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

LMT070DICFWD-NQA

LCD Module User Manual

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Rev.	Descriptions	Release Date
0.1	- Preliminary release	2017-02-14

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www.topwaysz.com
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1. General Specification

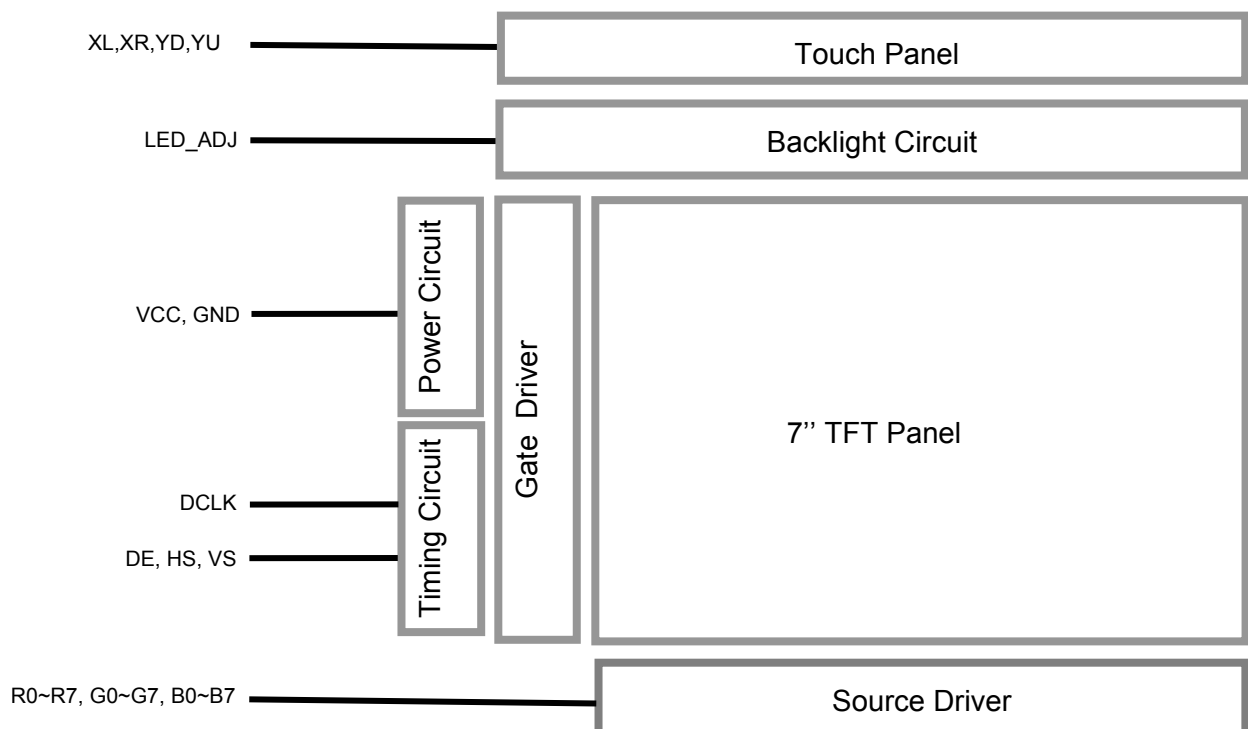|	
Signal Interface :	Digital 24-bits RGB
Display Technology :	a-Si TFT active matrix
Display Mode :	Transmissive / Normal White
Screen Size(Diagonal) :	7.0"
Outline Dimension :	190.0 x 112.0 x 19.8 (mm)
	(see attached drawing for details)
Active Area :	154.08 x 85.92 (mm)
Number of dots :	800x3(RGB) x 480
Pixel Pitch :	0.1926 x 0.179 (mm)
Pixel Configuration :	RGB Stripe
Backlight :	LED
Viewing Direction :	6 o'clock (Gray scale Inversion) (*1)
	12 o'clock (*2)
Operating Temperature :	-20 ~ +70°C
Storage Temperature :	-30 ~ +80°C
Touch Panel:	4wire resistive
Surface Treatment :	Anti-Glare Treatment

Note :

*1. For saturated color display content (eg. pure-red, 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 (K5)

K5 Pin No.	Pin Name	I/O	Descriptions	
			DE Mode <default>	Sync Mode
1	VCC	Power	Positive Power Supply	
2	VCC			
3	B0	Input	Blue Data	
:	:			
10	B7			
11	GND	Power	Power Supply GND (0V)	
12	G0	Input	Green Data	
:	:			
19	G7			
20	GND	Power	Power Supply GND (0V)	
21	R0	Input	Red Data	
:	:			
28	R7			
29	GND	Power	Power Supply GND (0V)	
30	LED_ADJ	Input	LED driver enable control	
31	NC	--	No connection, leave open	
32	NC	--	No connection, leave open	
33	DE	Input	DE Signal Input	Pull Lo
34	VS	Input	Pull Hi	Vertical Sync Input
35	HS	Input	Pull Hi	Horizontal Sync Input
36	DCLK	Input	Data Clock Input Data shall be latched at the falling edge of DCLK.	
37	XL	Passive	Touch Screen X+ terminal	
38	XR	Passive	Touch Screen X- terminal	
39	YD	Passive	Touch Screen Y- terminal	
40	YU	Passive	Touch Screen Y+ terminal	

Note:

* 1. 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 be low.
* 2. Dithering function enable control:
   When JP7 Close, JP8 Open, DITHB="1", Disable internal dithering function.
   When JP8 Close, JP7 Open, DITHB= "0", Enable internal dithering funtion. <default>
*3. U/D R/L Function Description:

Scan Control Input		Scanning direction	Jumper Setting
U/D	L/R		
GND	VCC	Up to down, left to right	JP3, JP6, Close; JP4, JP5 Open <default>
VCC	GND	Down to up, right to left	JP4, JP5, Close; JP3, JP6 Open
GND	GND	Up to down, right to left	JP4, JP6, Close; JP3, JP5 Open
VCC	VCC	Down to up, left to right	JP3, JP5, Close; JP4, JP6 Open

4. Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit	Condition
Power Supply voltage	V_{CC}	-0.3	6.0	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. Ambient temperature when the backlight is lit (reference value)
*4. 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

Top=25℃, GND=0V

Items	Symbol	Min.	Typ.	Max.	Unit	Remark
Power Supply Voltage	V_{CC}	4.5	5.0	5.5	V	(*1)
Input logic high voltage	V_{IH}	3.0	-	3.6	V	
Input logic low voltage	V_{IL}	0	-	0.7	V	
Logic Supply (VCC)	I_{VCC}	-	450	-	mA	LED_ADJ=Hi (*2)

Note:
*1. Never apply logic signal before the VCC.
*2. PWM signal (Freq<800Hz) could be applied to LED_ADJ pin for backlight brightness control, where its life time could be extend by lower its brightness.
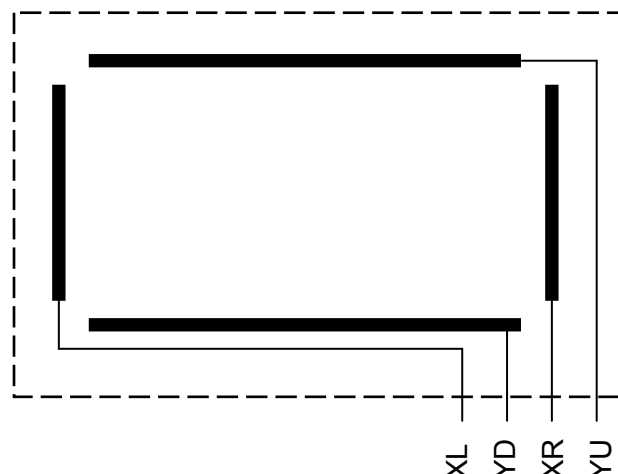
5.2 Touch panel Characteristics

T_{OP} =25°C

Items	MIN.	TYP.	MAX.	Unit	Applicable Pin
Terminal resistance	100	-	900	Ω	X- terminal
	200	-	1200	Ω	Y- terminal
Operating Voltage	-	-	7	V	-
Response time	-	-	10	ms	-
Operating Force	100	-	160	g	-
Life Time	-	1,000,000	-	times	-

Cautions:
   Exceeding the recommended Condition could cause substantial damage to the touch panel and shorten its lifetime.
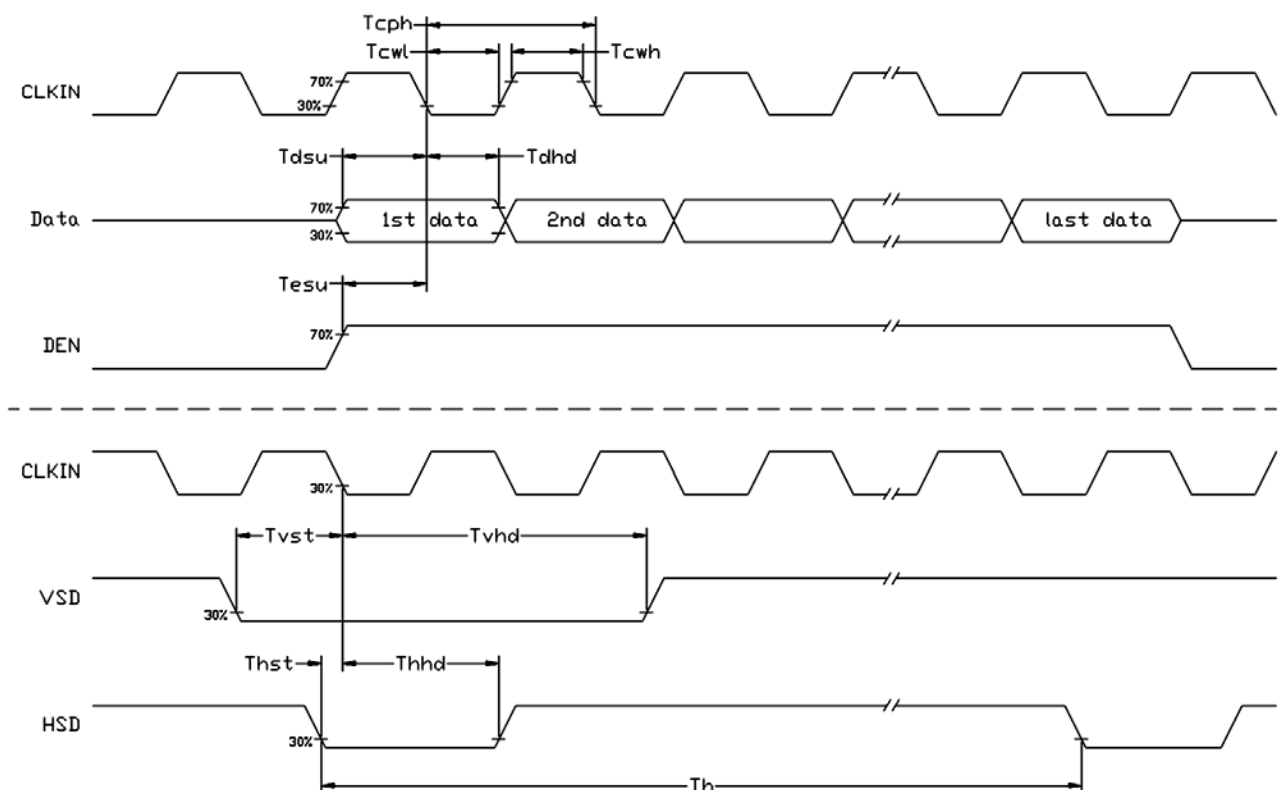
6. AC Characteristics

6.1 Timing Characteristics

Item	Symbol	MIN.	TYP.	MAX.	Unit	Remark
HS setup time	Thst	8	-	-	ns	
HS hold time	Thhd	8	-	-	ns	
VS setup time	Tvst	8	-	-	ns	
VS hold time	Tvhd	8	-	-	ns	
Data setup time	Tdsu	8	-	-	ns	
Data hole time	Tdhd	8	-	-	ns	
DE setup time	Tesu	8	-	-	ns	
V_{CC} Power On Slew rate	TPOR	-	-	20	ms	From 0 to 90% V_{CC}
DCLK cycle time	Tcph	20	-	-	ns	
DCLK pulse duty	Tcwh	40	50	60	%	

6.2 Input Clock and Data Timing Diagram

6.3 Timing

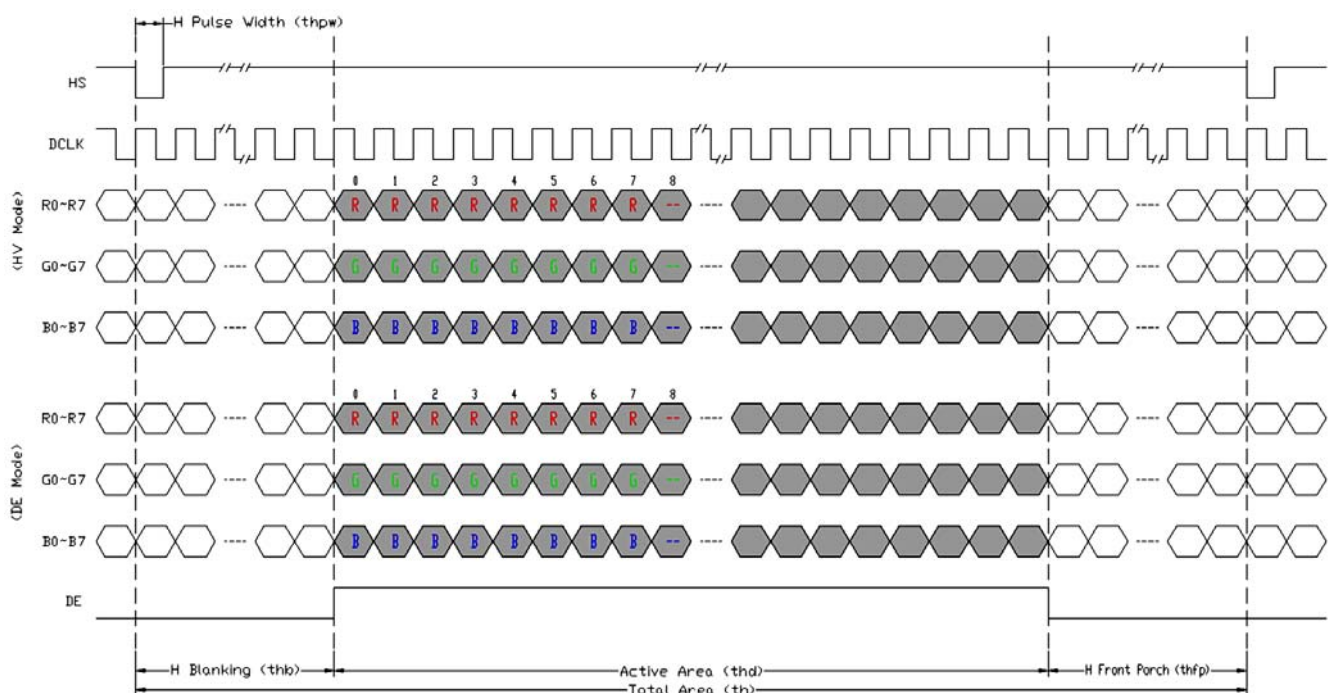| Item	Symbol	MIN.	TYP.	MAX.	Unit	Remark
Horizontal Display Area	thd	-	800	-	DCLK	
DCLK Frequency	fclk	26.4	33.3	46.8	MHz	
One Horizontal Line	th	862	1056	1200	DCLK	
HS pulse width	thpw	1	-	40	DCLK	
HS Blanking	thb	46	46	46	DCLK	
HS Front Porch	thfp	16	210	354	DCLK	
Vertical Display Area	tvd	-	480	-	TH	
VS period time	tv	510	525	650	TH	
VS pulse width	tvpw	1	-	20	TH	
VS Blanking	tvb	23	23	23	TH	
VS Front Porch	tvfp	7	22	147	TH	

6.4 Data Input Format

Figure 6-2-1 Horizontal input timing diagram.

Figure 6-2-2 Vertical input timing diagram.

6.5 Optical Characteristics

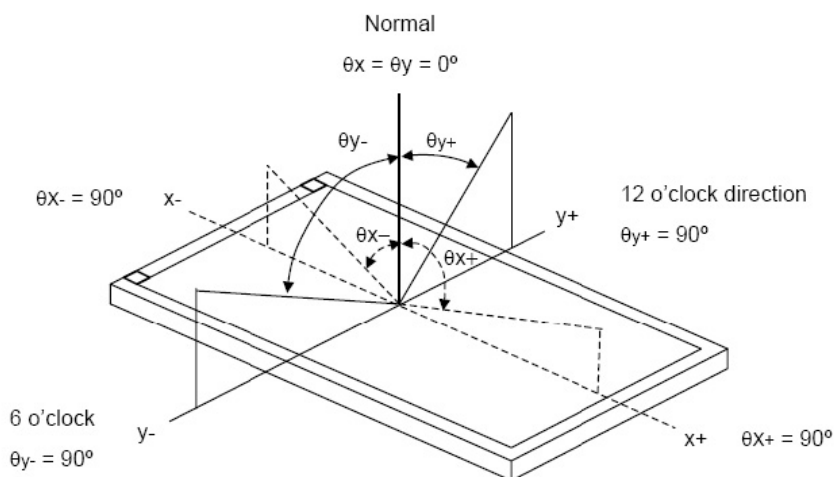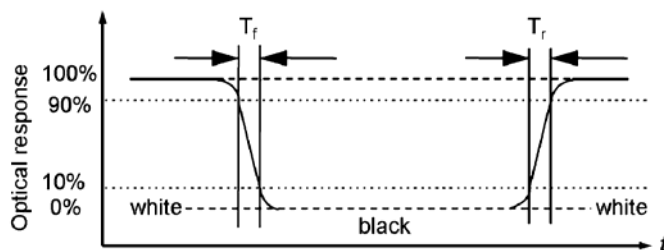| Item	Symbol	Condition	MIN.	TYP.	MAX.	UNIT	Note.
Viewing angle (CR≥10)	θ_L	9 o'clock	60	70	-	degree	*2
	θ_R	3 o'clock	60	70	-		
	θ_T	12 o'clock	40	50	-		
	θ_B	6 o'clock	60	70	-		
Response Time	T_f	Normal $\theta=0°$	-	10	20	msec	*3
	T_r		-	15	30	msec	
Contrast ratio	CR		400	500	-	-	*1
Color chromaticity	W_X		0.26	0.31	0.26	-	
	W_Y		0.28	0.33	0.38	-	
Luminance	L		-	400	-	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) = Luminance with all pixels white / Luminance with all pixels black
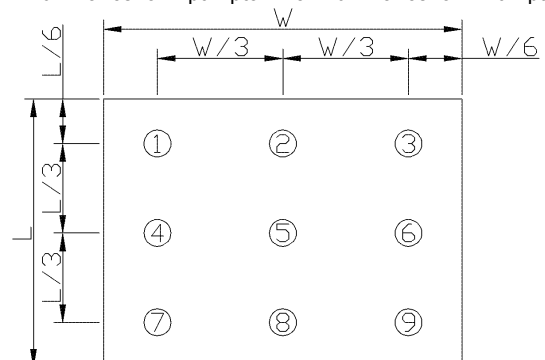
*2 Definition of Viewing Angle

*3 Definition of response time

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

*5. Given parameter measured without touch panel.

7. 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.
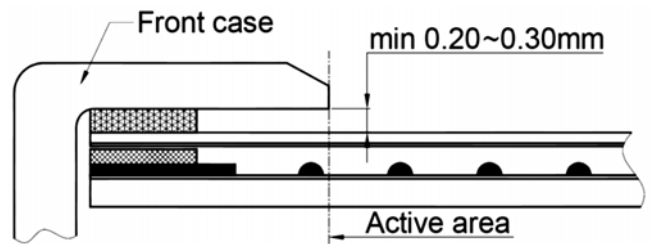
8.   Appendix <Inspection items and criteria for appearance defect>

Bright/Dark Dots:

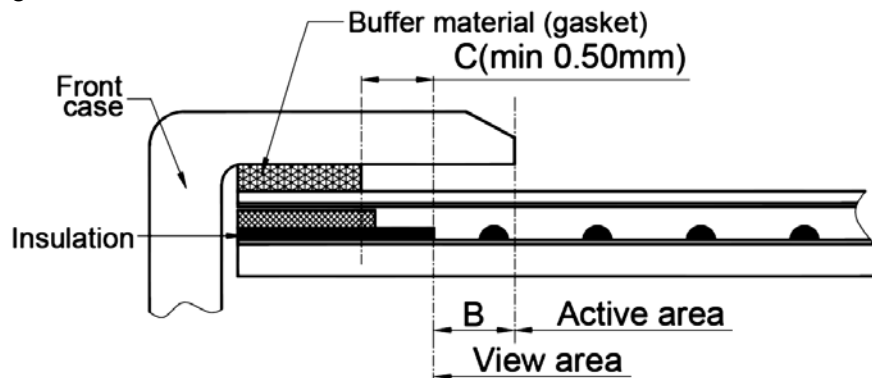| Defect Type	Specification	Major	Minor
Bright Dots	N≤ 2		●
Dark Dots	N≤ 3		●
Total Bright and Dark Dots	N≤ 4		●

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.
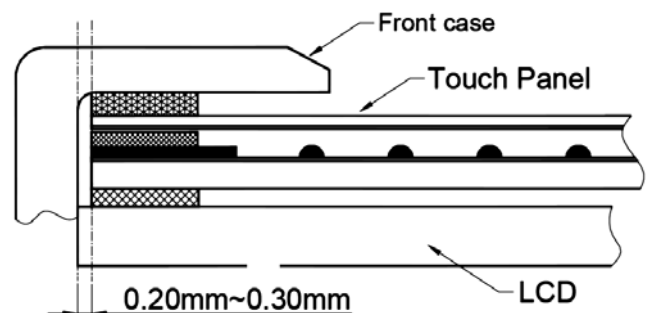
附录：Touch panel Design Precautions

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.