Specifications

TFT-LCDmodule

Model No：QY40049FOG-00

Customer name:

The project name:

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

	Signature	Date
Prepared by		
Checked by		
Approved by		

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1 General Description

QY40049FOG-00 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 3.93inch and thresolution is 1280x720. 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	Normally Black	
2	Screen Size	3.93inch (diagonal)	
3	Resolution	1280 X RGB X 720	
4	Color Number	16.7M	
5	Color Arrangement	RGB-stripe	
6	Driver IC		
7	Viewing Direction	ALL O'clock	
8	Interface	LVDS	
9	Surface Treatment	HC	

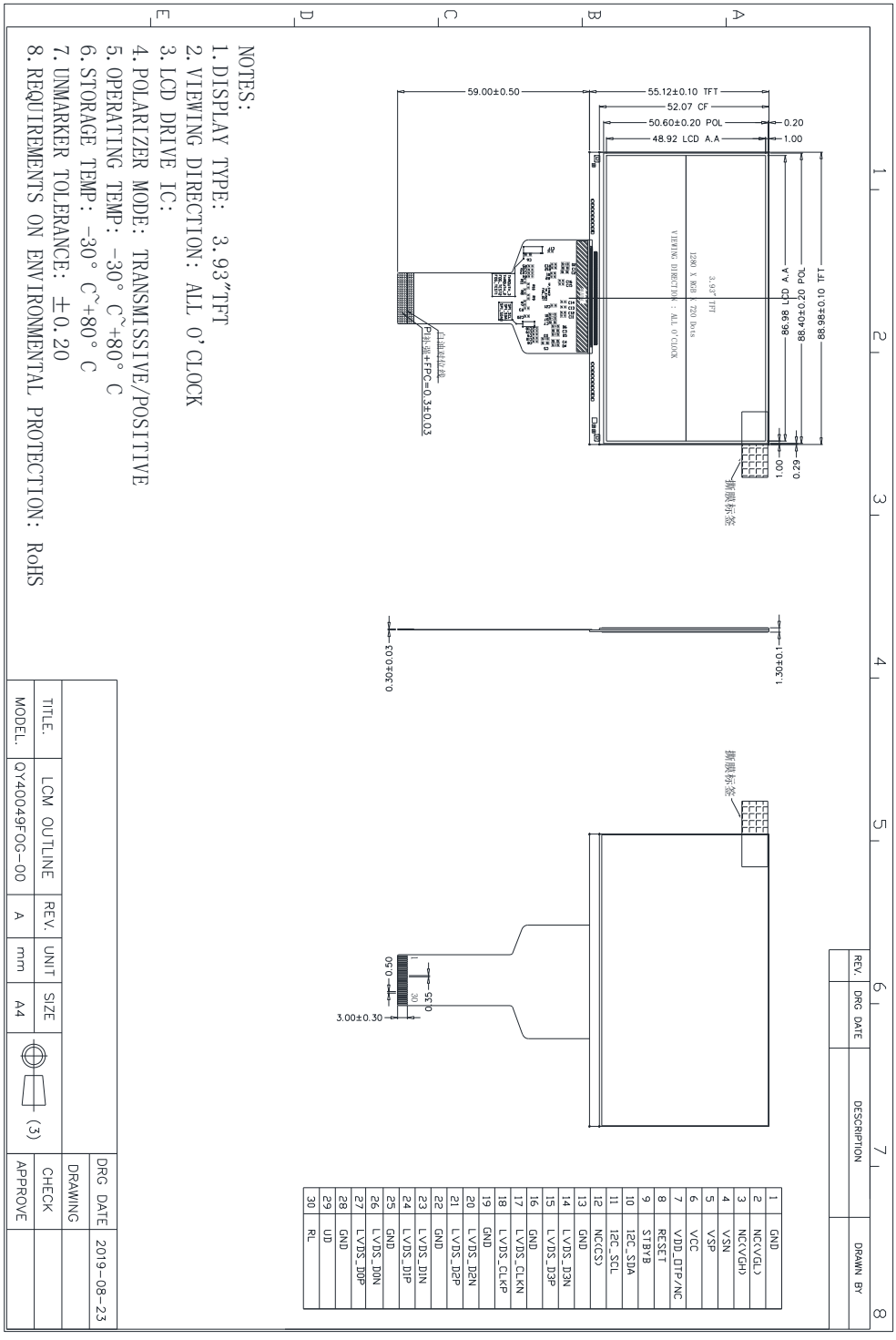
1.2 Application

- 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	88.976(W) x55.124(H) x 1.3+_0.1(D) (FOG,no include FPC)	mm
Active area	86.976(W) x48.924(H)	mm
Resolution	1280(H)RGBx 720(V) dots	-
Dot size	0.02265 (H) ×0.06795	mm
Module brightness		cd/㎡



1	GND
2	NC(VGL)
3	NC(VGH)
4	VSN
5	VSP
6	VCC
7	VDD_DTP/NC
8	RESET
9	STBYB
10	I2C_SDA
11	I2C_SCL
12	NC(CS)
13	GND
14	LVDS_D3N
15	LVDS_D3P
16	GND
17	LVDS_CLKN
18	LVDS_CLKP
19	GND
20	LVDS_D2N
21	LVDS_D2P
22	GND
23	LVDS_D1N
24	LVDS_D1P
25	GND
26	LVDS_D0N
27	LVDS_D0P
28	GND
29	UD
30	RL

Figure 1: Module specification of the module

Pin No.	Symbol	Functional	Notes
1	GND	Power Ground	
2	NC(VGL)	NC	
3	NC(VGH)	NC	
4	VSN	Power input for source driver and power circuits(-5.5v)	
5	VSP	Power input for source driver and power circuits(5.5V)	
6	VCC	Power supply	
7	VDD_OTP	Power input for OTP programming (8.6V). Leave this pin open or connect it to VCC1 when not programming OTP.	
8	RESET	The external reset input	
9	STBYB	Standby mode setting pin,	
10	I2C_SDA	Serial interface address and data input/output for I2C	
11	I2C_SCL	Serial interface clock input for I2C interface.	
12	NC/CS	NC	
13	GND	Power Ground	
14	LVDS_D3N	LVDS Mode pin	
15	LVDS_D3P	LVDS Mode pin	
16	GND	Power Ground	
17	LVDS_CLK	LVDS Mode pin	
18	LVDS	LVDS Mode pin	
19	GND	Power Ground	
20	LVDS_D2N	LVDS Mode pin	
21	LVDS_D2P	LVDS Mode pin	
22	GND	Power Ground	
23	LVDS_D1N	LVDS Mode pin	
34	LVDS_D1P	LVDS Mode pin	
25	GND	Power Ground	
26	LVDS_D0N	LVDS Mode pin	
27	LVDS_D0P	LVDS Mode pin	
28	GND	Power Ground	
29	UD	Gate up or down scan control	
30	RL	Horizontal shift direction (Source output) selection.	

< Table 2. Absolute Maximum Ratings>

Parameter	Symbol	Min.	Max.	Unit	Remarks
LC operating Voltage [1]	V_{OP}	4.7	5.3	V	Typ=5.0 Ta=25+/-2°C
Operating Temperature (Humidity)	T_{OP}	-30	+80	℃	
	RH		90	%	At 60°C
Storage Temperature (Humidity)	T_{ST}	-30	+80	℃	
	RH		90	%	At 60°C

6.2 DC Characteristics

9.2.1 For the digital circuit: Normal mode

(VCC1=VCC1P=VCC2=VCCIF=3.0V to 3.6V, VSS1=VSS2=VSSA=0V, T_{OP}=-40~105℃)

Parameter	Symbol	Conditions	Spec.			Unit
			Min.	Typ.	Max.	
Operating frequency, TTL mode	F_{TTL}	-	5.25	-	60	MHz
Operating frequency, LVDS mode	F_{LVDS}	1 port	15	-	110	MHz
		2 port	15		105	MHz
Supply voltage	VCC1 VCC1P VCC2 VCCIF	-	3.0	3.3	3.6	V
Internal digital operating voltage	VDDD VDDIF	-	1.4	1.5	1.6	V
OTP programming voltage	VDD_OTP	Current loading @10mA	8.5	8.6	8.7	V
Low level input voltage	Vil	-	VSS1-0.3	-	0.3 X VCC1	V
High level input voltage	Vih	-	0.7 X VCC1	-	VCC1+0.3	V
High level output voltage	V_{OH}	-	VCC1-0.4	-	-	V
Low level output voltage	V_{OL}	-	GND	-	GND+0.4	V
Pull low/high resistor	R_I	For I/O circuit	150	350	550	KΩ

Parameter	Symbol	Value	Unit	Remarks
TFT Gate ON Voltage	VGH	8	V	7.5~8.5
TFT Gate OFF Voltage	VGL	-8	V	-7.5~-8.5
TFT Common Electrode Voltage	VCOM	-0.2	V	
I/O Supply Voltage	IOVCC	3.3	V	
Liquid crystal driver supply voltage	VSP	5.5	V	
Liquid crystal driver supply voltage	VSN	-5.5	V	
Frame Frequency	f_Frame	60	Hz	

6.3 AC Characteristics

9.2.4 LVDS mode AC electrical characteristics

(VCC1=VCC1P=VCC2=VCCIF=3.0V to 3.6V, VSS1=VSS2=VSSA=0V, T_{OP}=-40~105℃)

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Clock frequency (1-port/2-port)	F_{LVCYC}	15	-	105/110	MHz
Clock period (1-port/2-port)	T_{LVCYC}	9.52/9.09	-	-	ns
1 data bit time	UI	-	1/7	-	T_{LVCYC}
Clock high time	T_{LVCH}	-	4	-	UI
Clock low time	T_{LVCL}	-	3	-	UI
Position 1	T_{POS1}	-0.2	0	0.2	UI
Position 0	T_{POS0}	0.8	1	1.2	UI
Position 6	T_{POS6}	1.8	2	2.2	UI
Position 5	T_{POS5}	2.8	3	3.2	UI
Position 4	T_{POS4}	3.8	4	4.2	UI
Position 3	T_{POS3}	4.8	5	5.2	UI
Position 2	T_{POS2}	5.8	6	6.2	UI
Input eye width	T_{EYEW}	0.6	-	-	UI
Input eye border	T_{EX}	-	-	-	UI
LVDS wake up time	T_{ENLVDS}	-	-	150	ms
LVDS clock to clock skew	T_{skew_EO}	-1/7		1/7	UI

Table 9.2: LVDS mode AC electrical characteristics

6.4 Timing

9.2.6 Reset timing

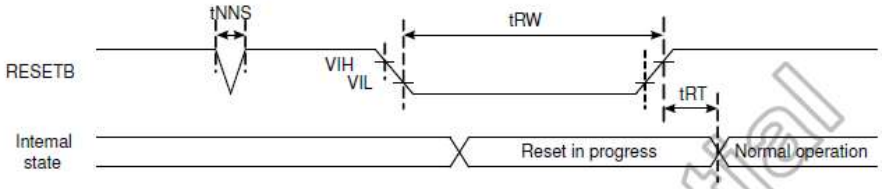


Figure 9.7: Reset timing

(VCC1=VCC1P=VCC2=VCCIF=3.0V to 3.6V, VSS1=VSS2=VSSA=0V, T_{OP}=-40~105℃)

Signal	Parameter	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
RESETB	Reset pulse width	tRW	10	-	-	μs
	Reset complete time	tRT	-	-	5	μs
	Negative spike noise width	tNNS	-	-	100	ns

Table 9.5: Reset timing parameter

9.2.7 SPI timing

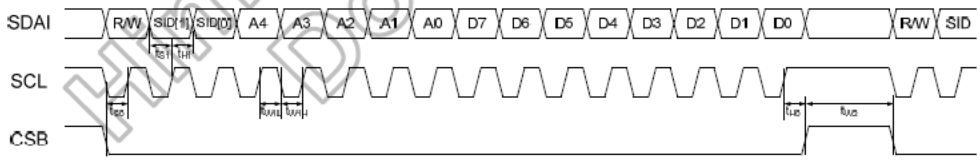


Figure 9.8: SPI signal timing

(VCC1=VCC1P=VCC2=VCCIF=3.0V to 3.6V, VSS1=VSS2=VSSA=0V, T_{OP}=-40~105℃)

Parameter	Symbol	Conditions	Spec.			Unit
			Min.	Typ.	Max.	
SDAI Setup Time	t_{S0}	CSB to SCL	60	-	-	ns
	t_{S1}	SDAI to SCL	60	-	-	ns
SDAI Hold Time	t_{H0}	CSB to SCL	60	-	-	ns
	t_{H1}	SDAI to SCL	60	-	-	ns
Pulse Width	t_{W1L}	SCL pulse width	100	-	-	ns
	t_{W1H}	SCL pulse width	100	-	-	ns
	t_{W2}	CSB pulse width	1	-	-	μs
Clock duty	-	-	40	50	60	%

Table 9.6: SPI timing parameter

9.2.8 I2C timing

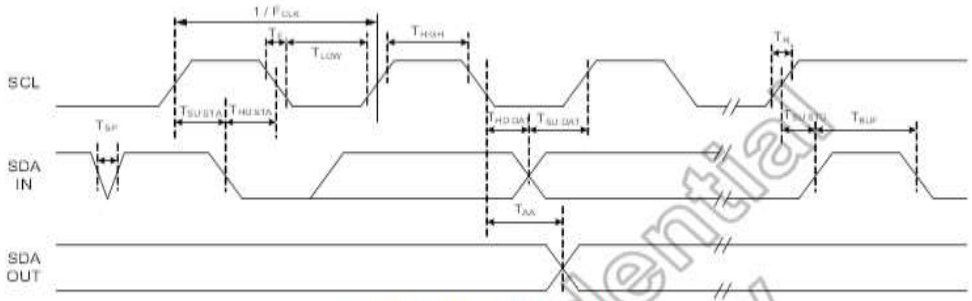


Figure 9.9: I2C signal timing

(VCC1=VCC1P=VCC2=VCCIF=3.0V to 3.6V, VSS1=VSS2=VSSA=0V, T_{OP}=-40~105℃)

Parameter	Symbol	Condition	Spec.			Unit
			Min.	Typ.	Max.	
Clock frequency	F_{CLK}	-	-	-	400	KHz
Clock high time	T_{HIGH}	-	600	-	-	ns
Clock low time	T_{LOW}	-	1300	-	-	ns
SDA and SCL rise time	T_R	-	-	-	300	ns
SDA and SCL fall time	T_F	-	-	-	300	ns
Start condition hold time	$T_{HD:STA}$	-	600	-	-	ns
Start condition setup time	$T_{SU:STA}$	-	600	-	-	ns
Data input hold time	$T_{HD:DAT}$	-	0	-	-	ns
Data input setup time	$T_{SU:DAT}$	-	100	-	-	ns
Stop condition setup time	$T_{SU:STO}$	-	600	-	-	ns
Output valid from clock	T_{AA}	-	-	-	900	ns
Bus free-time	T_{BUF}	Time the bus must be free before a new transmission can start	1300	-	-	ns
Input filter spike suppression	T_{SP}	SDA and SCL pins	-	-	10	ns

Table 9.7: I2C timing parameter

7. Optical Specification

4.2 Optical Specifications

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	Θ_3	CR > 10	70	85	-	Deg.	@CR>10
		Θ_9		70	85	-	Deg.	
	Vertical	Θ_{12}		70	85	-	Deg.	
		Θ_6		70	85	-	Deg.	
Luminance Contrast ratio		CR	Θ = 0°	1000	1500	-		
Cell Transmittance		Tr		-	5.5	-	%	W/O APF & W/O Haze & W/O CG
White Chromaticity		x	CIE 1931	0.285	0.295	0.305		CF @ C Light
		y		0.309	0.319	0.329		
Red Chromaticity		x	CIE 1931	0.622	0.632	0.642		
		y		0.301	0.311	0.321		
Green Chromaticity		x	CIE 1931	0.260	0.270	0.280		
		y		0.529	0.539	0.549		
Blue Chromaticity		x	CIE 1931	0.127	0.137	0.147		
		y		0.087	0.097	0.107		
Color Gamut (C light)				-	60	-	%	CF @ C Light
Response Time (Rising + Falling)		T_{RT}	Ta= 25° C Θ = 0°	-	40	45	ms	GTG@25℃

Figure 1. Optical Test Equipment Setup

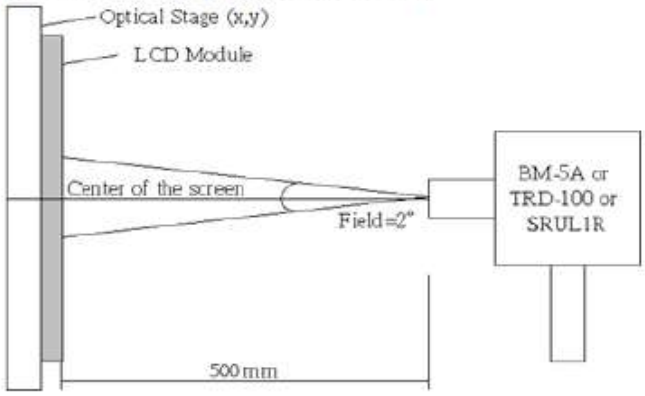


Figure 2. Response Time Testing

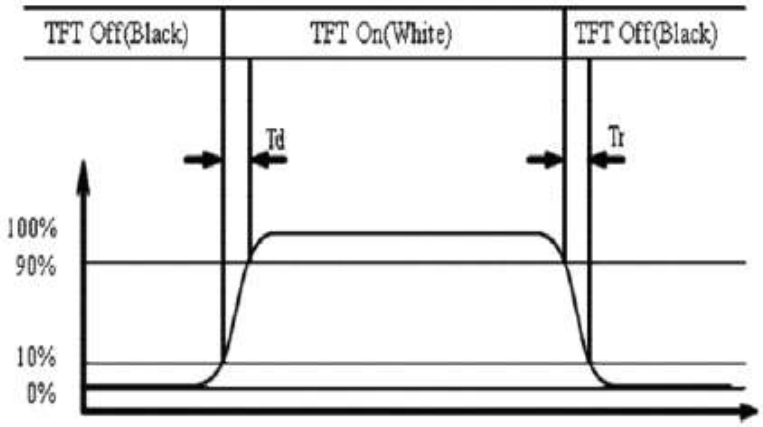


Figure 3. The Definition of Vth & Vsat

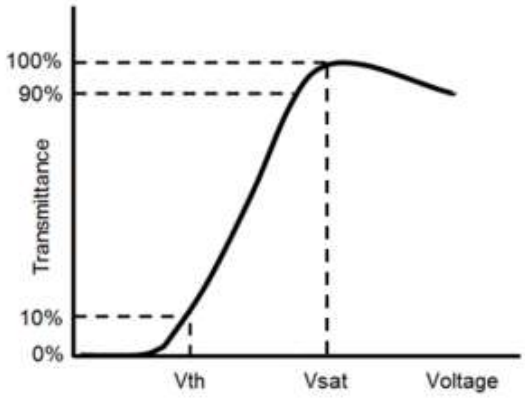
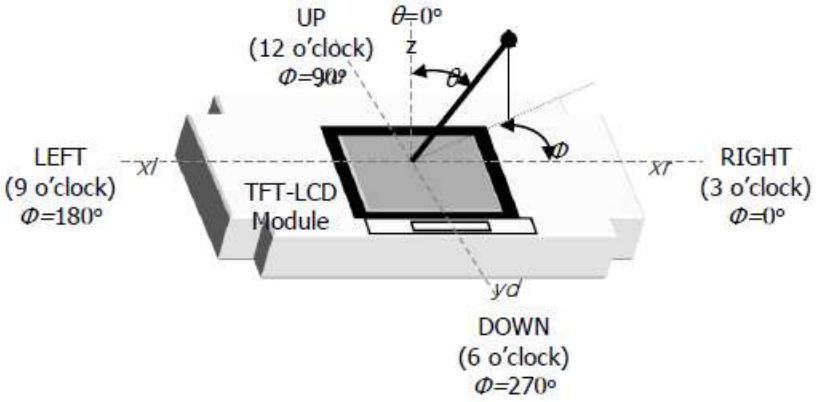
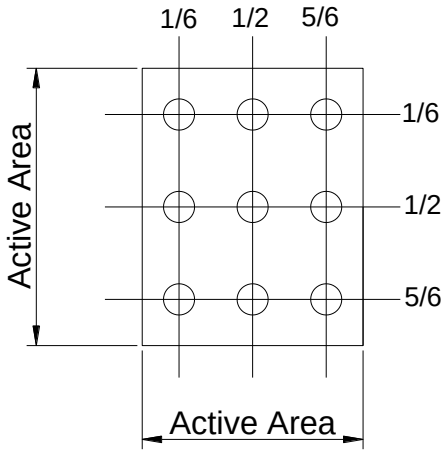


Figure 4. Viewing Angle Range is defined as follows;



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	-30	80	℃	Ambient
Storage temperature range	Tst	-30	80	℃	Ambient

9.0 RELIABILITY TEST

The Reliability test items and its conditions are shown in below.

<Table 8. Reliability test>

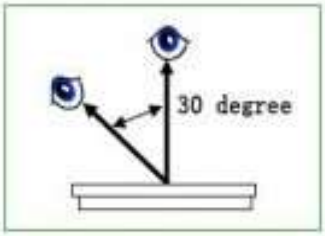
No	Test Items	Conditions
1	High temperature storage test	Ta = 80 ℃, 240 hrs
2	Low temperature storage test	Ta = -30℃, 240hrs
3	High temperature & high humidity operation test	Ta = 60 ℃, 90%RH, 240hrs
4	High temperature operation test	Ta = 70 ℃, 240 hrs
5	Low temperature operation test	Ta = -20 ℃, 240hrs
6	Thermal shock test	Ta = -30 ℃ ↔ 80 ℃ (30min), 100cycle

10 Inspection 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

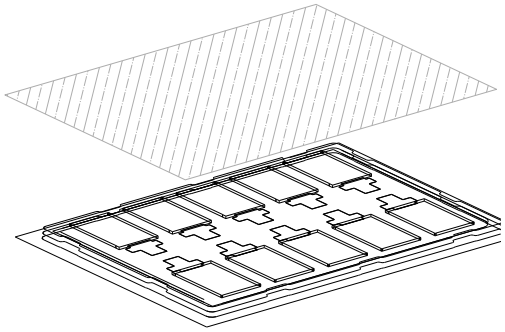
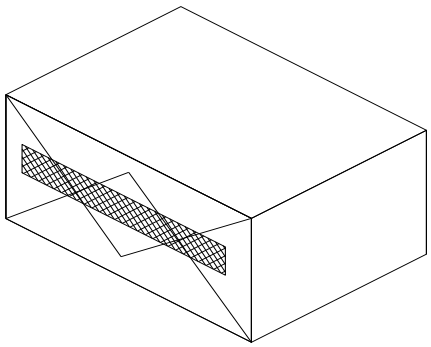
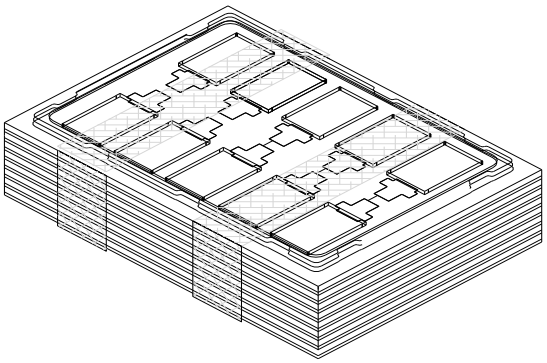
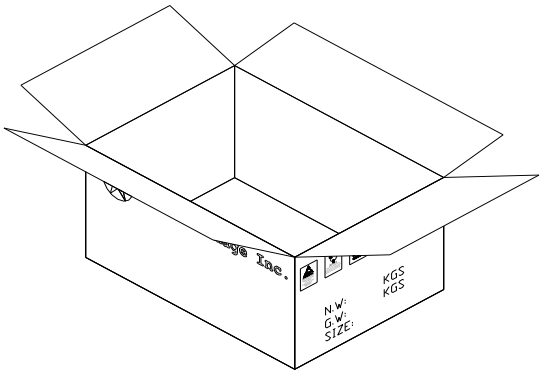
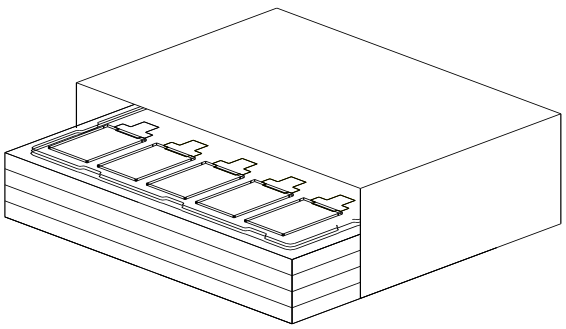
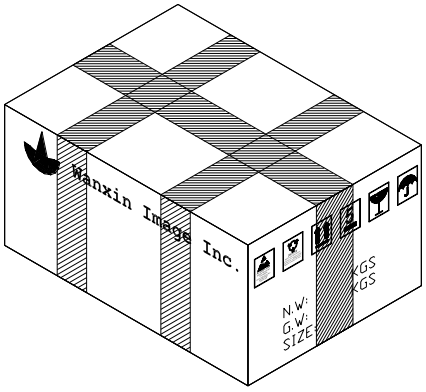
NO.	Item	Inspection standard	Rate
2.1	**Dot**	Case of Dot defect is below ① Bright Dot (whit spot) : "0" ② Dark Dot (black spot) : "0" (In case of Dark Dot on Main TFT LCD) - NG if there's full Dot defect. - Damaged less than the size of sub-pixel is not counted as defect - Dots darker than the size of sub-pixel are not defined as bright dot defect	minor

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

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 	4 
10 pcs per tray + 1 cover (EPE)	Packing bag
2 	5 
15 trays + 1 dummy tray = 150 ps	Putting bag into carton Protected by 2 pieces of cushion EPE sheet
3 	6 
Putting trays into anti-electrostatic bag	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.

12.1Handling

(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.

12.2Storage

(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.

12.3Operation

(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.

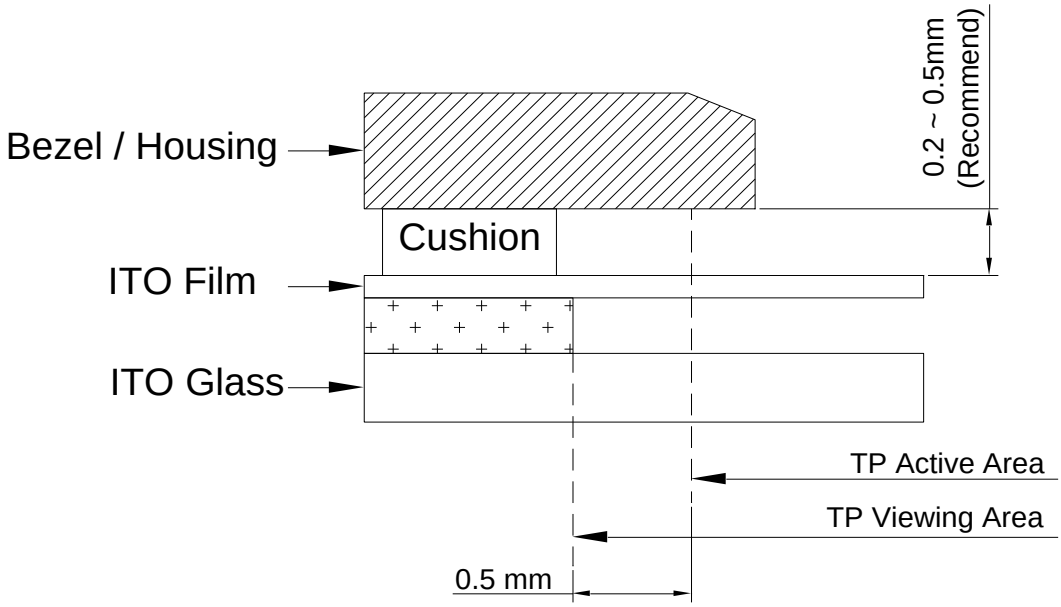
12.4Touch Panel Mounting Notes

(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.

12.5Others

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	2019-08-30	All	New released