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

LMT097DNGFWD-AAA

LCD Module User Manual

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Date: 2017-01-14	Date:	Date:

Rev.	Descriptions	Release Date
0.1	Preliminary	2016-04-27
0.2	Revise General Specification	2017-01-14

Table of Content

1. General Specification 3
2. Block Diagram 3
3. Terminal Function 4
3.1 K1 Terminal 4
3.2 K2 Terminal 4
3.3 K3 Terminal (Standard Mini USB) 4
4. Absolute Maximum Ratings 5
5. Electrical Characteristics 5
5.1 DC Characteristics 5
5.2 DC Characteristics(LVDS) 5
5.3 POWER ON/OFF SEQUENCE 6
6. AC Characteristics 7
6.1 AC Characteristics(LVDS) 7
6.2 AC Characteristics(TFT) 8
7. Optical Characteristics 9
8. Touch panel Design Precautions 10
9. Precautions for Use of LCD Modules 11
9.1 Handling Precautions 11
9.2 Storage precautions 11
9.3 Transportation Precautions 11

1. General Specification

Signal Interface :	LVDS (VESA 24 bits)
Display Mode :	Transmissive with Normally White
Screen Size :	9.7 inch
Outline Dimension :	231.8 x 167.8x 17.0(mm) (see outline drawing for details)
Active Area :	196.61x147.46(mm)
Number of dots :	1024x 3 (RGB) x 768
Dot Pitch :	0.192x 0.192(mm)
Pixel Configuration :	R.G.B. Vertical Stripe
Backlight :	White LED
Viewing Direction :	3 o'clock (Gray scale Inversion) (*1) 9 o'clock (*2)
Operating Temperature :	-20 ~ +70°C
Storage Temperature :	-30 ~ +80°C

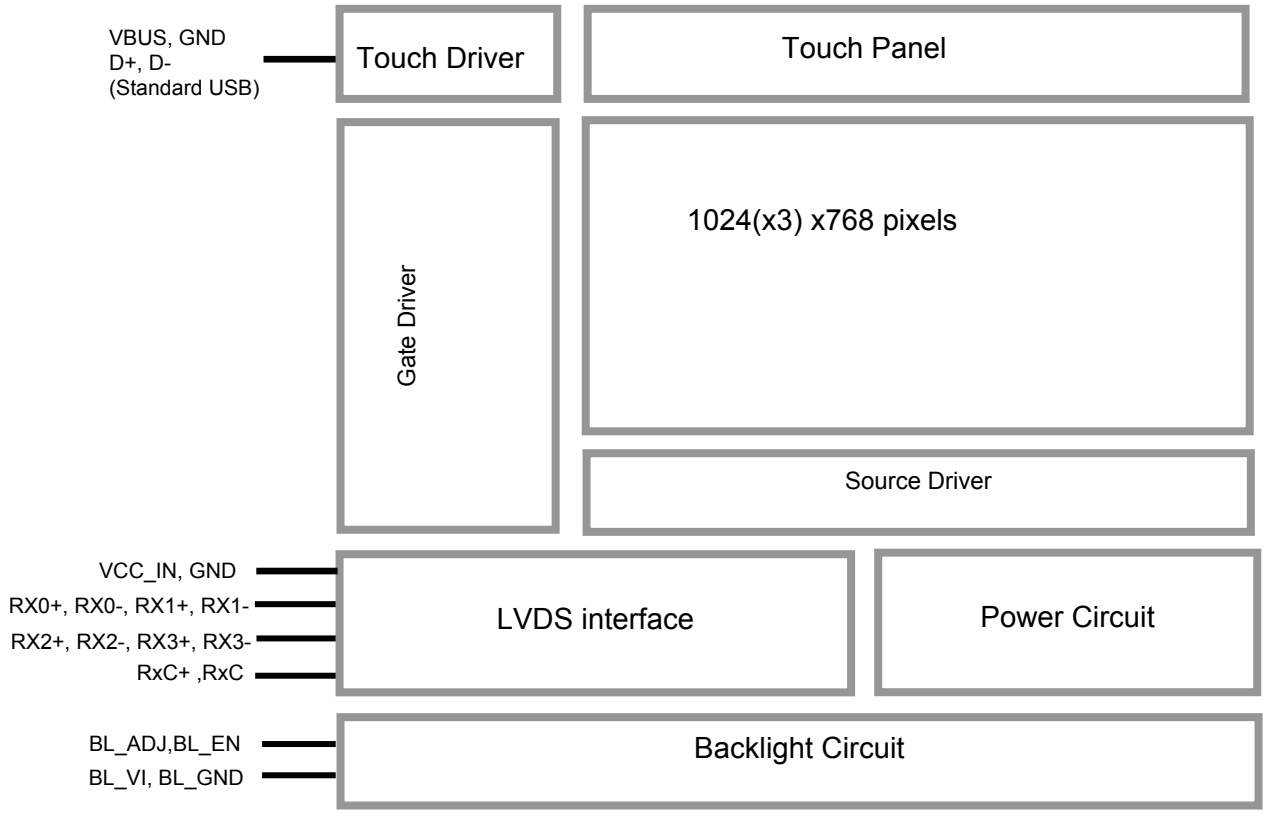
Note:

*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. Terminal Function

3.1 K1 Terminal

Pin No.	Pin Name	IO	Descriptions
1	RX3+	Input	LVDS receiver positive signal channel 3
2	RX3-	Input	LVDS receiver negative signal channel 3
3	NC	-	No connection
4	NC	-	No connection
5	GND	Power	Ground
6	RXC+	Input	LVDS receiver positive signal clock
7	RXC-	Input	LVDS receiver negative signal clock
8	GND	Power	Ground
9	RX2+	Input	LVDS receiver positive signal channel 2
10	RX2-	Input	LVDS receiver negative signal channel 2
11	GND	Power	Ground
12	RX1+	Input	LVDS receiver positive signal channel 1
13	RX1-	Input	LVDS receiver negative signal channel 1
14	GND	Power	Ground
15	RX0+	Input	LVDS receiver positive signal channel 0
16	RX0-	Input	LVDS receiver negative signal channel 0
17	NC	-	No connection
18	NC	-	No connection
19	VCC_IN	Power	Logic Positive Power Supply
20	VCC_IN	Power	Logic Positive Power Supply

3.2 K2 Terminal

Pin No.	Pin Name	IO	Descriptions
1	BL_VI	Power	Backlight Positive Power Supply
2	BL_ADJ	I/O	Backlight driver adjust control, active Low or keep open
3	BL_EN	I/O	Backlight Enable control, active Low or keep open
4	BL_GND	Power	Ground

3.3 K3 Terminal (Standard Mini USB)

Pin No.	Pin Name	I/O	Descriptions
1	VUSB	Power	Power supply
2	D-	I/O	USB DATA negative signal
3	D+	I/O	USB DATA positive signal
4	NC	-	-
5	GND	Power	Ground

Note:

**1: Dithering function enable control:*

When JP3 Close, JP4 Open, DITHB=" 1 " , Disable internal dithering function.

When JP4 Close, JP3 Open, DITHB=" 0 " , Enable internal dithering function. <default>

** 2. Mode select:*

When JP1 Close, JP2 Open, MODE=" 1 " , select DE mode, VS and HS must pull high. <default>

When JP2 Close, JP1 Open, MODE =" 0 " , select SYNC mode, DE must pull low.

4. Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit	Condition
Power Supply voltage	V_{CC_IN}	-0.3	3.6	V	
Backlight Supply voltage	B_{L_VI}	-0.3	13.0	V	
Operating Temperature	T_{OP}	-20	70	°C	No Condensation
Storage Temperature	T_{ST}	-30	80	°C	No Condensation

Note:
**1. This rating applies to all parts of the module. And should not be exceeded.*
**2. The operating temperature only guarantees operation of the circuit. The contrast, response speed, and the other specification related to electro-optical display quality is determined at the room temperature, T_{OP}=25℃*
**3. 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.*

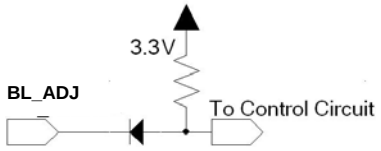
5. Electrical Characteristics

5.1 DC Characteristics

T_a=25°C

Items	Symbol	MIN.	TYP.	MAX.	Unit	Note
Power Supply Voltage	V_{CC_IN}	3.0	3.3	3.6	V	
Backlight Supply Voltage	V_{CC_IN}	11.5	12.0	12.5	V	
Input logic high voltage	V_{IH}	0.8 V_{CC_IN}	-	V_{CC_IN}	V	BL_ADJ,BL_EN
Input logic low voltage	V_{IL}	0	-	0.2 V_{CC_IN}	V	BL_ADJ,BL_EN
Logic Supply Current (V_{CC_IN})	I_{VCC_IN}	--	200	--	mA	
Backlight Supply Current (B_{L_VI})	I_{BL_VI}	--	185	--	mA	*1

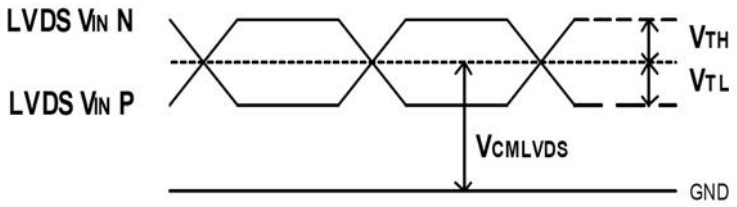
Note:
**1. BL_EN=Hi ,BL_ADJ=Hi or Both of Keep Open;*
**2. Recommended BL_ ADJ PWM Freq. is 3kHz.*
**3. Terminal circuit.*



5.2 DC Characteristics(LVDS)

VCC_IN=3.3V,GND=0V,T_a=25°C

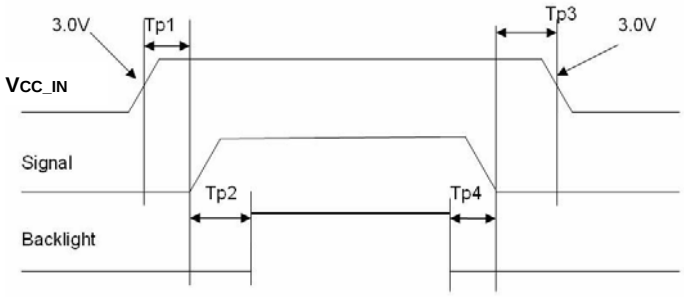
Items	Symbol	MIN.	TYP.	MAX.	Unit	Note
Differential Input High Threshold	V_{TH}	-	-	100	mV	
Differential Input Low Threshold	V_{TL}	-100	-	-	mV	
Input Current	I_{IN}			±10	uA	
Differential Input common Mode voltage	V_{CMLVDS}	1.65	-	2.1	V	



LVDS DC timing diagram

5.3 POWER ON/OFF SEQUENCE

Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Note
V_{CC_IN} 3.3V to signal starting	Tp1	0	-	50	ms	
Signal staring to backlight on	Tp2	150	-	-	ms	
Signal off to V_{CC_IN} 3.0V	Tp3	0	-	50	ms	
Backlight off to signal off	Tp4	150	-	-	ms	



Interface Power On/Off Sequence

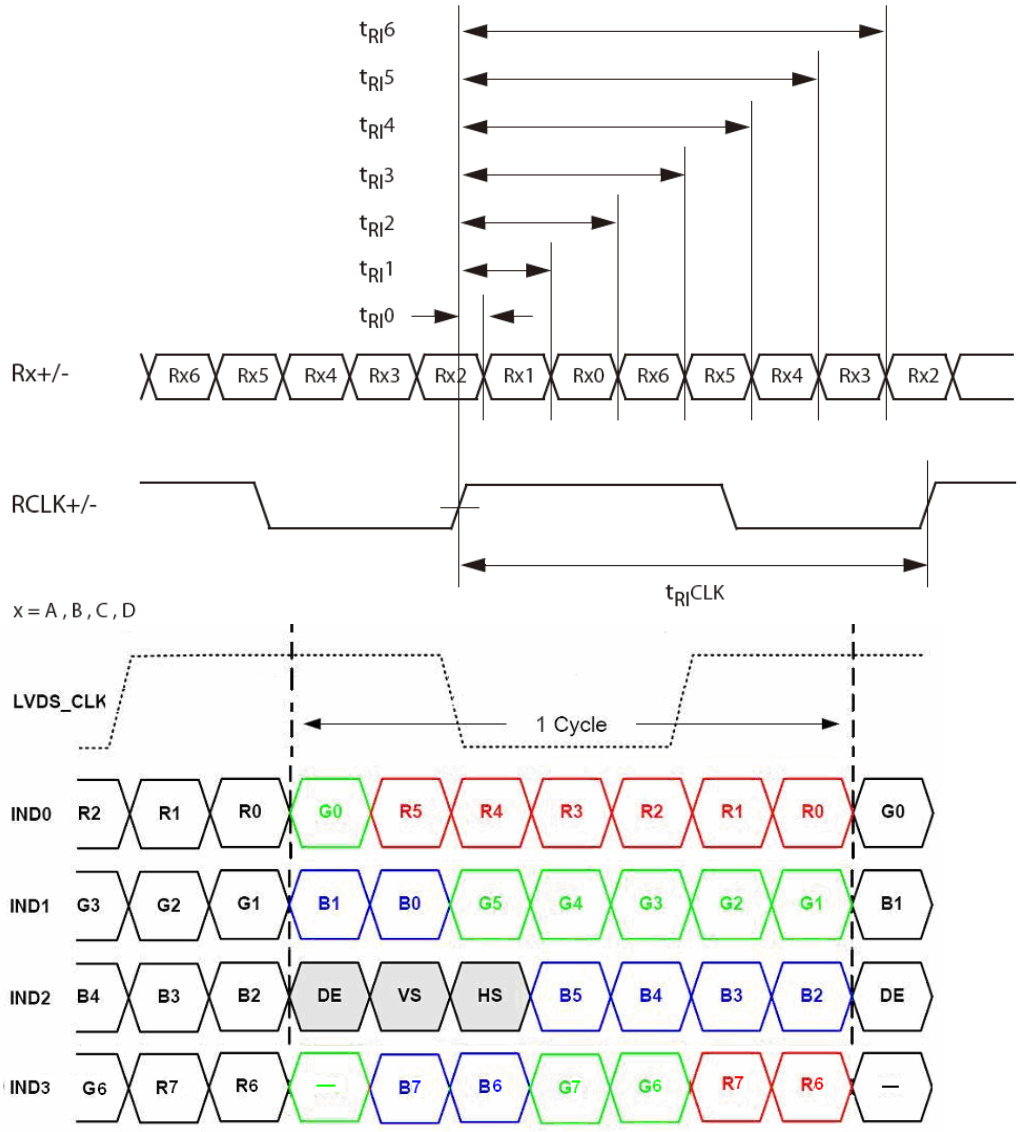
6. AC Characteristics

6.1 AC Characteristics(LVDS)

VCC_IN=3.3V,GND=0V,T_a=25°C

Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Input CLK period	tRICLK	8.9	-	50	ns	
Input Data Position 0 (tRICLK = 8.9ns)	tRI0	-0.3	-	+0.3	ns	
Input Data Position 1 (tRICLK = 8.9ns)	tRI1	tRICLK/7-0.3	tRICLK/7	tRICLK/7+0.3	ns	
Input Data Position 2 (tRICLK = 8.9ns)	tRI2	2tRICLK/7-0.3	2tRICLK/7	2tRICLK/7+0.3	ns	
Input Data Position 3 (tRICLK = 8.9ns)	tRI3	3tRICLK/7-0.3	3tRICLK/7	3tRICLK/7+0.3	ns	
Input Data Position 4 (tRICLK = 8.9ns)	tRI4	4tRICLK/7-0.3	4tRICLK/7	4tRICLK/7+0.3	ns	
Input Data Position 5 (tRICLK = 8.9ns)	tRI5	5tRICLK/7-0.3	5tRICLK/7	5tRICLK/7+0.3	ns	
Input Data Position 6 (tRICLK = 8.9ns)	tRI6	6tRICLK/7-0.3	6tRICLK/7	6tRICLK/7+0.3	ns	

Input Clock and Data timing Diagram:



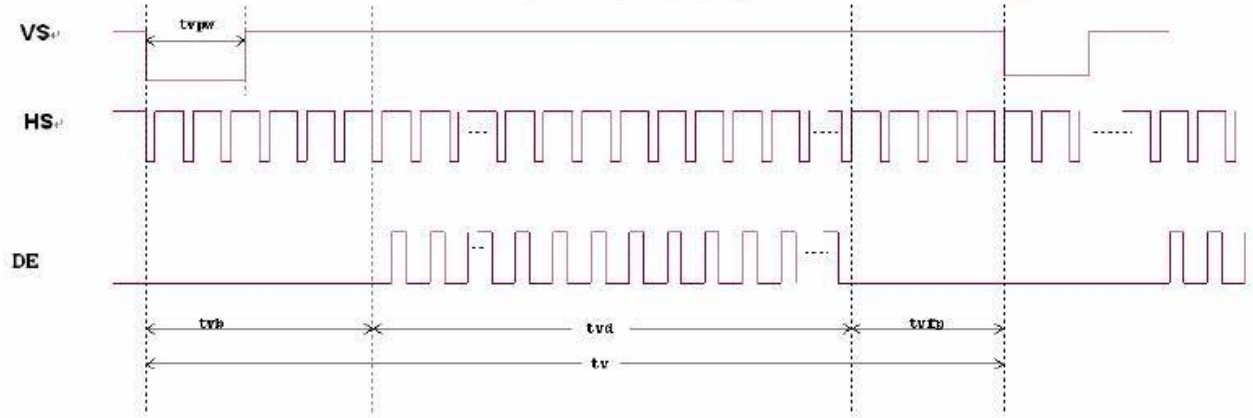
6.2 AC Characteristics(TFT)

Item	Symbol	MIN.	TYP.	MAX.	Unit	Remark
DCLK Frequency	fclk	57	65	70.5	MHz	
One Horizontal Line	th	1200	1344	1400	DCLK	
Horizontal Display Area	thd	-	1024	-	DCLK	
HS pulse width	thpw	1	-	140	DCLK	
HS Blanking	thb		160		DCLK	
HS Front Porch	thfp	16	160	216	DCLK	

Item	Symbol	Values			Unit	Remark
		MIN.	TYP.	MAX.		
VS period time	tv	792	806	840	TH	
Vertical Display Area	tvd	-	768	-	TH	
VS pulse width	tvpw	1	-	20	TH	
VS Blanking	tvb		23		TH	
VS Front Porch	tvfp	1	15	49	TH	

Note: DE timing refer to HSD, VSD input timing.

1 Horizontal input timing diagram.

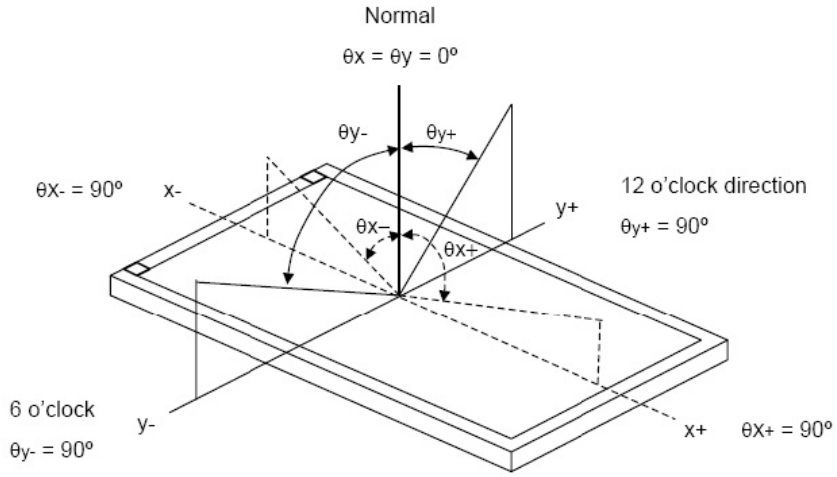


Vertical input timing diagram.

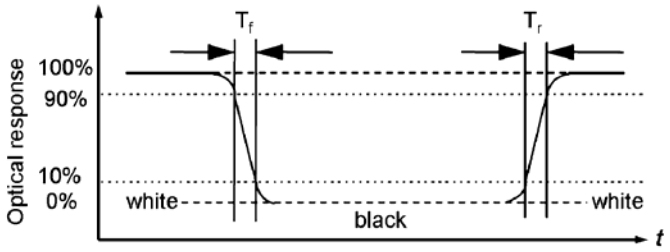
7. Optical Characteristics

Item	Symbol	Condition	MIN.	TYP.	MAX.	UNIT	Note.
Viewing angle (CR≥10)	θ_L	9 o'clock	-	60	-	degree	*2
	θ_R	3 o'clock	-	70	-		
	θ_T	12 o'clock	-	70	-		
	θ_B	6 o'clock	-	70	-		
Response Time	T_f	Normal θ=0°	-	20	-	msec	*3
	T_r		-	20	-	msec	
Contrast ratio	CR		-	500	-	-	*1
Color chromaticlty	W_X		-	0.313	-	-	
	W_Y		-	0.329	-	-	
Luminance	L		-	200	-	cd/m^2	*4
Luminance uniformity	Y_U		-	75	-	%	*4

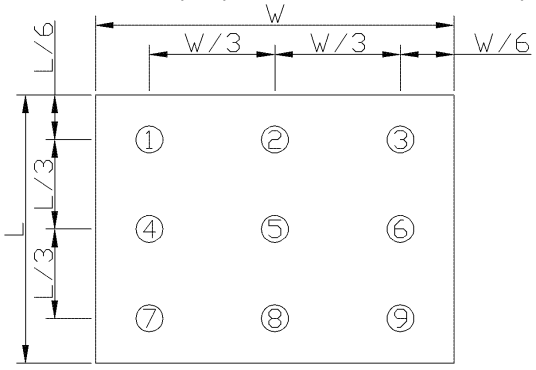
Note:
*1. Definition of Contrast Ratio
The contrast ratio could be calculate by the following expression:
Contrast Ratio (CR) = Luminanc with all pixels white / Luminance with all pixels black
*2 Definition of Viewing Angle



*3 Definition of response time

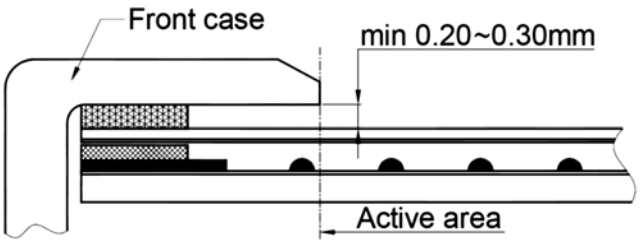


*4 Definition of Luminance Uniformity
Luminance uniformity (Lu)=
Min. Luminance form pt1~pt9 / Max Luminance form Pt1~pt9

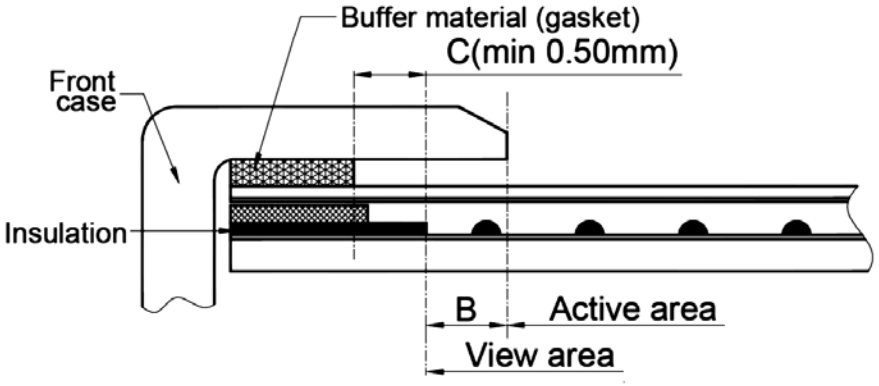


8. Touch panel Design Precautions

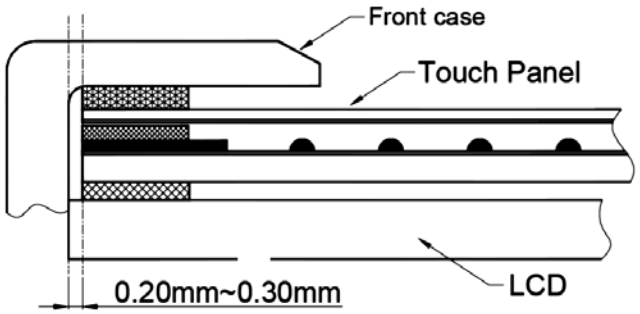
1. It should prevent front case touching the touch panel Active Area (A.A.) to prevent abnormal touch.
   It should left gab (e.g. 0.2~0.3mm) in between.



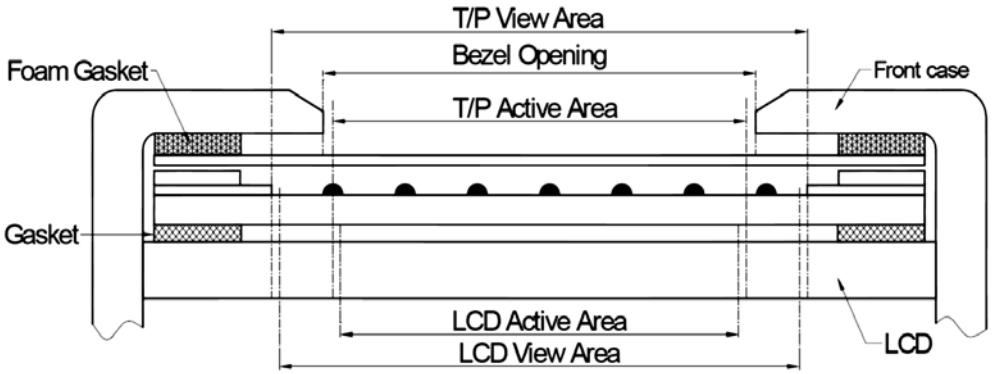
2. Outer case design should take care about the area outside the A.A.
   Those areas contain circuit wires which is having different thickness. Touching those areas could de-form the ITO film. As a result case the ITO cold be damaged and shorten its lifetime.
   It is suggested to protect those areas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



9. Precautions for Use of LCD Modules

9.1 Handling Precautions

9.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

9.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

9.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

9.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

9.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

- Isopropyl alcohol
- Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

- Water
- Ketone
- Aromatic solvents

9.1.6 Do not attempt to disassemble the LCD Module.

9.1.7 If the logic circuit power is off, do not apply the input signals.

9.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

9.1.8.1 Be sure to ground the body when handling the LCD Modules.

9.1.8.2 Tools required for assembly, such as soldering irons, must be properly ground.

9.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

9.1.8.4 The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

9.2 Storage precautions

9.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

9.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:
Temperature : 0℃ ～ 40℃ Relatively humidity: ≤80%

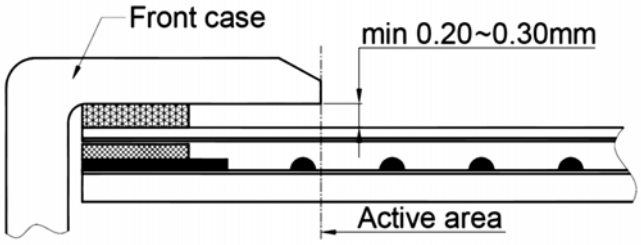
9.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

9.3 Transportation Precautions

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.



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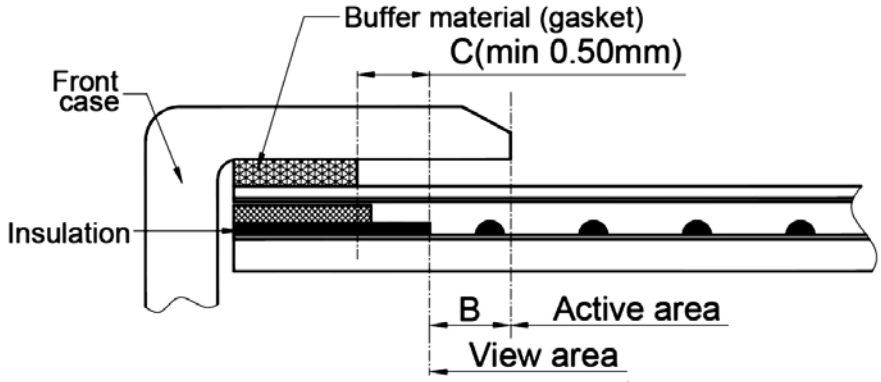

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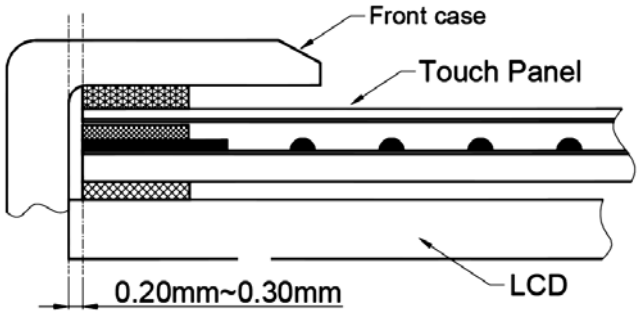

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