深圳市拓普微科技开发有限公司
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LMT121DNGFWD-1

LCD Module User Manual

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Liu		
Date: 2019-03-27	Date:	Date:

Rev.	Descriptions	Release Date
0.1	Preliminary	2019-03-27

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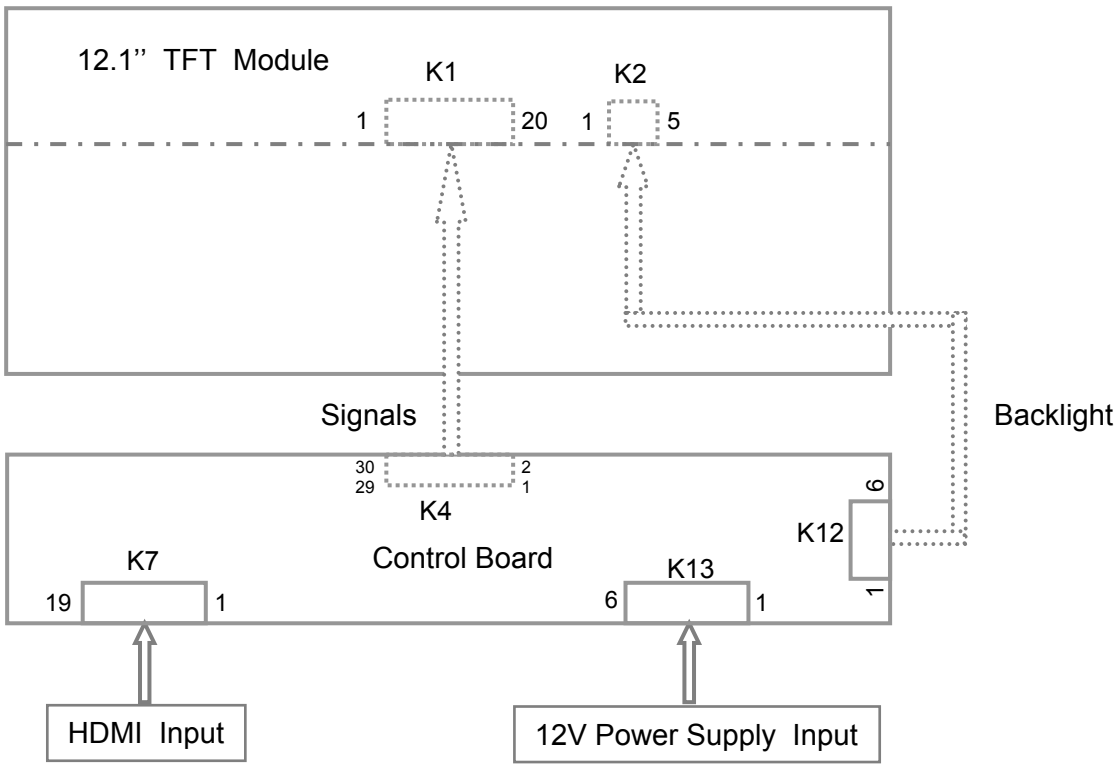
1. General Specification

Signal Interface :	HDMI
Display Technology :	a-Si TFT active matrix
Display Mode :	TN Type Full Color / Transmissive / Normal White
Screen Size :	12.1 inch (Diagonal)
Outline Dimension :	279.0x209.0x9.0 (mm) (see Outline DWG for details)
Active Area :	245.76 x184.32 (mm)
Number of dots :	1024 x 768
Dot Pitch :	0.240 x 0.240(mm)
Pixel Configuration :	R.G.B. Vertical Stripe
Backlight :	White LED
Surface Treatment :	Anti-Glare
Viewing Direction :	6 o'clock
Operating Temperature :	0 ~ +50°C
Storage Temperature :	-10 ~ +60°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. Input/Output Terminals

3.1 TFT LVDS Input Terminals (K1)

Pin No.	Pin Name	IO	Descriptions	
			24Bit Mode	18Bit Mode
1	VCC	Power	TFT Power Input (3.3V)	
2				
3	GND	Power	Ground	
4	FRC	Input	H:8Bits LVDS Input (24bit mode)	L/NC: 6Bits LVDS Input (18bit mode)
5	RIN0-	Input	LVDS receiver negative signal channel 0	
6	RIN0+	Input	LVDS receiver positive signal channel 0	
7	GND	Power	Ground	
8	RIN1-	Input	LVDS receiver negative signal channel 1	
9	RIN1+	Input	LVDS receiver positive signal channel 1	
10	GND	Power	Ground	
11	RIN2-	Input	LVDS receiver negative signal channel 2	
12	RIN2+	Input	LVDS receiver positive signal channel 2	
13	GND	Power	Ground	
14	CLKIN-	Input	LVDS receiver negative signal clock	
15	CLKIN+	Input	LVDS receiver positive signal clock	
16	GND	Power	Ground	
17	RIN3-	Input	LVDS receiver negative signal channel 3.(Used for 8Bits LVDS Input; GND for 6Bits)	
18	RIN3+	Input	LVDS receiver positive signal channel 3.(Used for 8Bits LVDS Input; GND for 6Bits)	
19	DPS	Input	Display Reversed Function (H: Display Reverse; L/NC: Normal Display)	
20	NC	--	No Connection	

3.2 BackLight Terminals (K2)

Pin No.	Pin Name	IO	Descriptions
1	NC	-	No Connection
2	BLADJ	Input	Backlight dimming control PWM may be used to adjust the output brightness
3	BLEN	Input	Backlight Driver Control BLEN=Hi, Backlight enable; BLEN=Lo, Backlight disable.
4	BLGND	Power	Power Supply GND (0V)
5	BLVCC	Power	Positive Power Supply

3.3 Control Board LVDS Output Terminal (K4)

Pin No.	Pin Name	I/O	Descriptions
1-3	VCC	Power	TFT Power Output (3.3V)
4-6	GND	Power	Power Supply GND (0V)
7	TXD0-	Output	LVDS Ch0 signal
8	TXD0+	Output	
9	TXD1-	Output	LVDS Ch1 signal
10	TXD1+	Output	
11	TXD2-	Output	LVDS Ch2 signal
12	TXD2+	Output	
13-14	GND	Power	Power Supply GND (0V)
15	TXDC-	Output	LVDS Clk signal
16	TXDC+	Output	
17-30	--	--	Reserved, leave open

3.4 HDMI Terminals (K7)

Pin No.	Pin Name	I/O	Descriptions
1	TMDS_D2+	Input	HDMI receiver positive signal channel 2
2	TMDS_D2 Shield	Power	Power Supply GND (0V)
3	TMDS_D2 -	Input	HDMI receiver negative signal channel 2
4	TMDS_D1+	Input	HDMI receiver positive signal channel 1
5	TMDS_D1 Shield	Power	Power Supply GND (0V)
6	TMDS_D1 -	Input	HDMI receiver negative signal channel 1
7	TMDS_D0+	Input	HDMI receiver positive signal channel 0
8	TMDS_D0 Shield	Power	Power Supply GND (0V)
9	TMDS_D0 -	Input	HDMI receiver negative signal channel 0
10	TMDS_Clock+	Input	HDMI receiver positive signal clock
11	TMDS_Clock Shield	Power	Power Supply GND (0V)
12	TMDS_Clock-	Input	HDMI receiver negative signal clock
13	NC	--	No connection
14	NC	--	No connection
15	SCL_HDMI	Input	Serial data clock
16	SDA_HDMI	I/O	Serial data out
17	GND	Power	Power Supply GND (0V)
18	+5_Power	Power	Power supply for DDC memory
19	Hot_Plug_Detect	Output	Hot Plug Detect signal

3.5 Backlight Voltage Terminal (K12)

Pin No.	Pin Name	I/O	Descriptions
1	NC	-	No Connection
2	VSS	Power	Power Supply VSS（0V）
3	PWM	Output	Backlight Control Signal（PWM）(Active High) (*1)
4	BLEN	Output	Backlight Enable Signal (Active High) （*1）
5	12V(VDD)	Power	Power Supply for TFT（12V）
6	NC	-	No Connection

3.6 Power Supply Terminals (K13)

Pin No.	Pin Name	IO	Descriptions
1	12V(VDD)	Power	Positive Power Supply(+12V)
2			
3	NC(BLEN)	Input	Backlight Driver Control (default: BLEN = Hi) BLEN=Hi, Backlight Driving Booster enable BLEN=Lo, Backlight Driving Booster disable
4	PWM	Input	Backlight dimming control (default: PWM = 100%) PWM may be used to adjust the output brightness
5	VSS	Power	Power Supply VSS (0V)
6			

4. Absolute Maximum Ratings

Items	Symbol	MIN.	MAX.	Unit	Condition
Power supply voltage	VDD	-0.3	13	V	V_{VSS} = 0V
PWM or BLEN Voltage	V	-0.3	5.5	V	V_{VSS} = 0V
Operation Temperature	T_{op}	0	50	℃	No Condensation
Storage Temperature	T_{st}	-10	60	℃	No Condensation

Cautions:

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

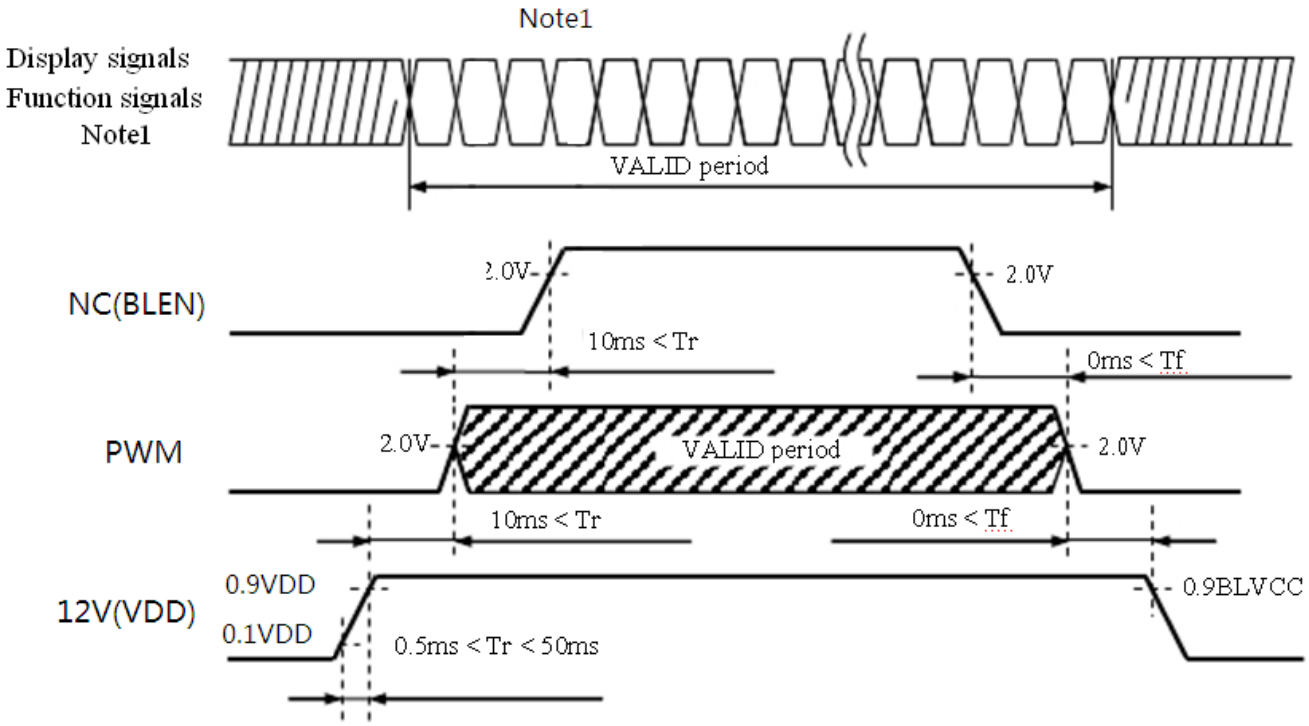
5.1 Driving TFT LCD Panel

V_{VSS}=0V, V_{DD}=12.0V, T_{OP}=25℃

Items	Symbol	MIN.	TYP.	MAX.	Unit	Note
Power supply voltage	VDD	11.0	12.0	13.0	V	VDD
Power supply current	I_{VDD}	550	650	750	mA	*1
PWM Input Frequency	f_{PWM}	200	-	20k	Hz	*2
Input high voltage	V_{IH}	2.0	-	3.3	V	PWM,BLEN
Input low voltage	V_{IL}	0	-	0.8	V	
PWM pulse width	tPWH	5	-	-	us	*3,*4
PWM duty ratio	DR_{PWM}	1	-	100	%	

*1: All black pattern.
*2: Depending on the frequency used ,some noise may appear on the screen,please conduct a thorough evaluation,
*3: While the BLEN signal is high ,do not set the tPWH(PWM pulse width) is less than 5us .It may cause abnormal working is the backlight .In this case,turn the backlight off and then on again by BLEN signal.
*4: Regardless of the PWM frequency,both PWM duty radio and PWM pulse width must be always more than the minimum values.

5.2 Power supply voltage Sequence



Note1:The backlight should be turned on within the valid period of display and function signals,in order to avoid unstable data display.

6. Optical Characteristics

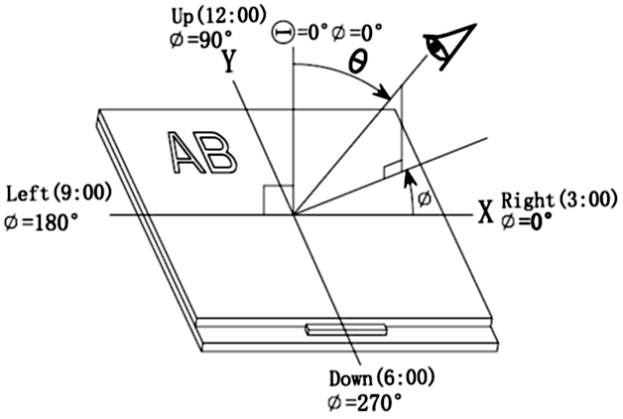
(Note*1,*2)

Parameter		Condition	Symbol	min.	typ.	max.	Unit	Measuring instrument	Remarks
Luminance		White at center $\theta_R = 0^\circ, \theta_L = 0^\circ, \theta_U = 0^\circ, \theta_D = 0^\circ$	L	300	450	-	cd/m2	BM-5A	-
Contrast ratio		White/Black at center $\theta_R = 0^\circ, \theta_L = 0^\circ, \theta_U = 0^\circ, \theta_D = 0^\circ$	CR	500	700	-	-	BM-5A	Note3
Luminance uniformity		White $\theta_R = 0^\circ, \theta_L = 0^\circ, \theta_U = 0^\circ, \theta_D = 0^\circ$	LU	-	1.25	(1.33)	-	BM-5A	Note6
Chromaticity	White	**x** coordinate	Wx	0.263	0.313	0.363	-	SR-3	Note5
		y coordinate	Wy	0.279	0.329	0.379	-		
	Red	**x** coordinate	Rx	-	TBD	-	-		
		y coordinate	Ry	-	TBD	-	-		
	Green	**x** coordinate	Gx	-	TBD	-	-		
		y coordinate	Gy	-	TBD	-	-		
	Blue	**x** coordinate	Bx	-	TBD	-	-		
		y coordinate	By	-	TBD	-	-		
Color gamut		$\theta_R = 0^\circ, \theta_L = 0^\circ, \theta_U = 0^\circ, \theta_D = 0^\circ$ at center, against NTSC color space	C	48	55	-	%		
Response time		White to Black	Ton	-	(3)	(5)	ms	BM-5A -10000	Note4
		Black to White	Toff	-	(5)	(8)	ms		
Viewing angle	Right	$\theta_U = 0^\circ, \theta_D = 0^\circ$, CR≥10	θ_R	70	80	-	°	EZ Contrast	Note2
	Left	$\theta_U = 0^\circ, \theta_D = 0^\circ$, CR≥10	θ_L	70	80	-	°		
	Up	$\theta_R = 0^\circ, \theta_L = 0^\circ$, CR≥10	θ_U	70	80	-	°		
	Down	$\theta_R = 0^\circ, \theta_L = 0^\circ$, CR≥10	θ_D	70	80	-	°		

Note:
*1. The value above are initial Characteristics.
* 2: Measurement conditions are as follows.
Ta= 25℃, VDD= 12.0V, PWM duty ratio: 100%,
Display mode: XGA, Horizontal cycle= 1/48.363kHz, Vertical cycle= 1/60.0Hz,

Note 1:
The data are measured after LEDs are turned on for 5 minutes. LCM displays full white. The brightness is the average value of 9 measured spots. Measurement equipment SR-3A (1°)
Measuring condition:
- Measuring surroundings: Dark room
- Measuring temperature: Ta=25℃.
- Adjust operating voltage to get optimum contrast at the center of the display.

Note 2:
The definition of viewing angle:
Refer to the graph below marked by θ and Φ

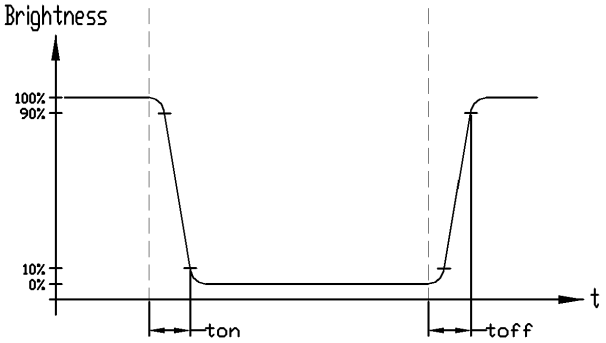


Note 3:
The definition of contrast ratio (Test LCM using SR-3A (1°)):

$$\text{Contrast Ratio(CR)} = \frac{\text{Luminance When LCD is at "White" state}}{\text{Luminance When LCD is at "Black" state}}$$

(Contrast Ratio is measured in optimum common electrode voltage)

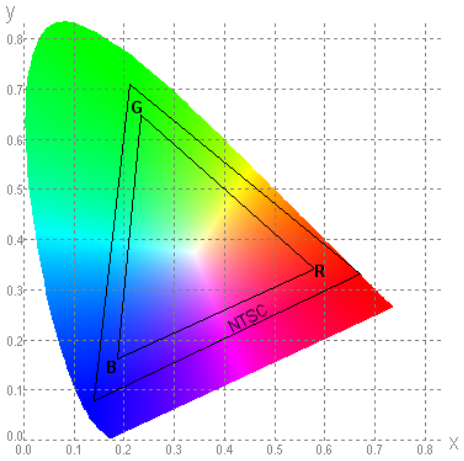
Note 4:
Definition of Response time. (Test LCD using BM-7A(2°)):
The output signals of photo detector are measured when the input signals are changed from "black" to "white"(falling time) and from "white" to "black"(rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes.Refer to figure as below.



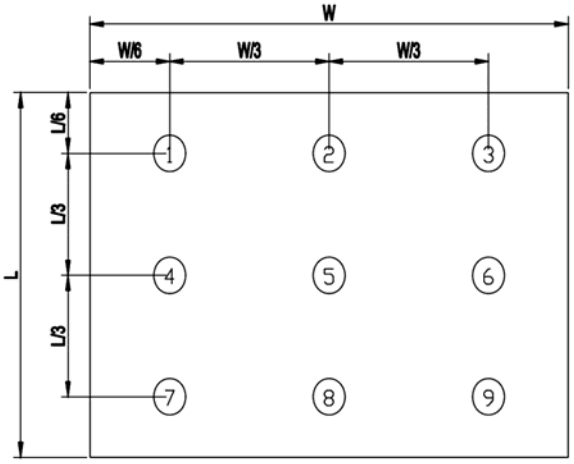
Note 5:
Definition of Color of CIE1931 Coordinate and NTSC Ratio.

Color gamut:

$$S = \frac{\text{Area of RGB triangle}}{\text{Area of NTSC triangle}} \times 100\%$$



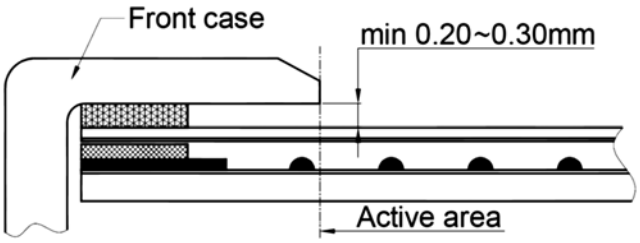
Note 6:
The luminance uniformity is calculated by using following formula.
△Bp = Bp (Min.) / Bp (Max.)×100 (%)
Bp (Max.) = Maximum brightness in 9 measured spots
Bp (Min.) = Minimum brightness in 9 measured spots.



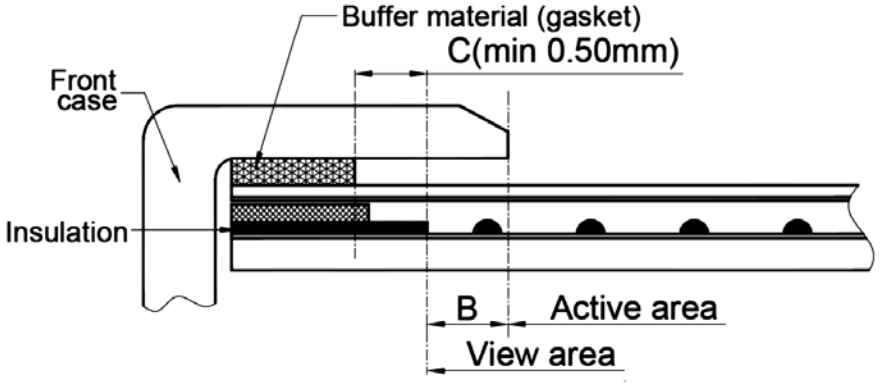
Note 7:
Measured the luminance of white state at center point

7. Touch panel Design Precautions

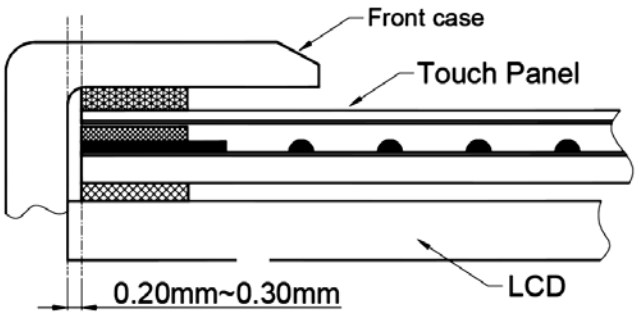
1. It should prevent front case touching the touch panel Active Area (A.A.) to prevent abnormal touch.
   It should left gab (e.g. 0.2~0.3mm) in between.



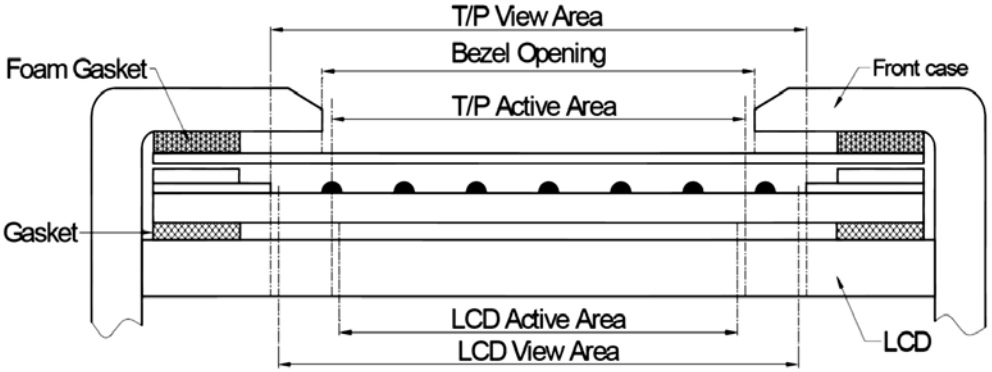
2. Outer case design should take care about the area outside the A.A.
   Those areas contain circuit wires which is having different thickness. Touching those areas could de-form the ITO film. As a result case the ITO cold be damaged and shorten its lifetime.
   It is suggested to protect those areas 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.



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.