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

LMT121DNEFWD-NNA

LCD Module User Manual

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Date: 2014-01-22	Date:	Date:

Rev.	Descriptions	Release Date
0.1	Preliminary	2014-01-21

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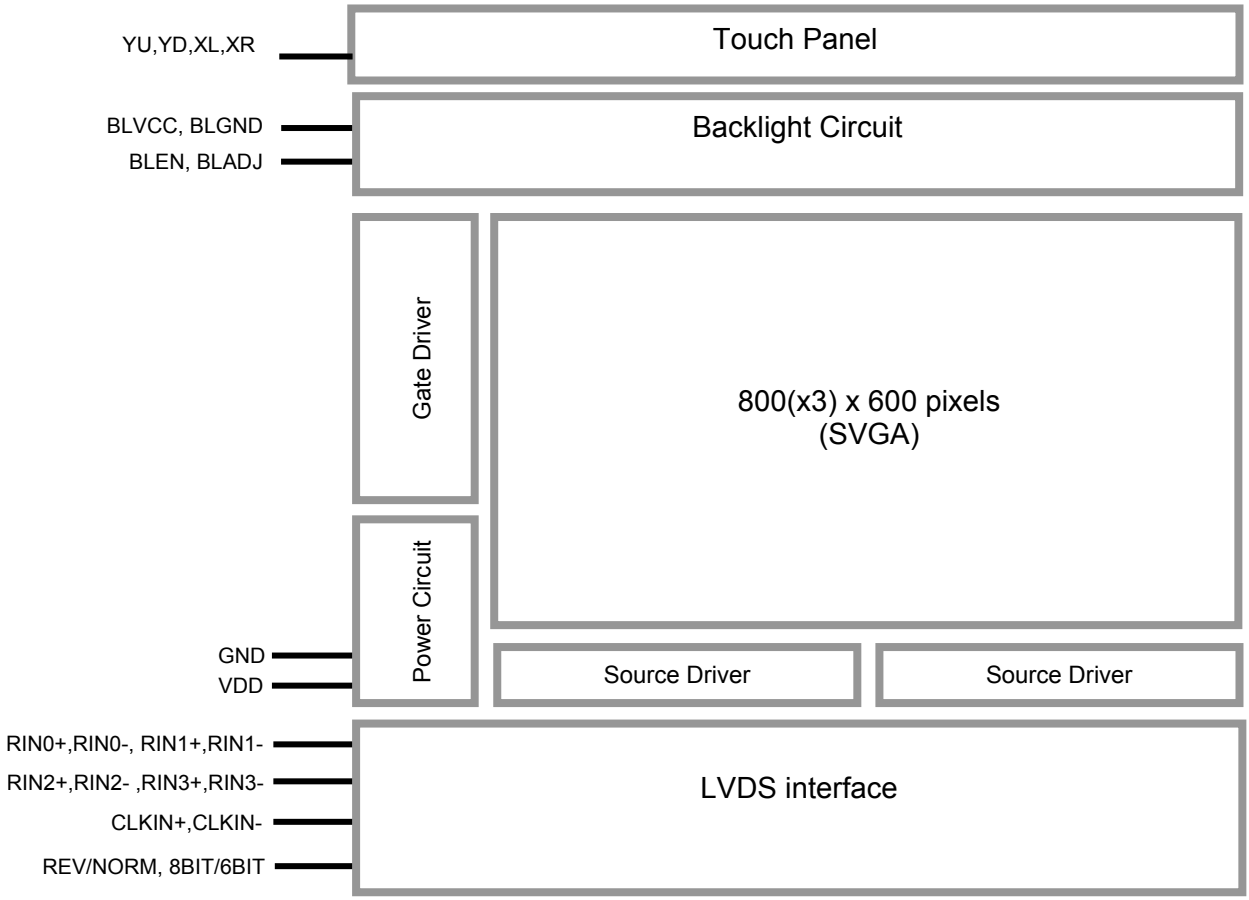
1. General Specification

Signal Interface :	LVDS
Display Technology :	a-Si TFT active matrix
Display Mode :	TN Type Full Color / Transmissive / Normal White
Screen Size :	12.1 inch (Diagonal)
Outline Dimension :	276.0x209.0x12.0 (mm) (see Outline DWG for details)
Active Area :	246.0x184.5 (mm)
Number of dots :	800x 3 (RGB) x 600
Dot Pitch :	0.3075x0.3075 (mm)
Pixel Configuration :	R.G.B. Vertical Stripe
Backlight :	White LED
Surface Treatment :	Anti-Glare
Viewing Direction :	6 o'clock
Operating Temperature :	-20 ~ +70°C
Storage Temperature :	-30 ~ +80°C

2. Block Diagram



3. Input/Output Terminals

3.1 TFT Terminals

Pin No.	Pin Name	IO	Descriptions	
			24Bit Mode	18Bit Mode
1	VDD	Power	Power Supply(3.3V)	
2				
3	GND	Power	Ground	
4	8BIT/6BIT	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	No Connection
18	RIN3+	Input	LVDS receiver positive signal channel 3	No Connection
19	REV/NORM	Input	Display Reversed Function (H: Display Reverse; L/NC: Normal Display)	
20	GND	Power	Ground	

3.2 BackLight Terminals

Pin No.	Pin Name	IO	Descriptions
1	BLVCC	Power	Positive Power Supply(12.0V)
2	BLGND	Power	Power Supply GND (0V)
3	BLEN	Input	Backlight Driver Control BLEN=Hi（5.0V）, Backlight Driving Booster enable BLEN=Lo, Backlight Driving Booster disable
4	BLADJ	Input	Backlight dimming control PWM may be used to adjust the output brightness
5	NC	-	-

3.3 Touch Panel Controller Terminal

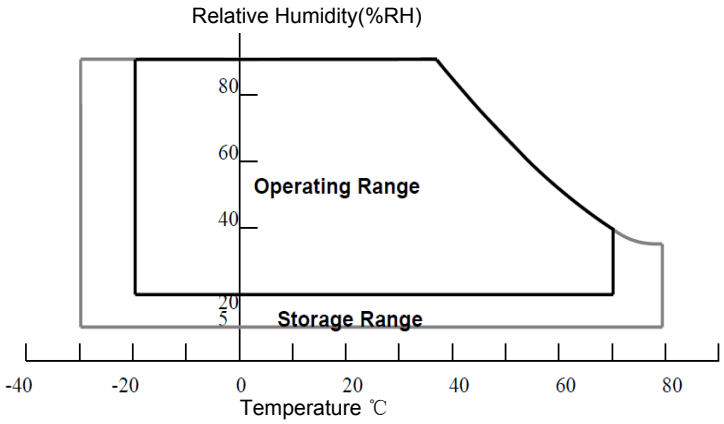
Pin No.	Pin Name	I/O	Descriptions
1	YD	Passive	y-axis down side
2	XL	Passive	x-axis left side
3	YU	Passive	y-axis upper side
4	XR	Passive	x-axis right side

4. Absolute Maximum Ratings

GND=0V, T_{OP}=25°C

Items	Symbol	Min.	Max.	Unit	Condition
Power Voltage	VDD	-0.3	+5.0	V	GND = 0V
Input voltage	V_{IN}	-0.3	+3.3	V	GND= 0V
Operating Temperature	T_{OP}	-20	+70	°C	No Condensation
Storage Temperature	T_{ST}	-30	+80	°C	No Condensation

Note1: V_{IN} represent RIN0±,RIN1±,RIN2±,RIN3±,CLKIN±
Note2: Recommanded Temperature/Humidity Graph as follow



5. Electrical Characteristics

5.1 LVDS Interface Characteristics

GND=0V, VDD=3.3V, T_{OP}=25°C

Items	Symbol	MIN.	TYP.	MAX.	Unit	Note
Power supply voltage	VDD	3.0	3.3	3.6	V	*1
Power supply current	IDD	-	270	325	mA	
Permissible ripple voltage	VRP	-	-	100	mV	
Differential input voltage	|Vid|	250	-	450	mV	
Differential input threshold voltage for LVDS receiver	VTL	-100	-	-	mV	VCM=1.25V,*2
	VTH	-	-	100	mV	
Input voltage width for LVDS receiver	Vi	0	-	2.4	V	
Terminating resistor	RT	-	100	-	Ω	
Rush current	Irush	-	-	1.5	A	

*1: All black pattern
*2: Common mode voltage for LVDS receiver

5.2 LED Backlight Interface Characteristics

V_{BLGND} =0V , V_{BLVCC} =12.0V ,T_{OP}=25°C

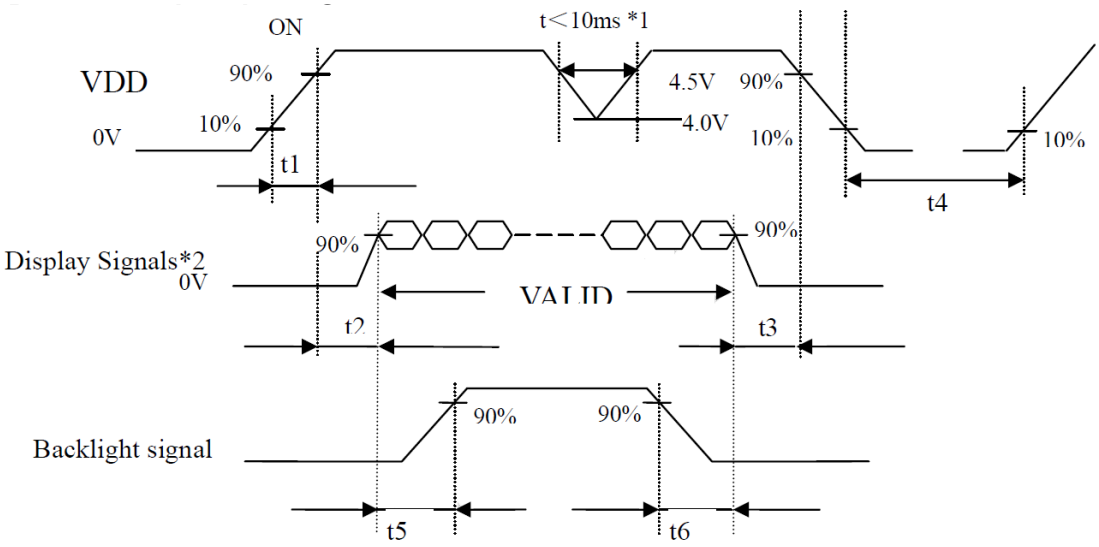
Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Note
Backlight Supply Voltage	V_{BLVCC}	11.5	12.0	12.5	V	
Backlight Supply Current	I_{BLICC}	--	200	-	mA	
Backlight Enable High	V_{BLENH}	-	5.0	-	V	
Backlight Enable Low	V_{BLENL}	-	0	-	V	
Operating lifetime	Hr	50000	-	-	Hour	ILED=80 mA
PWM Input Threshold Voltage	V_{PWMH}	1.2	-	-	V	
	V_{PWML}	-	-	0.4	V	
PWM Input Frequency	$1/T_{PWM}$	100	200	10K	Hz	

5.3 Touch Panel Characteristic

T_{OP}=25°C

Items	MIN.	TYP.	MAX.	Unit	Note
Operating Voltage	-	5.0	-	V	XL, XR, YU, YD
Operating Pressure	30	-	70	mg	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

5.4



Timing : 0.47ms<t1 <10ms; 0.5 ms<t2 <50ms; 0ms<t3 <50ms; t4 >1000ms; t5 >200ms; t6 >200ms;

*1. When VDD is on, but the value is lower than 4.5V, a protection circuit may work, then the module may not display.

*2 The signal line is not connected with the module, at the end of cable the terminal resistor of 100Ω should be added.

Note1: Display signals (D0+/-, D1+/-, D2+/-, D3+/- and CK+/-) must be “0” voltage, exclude the VALID period (See above sequence diagram). If these signals are higher than 0.3 V, the internal circuit is damaged.If some of display signals of this product are cut while this product is working, even if the signal input to it once again, it might not work normally. If customer stops the display signals, they should cut VDD.

Note2: When VDD is on, it should be set above 4.0V.

Note3: The backlight power supply voltage should be inputted within the valid period of display and function signals, in order to avoid unstable data display.

6. AC Characteristics

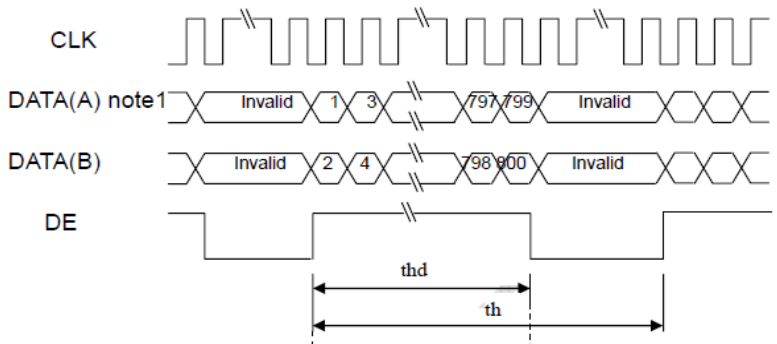
6.1 Timing Characteristics

Parameter		Symbol	min.	typ.	max.	Unit	Remarks
Clock	Frequency	1/tc	33.16	39.80	49.74	MHz	LVDS
		tc	30.16	25.13	20.10	ns	transmitter input
	Rise time, Fall time	-	Refer to the timing characteristics of LVDS transmitter			ns	* 1
	Duty	-				-	
Horizontal signals	Cycle	th	14.8	18.0	26.5	μs	55.5kHz(typ.)
			920	1056	1240	CLK	
	Display period	thd	800			CLK	-
Vertical signals	Cycle	tv	13.3	16.67	20	ms	60.0Hz(typ.)
			608	628	650	H	
	Display period	tvd	600			H	-
DE/Data	Setup time	-	Refer to the timing characteristics of LVDS transmitter			ns	* 1
	Hold time	-				ns	
	Rise time, Fall time	-				ns	

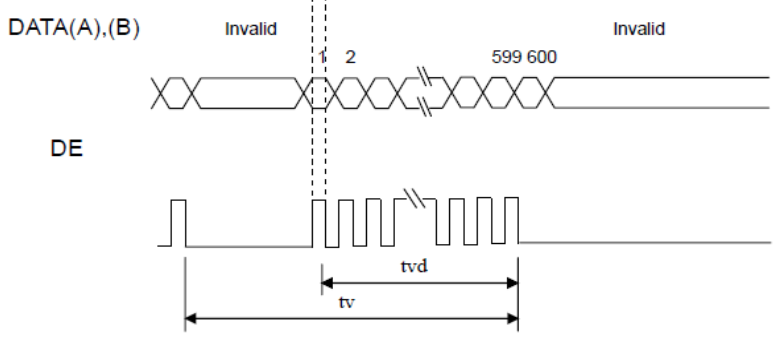
*1: See the data sheet of LVDS transmitter.

6.2 Input signal timing chart

Horizontal timing



Vertical timing



Note 1:
DATA(A)=RA0-RA7,GA0-GA7,BA0-BA7
DATA(B)=RB0-RB7,GB0-GB7,BB0-BB7

7. Optical Characteristics

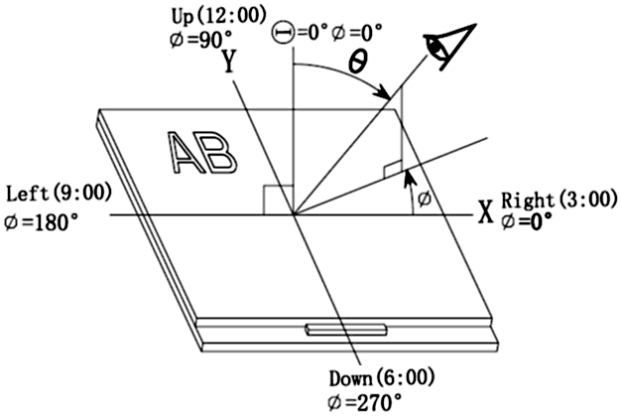
Parameter *1		Condition	Symbol	min.	typ.	max.	Unit	Remarks
Luminance		White at center θR=0°, θL=0° θU=0°, θD=0°	L	-	450	-	cd/m^2	-
Contrast ratio		White/Black at center θR=0°, θL=0° θU=0°, θD=0°	CR	-	700	-	-	Note3
Luminance uniformity		White θR=0°, θL=0° θU=0°, θD=0	LU	-	1.25	(1.33)	-	Note6
Chromaticity	White	X coordinate	Wx		0.313		-	Note5
		Y coordinate	Wy		0.329		-	
	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		θL=0 , θD=0 At center,against NTSC	C	-	55	-	%	
Response time		White to black	Ton	-	10	(20)	ms	Note4
		Black to white	Toff	-	25	(30)	ms	
		Ton+ Toff	-	-	35	(50)	ms	
Viewing angle	Right	θU=0°, θD=0°, CR≥10	θR	-	80	-	°	Note2
	Left	θU=0°, θD=0°, CR≥10	θL	-	80	-	°	
	Up	θR=0°, θL=0°, CR≥10	θU	-	65	-	°	
	Down	θR=0°, θL=0°, CR≥10	θD	-	75	-	°	

Note:

*1. The value above are initial Characteristics.

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

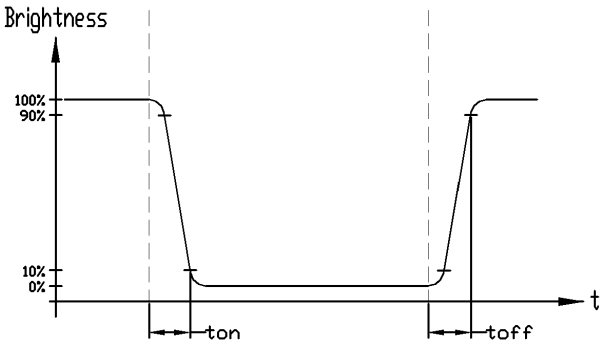


Note 3:
The definition of contrast ratio (Test LCM using SR-3A (1°)):

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

(Contrast Ratio is measured in optimum common electrode voltage)

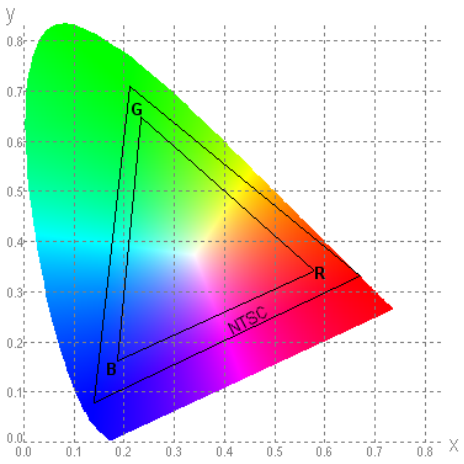
Note 4:
Definition of Response time. (Test LCD using BM-7A(2°)):
The output signals of photo detector are measured when the input signals are changed from "black" to "white"(falling time) and from "white" to "black"(rising time), respectively. The response time is defined as the time interval between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



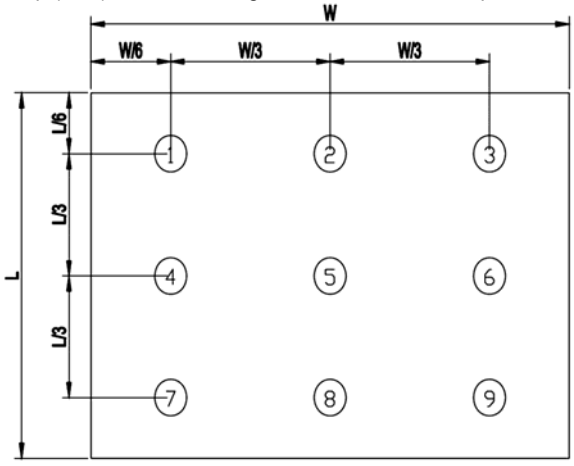
Note 5:
Definition of Color of CIE1931 Coordinate and NTSC Ratio.

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

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

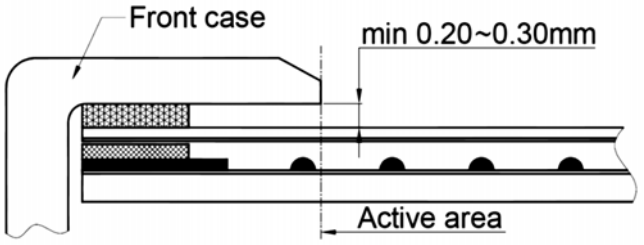
- When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
- The protection film is attached to the polarizer 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

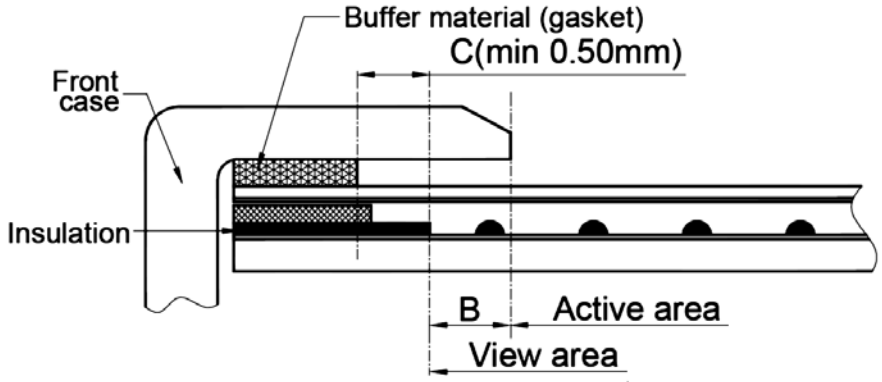
The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

附录：Touch panel Design Precautions

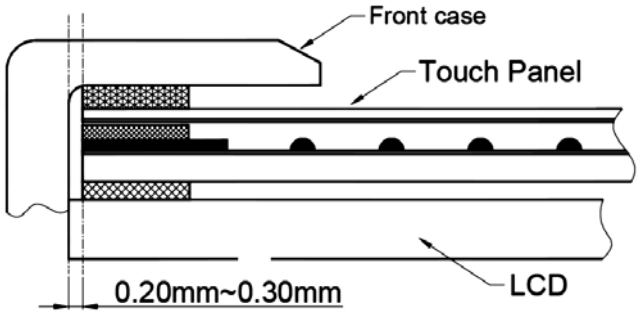
1. It should prevent front case touching the touch panel Active Area (A.A.) to prevent abnormal touch.
   It should left gab (e.g. 0.2~0.3mm) in between.



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.