Specifications

TFT-LCDmodule

Model No：SX035HVGA45P-01-V01

For Customer's Acceptance	
Approved by	**Comment**

	Signature	Date
Prepared by		
Checked by		
Approved by		

Contents

1   General Description

SX035HVGA45P-01-V01 is a transmissive type a-Si TFT-LCD (amorphous silicon thin film transistor liquid crystal display) module, which is composed of a TFT-LCD panel, a driver circuit a backlight unit, The panel size is 3.5inch and thresolution is 320X480. High image quality a-Si TFT LCD module. Partial-screen display function is available. Sleep and Stand-by modes are available for power saving.

1.1   Features

No	Item	Specification	Remark
1	Display Mode	High Resolution & Wide View	
2	Screen Size	3.5inch (diagonal)	
3	Resolution	320XRGBX480	
4	Color Number	262K TFT	
5	Color Arrangement	RGB-stripe	
6	Driver IC	ILI9488	
7	Back Light	White LED*6	
8	Viewing Direction	12 O'clock	
9	Interface	MCU 8/MCU16 Bit/4-Line SPI	
10	Surface Treatment	UV Cut	
11	Module brightness	300 cd/㎡	

1.2   Application

- Mobile phone.
- Portable multimedia device.

2   Outline Dimension

The mechanical detail is shown in Fig. 1 and summarized in Table 1 below.

Parameter	Specifications	Unit
Outline dimensions	54(W) x84.2(H) x 2.2(D) (LCM,no include FPC)	mm
Active area	48.96(W) x73.44(H)	mm
Resolution	320(H)RGBx480(V)	dots
Dot size	0.153(H) x 0.153(V)	mm

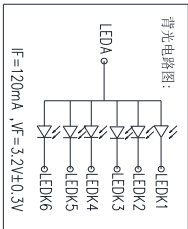## 3 Module specification of the module

NOTES：Main LCD: TFT 65K/262K/16.7M COLORS
1. VIEWING DIRECTION：ALL.
2. OPERATING TEMP.：-20°C~70°C
3. STORAGE TEMP.：-30°C'80°C
4. MAIN LCD DRIVER: ILI9488
5. BACKLIGHT: 6 Chips LED parallel
6. ROHS COMPLIANCY
7. GENERAL TOLERANCE:±0.2

背光电路图：
LEDA
LEDK1 LEDK2 LEDK3 LEDK4 LEDK5 LEDK6
IF=120mA ,VF=3.2V±0.3V

3.5'' TFT
DOTS:320*RGB*480
ALL 0'clock

84.20±0.2 BL
80.22±0.2 LCD
73.44 LCD A.A
(2.20)
54.00±0.2 BL
51.96±0.2 LCD
48.96 LCD A.A
(2.27)
PULL TAPE
13.90±0.3
13.80±0.1
8.25±0.3
3.50
PI补强（总厚度0.2±0.03mm）
2.20±0.1

13.80±0.1
0.60
2.50
0.30
0.30

黄色绝缘纸（0.05mm）
胶铁一体

深圳市上线电子有限公司
REVISED RECORD
PRODUCT NO：SX035HVGA45P-01-V01
UNIT mm
SCALE 1:1
PAGE 1/1
DRAWN BY QIAO
CHECKED BY
APPROVED BY
ORG DATE

PIN	DESCRIPTION
1	VU
2	XL
3	YD
4	XR
5	LED K
6	LED K
7	LED A
8	LED A
9	GND
10	VCC
11	IOVCC
12	TE
13	CS
14	RS
15	WR
16	RD
17	SDA
18	SDO
19	D0
20	D1
21	D2
22	D3
23	D4
24	D5
25	D6
26	D7
27	D8
28	D9
29	D10
30	D11
31	D12
32	D13
33	D14
34	D15
35	D16
36	D17
37	ENABLE
38	DOTCLK
39	HSYNC
40	GND
41	VSYNC
42	RESET
43	IM2
44	IM1
45	IM0
46	GND

Customer's Approval
Customer
Date

4 Electrical Characteristics

4.1 TFT-LCD Module

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Power & Operation Voltage							
Analog operating voltage	VCI	-	2.5	2.8	3.3	V	
Logic operating voltage	IOVCC	-	1.65	1.8	3.3	V	Note 1, 2
OTP Supply voltage	DDVDH	-	-	7	-	V	Note 1
Logic High level input voltage	VIH	-	0.7*IOVCC		IOVCC	V	Note 1
Logic Low level input voltage	VIL	-	-0.3		0.3*IOVCC	V	Note 1
Logic High level output voltage TE, SDO (SDA) , CABC_PWM	VOH	IOH = -1.0mA	0.8*IOVCC		IOVCC	V	Note 1
Logic Low level output voltage TE, SDO (SDA) , CABC_PWM	VOL	IOL = +1.0mA	0		0.2*IOVCC	V	Note 1
Gate Driver High Voltage	VGH	-	10.0	-	20	V	
Gate Driver Low Voltage	VGL	-	-15.0	-	-6.0	V	
Driver Supply Voltage	-	|VGH-VGL|	16	-	32	V	
Input and Output							
Logic High Level Input Voltage	VIH	-	0.7*IOVCC	-	IOVCC	V	
Logic Low Level Input Voltage	VIL	-	DGND	-	0.3*IOVCC	V	
VCOM Operation							
DC VCOM Amplitude Voltage	VCOM	-	-2.0	-	-0.06	V	Note 3
Source Driver							
Source Output Range	VSOUT	-	0.1	-	VREG1OUT-0.1	V	Note 4
Positive Gamma Reference Voltage	VREG1OUT	-	3.625	-	5.5	V	
Negative Gamma Reference Voltage	VREG2OUT	-	-5.5	-	-3.625	V	
Source Output Setting Time	Tr	Below with 99% precision	-	10	-	uS	Note 3. 4
Output Deviation Voltage (Source Output channel)	Vdev	Sout>=4.2V Sout<=0.8V	-	-	20	mV	Note 3
		4.2V>Sout>0.8V	-	-	15	mV	-
Output Offset Voltage	VOFFSET	-	-	-	35	mV	Note 3
Booster Operation							
Booster (VCIx2) Voltage	DDVDH	-			6	V	
Booster (VCIx2) Voltage	DDVDL	-	-6			V	
Booster (VCIx2 Drop Voltage)	VCI1x2 drop	loading=1mA	-	-	5	%	
Gate Driver High Voltage	VGH	-	10.0	-	20	V	
Gate Driver Low Voltage	VGL	-	-15.0	-	-6.0	V	
Standby mode current consumption (Ta = 25℃, Interface: DBI and DPI)							
Sleep in mode	VCI	VCI=2.8V	-	100	-	uA	
Deep Standby mode	VCI	IOVCC=1.8V	-	1	-	uA	

Notes:

1. Ta = -30 to 70 ℃ (no damage up to 85℃ (at maximum)), IOVCC=1.65V to 3.3V, VCI=2.5V to 3.3V, DGND=0V.

2. Supply the digital IOVCC voltage equal to or less than the analog VCI voltage.

3. Source channel loading = 10KΩ,30pF/channel

4. The maximum value is between 10KΩ,30pF/channel and Gamma setting value.

4.2 Back-Light Unit

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Current	IF	--	160	--	mA	IF=160mA IF=3.2V
Forward voltage	VF	3.0	3.2	3.4	V	
Chroma	X	0.250	--	0.30		
	Y	0.250	--	0.30		
Uniformity	UBL	80	--	--	%	
Number of LED	-	-	8	--	Piece	-
Backlight Color	White					

- The luminous intensity of LED is strongly dependent on the driving current.

- It is recommended the input of backlight to be constant current rather than constant voltage.

5   TFT-LCM Interface Specification

Pin No	Symbol	Description
1	Y(U)	Touch panel pin / up
2	X(L)	Touch panel pin / left
3	Y(D)	Touch panel pin / down
4	X(R)	Touch panel pin / right
5-6	K	Backlight cathode
7	A	Backlight anode
8	GND	Ground(0V)
9	VCI	Power supply(2.8V)
10	IOVCC	Power supply for the logic circuit(1.8V)
11	TE	Tearing effect output pin
12	CS	Chip select pin
13	RS	Data/Command control Pin
14	WR	Write execution control Pin
15	RD	Read execution control Pin
16	SDA	Serial in signal
17	SDO	Serial out signal
18-35	DB0~DB17	Data bus
36	DE	A data ENABLE signal for RGB I/F mode
37	DCLK	Dot clock signal for RGB interface operation
38	HSYNC	Horizontal sync. signal in DPI interface mode
39	GND	Ground(0V)
40	VSYNC	Frame synchronizing signal for RGB interface operation
41	RESET	Reset signal input
42-44	IM2-IM0	Interface Select Pin
45	GND	Ground(0V)

6   Timing Characteristics

Please refer to the ILI9488 specification.

7. Optical Specification

The optical characteristics are measured under stable conditions as following notes.

Table 3   Optical Characteristics

Item	Conditions		Min.	Typ.	Max.	Unit	Note
Viewing Angle （CR>10）	Horizontal	θ_{x+}	-	(45)	-	deg.	(1),(2),(6),(7) ,(8)
		θ_{x-}	-	(45)	-		
	Vertical	θ_{y+}	-	(45)	-		
		θ_{y-}	-	(20)	-		
Contrast Ratio	Center		-	(500)	-	-	(1),(3),(6)(7), (8)
Response Time	Rising + Falling		-	(20)	-	ms	(1),(4),(6),(7) ,(8)
CF Color Chromaticity (CIE1931)	Red	x	Typ. -0.03	(0.626)	Typ. +0.03	-	Under C-light
	Red	y		(0.334)		-	
	Green	x		(0.277)		-	
	Green	y		(0.549)		-	
	Blue	x		(0.142)		-	
	Blue	y		(0.122)		-	
	White	x		(0.303)		-	
	White	y		(0.325)		-	
NTSC	CIE1931		-	(60)	-	%	(1),(6),(7),(8)
Transmittance	Without POL		-	(15.7)	-	%	(1),(5),(6),(7) ,(8)

Note 1: The brightness test equipment setup

I_B=60mA, Field=2° (As measuring "black" image, field=2° is the best testing condition.)

50 cm

BM-7

Field = 2°

The center of the screen

TFT-LCD Panel
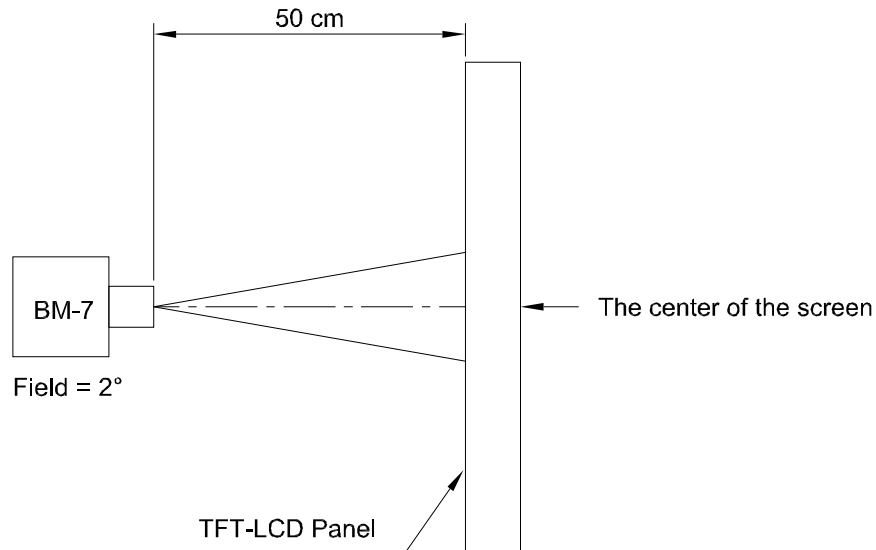
Note 2: Definition of contrast ratio (**C.R**)

$$C.R = \frac{\text{Brightness When LCD is at "White" State}}{\text{Brightness When LCD is at "Black" State}}$$

Note 3: Definition of response time
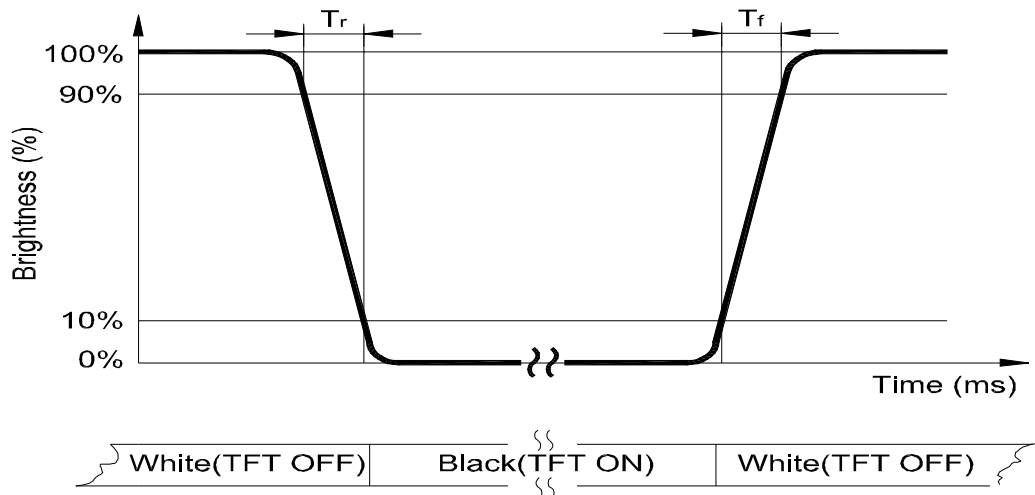
T_r T_f

100%
90%

Brightness (%)

10%
0%

Time (ms)

White(TFT OFF)   Black(TFT ON)   White(TFT OFF)

Note 4: Definition of viewing angle

Note 5: Definition of uniformity (**Un**)

$$Un = \frac{Bmin}{Bmax} \times 100\%$$

8 Environment Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Remark
Operation temperature range	Top	-20	70	℃	Ambient
Storage temperature range	Tst	-30	80	℃	Ambient

- Corrosive gas environment is not acceptable.

- TFT-LCD color will change slightly depending on environment temperature. This phenomenon is reversible. Current reduction rate of LED backlight is according to the graph indicated below:

Ambient Temperature (℃)
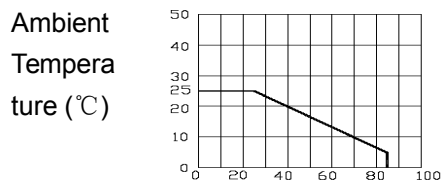
Allowable Forward Current (mA)

9 Reliability Test Items

Item	Test Condition		Criterion
High Temperature Storage	80 ℃, 240 hrs		There should be no change which might affect the practical display function when the display quality test is conducted under normal operating condition.
Low Temperature Storage	-30 ℃, 240 hrs		
High Temp. & High Humidity Storage	60 ℃, 90％ RH, 240 hrs		
Vibration Test (Non-operating)	Freq.:10~55~10 Hz, Amp.:1.5mm 1 hr for each direction of X, Y, Z		
Electrostatic Discharge Test (Non-operating)	Terminals	150 pF, 0 Ω, ±300 V, Contact	
	Panel	150 pF, 330 Ω, ±8 KV, Air	
Thermal Shock (Static)	-30℃, 30 min /80℃, 30 min, 20 cycles		
High Temperature Operation	70 ℃, 240 hrs		
Low temperature Operation	-20 ℃, 240 hrs		
High Temperature & High Humidity (Operating)	50 ℃, 90％ RH, 240 hrs		
FPC Peeling Strength Test	Pull speed: 50 mm/min, +90°,		> 400gf/cm

10 Inspaction Standard

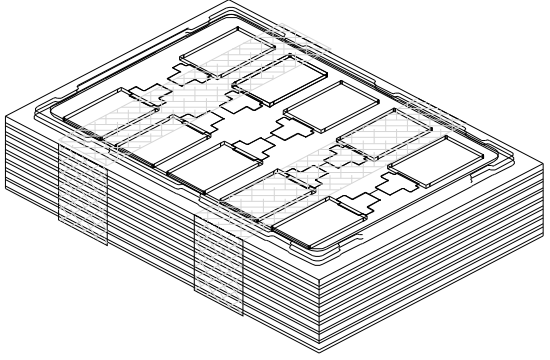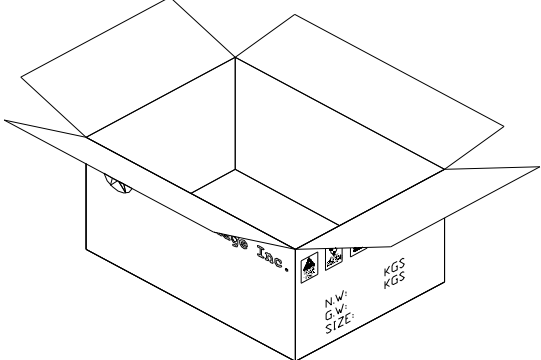This standard apply to TFT module specification.
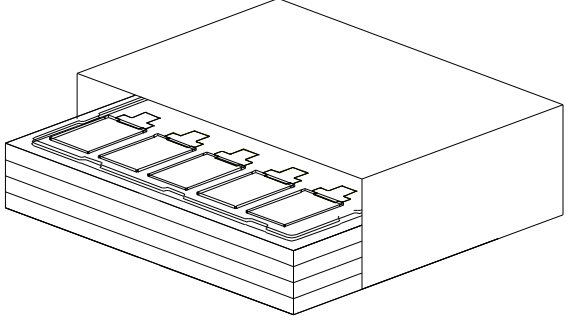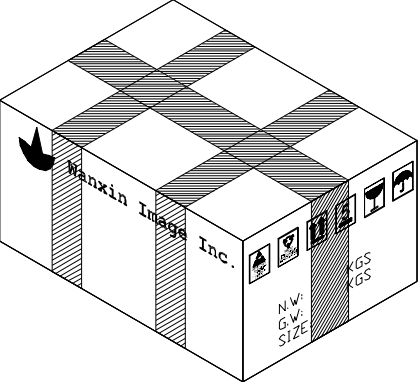
1. Inspection condition:
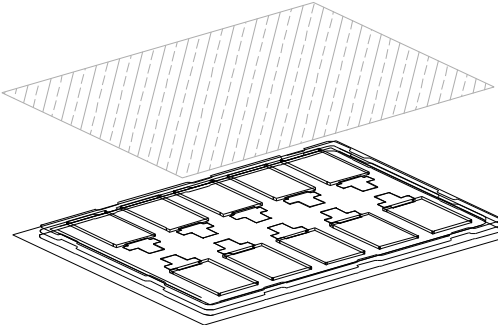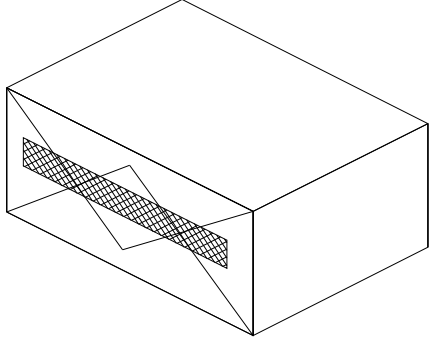
   Under daylight lamp 20～40W，product distance inspector'eye 30cm.incline degree 30°。
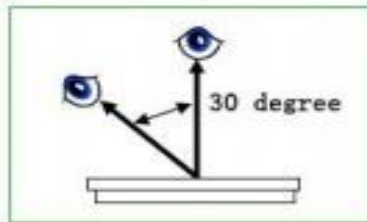
2. Inspection standard

NO.	Item	Inspection standard	Rate
2.1	Dot	Case of Dot defect is below ① Bright Dot (whit spot) : "0" ② Dark Dot (black spot) : "0" (In case of Dark Dot on Main TFT LCD) - NG if there's full Dot defect. - Damaged less than the size of sub-pixel is not counted as defect - Dots darker than the size of sub-pixel are not defined as bright dot defect **area size（mm）** / **Acceptable number** Φ≤0.10 / ignore 0.10＜Φ≤0.15 / 3 0.15＜Φ≤0.20 / 2 0.25＜Φ≤0.25 / 1 0.25＜Φ / 0	minor
2.2	line	**Size（mm）** / / **Acceptable number** ignore / W≤0.03 / ignore L≤4.0 / 0.03＜W≤0.04 / 2 L≤4.0 / 0.04＜W≤0.05 / 1 / 0.05＜W / Treat with dot non-conformance	

11 Package

1 10 pcs per tray + 1 cover (EPE)	4 Packing bag
2 15 trays + 1 dummy tray = 150 ps	5 Putting bag into carton Protected by 2 pieces of cushion EPE sheet
3 Putting trays into anti-electrostatic bag	6 Packing carton with sealing tape Carton outline size: 400×295×145 (mm)

12 Precautions

Please pay attentions to the followings as using the LCD module.

12.1 Handling

(a) Do not apply strong mechanical stress like drop, shock or any force to LCD module. It may cause improper operation, even damage.

(b) Because the polarizer is very fragile and easy to be damaged, do not hit, press or rub the display surface with hard materials.

(c) Do not put heavy or hard material on the display surface, and do not stack LCD modules.

(d) If the display surface is dirty, please wipe the surface softly with cotton swab or clean cloth.

(e) Avoid using Ketone type materials (e.g. Acetone), Toluene, Ethyl acid or Methyl chloride to clean the display surface. It might damage the touch panel surface permanently. The recommended solvents are water and Isopropyl alcohol.

(f) Wipe off water droplets or oil immediately.

(g) Protect the LCD module from ESD. It will damage the LSI and the electronic circuit.

(h) Do not touch the output pins directly with bare hands.

(i) Do not disassemble the LCD module.

(j) Do not lift the FPC of Touch Panel.

12.2 Storage

(a) Do not leave the LCD modules in high temperature, especially in high humidity for a long time.

(b) Do not expose the LCD modules to sunlight directly.

(c) The liquid crystal is deteriorated by ultraviolet. Do not leave it in strong ultraviolet ray for a long time.

(d) Avoid condensation of water. It may cause improper operation.

(e) Please stack only up to the number stated on carton box for storage and transportation. Excessive weight will cause deformation and damage of carton box.

12.3　Operation

(a) When mounting or dismounting the LCD modules, turn the power off.

(b) Protect the LCD modules from electric shock.

(c) The Driver IC control algorithms stated above should always obeyed to avoid damaging the LSI and electronic circuit.

(d) Be careful to avoid mixing up the polarity of power supply for backlight.

(e) Absolute maximum rating specified above has to be always kept in any case. Exceeding it may cause non-recoverable damage of electronic components or, nevertheless, burning.

(f) When a static image is displayed for a long time, remnant image is likely to occur.

(g) Be sure to avoid bending the FPC to an acute shape, it might break FPC.

(h) Most of the touch screens have air vent to equalize the inside air pressure to the outside one. The air vent must be open and liquid contact must be avoided as the liquid may be absorbed if the liquid is accumulated near the air vent.

(i) For the fragility of ITO film, it should avoid to use too tapering pen as the input material.

12.4　Touch Panel Mounting Notes

(a) If a cushion is used between bezel/housing and film must be choose as free as enough to absorb the expansion and contraction to avoid the distortion of film.

(b) The cushion must be placed out of the Viewing Area.

(c) Bezel/Housing edge must be posited between Key Area and Viewing Area. The edge enters the Key Area may cause unexpected input if the gap is too narrow or foreign particles like dusts exist between Bezel/Housing and ITO film.

(d) Mounting example:
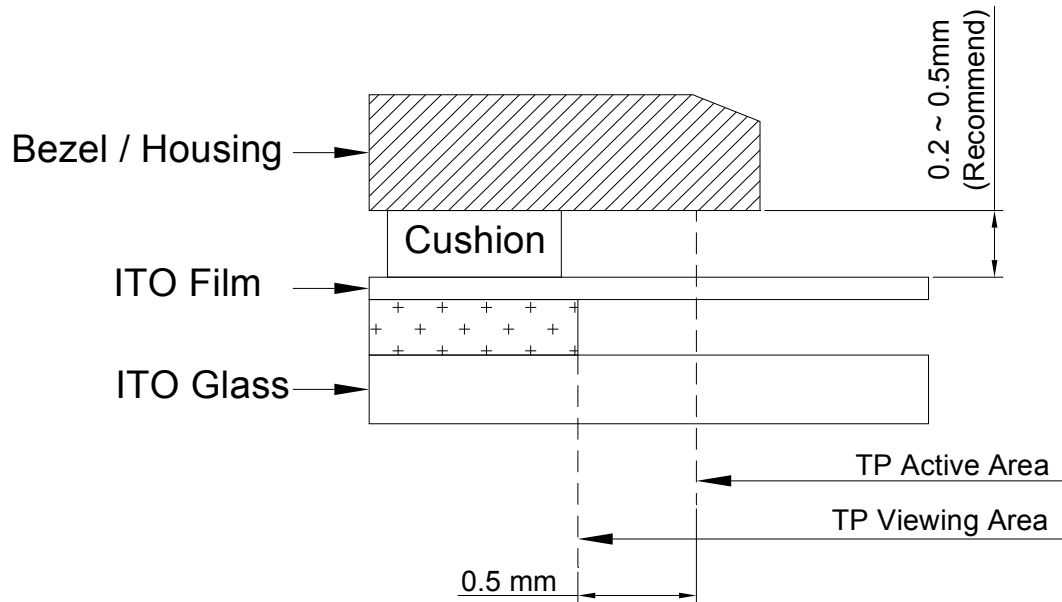
The corner part has conductivity. Do not touch any metal part after mounting.

12.5 Others

a) If the liquid crystal leaks from the panel, it should be kept away from the eyes or mouth.

b) For the fragility of polarizer, it is recommended to attach a transparent protective plate over the display surface.

c) It is recommended to peel off the protection film on the polarizer slowly so that the electrostatic charge can be minimized.

13 Records of Version

Version	Revise Date	Page	Content
A	2023-05-05	All	New released