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

LMT104DNEFWU-NNA-1

LCD Module User Manual

Prepared by:	Checked by:	Approved by:
Wei		
Date: 2016-08-15	Date:	Date:

Rev.	Descriptions	Release Date
0.1	**Preliminary**	**2016-08-15**

Table of Content

1. General Specification

Signal Interface :	Digital 24-bit RGB
Display Technology :	a-Si TFT active matrix
Display Mode :	Transmissive with Normally White
Screen Size :	10.4 inch
Outline Dimension :	228.4 x 175.4 x 7.7(mm) (see outline drawing for details)
Active Area :	211.2x158.4 (mm)
Number of dots :	800x 3 (RGB) x 600
Pixel Pitch :	0.264x 0.264(mm)
Pixel Configuration :	R.G.B. Stripe
Backlight :	White LED
Viewing Direction :	6 o'clock(Gray scale Inversion)(*1) 12 o'clock(*2)
Operating Temperature :	-20 ~ +70°C
Storage Temperature :	-30 ~ +80°C

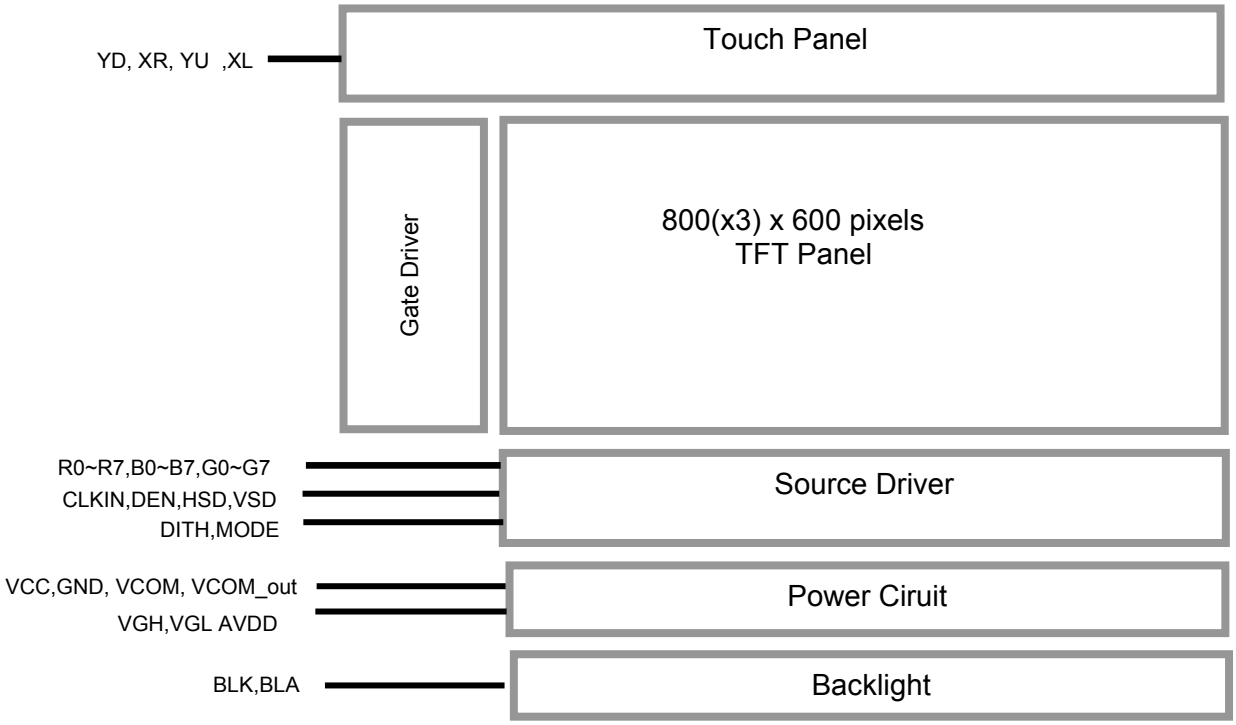
Note:

*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 TFT Terminal

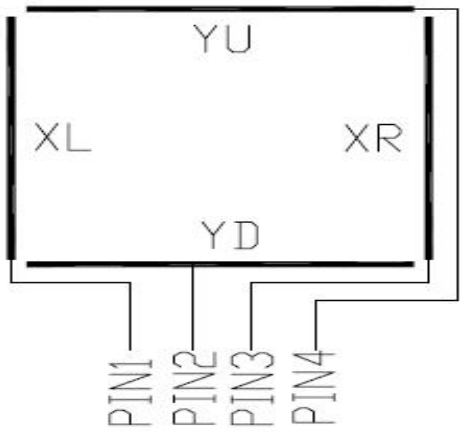
Pin No.	Pin Name	IO	Descriptions
1	GND	Power	Power Ground(0V)
2	AVDD	Power	Power for Analog Circuit
3	VCC	Power	Power for Digital Circuit
4	R0	Input	8bit Data for Red
:	:		
11	R7		
12	G0	Input	8bit Data for Green
:	:		
19	G7		
20	B0	Input	8bit Data for Blue
:	:		
27	B7		
28	CLKIN	Input	Clock for input data
29	DEN	Input	Data enable signal
30	HSD	Input	Horizontal Sync Input
31	VSD	Input	Vertical Sync Input
32	MODE	Input	H: DE mode (Default) L: SYNC mode
33	NC	--	No connection
34	NC		
35	NC		
36	VCC	Power	Power for Digital Circuit
37	NC	--	No connection
38	GND	Power	Power Ground(0V)
39	GND	Power	Power Ground(0V)
40	AVDD	Power	Power for Analog Circuit
41	VCOM	Power	Common Voltage
42	DITH	Input	Dithering setting DITH="H" 6bit resolution
43	NC	--	No connection
:	:		
55	NC		
56	VGH	Power	Gate ON Voltage
57	VCC	Power	Power for Digital Circuit
58	VGL	Power	Gate OFF Voltage
59	GND	Power	Power Ground(0V)
60	NC	--	No connection

3.2 K2 (Backlight Terminal)

Pin No.	Pin Name	IO	Descriptions
1	BLA	Power	LED driving anode (Red)
2	BLK	Power	LED driving cathode (white)

3.3 Touch Panel Terminal

Pin No.	Pin Name	IO	Descriptions
1	XL	Passive	Left Side sense Terminal
2	YD	Passive	Down Side sense Terminal
3	XR	Passive	Right Side sense Terminal
4	YU	Passive	Up Side sense Terminal



4. Absolute Maximum Ratings

GND=0V

Items	Symbol	Min.	Max.	Unit	Condition
Power Supply voltage	VCC	-0.3	5.0	V	
Analog Power Supply voltage	VADD	-0.5	15.0	V	
Power Voltage	V_{GH}	-0.3	42.0	V	
	V_{GL}	-20.0	0.3	V	
	VGH-VGL	-0.30	40.0	V	
Signal Input	Vin	-0.50	5.00	V	(*1)
Operating Temperature	T_{OP}	-20	70	°C	No Condensation
Storage Temperature	T_{ST}	-30	80	°C	No Condensation
Operating and Storage Humidity	HSTG	--	90	%(RH)	
Relative Humidity(*2)	RH	--	≤90	%	Ta≤40℃
		--	≤85	%	40℃＜Ta≤50℃
		--	≤55	%	50℃＜Ta≤60℃
		--	≤36	%	60℃＜Ta≤70℃
		--	≤24	%	70℃＜Ta≤80℃
Absolute Humidity	AH	--	≤70	g/m^3	Ta＞70℃

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

VCC=3.3V,GND=0V,Ta=25℃

Items		Symbol	MIN.	TYP.	MAX.	Unit	Note
Digital Power Supply Voltage		VCC	3.0	3.3	3.6	V	
Digital Supply Current		ICC	--	10.2	--	mA	Black Pattern
Analog Power Supply Voltage		VADD	10.8	11.0	11.2	V	Very important voltage, exceed this value may cause abnormal display
Gate on voltage		VGH	20.0	21.0	22.0	V	
Gate off voltage		VGL	-7.5	-7.0	-6.5	V	
Common Electrode Driving voltage		VCOM	3.85	3.90	3.95	V	
Input Signal Voltage	Low Level	VIL	0	--	0.3xVCC	V	R0~R7,G0~G7, B0~B7,DE,DCLK, HSYNC,VSYNC, MODE,RESET, DITH
	High Level	VIH	0.7xVCC	--	VCC	V	
Analog Supply Current		IAVDD	--	34.3	--	mA	AVDD=11.0V
Current of Gate on Current		IVGH	--	0.7	--	mA	VGH=21.0V
Current of Gate off Current		IVGL	--	0.7	--	mA	VGL=-7.0V
Current of Vcom		Ivcom	--	0.002	--	mA	VCOM=3.90V

Note:

*1.Be sure to apply VCC and VGL to the LCD first,and then apply VGH.

*2.VCC setting should match the signals output voltage(refer to Note 3)of customer's system board.

*3. DCLK,HS,VS,DE,R0~R7,G0~G7,B0~B7,MODE DITHB.

5.2 LED Backlight Circuit Characteristics

T_a=25°C

Items	Symbol	MIN.	TYP.	MAX.	Unit	Note
Forward Voltage	VfBLA	--	9.6	10.5	V	
Forward Current	IfBLA	--	240		mA	
Life Time	--	--	30000	--	hrs	(*1)

Note:

*1.If is defined for twelve channels.

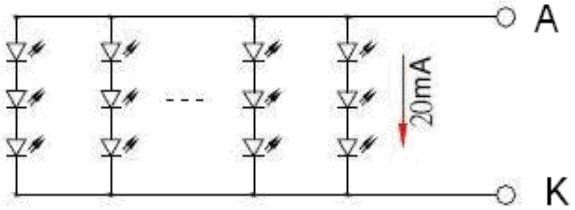
Optical performance should be evaluated at Ta=25℃ only.

If LED is driven by high current, high ambient temperature & humidity condition,
The life time of LED will be reduced.

Operating life means brightness goes down to 50% of initial brightness.

Typical operating life time is estimated data.

*2. Exceeding the recommended driving current could cause substantial damage to the backlight and shorten its lifetime.



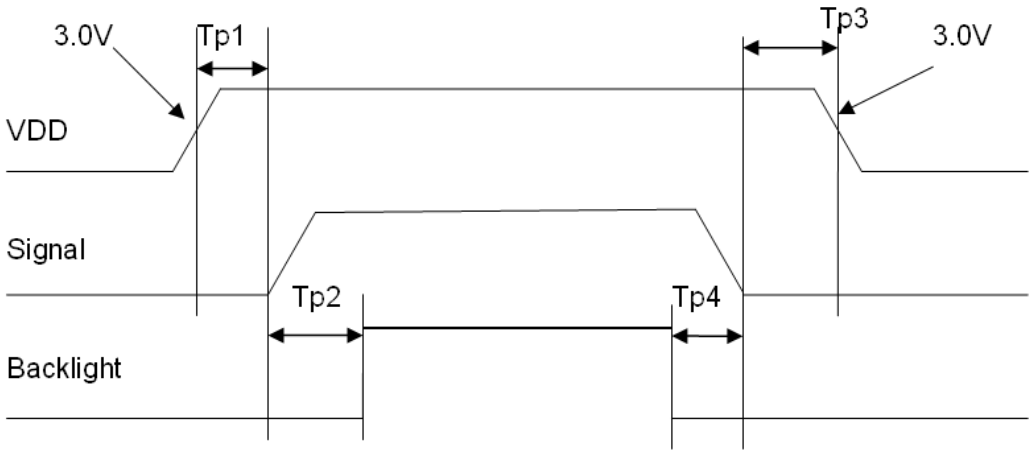
No. of LED= 3x12 pcs

5.3 Touch Panel Characteristics

Items	MIN.	TYP.	MAX.	Unit	Note
Operating Voltage	--	5.0	--	V	
Terminal resistance	300	--	900	Ω	X-terminal
	200	--	500	Ω	Y-terminal
Response time	--	10	--	ms	
Life Time	--	1,000,000	--		

5.4 System Power ON/OFF sequence

Items	Symbol	MIN.	TYP.	MAX.	Unit	Note
VDD 3.0V to signal starting	Tp1	0	-	50	ms	
Signal starting to backlight on	Tp2	150	-	-	ms	
Signal off to VDD 3.0V	Tp3	0	-	50	ms	
Backlight off to signal off	Tp4	150	-	-	ms	



6. AC Characteristics

6.1 Timing Characteristics

HV SYNC MODE

Parameter		Symbol	MIN.	TYP.	MAX.	Unit
Dclk frequency		1/Tclk	34.5	39.6	50.4	MHz
HSD	Valid Data Width	Thd		800		tclk
	One Horizontal Line	th	900	1000	1200	tclk
	HS Pulse Width	thpw	1	-	40	tclk
	HS Back Porch	thb		88		tclk
	HS Front Porch	thfp	12	112	312	tclk
VSD	Frame rate	-	-	60	70	Hz
	Vertical Display Area	tvd		600		th
	VS Period Time	tv	604	628	800	th
	VS Pulse Width	tvpw	1	-	20	th
	VS Back Porch	tvb		39		th
	VS Front Porch	tvfp	1	21	61	th

Note: DE signal is necessary.

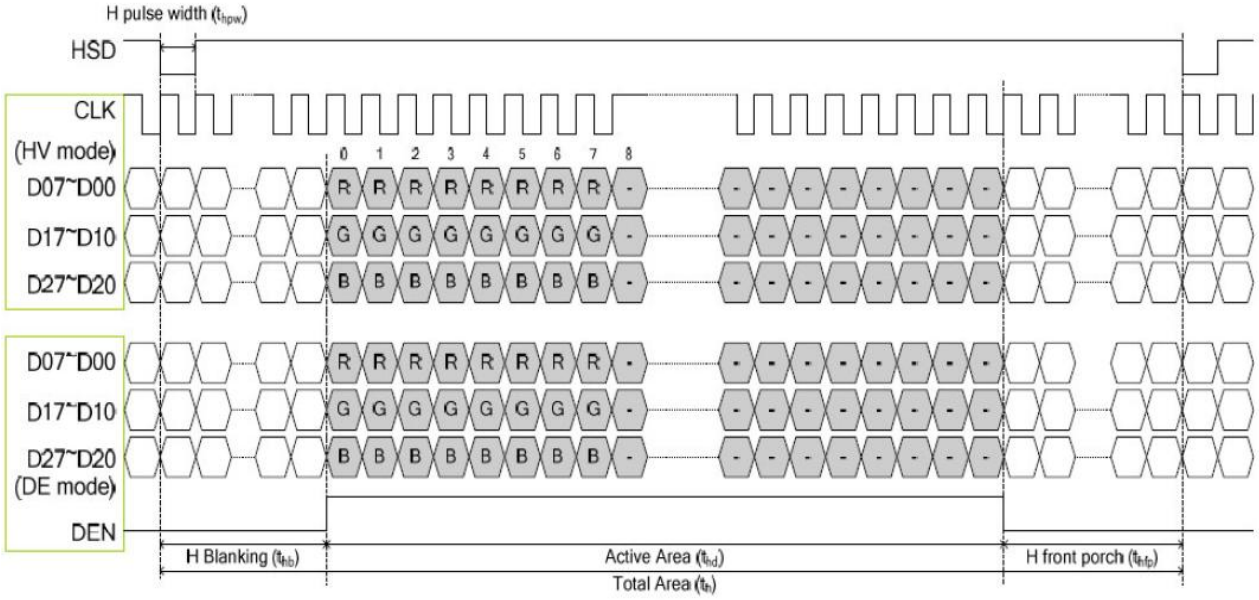
DE MODE

Parameter		Symbol	MIN.	TYP.	MAX.	Unit
Dclk frequency		Fclk	32.6	39.6	62.4	MHz
HSD	Horizontal total	Th	890	1000	1300	tclk
	Valid Data Width	Thd		800		tclk
	Horizontal blanking	Thb+ Thfp	90	200	500	tclk
VSD	Vertical total	Tv	610	660	800	th
	Valid Data Width	Tvd		600		th
	Vertical blanking	Tvb+ Tvfp	10	60	200	th

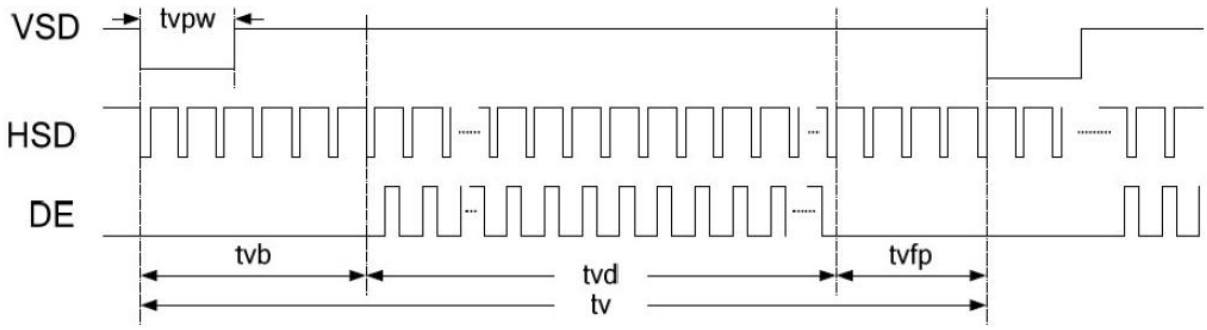
Note: HSD&VSD signal is unnecessaryv.

Data input timing format

Horizontal Timing



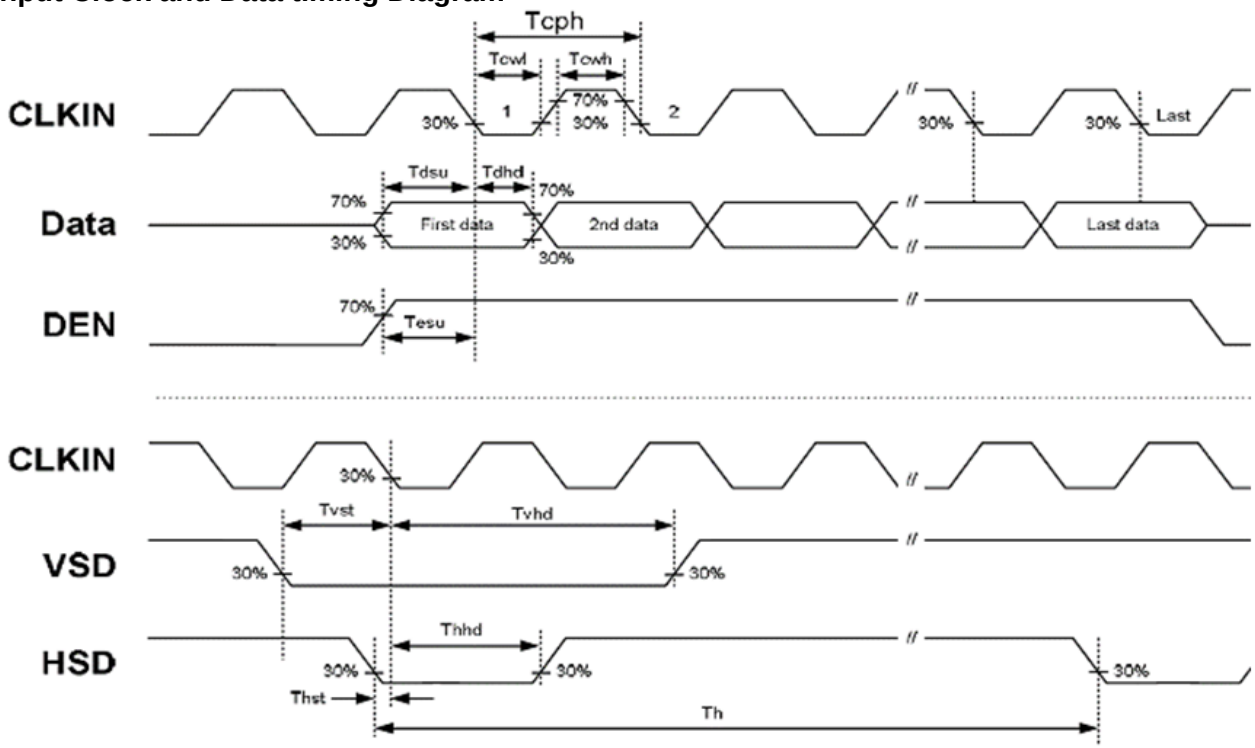
Vertical Timing



AC Electrical Characteristics

Parameter	Symbol	Spec			Unit	Remark
		MIN.	TYP.	MAX.		
DCLK frequency	F_{clk}	32.6	39.6	62.4	MHz	
DCLK cycle time	T_{cph}	14	-	-	ns	
DCLK pulse width	T_{cph}	40%	50%	60%	Tcph	
VS setup time	T_{vst}	5	-	-	ns	
VS hold time	T_{vhd}	5	-	-	ns	
HS setup time	T_{hst}	5	-	-	ns	
HS hold time	T_{hst}	5	-	-	ns	
Data setup time	T_{hst}	5	-	-	ns	Data to DCLK
Data hold time	T_{dhd}	5	-	-	ms	Data to DCLK
DE setup time	T_{dhd}	5	-	-	ns	
DE hold time	T_{ehd}	5	-	-	ns	

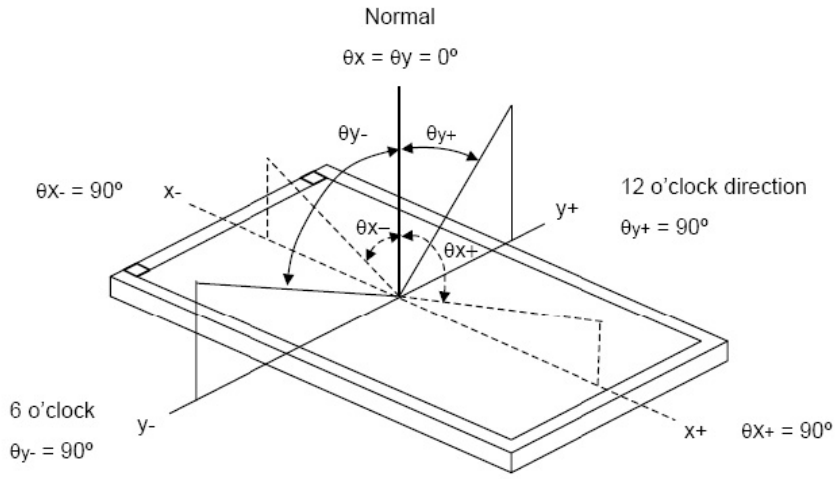
Input Clock and Data timing Diagram



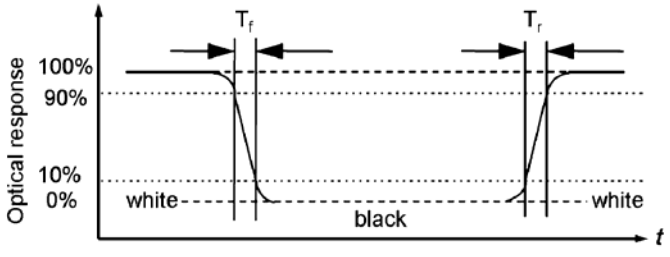
7. Optical Characteristics

Item	Symbol	Condition	MIN.	TYP.	MAX.	UNIT	Note.
Viewing angle (CR≥10)	θ_L	9 o'clock	60	70	-	degree	*2
	θ_R	3 o'clock	60	70	-		
	θ_T	12 o'clock	50	60	-		
	θ_B	6 o'clock	60	70	-		
Response Time	T_f	Normal θ=0°	-	10	15	msec	*3
	T_r		-	15	25	msec	
Contrast ratio	CR		400	500	-	-	*1
Color chromaticlty	W_X		0.26	0.31	0.26	-	
	W_Y		0.28	0.33	0.38	-	
Luminance	L		200	250	-	cd/m^2	*4
Luminance uniformity	Y_U		70	75	-	%	*4

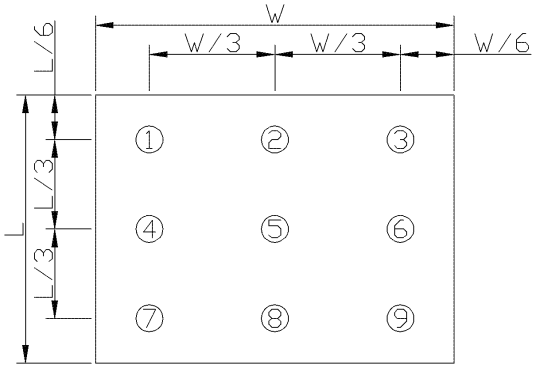
Note:
*1. Definition of Contrast Ratio
The contrast ratio could be calculate by the following expression:
Contrast Ratio (CR) = Luminanc with all pixels white / Luminance with all pixels black
*2 Definition of Viewing Angle



*3 Definition of response time

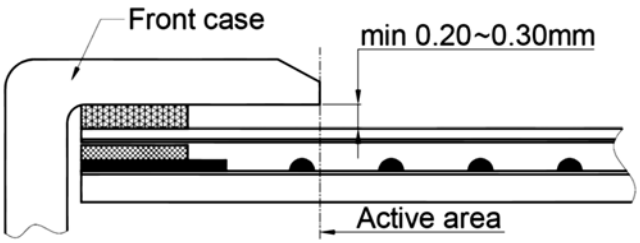


*4 Definition of Luminance Uniformity
Luminance uniformity (Lu)=
Min. Luminance form pt1~pt9 / Max Luminance form Pt1~pt9

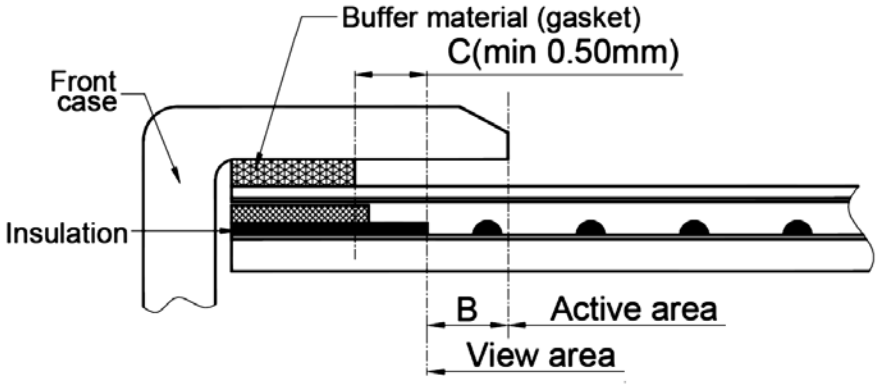


8. Touch panel Design Precautions

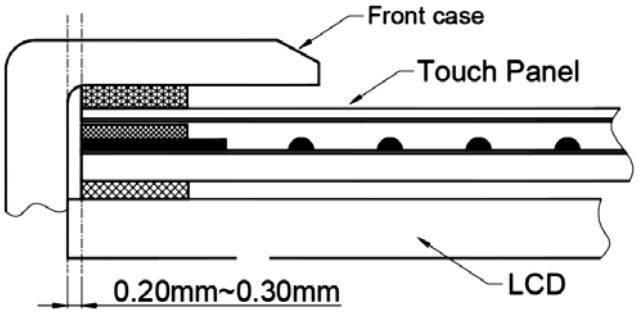
1. It should prevent front case touching the touch panel Active Area (A.A.) to prevent abnormal touch.
   It should left gab (e.g. 0.2~0.3mm) in between.



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 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. I In general design,
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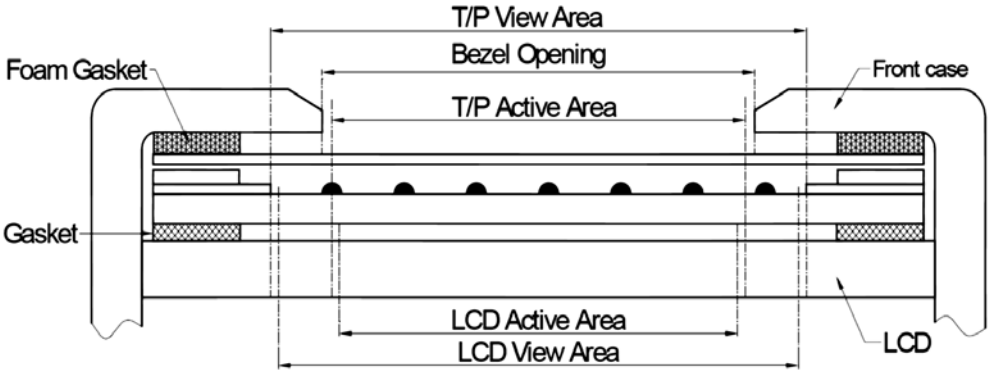
   and touch panel A.A. should be bigger than the LCD A.A.



9. Precautions for Use of LCD Modules

9.1 Handling Precautions

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

8.1.2 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.

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

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

8.1.5 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

8.1.6 Do not attempt to disassemble the LCD Module.

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

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

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

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

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

8.1.8.4 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

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

8.2.2 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%

8.2.3 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

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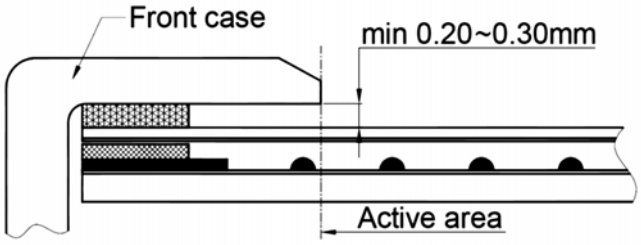

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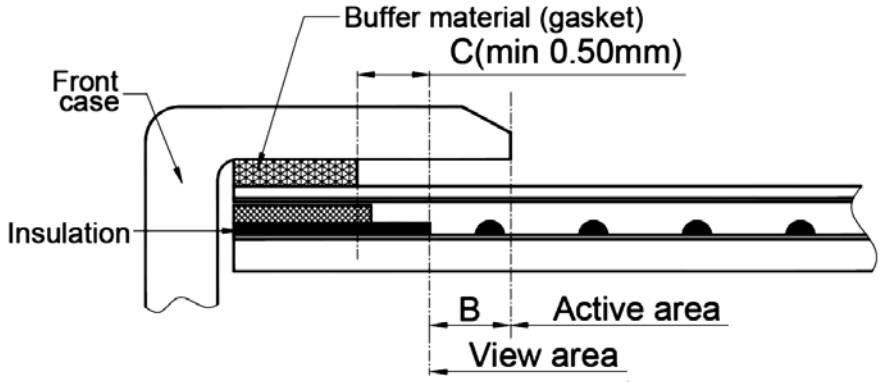

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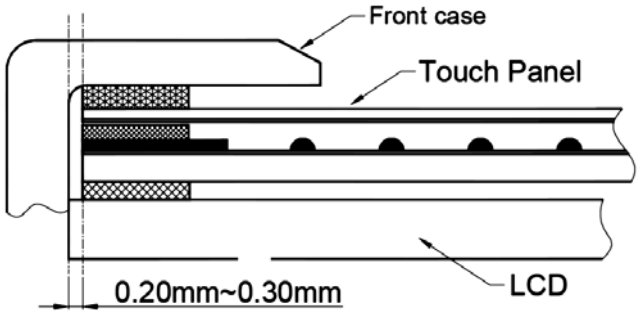

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