		
	Duty	-	0.45	0.50	0.55	-	t_{CLKL}/ t_{CLK}
DE	Setup Time	t_{DES}	5	-	-	ns	
	Hold Time	t_{DEH}	10	-	-		
	Rise/Fall Time	t_{DEr}, t_{DEf}	-	-	16		
	Horizontal Period	t_{HP}	862	1056	1100	t_{CLK}	
	Horizontal Valid	t_{HV}	800				
	Horizontal Blank	t_{HBK}	t_{HP} - t_{HV}				
	Vertical Period	t_{VP}	628	635	650	t_{HP}	
	Vertical Valid	t_w	480				
	Vertical Blank	t_{VBK}	t_{VP} - t_w				
DATA	Setup Time	t_{DS}	5	-	-	ns	
	Hold Time	t_{DH}	10	-	-		
	Rise/Fall Time	t_{Dr}, t_{Df}	-	-	3		

6.2 Timing Diagram

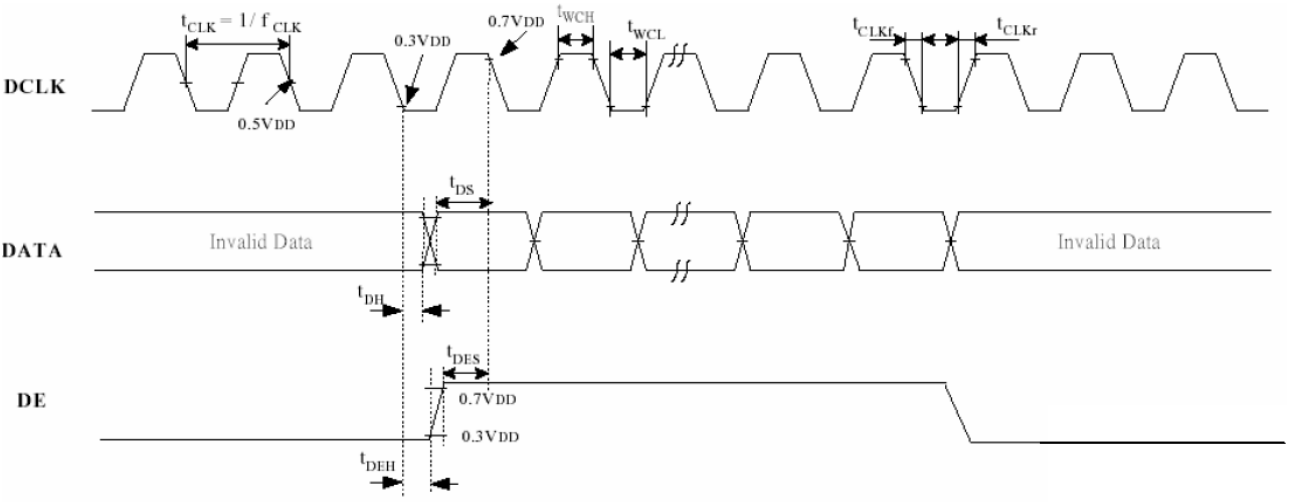


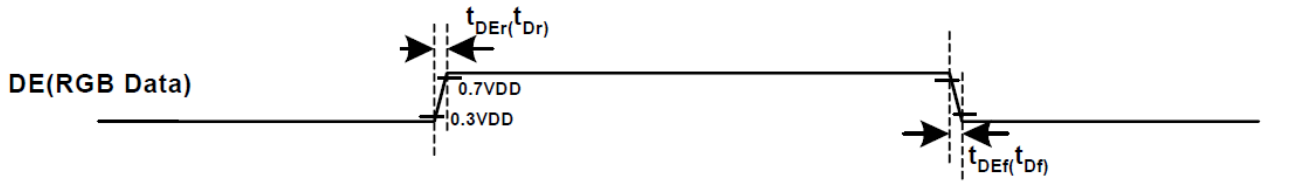
Input Vertical Timing





Input Horizontal Timing





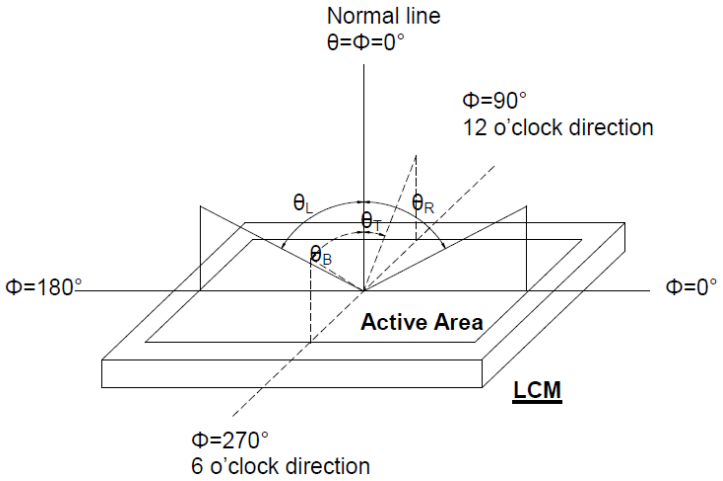
DE and RGB Input Timing

7. Optical Characteristics

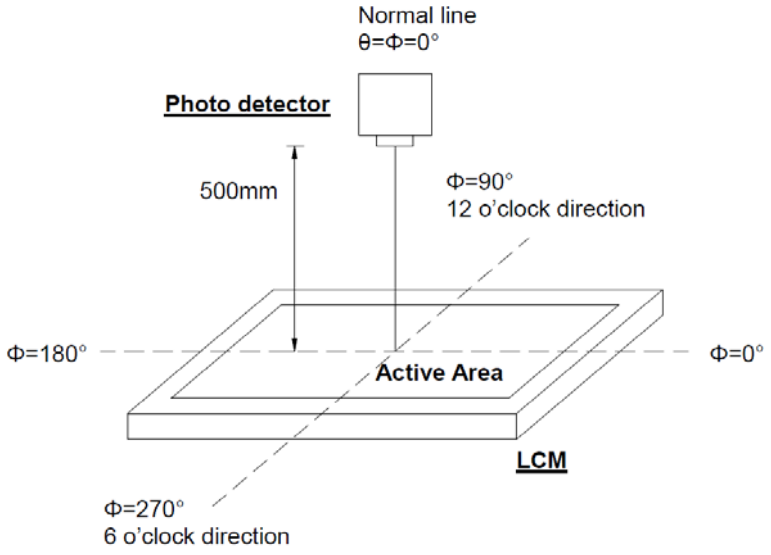
VCC=3.3V,VLED=5.0V,Top=25℃

Item	Symbol	Condition	MIN.	TYP.	MAX.	UNIT	Note.
Viewing angle (CR≥10)	θ_L	9 o'clock	60	70	-	degree	Note1
	θ_R	3 o'clock	60	70	-		
	θ_T	12 o'clock	40	50	-		
	θ_B	6 o'clock	60	70	-		
Response Time	T_{on}	Normal θ=0°	-	10	20	msec	Note3
	T_{off}		-	15	30	msec	
Contrast ratio	CR		400	500	-	-	Note2 Note5 Note6
Color chromaticlty	W_X		0.26	0.31	0.36	-	
	W_Y		0.28	0.33	0.38	-	
Luminance	L		-	300	-	cd/m^2	Note6
Luminance uniformity	Y_U		70	75	-	%	Note7

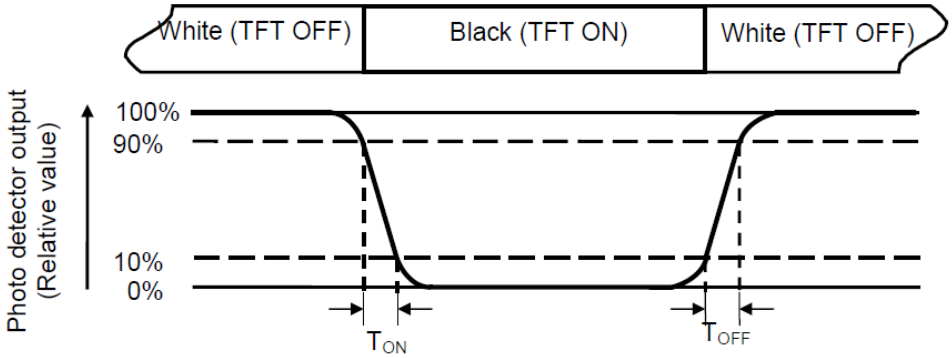
Note 1: Definition of viewing angle range



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.)



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 (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) is the time between photo detector output intensity changed from 10% to 90%.



Note 4: Definition of contrast ratio

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

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 VLED=5.0V.

8. Precautions of using LCD Modules

Mounting

- Mounting must use holes arranged in four corners or four sides.
- The mounting structure so provide even force on to LCD module. Uneven force (ex. Twisted stress) should not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- It is suggested to attach a transparent protective plate to the surface in order to protect the polarizer. It should have sufficient strength in order to the resist external force.
- The housing should adopt radiation structure to satisfy the temperature specification.
- Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. Never rub with dust clothes with chemical treatment. Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics deteriorate the polarizer.)
- When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzine. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer

Operating

- The spike noise causes the mis-operation of circuits. It should be within the ±200mV level (Over and under shoot voltage)
- Response time depends on the temperature.(In lower temperature, it becomes longer.)
- Brightness depends on the temperature. (In lower temperature, it becomes lower.) And in lower temperature, response time(required time that brightness is stable after turned on) becomes longer.
- Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- When fixed patterns are displayed for a long time, remnant image is likely to occur.
- Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference

Electrostatic Discharge Control

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter.

Storage

When storing modules as spares for a long time, the following precautions are necessary.

- Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
- The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.

Protection Film

- When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
- The protection film is attached to the polarizer with a small amount of glue. If some stress is applied to rub the protection film against the polarizer during the time you peel off the film, the glue is apt tore main on the polarizer. Please carefully peel off the protection film without rubbing it against the polarizer.
- When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the polarizer after the protection film is peeled off.
- You can remove the glue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.

Transportation

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

9. Appendix <Inspection items and criteria for appearance defect>

9.1 Bright/Dark Dots:

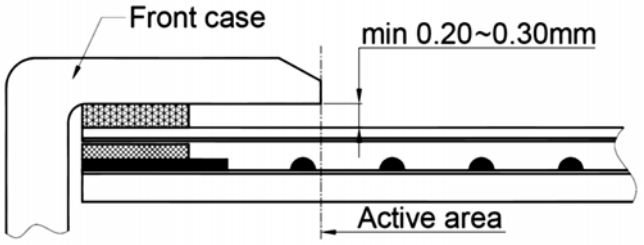
Defect Type	Specification	Major	Minor
Bright Dots	N≤ 2		●
Dark Dots	N≤ 3		●
Total Bright and Dark Dots	N≤ 4		●

Note: 1. **The definition of dot:** The size of a defective dot over 1/2 of whole dot is regarded as one defective dot.

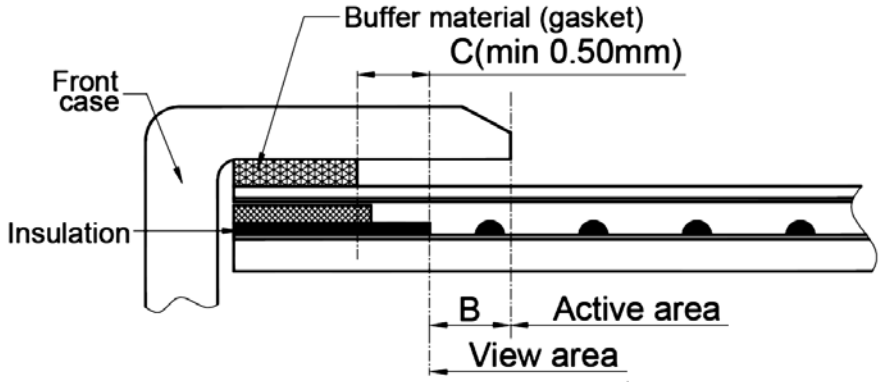
2. **Bright dot:** Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.
3. **Dark dot:** Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue pattern.

附录：Touch panel Design Precautions

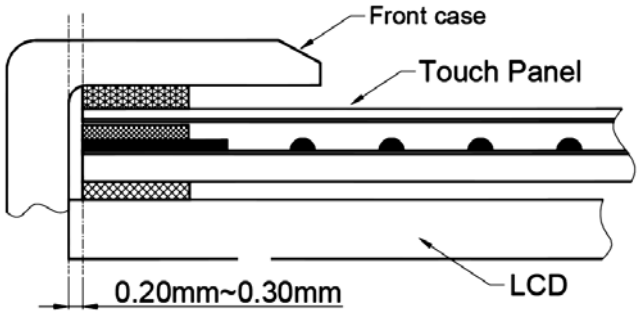
1. It should prevent front case touching the touch panel Active Area (A.A.) to prevent abnormal touch.
   It should left gab (e.g. 0.2~0.3mm) in between.



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≥0.50mm; C≥0.50mm。



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.