MODEL No: BI030TFX

1. Scope

This data sheet is to introduce the specification of BI030TFX active matrix TFT module. It is composed of a color TFT-LCD panel, driver IC, FPC and a backlight unit. The 3.0" display area contains 240(RGB) x 400 pixels.

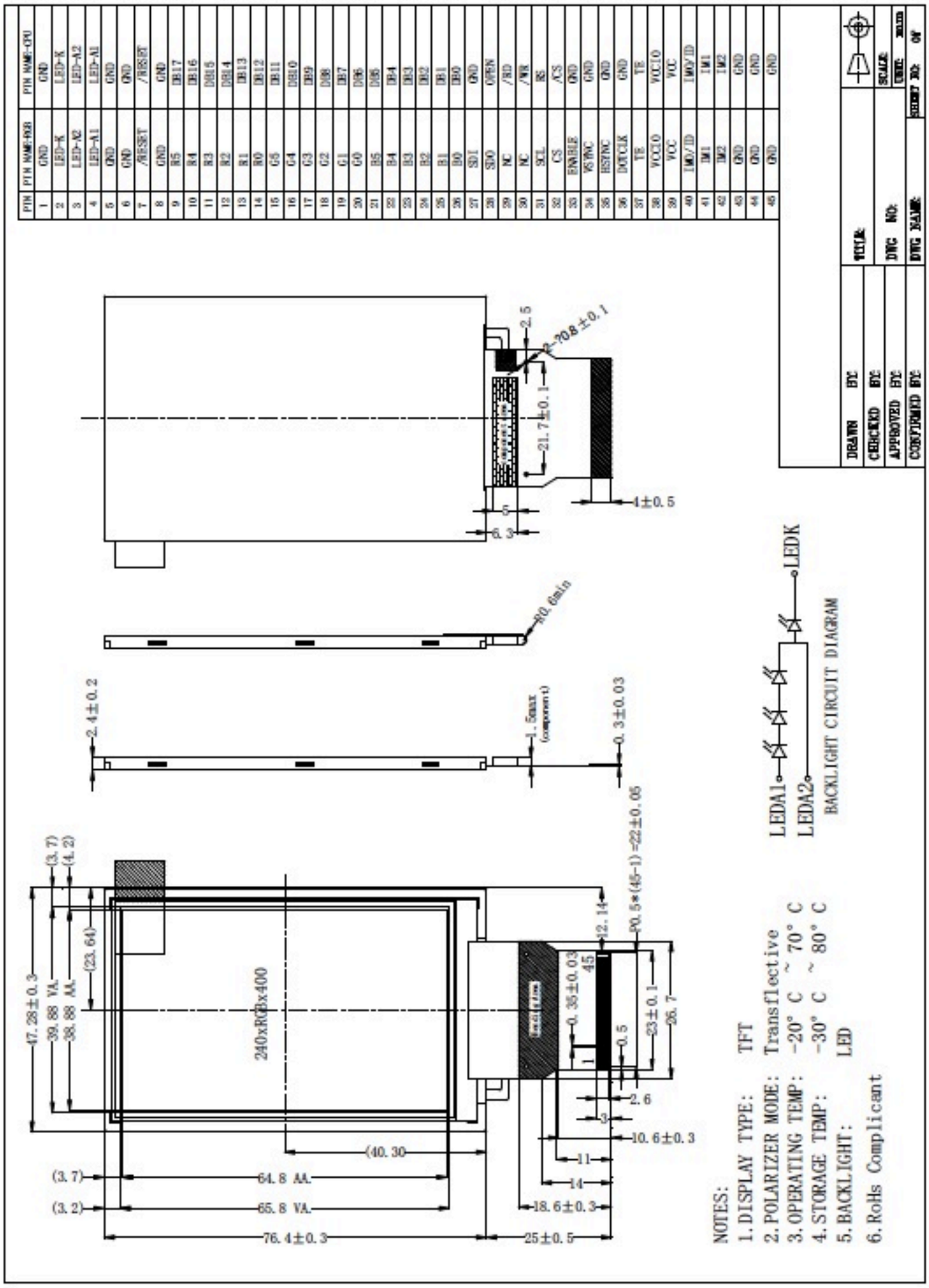
2. Application

Digital equipments which need color display outdoor, mobile phone, mobile navigator/video systems.

3. General Information

Item	Contents	Unit
Size	3.0	inch
Resolution	240(RGB) x 400	/
Technology type	a-si TFT	/
Color depth	262K	/
Pixel pitch	0.162x0.162	mm
Pixel Configuration	R.G.B. Vertical Stripe	/
Outline Dimension (W x H x D)	47.28x 76.4x2.4	mm
Active Area	38.88 x 64.8	mm
Display Mode	Transflective (ECB)	/
Viewing Direction	12 O'clock	/
Backlight Type	3 LEDs	/
Driver IC	HX8352B	/

4. Outline Drawing



5. Interface signals

No	Symbol (CPU)	Symbol (RGB)	Description	Remarks
1	GND	GND	Ground	
2	LED-K	LED-K	Power supply for LED(Low voltage)	
3	LED-A2	LED-A2	Power supply for LED(High voltage2)	
4	LED-A1	LED-A1	Power supply for LED(High voltage1)	
5	GND	GND	Ground	
6	GND	GND	Ground	
7	/RESET	/RESET	RESET serial(Low active)	
8	GND	GND	Ground	
9	DB17	R5	CPU: Data bus serial(MSB) RGB:RED data signal(MSB)	
10	DB16	R4	CPU: Data bus serial RGB:RED data signal	
11	DB15	R3	CPU: Data bus serial RGB:RED data signal	
12	DB14	R2	CPU: Data bus serial RGB:RED data signal	
13	DB13	R1	CPU: Data bus serial RGB:RED data signal	
14	DB12	R0	CPU: Data bus serial RGB:RED data signal(LSB)	
15	DB11	G5	CPU: Data bus serial RGB:GREEN data signal(MSB)	
16	DB10	G4	CPU: Data bus serial RGB:GREEN data signal	
17	DB9	G3	CPU: Data bus serial RGB:GREEN data signal	
18	DB8	G2	CPU: Data bus serial RGB:GREEN data signal	
19	DB7	G1	CPU: Data bus serial RGB:GREEN data signal	
20	DB6	G0	CPU: Data bus serial RGB:GREEN data signal(LSB)	
21	DB5	B5	CPU: Data bus serial RGB:BLUE data signal(MSB)	
22	DB4	B4	CPU: Data bus serial RGB:BLUE data signal	
23	DB3	B3	CPU: Data bus serial RGB:BLUE data signal	
24	DB2	B2	CPU: Data bus serial RGB:BLUE data signal	
25	DB1	B1	CPU: Data bus serial RGB:BLUE data signal	
26	DB0	B0	CPU: Data bus serial RGB:BLUE data signal(LSB)	
27	GND	SDI	CPU: ground RGB: serial data input pin	

28	OPEN	SDO	CPU: not use. Leave open or to GND/VCCIO RGB: Serial data output pin	
29	/RD	NC	CPU: read signal and read data RGB: no connect	
30	/WR	NC	CPU: write signal and write data RGB: no connect	
31	RS	SCL	CPU: data/ command selection pin RGB: Serial Clock signal	
32	/ CS	CS	Chip select signal	
33	GND	ENABLE	CPU: ground RGB: a data enable signal	
34	GND	VSYNC	CPU: ground RGB: frame synchronizing signal	
35	GND	HSYNC	CPU: ground RGB: frame synchronizing signal	
36	GND	DOTCLK	CPU: ground RGB: pixel clock signal	
37	TE	TE	CPU: tearing effect output RGB: not used ,please open this pin	
38	VCCIO	VCCIO	I/O Pad and digital power supply	
39	VCC	VCC	Analog power supply	
40	IM0/1D	IM0/1D	System interface select	
41	IM1	IM1	System interface select	
42	IM2	IM2	System interface select	
43	GND	GND	Ground	
44	GND	GND	Ground	
45	GND	GND	Ground	

The recommended connector: FH19SC-45S-0.5SH(0.5) (HRS)

6. Absolute maximum Ratings

6.1. Electrical Absolute max. ratings

Parameter	Symbol	MIN	MAX	Unit	Remark
Supply Voltage	VCC	-0.3	4.6	V	
Supply Voltage	VCCIO	-0.3	4.6	V	
Input voltage	D[17: 0], CS, RD, WR, RS/SCL, SDI, VSYNC, HSYNC, DOTCLK, ENABLE, BS[2:0]	-0.3	VCC+0.3	V	

6.2 Environment Conditions

Item	Symbol	MIN	MAX	Unit	Remark
Operating Temperature	TOPR	-20	70	℃	
Storage Temperature	TSTG	-30	80	℃	

6.3 LED Backlight Absolute max. ratings

Item	Symbol	MIN	MAX	Unit	Remark
LED Forward Current	ILED	--	25	mA	For each LED

7 Electrical Specifications

7.1 Electrical characteristics

GND=0V, Ta=25℃

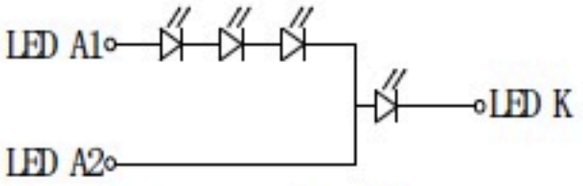
Item	Symbol	MIN	TYP	MAX	Unit	Remark
Supply Voltage	VCC	2.5	2.8	3.3	V	
Supply Voltage	IOVCC	1.65	2.8	3.3	V	
Input Signal Voltage	V_{IL}	-0.3	-	0.2* IOVCC	V	
	V_{IH}	0.8* IOVCC	-	IOVCC	V	
Output Signal Voltage	V_{OL}	-	-	0.2* IOVCC	V	IOVCC=1.65~2.4V IOL=0.1mA
	V_{OH}	0.8* IOVCC	-	-	V	IOH=-0.1mA
(Panel+LSI) Power Consumption	Black Mode (60Hz)	-	49.5	-	mW	
	Standby Mode	-	0.132	-	mW	

7.2 LED Backlight

Ta=25℃

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	IF	-	20	-	mA	
Forward Voltage	VF	-	12.8	-	V	
Backlight power	W_{BL}		256		mW	Note
LED lifetime		-	30,000	-	Hr	

Note 1 : The LED driving condition is defined for each LED module.
Note 2: Backlight unit driving must depend on Forward Current setting.



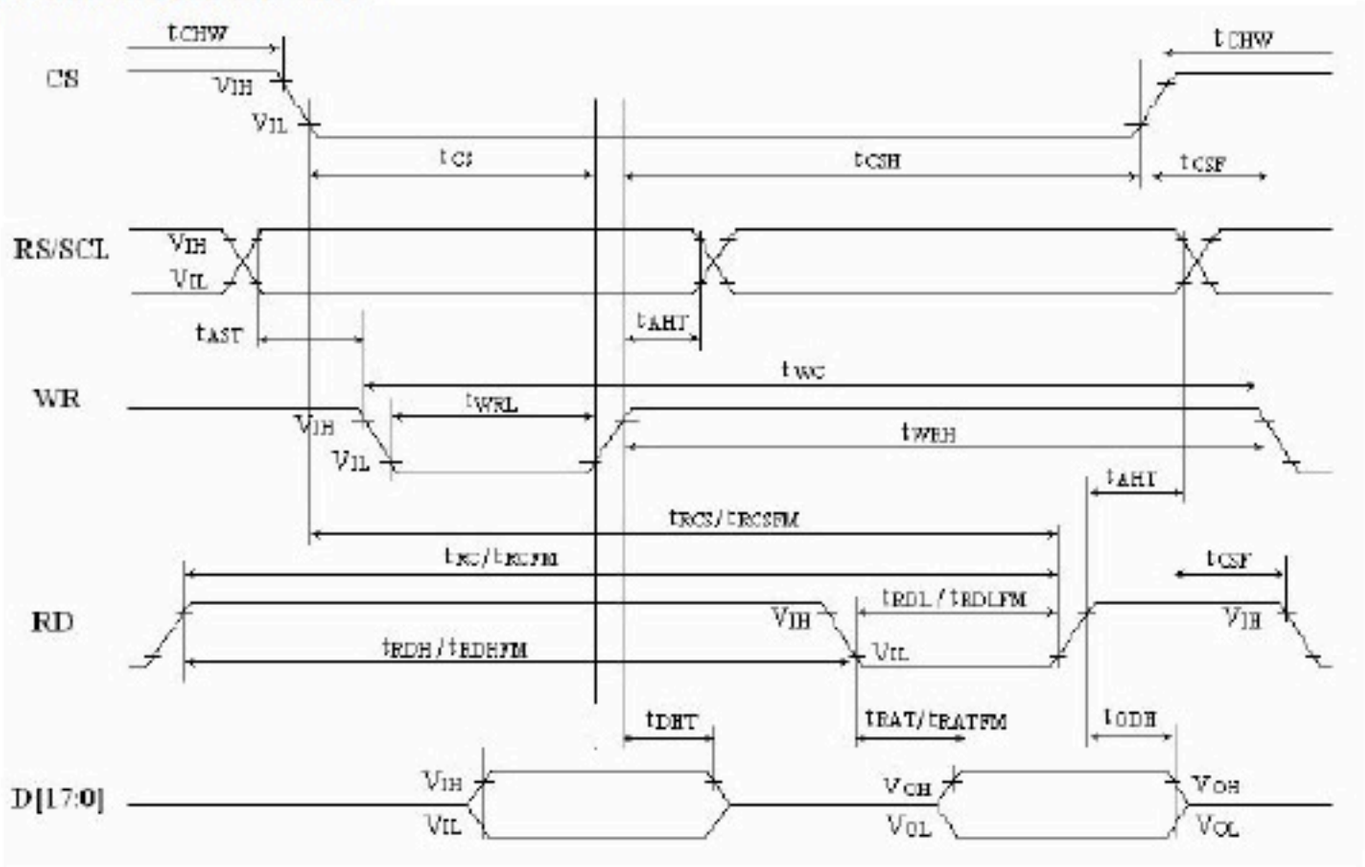
LED connection of backlight

8. Command/AC Timing

8.1 CPU Interface Timing

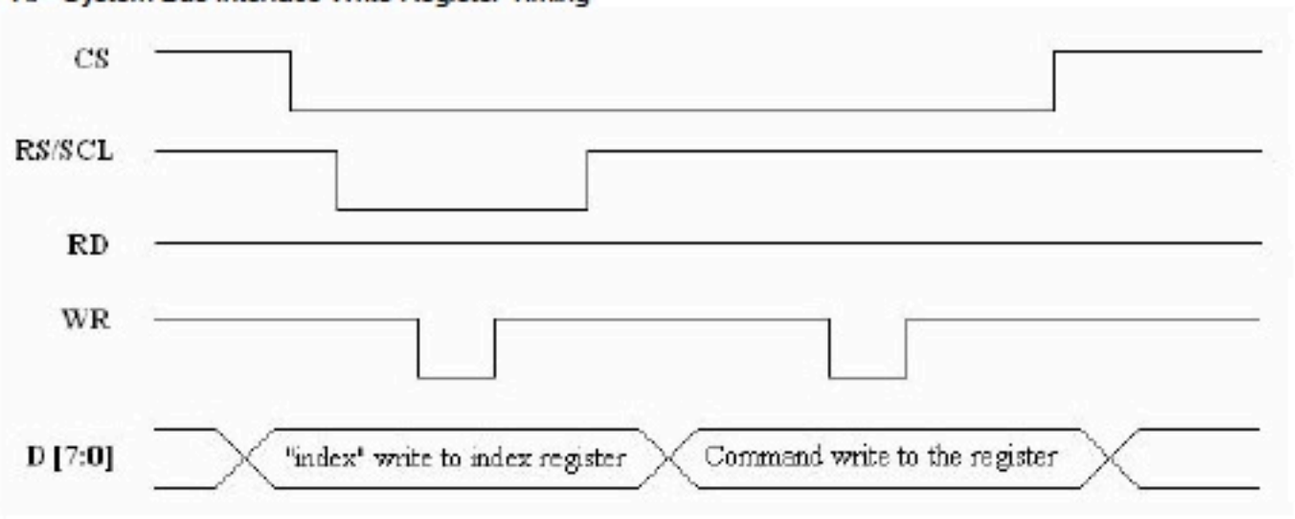
Signal	Symbol	Parameter	Min	Max	Unit	description
RS/SCL	t_{AST} t_{AHT}	Address setup time Address hold time(Write/Read)	10 10	--	ns	-
CS	t_{CHW} t_{CS} t_{RCSFM} t_{CSF} t_{CSH}	Chip select "H" pulse width Chip select setup time (Write) Chip select setup time Chip select wait time(Write/Read) Chip select hold time	0 35 355 10 10	--	ns	-
WR	t_{WC}	Write cycle	100	--	ns	-
			33(5)	--	ns	Define under 8-bit only
	t_{WRH} t_{WRL}	Control pulse "H" duration Control pulse "L" duration	15 15	--	ns	-
RD	t_{RC} t_{RDH} t_{RDL}	Read cycle Control pulse "H" duration Control pulse "L" duration	450 90 355	--	ns	When read from GRAM
D[17:0]	t_{DST} t_{DHT} t_{RATFM} t_{ODH}	Data setup time Data hold time Read access time Output disable time	15 10 -- 20(4)	-- -- 340(4) 80(4)	ns	For maximum C_L=30pF For minimum C_L=8pF

CPU Interface characteristics

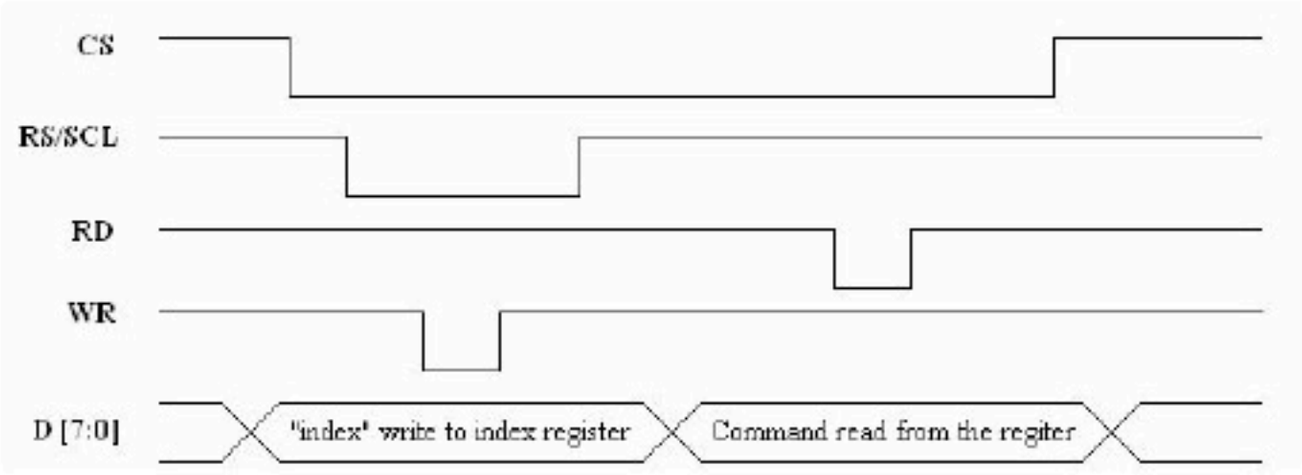


8.2 CPU Interface Register write/read timing

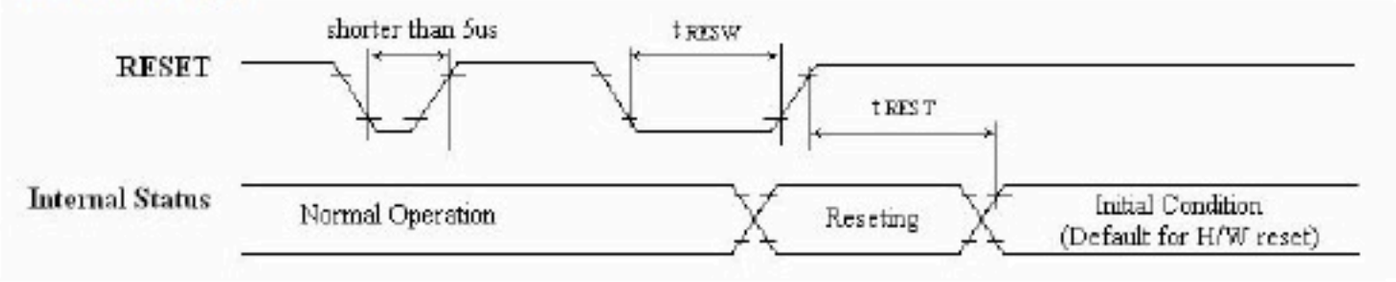
A. System Bus Interface Write Register Timing



B. System Bus Interface Read Register Timing



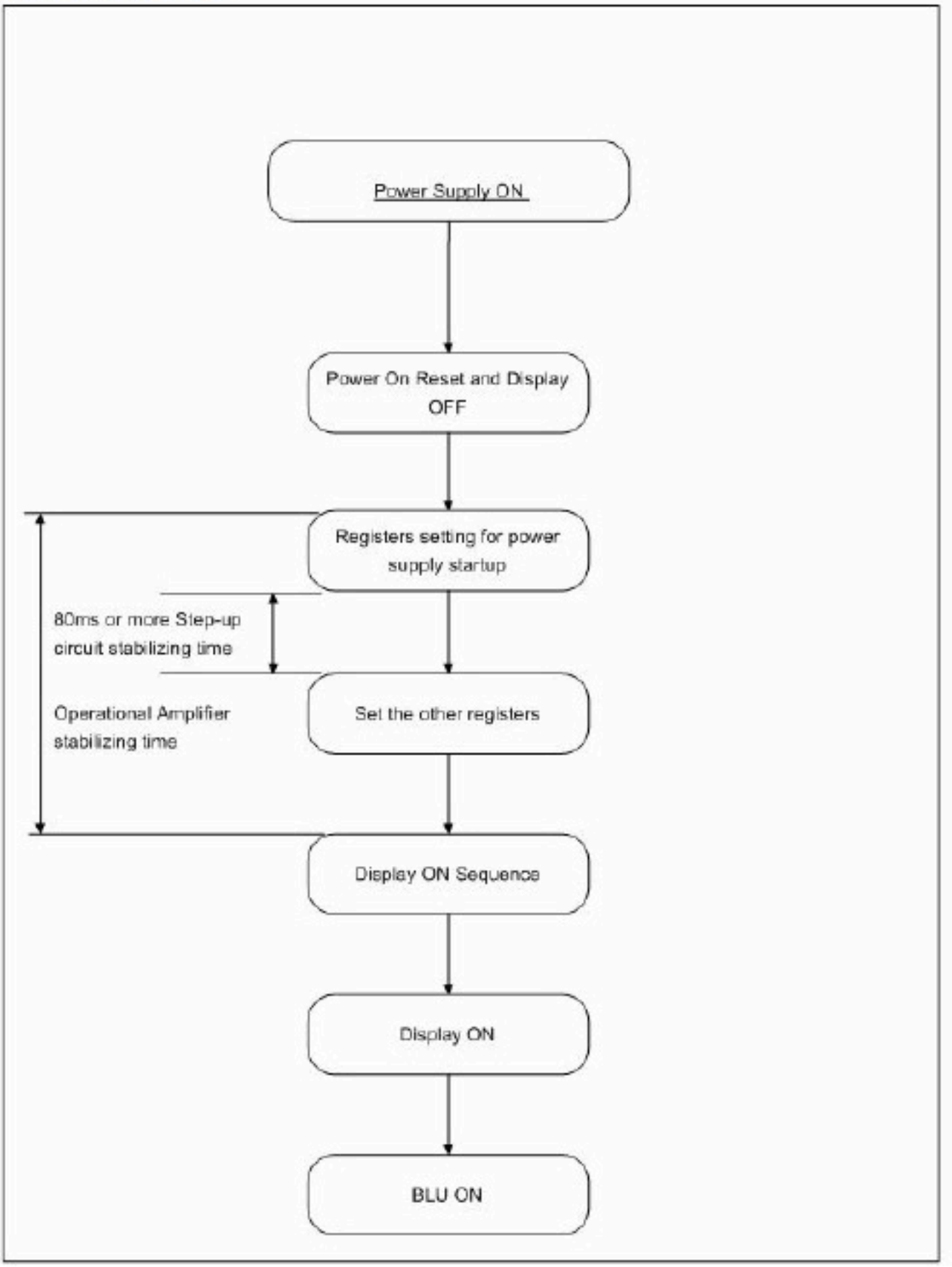
8.3 reset timing



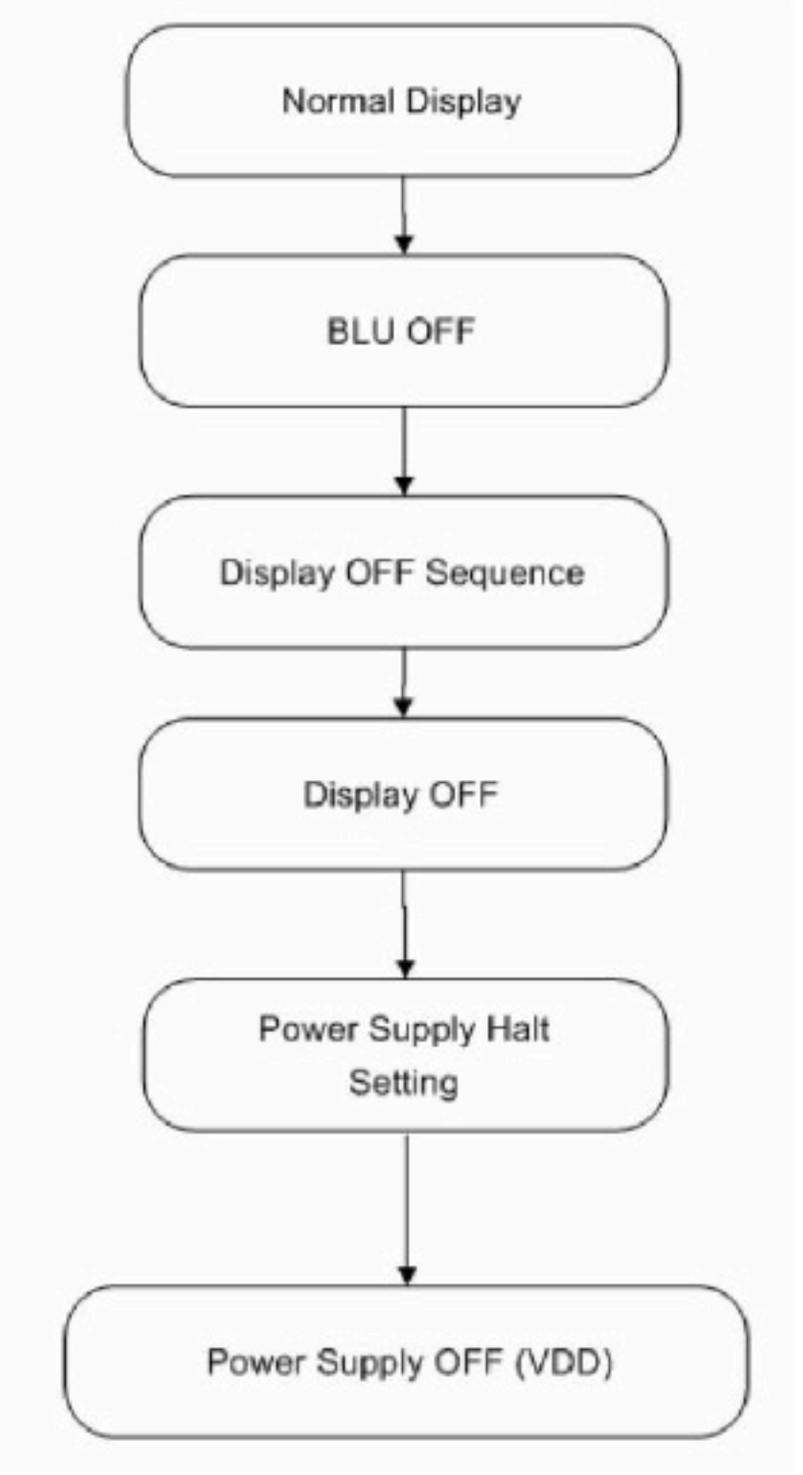
Symbol	Parameter	Related pins	Min	Typ	Max	Note	Unit
tRESW	Reset low pulse width	RESET	10	-	-	-	us
tREST	Reset complete time	-	-	-	5	When reset applied during "Sleep In mode"	ms
		-		-	120	When reset applied during "Sleep Out mode"	ms

8.4 POWER ON/OFF SEQUENCE

8.4.1 POWER ON SEQUENCE



8.4.2 POWER OFF SEQUENCE



9. Optical Specification

9 .1 Backlight is ON

Item		Symbol	Condition	Min	Typ.	Max.	Unit	Remark
Contrast Ratio		CR	θ=0°	80	100	-		Note1 Note2
Response Time		Ton/ Toff	25℃	-	35	-	ms	Note1 Note3
View Angles		ΘT	CR≧10		55	60	Degree	Note 4
		ΘB			40	45		
		ΘL			40	45		
		θR			45	50		
Chromaticity	White	x	Brightness is on	Typ-0.05	0.30	Typ+0.05		Note5, Note1
		y			0.33			
	Red	x			0.57			
		y			0.32			
	Green	x			0.33			
		y			0.48			
	Blue	x			0.16			
		y			0.14			
Luminance		L		110	130	-	cd/m²	Note1 Note6

9.2 Backlight is OFF

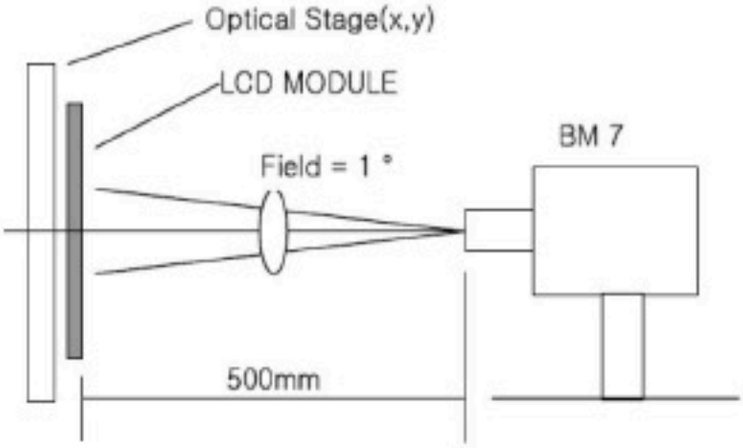
Item		Symbol	Condition	Min	Typ.	Max.	Unit	Remark
Contrast Ratio		CR	θ=0°	-	8.0	-		Note 7
View Angles		ΘT	CR≧2	-	60	-	Degree	
		ΘB		-	60	-		
		ΘL		-	55	-		
		θR		-	60	-		
Chromaticity	White	x	Brightness is off	Typ-0.05	0.31	Typ+0.05		
		y			0.33			
Reflectance		R		-	6.85%	-		
Response Time		Ton/ Toff	25℃	-	25	-	ms	Note1 Note3
Luminance		L		110	130	-	cd/m²	Note1 Note6

TEST CONDITIONS: VDD=2.8V, I_L=20mA(LED current), the ambient temperature is 25℃.

Note 1: Definition of optical measurement system.

Temperature = 25℃(±3℃)

LED back-light: ON, Environment brightness < 150 lx

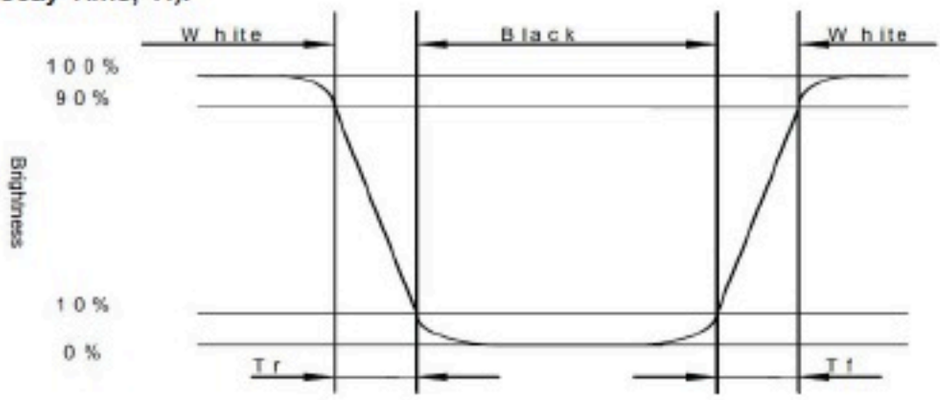


Note 2: Contrast ratio is defined as follow:

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

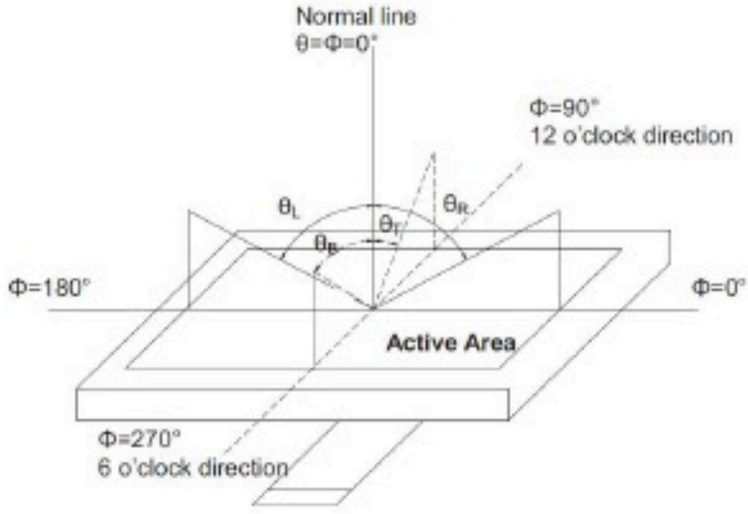
Note 3: Response time is defined as follow:

Response time is the time required for the display to transition from black to white (Rise Time, Tr) and from white to black(Decay Time, Tf).



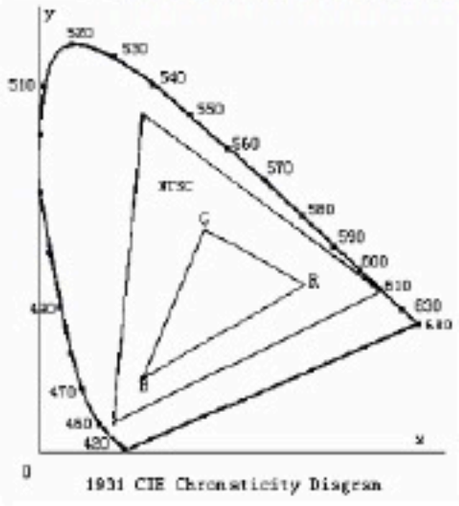
Note 4: Viewing angle range is defined as follow:

Viewing angle is measured at the center point of the LCD.



Note 5: Color chromaticity is defined as follow: (CIE1931)

Color coordinates measured at center point of LCD.

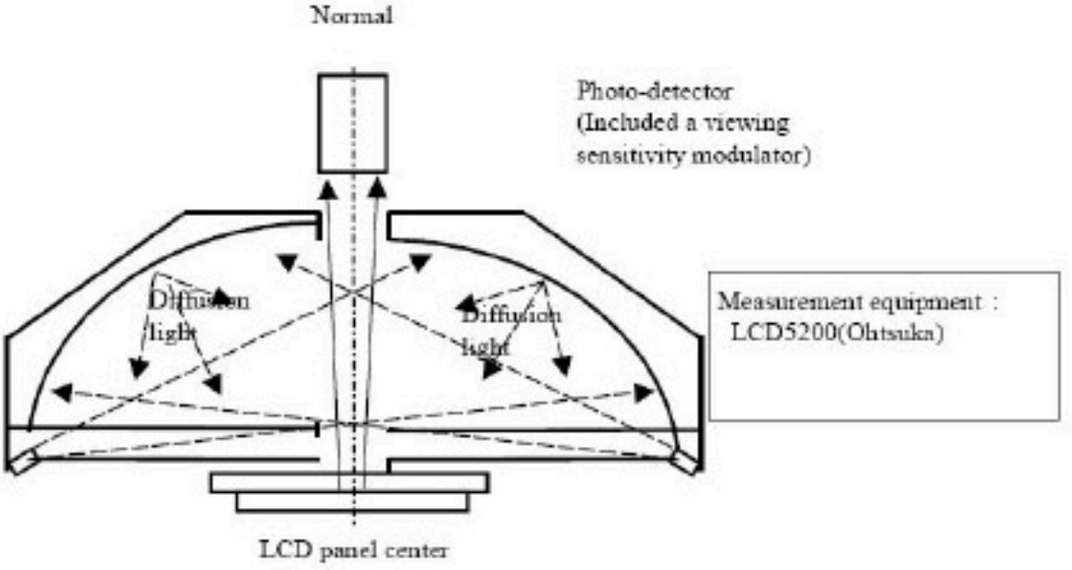


$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$

Note 6: Luminance is defined as follow:

Luminance is defined as the brightness of all pixels "White" at the center of display area on optimum contrast.

Note 7: Reflectance measurement system is defined as follow:



10. Environmental / Reliability Tests

No	Test Item	Condition	Judgment criteria
1	High Temp Operation	Ts=+70℃, 240hrs	Per table in below
2	Low Temp Operation	Ta=-20℃, 240hrs	Per table in below
3	High Temp Storage	Ta=+80℃, 240hrs	Per table in below
4	Low Temp Storage	Ta=-30℃, 240hrs	Per table in below
5	High Temp & High Humidity Storage	Ta=+40℃, 90% RH 240 hours	Per table in below (polarizer discoloration is excluded)
6	Thermal Shock (Non-operation)	-30℃ 30 min~+80℃ 30 min, Change time:5min, 20 Cycles	Per table in below
7	ESD (Operation)	C=150pF, R=330Ω，5points/panel Air:±8KV, 5times; Contact:±4KV, 5 times;	Per table in below
8	Vibration (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z.	Per table in below
9	Shock (Non-operation)	60G 6ms, ±X,±Y,±Z 3times, for each direction	Per table in below
10	Package Drop Test	Height:80 cm, 1 corner, 3 edges, 6 surfaces	Per table in below

INSPECTION	CRITERION(after test)
Appearance	No Crack on the FPC, on the LCD Panel
Alignment of LCD Panel	No Bubbles in the LCD Panel No other Defects of Alignment in Active area
Electrical current	Within device specifications
Function / Display	No Broken Circuit, No Short Circuit or No Black line No Other Defects of Display

11. Precautions for Use of LCD Modules

11.1 Safety

The liquid crystal in the LCD is poisonous. Do not put it in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.

11.2 Handling

A. The LCD and touch panel is made of plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.
B. Do not handle the product by holding the flexible pattern portion in order to assure the reliability
C. Transparency is an important factor for the touch panel. Please wear clear finger sacks, gloves and mask to protect the touch panel from finger print or stain and also hold the portion outside the view area when handling the touch panel.
D. Provide a space so that the panel does not come into contact with other components.
E. To protect the product from external force, put a covering lens (acrylic board or similar board) and keep an appropriate gap between them.
F. Transparent electrodes may be disconnected if the panel is used under environmental conditions where dew condensation occurs.
G. Property of semiconductor devices may be affected when they are exposed to light, possibly resulting in IC malfunctions.
H. To prevent such IC malfunctions, your design and mounting layout shall be done in the way that the IC is not exposed to light in actual use.

11.3 Static Electricity

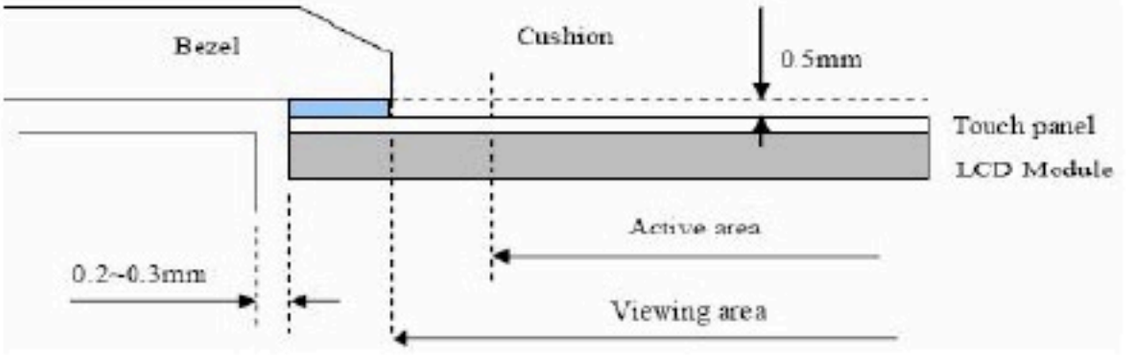
A. Ground soldering iron tips, tools and testers when they are in operation.
B. Ground your body when handling the products.
C. Power on the LCD module before applying the voltage to the input terminals.
D. Do not apply voltage which exceeds the absolute maximum rating.
E. Store the products in an anti-electrostatic bag or container.

11.4Storage

A. Store the products in a dark place at +25℃±10℃ with low humidity (40% RH to 60% RH). Don't expose to sunlight or fluorescent light.
B. Storage in a clean environment, free from dust, active gas, and solvent.

11.5 Cleaning

A. Do not wipe the touch panel with dry cloth, as it may cause scratch.
B. Wipe off the stain on the product by using soft cloth moistened with ethanol. Do not allow ethanol to get in between the upper film and the bottom glass. It may cause peeling issue or defective operation. Do not use any organic solvent or detergent other than ethanol.

11.6 Cautions for installing and assembling

Bezel edge must be positioned in the area between the Active area and View area. The bezel may press the touch screen and cause activation if the edge touches the active area. A gap of approximately 0.5mm is needed between the bezel and the top electrode. It may cause unexpected activation if the gap is too narrow. There is a tolerance of 0.2 to 0.3mm for the outside dimensions of the touch panel and tail. A gap must be made to absorb the tolerance in the case and connector.