AGTechnologies
LCD Displays

Specifications

TFT-LCDmodule

Model No：AGO-040J0-NN-N

Customer name:

The project name:

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

	Signature	**Date**
Prepared by		
Checked by		
Approved by		

AGTechnologies
LCD Displays

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1 General Description

AGO-040J0-NN-N 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 3.97inch and the solution is 480x800. 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	3.97inch (diagonal)	
3	Resolution	480XRGBX800	
4	Color Number	16.7M	
5	Color Arrangement	RGB-stripe	
6	Driver IC	GC9503CV	
7	Back Light	White LED*8	
8	Viewing Direction	ALL O'clock	
9	Interface	MIPI	
10	Surface Treatment	UV Cut	

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	55.44(W) x96.15(H) x2.1±0.1(D) (LCM,no include FPC)	mm
Active area	51.84(W) x86.40(H)	mm
Resolution	480(H)RGBx 800(V) dots	-
Dot size	0.108 (H) ×0.108	mm
Module brightness	280	cd/㎡

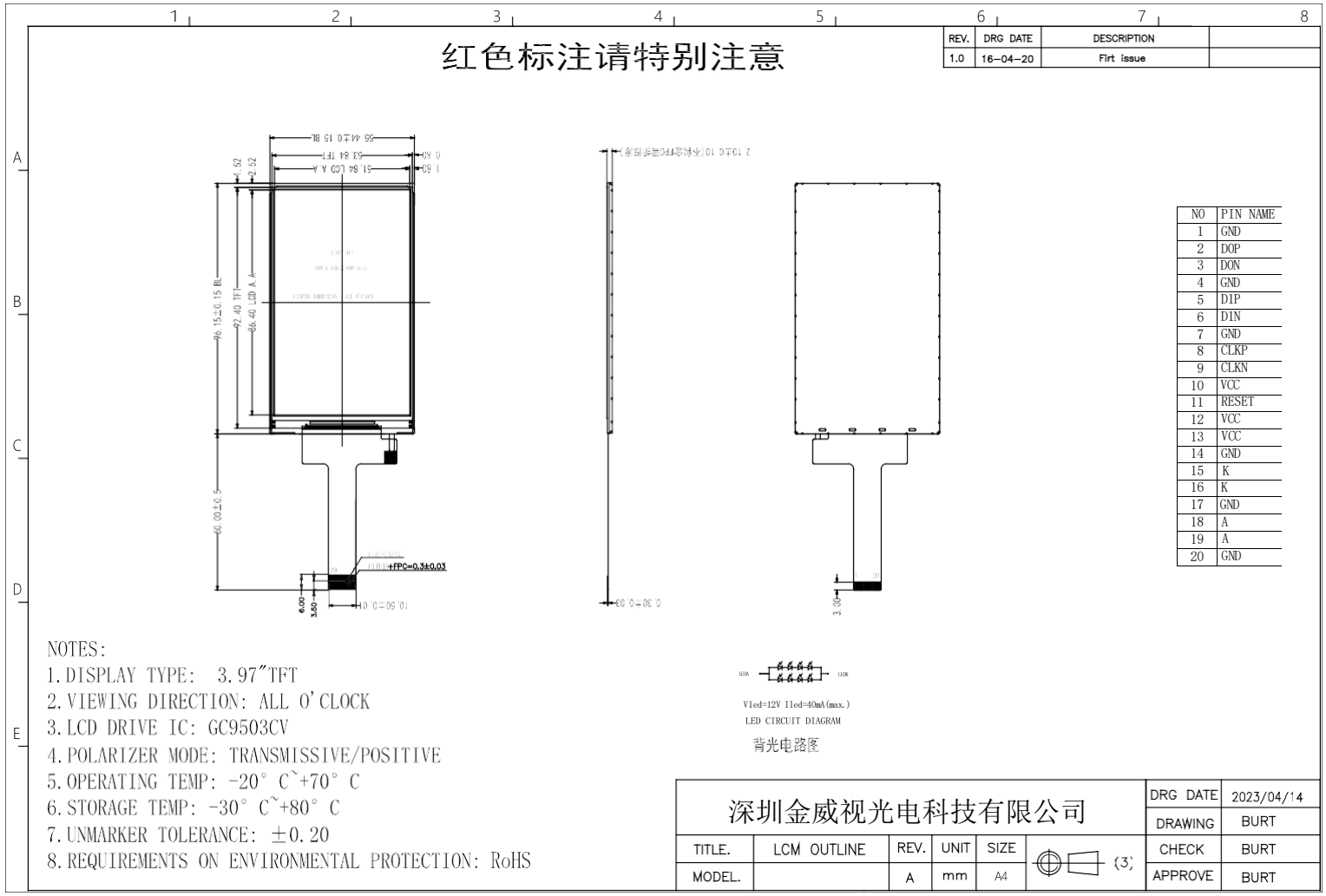


Figure 1: Module specification of the module

3 Electrical Characteristics

3.1 TFT-LCD Module

Ta=25℃

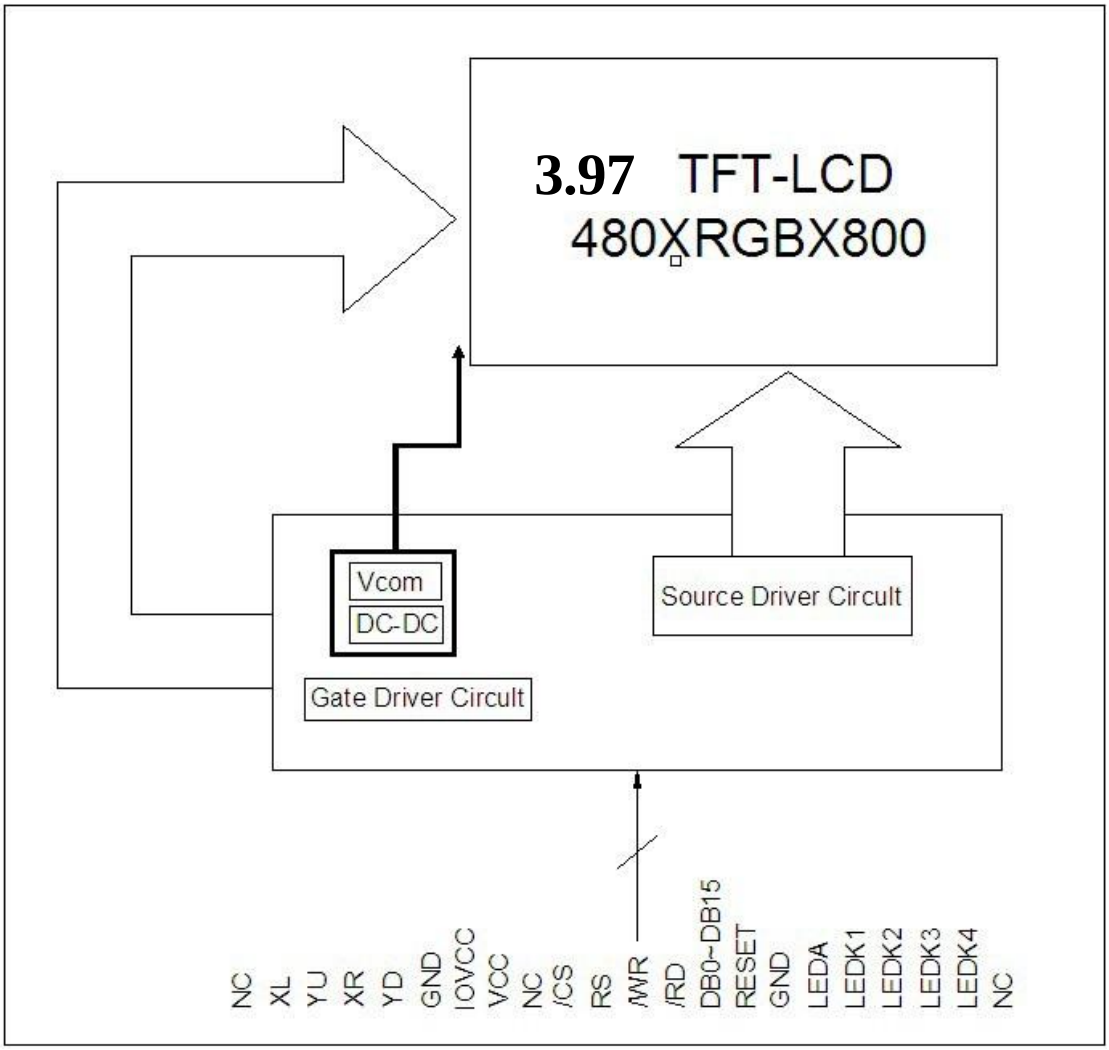
Item	Symbo	Value			Unit	Notes
		Min	Typ	Max		
Supply Voltage for logic	Vcc	2.5	2.8	3.3	V	
	Vci	2.5	2.8	3.3		
TFT Gate ON Voltage	VGH *	10	15	20	V	
TFT Gate OFF Voltage	VGL	-15	-8	-5	V	

3.2 Back-Light Unit

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Current	IF	--	40	50	mA	IF=40mA VF=12V
Forward voltage	VF	11.2	12	12.8	V	
Chroma	X	0.240		0.28		
	Y	0.250		0.29		
Brightness	L	5000			Cd/m2	
Uniformity	UBL	80			%	

- 8 LEDs used
- 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.

4 Block Diagram



Pin No.	Symbol	Functional	Notes
1	GND	Ground	
2	D0P	MIPI_DSI data lane 0 positive_ end input pin	
3	D0N	MIPI_DSI data lane 0 negative _ end input pin	
4	GND	Ground	
5	D1P	MIPI_DSI data lane 1 positive end input pin	
6	D1N	MIPI_DSI data lane 1 negative _end input pin	
7	GND	Ground	
8	CLKP	MIPI_DSI clock lane positive_ end input pin	
9	CLKN	MIPI_DSI clock lane negative_ end input pin	
10	VCC	Power supply for the system 2.8V	
11	RESET	Reset signal pin	
12,13	VCC	Power supply for the system 2.8V	
14	GND	Ground	
15,16	LED-K	Power supply for backlight cathode input terminal.	
17	GND	Ground	
18,19	LEDA	Power supply for backlight anode input terminal.	
20	GND	Ground	

5 TFT-LCM Interface Specification

6 Description of Interface'Signal

6.1 Mipi Interface- High Speed Mode Timing Characteristics

9.8.3. DSI Timing Characteristics

9.8.4. High Speed Mode – Clock Channel Timing

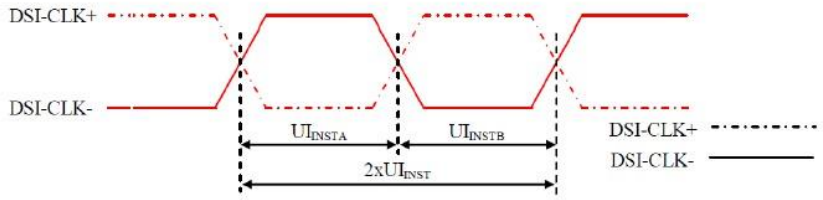


Figure 114 DSI Clock Channel Timing

Table 45 DSI Clock Channel Timing

Signal	Symbol	Parameter	Min	Max	Unit
DSI-CLK+/-	$2xUI_{INST}$	Double UI instantaneous	4	25	ns
DSI-CLK+/-	UI_{INSTA}, UI_{INSTB}	UI instantaneous Half	2	12.5	ns

Note: $UI = UI_{INSTA} = UI_{INSTB}$

9.8.5. High Speed Mode – Data Clock Channel Timing

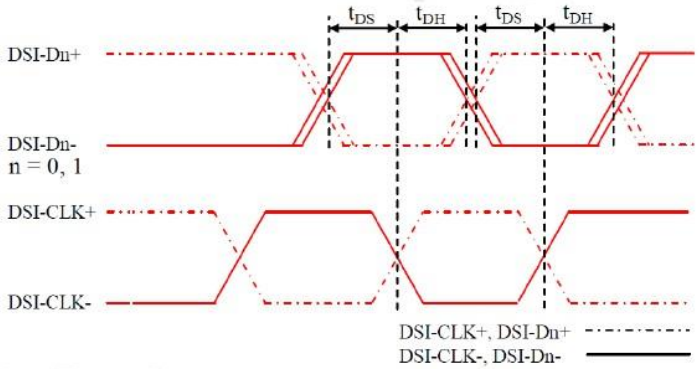


Figure 115 DSI Data to Clock Channel Timings

Table 46 DSI Data to Clock Channel Timings

Signal	Symbol	Parameter	Min	Max
DSI-Dn+/- , n=0 and 1	t_{DS}	Data to Clock Setup time	0.15xUI	-
	t_{DH}	Clock to Data Hold Time	0.15xUI	-

9.8.6 High Speed Mode – Rise and Fall Timings

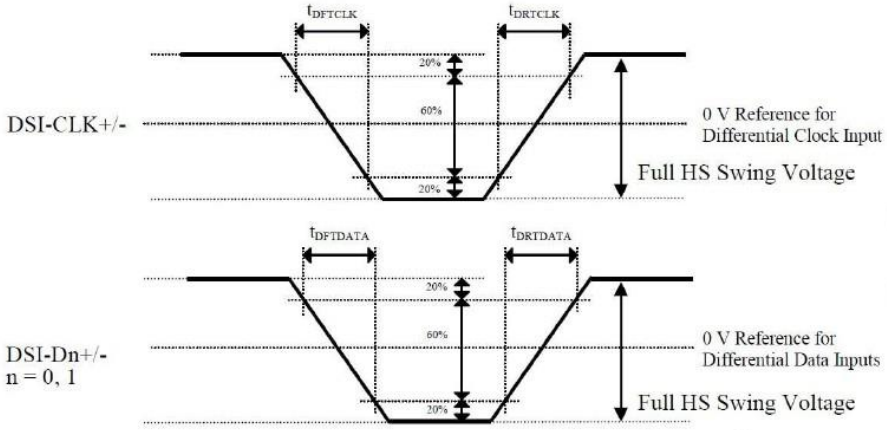


Figure 116 Rise and Fall Timings on Clock and Data Channels

Table 47 Rise and Fall Timings on Clock and Data Channels

Parameter	Symbol	Condition	Specification			
			Min	Typ	Max	Unit
Differential Rise Time for Clock	t_{DRTCLK}	DSI-CLK+/-	-	-	150 (Note)	ps
Differential Rise Time for Data	$t_{DRTDATA}$	DSI-Dn+/- n=0 and 1	-	-	150 (Note)	ps
Differential Fall Time for Clock	t_{DFTCLK}	DSI-CLK+/-	-	-	150 (Note)	ps
Differential Fall Time for Data	$t_{DFTDATA}$	DSI-Dn+/- n=0 and 1	-	-	150 (Note)	ps

Note:The display module has to meet timing requirements, what are defined for the transmitter (MPU) on MIPI D-Phy standard

6.2 DC Characteristics

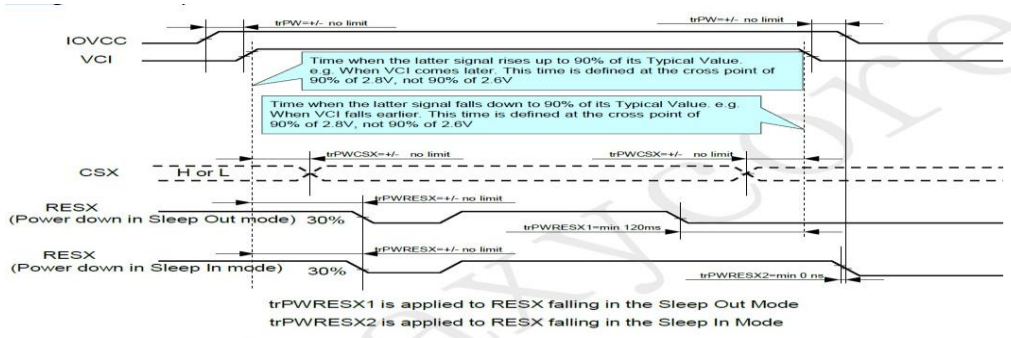
9.7. DC Characteristics for DSI HS mode

Parameter	Symbol	Condition	Specification			Unit
Input Common Mode Voltage for Clock	V_{CMCLK}	DSI-CLK+/- Note 2, Note 3	70	-	330	mV
Input Common Mode Voltage for Data	V_{CMDATA}	DSI-Dn+/- Note 2, Note 3, Note 5	70	-	330	mV
Common Mode Ripple for Clock Equal or Less than 450MHz	$V_{CMRCLKL450}$	DSI-CLK+/- Note 4	-50	-	50	mV
Common Mode Ripple for Data Equal or Less than 450MHz	$V_{CMRDATAL450}$	DSI-Dn+/- Note 4, Note 5	-50	-	50	mV
Common Mode Ripple for Clock More than 450MHz (peak sine wave)	$V_{CMRCLKM450}$	DSI-CLK+/-	-	-	100	mV
Common Mode Ripple for Data More than 450MHz (peak sine wave)	$V_{CMRDATAM450}$	DSI-Dn+/- Note 5	-	-	100	mV
Differential Input Low Level Threshold Voltage for Clock	$V_{THLCLK-}$	DSI-CLK+/-	-70	-	-	mV
Differential Input Low Level Threshold Voltage for Data	$V_{THLDATA-}$	DSI-Dn+/- Note 5	-70	-	-	mV
Differential Input High Level Threshold Voltage for Clock	$V_{THHCLK+}$	DSI-CLK+/-	-	-	70	mV
Differential Input High Level Threshold Voltage for Data	$V_{THHDATA+}$	DSI-Dn+/- Note 5	-	-	70	mV
Single-ended Input Low Voltage	V_{ILHS}	DSI-CLK+/-, DSI-Dn+/- Note 3, Note 5	-40	-	-	mV
Single-ended Input High Voltage	V_{IHHS}	DSI-CLK+/-, DSI-Dn+/- Note 3, Note 5	-	-	460	mV
Differential Termination Resistor	R_{TERM}	DSI-CLK+/-, DSI-Dn+/- Note 5	80	100	125	Ω
Single-ended Threshold Voltage for Termination Enable	$V_{TERM-EN}$	DSI-CLK+/-, DSI-Dn+/- Note 5	-	-	450	mV
Termination Capacitor	C_{TERM}	DSI-CLK+/-, DSI-Dn+/- Note 5, Note 6	-	-	60	pF

Note:

1. Ta = -30℃ to 70℃ (to +85℃ no damage), IOVCC = 1.65 to 1.95V.
2. Includes 50mV (-50mV to 50mV) ground difference.
3. Without VCMRCLKM450/VCMRDATAM450.
4. Without 50mV (-50mV to 50mV) ground difference.
5. n = 0 and 1.
6. For higher bit rates a 14pF capacitor will be needed to meet the common-mode return loss specification.

6.4 Reset Timing

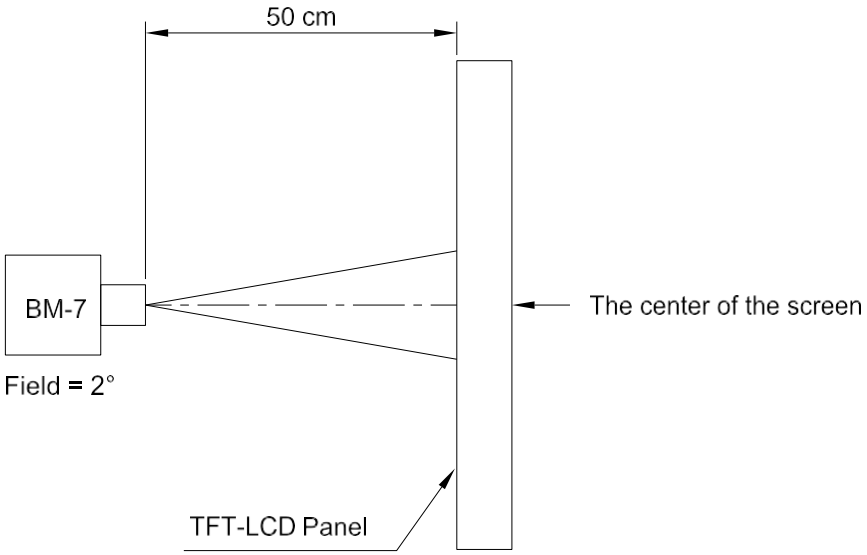


7. Optical Specification

Item	Symbol	Condition	Specification			Unit	Remark
			Min.	Typ.	Max.		
Response Time	Tr+Tf	Ta=25℃ θ= 0°	-	35	45	ms	Note 1,2,3
Contrast Ratio	CR	θ= 0°	750	1000	-		Note 1,2,4
Viewing Angle	Left (9 O'Clock)	CR≧10	70	80	-	deg.	Note 1,2,5,8 Normal Pol
	Right (3 O'Clock)		70	80	-		
	Top (12 O'Clock)		70	80	-		
	Bottom (6 O'Clock)		70	80	-		
Color Chromaticity (CF only with C light, CIE 1931)	Rx	θ= 0°	-0.015	0.635	+0.015		Note 1,6 CF Glass
	Ry			0.335			
	Gx			0.287			
	Gy			0.587			
	Bx			0.137			
	By			0.148			
	Wx			0.305			
	Wy			0.340			
Color Gamut (CF only with C light, CIE 1931)	NTSC	θ= 0° CIE1931	55	60	-	%	Note 1,6 CF Glass
Transmittance (Without APCF)	Tr	θ= 0°	(4.1)	(4.8)	-	%	Note 1,7,8 Normal Pol

Note 1: The brightness test equipment setup

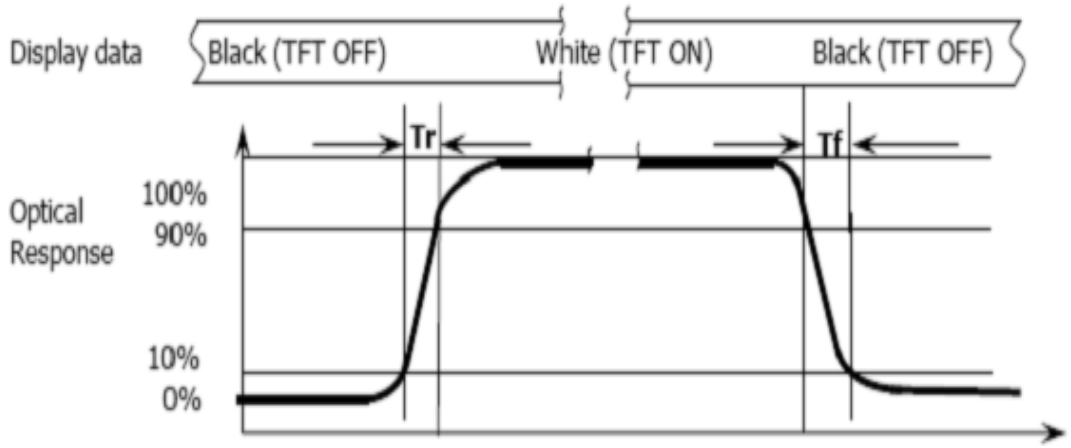
I_B=60mA, Field=2° (As measuring “black” image, field=2° is the best testing condition.)



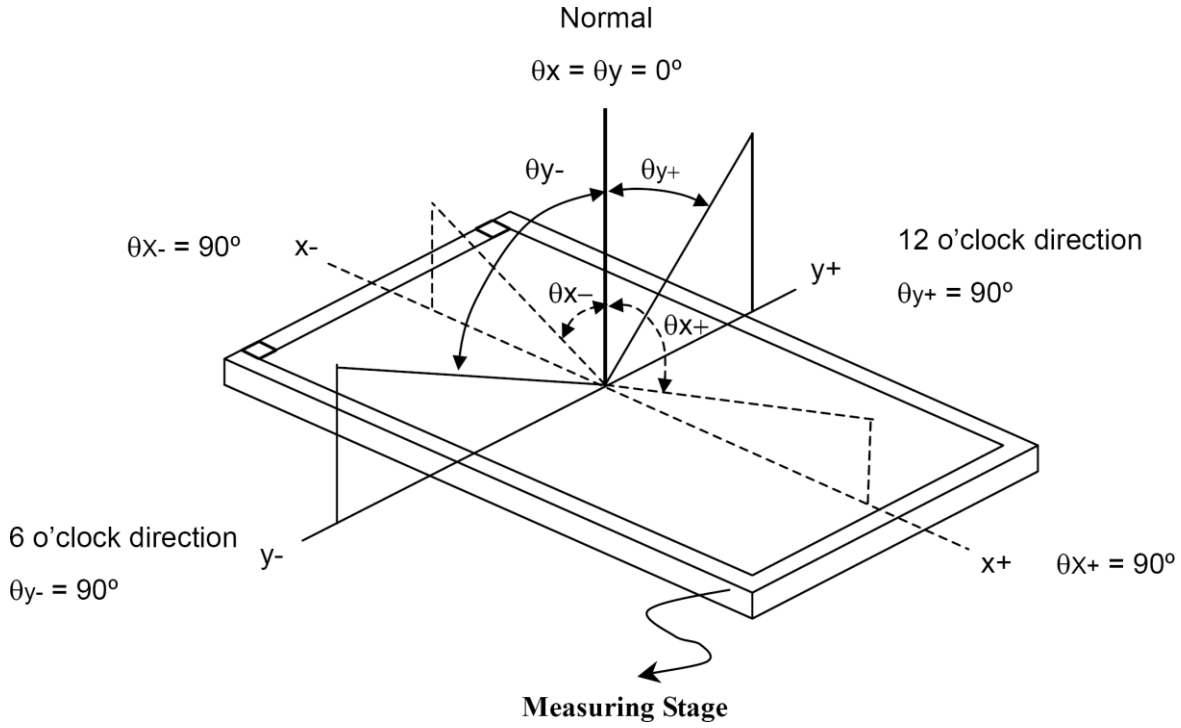
Note 2: Definition of contrast ratio (**C.R**)

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

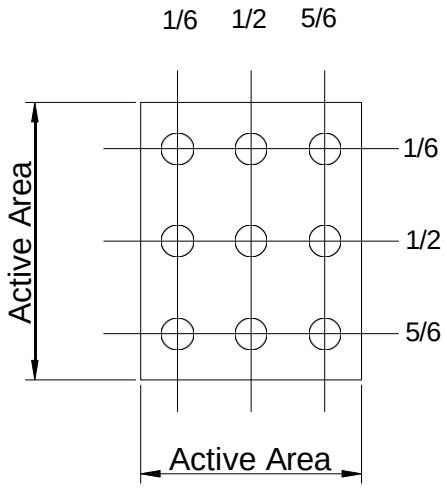
Note 3: Definition of response time



Note 4: Definition of viewing angle



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



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

8 Environment Absolute Maximum Ratings

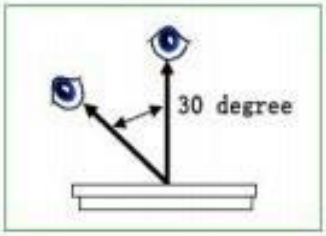
Item	Symbol	Min	Max	Unit	Remark
Operation temperature range	Top	-10	60	℃	Ambient
Storage temperature range	Tst	-20	70	℃	Ambient

10 Inspection Standard

This standard apply to TFT module specification.

1. Inspection condition:

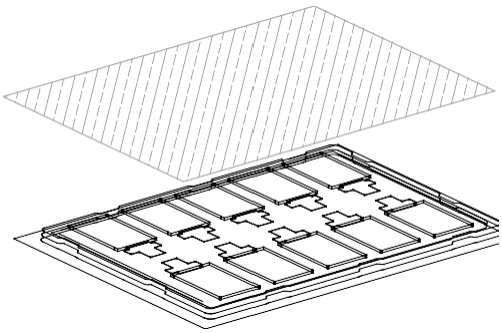
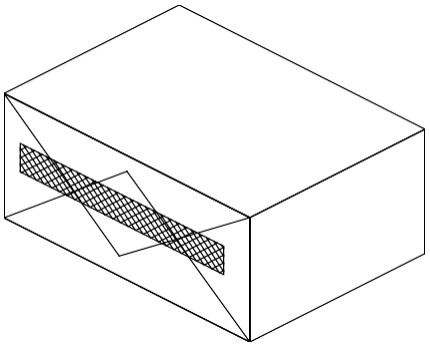
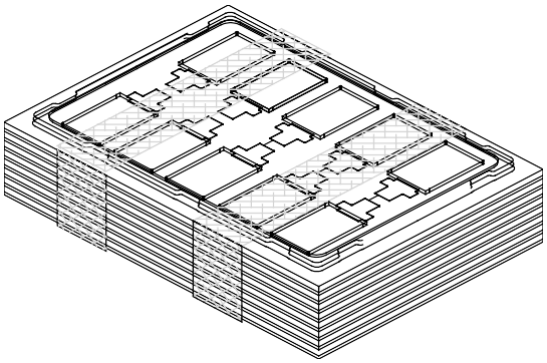
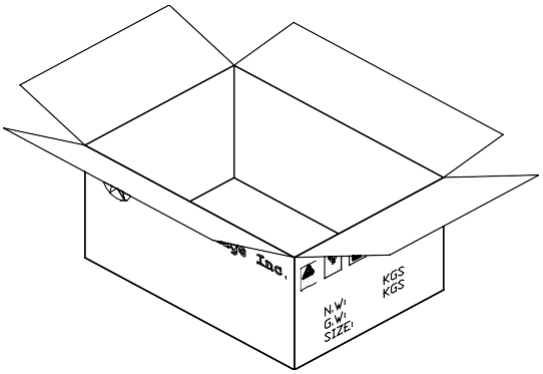
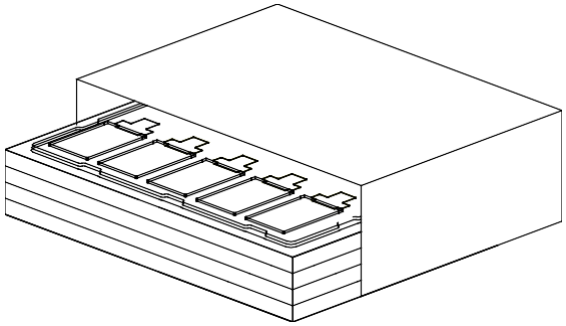
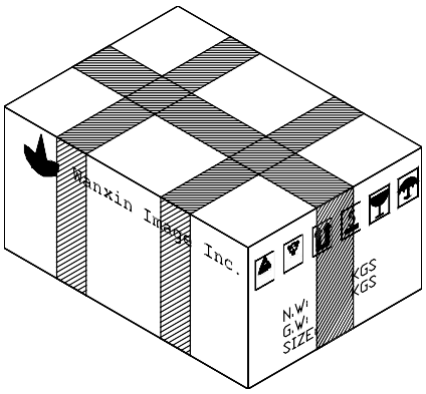
Under daylight lamp 20~40W, product distance inspector'eye 30cm.incline degree 30° .



2. Inspection standard

<table>
<tr><th>NO.</th><th>Item</th><th>Inspection standard</th><th>Rate</th></tr>
<tr><td>2.1</td><td>Dot</td><td>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
<table><tr><th>area / size (mm)</th><th>Acceptable number</th></tr><tr><td>Φ≤0.10</td><td>ignore</td></tr><tr><td>0.10<Φ≤0.15</td><td>3</td></tr><tr><td>0.15<Φ≤0.20</td><td>2</td></tr><tr><td>0.25<Φ≤0.25</td><td>1</td></tr><tr><td>0.25<Φ</td><td>0</td></tr></table></td><td rowspan="2">minor</td></tr>
<tr><td>2.2</td><td>line</td><td><table><tr><th colspan="2">Size (mm)</th><th>Acceptable number</th></tr><tr><td>ignore</td><td>W≤0.03</td><td>ignore</td></tr><tr><td>L≤4.0</td><td>0.03<W≤0.04</td><td>2</td></tr><tr><td>L≤4.0</td><td>0.04<W≤0.05</td><td>1</td></tr><tr><td></td><td>0.05<W</td><td>Treat with dot non-conformance</td></tr></table></td></tr>
</table>

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.

12.1 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.

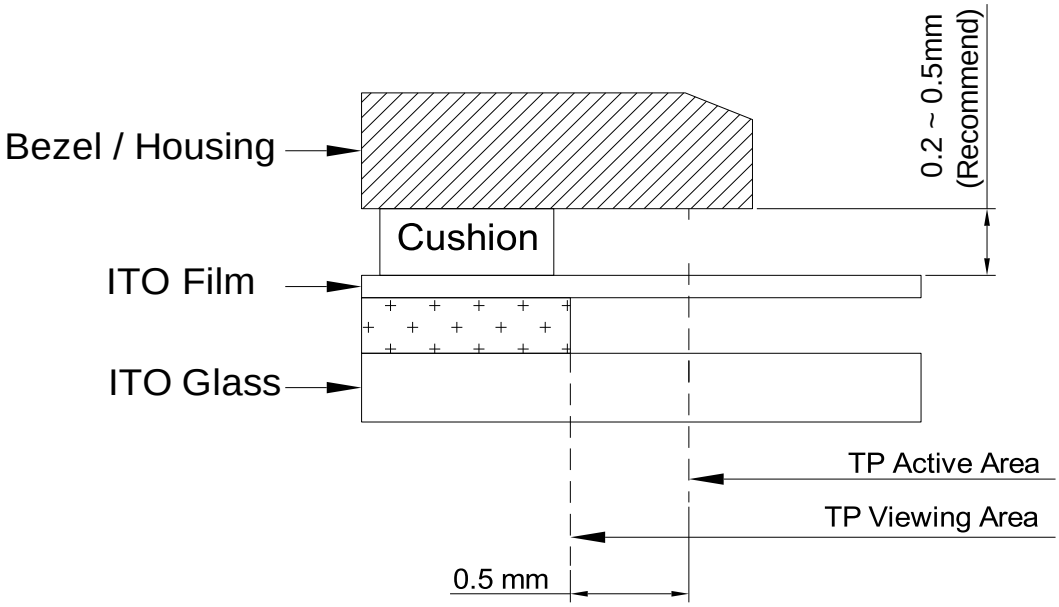
12.4 Touch Panel Mounting Notes

(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	2023.04.29	All	New released