Specifications

TFT-LCD module

Model No：FRD2803601

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

	Signature	Date
Prepared by		
Checked by		
Approved by		

Contents

1. Document revision history :

DOCUMENT REVISION	DATE	DESCRIPTION	PREPARED BY	APPROVED BY
A	2017-04-02	First Release.		

2.General Description

FRD2803601 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 2.8 inch and the resolution is 240×320. High image quality a-Si TFT LCD module. Partial-screen display function is available. Sleep and Stand-by modes are available for power saving.

2.1 Features

No	Item	Specification	Remark
1	Display Mode	Normally White	
2	Screen Size	2.4inch (diagonal)	
3	Resolution	240×RGB×320	
4	Color Number	262K	
5	Color Arrangement	TFT Active matrix	
6	Driver IC	ILI9341	
7	Back Light	White LED*4	
8	Viewing Direction	12'clock	
9	Interface	MCU-L8bit	
10	Surface Treatment		
11	touch panel		

2.2 Application
◆ Mobile phone.
◆ Portable multimedia device.
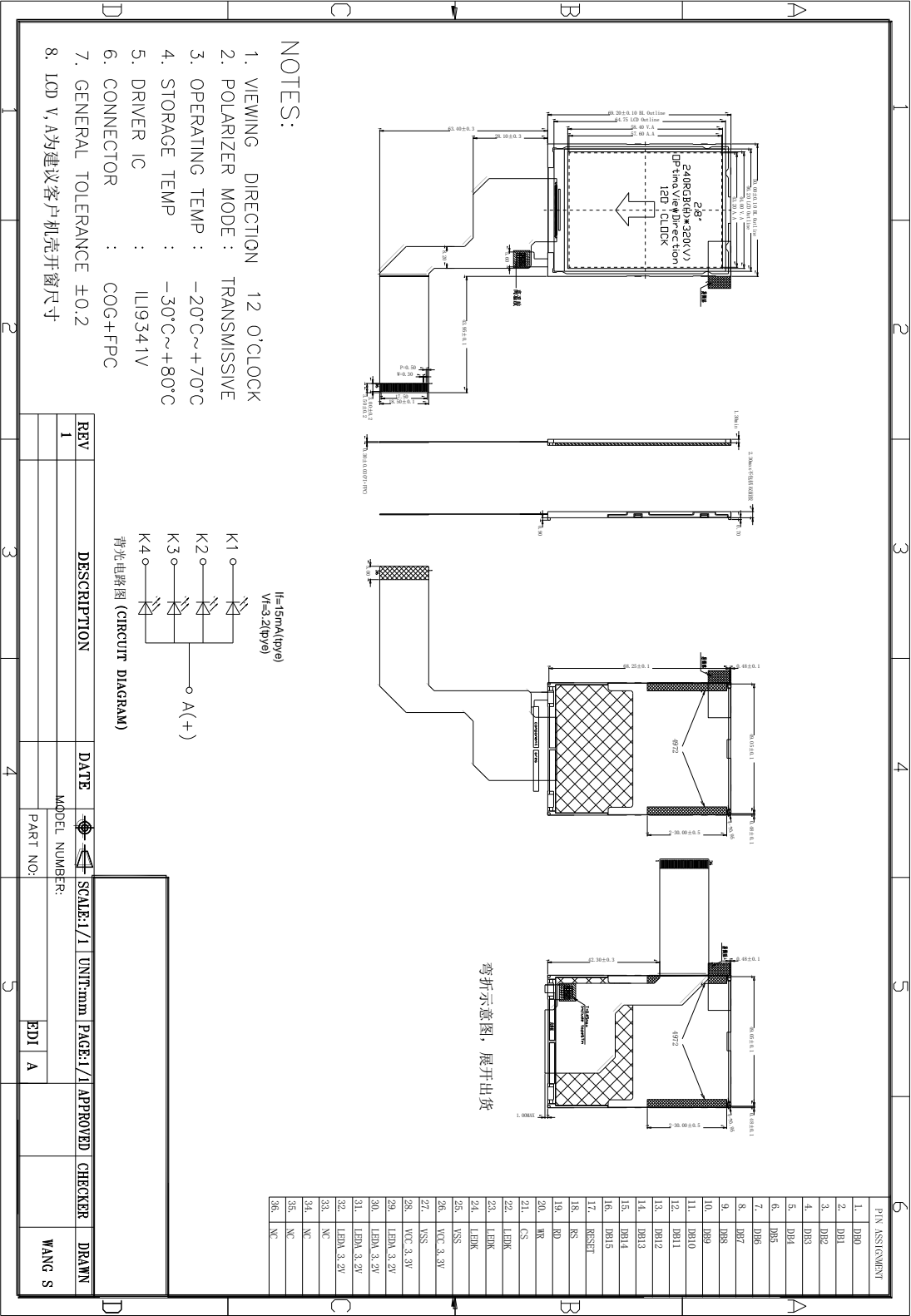
3.Outline Dimension

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

Parameter	Specifications	Unit
Outline dimensions	50.00(W) ×69.20(H) × 2.3 (D) (LCM, not include FPC)	mm
Active area	43.20(W) ×57.60(H)	mm
Resolution	240(H)RGB× 320(V) dots	-
Dot size	0.153(H) x 0.153(V)	mm

Figure 1:   Module specification of the module

NOTES:

1. VIEWING DIRECTION 12 O'CLOCK
2. POLARIZER MODE : TRANSMISSIVE
3. OPERATING TEMP : -20℃~+70℃
4. STORAGE TEMP : -30℃~+80℃
5. DRIVER IC : ILI9341V
6. CONNECTOR : COG+FPC
7. GENERAL TOLERANCE ±0.2
8. LCD V,A为建议客户机壳开窗尺寸

背光电路图（CIRCUIT DIAGRAM）

If=15mA(tpye)
Vf=3.2(tpye)

K1 K2 K3 K4   A(+)

2.8"
240RGB(H)×320(V)
Optima View Direction
12D：CLOCK

弯折示意图，展开出货

	REV	DESCRIPTION	DATE
	1		

MODEL NUMBER:
PART NO:
SCALE:1/1 UNIT:mm PAGE:1/1
EDI A

	APPROVED	CHECKER	DRAWN
			WANG S

PIN ASSIGNMENT

PIN	
1.	DB0
2.	DB1
3.	DB2
4.	DB3
5.	DB4
6.	DB5
7.	DB6
8.	DB7
9.	DB8
10.	DB9
11.	DB10
12.	DB11
13.	DB12
14.	DB13
15.	DB14
16.	DB15
17.	RESET
18.	RS
19.	RD
20.	WR
21.	CS
22.	NC
23.	LEDK
24.	LEDK
25.	VSS
26.	VCC 3.3V
27.	VSS
28.	VCC 3.3V
29.	LEDA 3.2V
30.	LEDA 3.2V
31.	LEDA 3.2V
32.	LEDA 3.2V
33.	NC
34.	NC
35.	NC
36.	NC

4.TFT-LCM Interface Specification

Pin No	Symbol	Description	Note
1-8	DB0-DB07	Data bus	
9-16	DB8-DB15	NC	
17	/RESET	Reset signal input Pin	
18	D/C	Parallel interface (D/CX): The signal for command or	
19	RD	Read signal	
20	WR	Write signal	
21	CS	Chip select input pin.	
22-24	LEDK	Power supply Cathode input for backlight	
25	GND	System Ground	
26	VCC	Power supply input for LCM: 3.3	
27	GND	System Ground	
28	VCC	Power supply input for LCM: 3.3	
29-32	LEDA	Power supply Anode input for backlight	
33-36	NC	No connection	

5. Absolute Maximum Ratings

5.1 Electrical Maximum Ratings – for IC Only

Table 3: Electrical Maximum Ratings – for IC

Parameter	Symbol	Min.	Max.	Unit	Note
Power supply voltage (VCC)	VCC	-0.3	+4.0	V	1
Power supply voltage (IOVCC)	IOVCC	-0.3	+3.6	V	1

Note:

1.IOVCC,VCI, GND must be maintained.

2.The modules may be destroyed if they are used beyond the absolute maximum ratings.

5.2 Environmental Condition

Table 4

Item	Operating temperature (Topr)		Storage temperature (Tstg) (Note 1)		Remark
	Min.	Max.	Min.	Max.	
Ambient temperature	-20℃	+70℃	-30℃	+80℃	Dry
Humidity (Note 1)	80% max. RH for Ta 40℃< 50% RH for 40℃ ＜ Ta Maximum operating temperature				No condensation

Note 1: Product cannot sustain at extreme storage conditions for long time.

6. Electrical Specifications

Typical Electrical Characteristics

At Ta = 25 ℃, VCI = 2.6V to 3.3V, IOVCC= 1.65V to 3.3V GND=0V.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply voltage (analog)	VCI-GND		2.6	2.8	3.3	V
Supply voltage (logic)	IOVDD-GND		1.65	1.8	3.3	V
Supply current (Logic & LCD)	ICC	VCI=2.8V	-	-	10	mA
Supply voltage of white LED backlight	VLED $=V_{(BL+)}-$ $V_{(BL-)}$	Forward current =60 mA Number of LED dies = 4	2.8	3.2	3.6	V
Luminance (on the module surface)			250	-	-	cd/m^2

7.Timing Characteristics

The following figure shows a write cycle for the 8080- I MCU interface.

WRX

D[7:0], D[8:0] or
D[15:0], D[17:0]

The host asserts D[17:0],
D[15:0], D[8:0] or D[7:0] lines
when there is falling edge of
WRX

ILI9341 reads D[17:0],
D[15:0], D[8:0] or D[7:0]
lines when there is rising
edge of WRX

The host negates D[17:0],
D[15:0], D[8:0] or D[7:0]
lines.

Note: WRX is an unsynchronized signal (It can be stopped)

Interface

CSX

RESX

D/CX

WRX

RDX

D[17:0] — Command Address — Command Data

ILI9341

D[17:0] (LCD to Host) — Hi-Z

Host

D[17:0] Host to LCD — Command Address — Command Data

Signals on D[17:0], D/CX, RDX and WRX wires during
CSX=" H" are ignored.

65K color: 16-bit/pixel (RGB 5-6-5 bits input)

One pixel (3 sub-pixels) display data is sent by 2 transfers when DBI [2:0] bits of 3Ah register are set to "101".

Count	0	1	2	3	4	…	477	478	479	480
D/CX	0	1	1	1	1	…	1	1	1	1
D8										
D7	C7	0R4	0G2	1R4	1G2	…	238R4	238G2	239R4	239G2
D6	C6	0R3	0G1	1R3	1G1	…	238R3	238G1	239R3	239G1
D5	C5	0R2	0G0	1R2	1G0	…	238R2	238G0	239R2	239G0
D4	C4	0R1	0B4	1R1	1B4	…	238R1	238B4	239R1	239B4
D3	C3	0R0	0B3	1R0	1B3	…	238R0	238B3	239R0	239B3
D2	C2	0G5	0B2	1G5	1B2	…	238G5	238B2	239G5	239B2
D1	C1	0G4	0B1	1G4	1B1	…	238G4	238B1	239G4	239B1
D0	C0	0G3	0B0	1G3	1B0	…	238G3	238B0	239G3	239B0

65K color: 16-bit/pixel (RGB 5-6-5 bits input)

One pixel (3 sub-pixels) display data is sent by 1 transfer when DBI [2:0] bits of 3Ah register are set to "101".

Count	0	1	2	3	…	238	239	240
D/CX	0	1	1	1	…	1	1	1
D17		0R4	1R4	2R4	…	237R4	238R4	239R4
D16		0R3	1R3	2R3	…	237R3	238R3	239R3
D15		0R2	1R2	2R2	…	237R2	238R2	239R2
D14		0R1	1R1	2R1	…	237R1	238R1	239R1
D13		0R0	1R0	2R0	…	237R0	238R0	239R0
D12		0G5	1G5	2G5	…	237G5	238G5	239G5
D11		0G4	1G4	2G4	…	237G4	238G4	239G4
D10		0G3	1G3	2G3	…	237G3	238G3	239G3
D8	C7	0G2	1G2	2G2	…	237G2	238G2	239G2
D7	C6	0G1	1G1	2G1	…	237G1	238G1	239G1
D6	C5	0G0	1G0	2G0	…	237G0	238G0	239G0
D5	C4	0B4	1B4	2B4	…	237B4	238B4	239B4
D4	C3	0B3	1B3	2B3	…	237B3	238B3	239B3
D3	C2	0B2	1B2	2B2	…	237B2	238B2	239B2
D2	C1	0B1	1B1	2B1	…	237B1	238B1	239B1
D1	C0	0B0	1B0	2B0	…	237B0	238B0	239B0

8.Power Supply Configuration

19.4.1. Power Structure
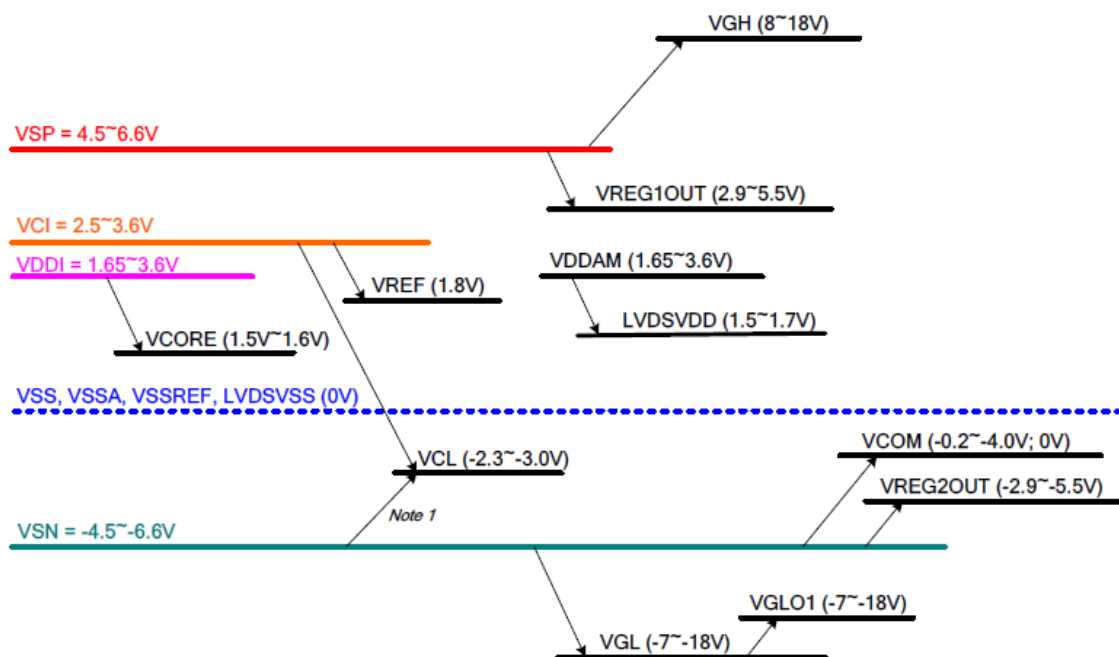
Figure 130: Power Structure of Power Mode 4

9.Optical Specification

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		-	30	-	ms	(1),(4),(6),(7) ,(8)
CF Color Chromaticity (CIE1931)	Red x		Typ. -0.015	0.626	Typ. +0.015	-	Under C-light
	Red y			0.336		-	
	Green x			0.276		-	
	Green y			0.550		-	
	Blue x			0.144		-	
	Blue y			0.130		-	
	White x			0.307		-	
	White y			0.329		-	
NTSC	CIE1931		-	55	-	%	(1),(6),(7),(8)
Transmittance	-		-	4.97	5.4	-	%	(1),(5),(6),(7) ,(8)

Note (1) Measurement Setup:

The LCD module should be stabilized at given temperature(25℃) for 15 minutes to
Avoid abrupt temperature change during measuring. In order to stabilize the luminance,
the measurement should be executed after lighting backlight for 15 minutes in a
windless room.

Figure 2 Measurement Setup
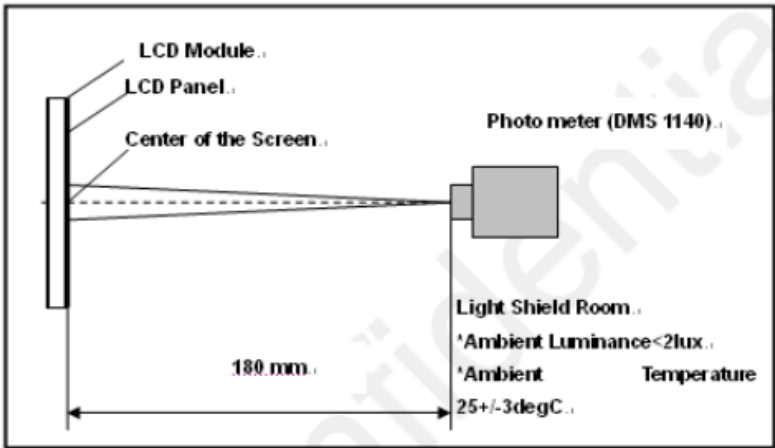
Note (2) Definition of Viewing Angle

Figure 3 Definition of Viewing Angle
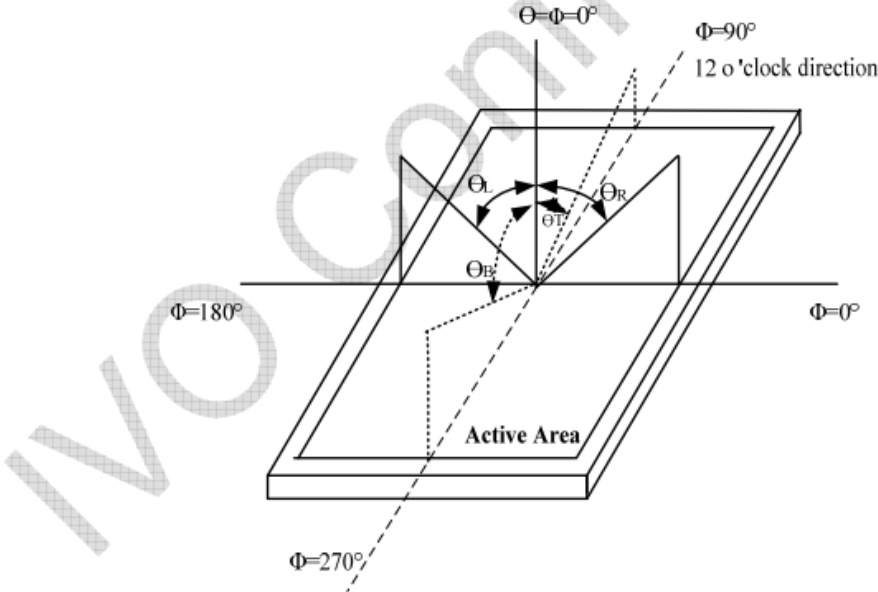
Note (3) Definition Of Contrast Ratio (CR)

The contrast ratio can be calculated by the following expression

Contrast Ratio (CR) = L63 / L0

L63: Luminance of gray level 63, L0: Luminance of gray level 0

Note (4) Definition Of Response Time (TR, TF)

Figure 4 Definition of Response Time
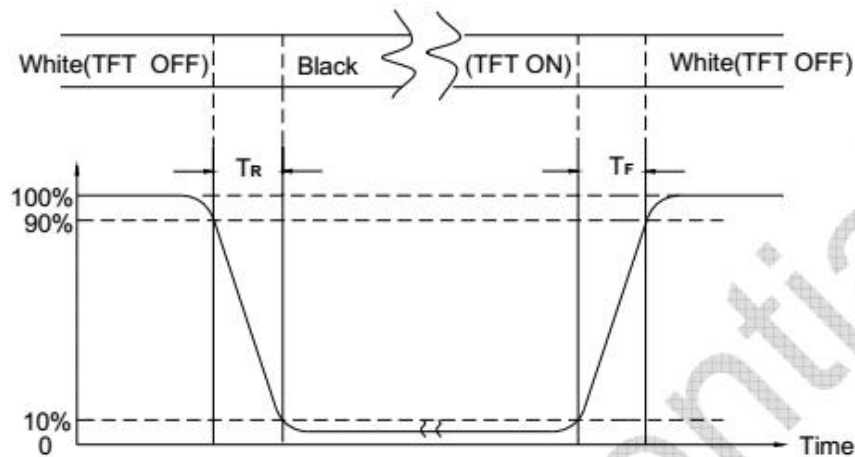
Note (5) Definition of Transmittance (Module is without signal input and IVO reference backlight).

$$\text{Transmittance} = \frac{\text{Luminance of LCD Module}}{\text{Luminance of Back light}} \times 100\%$$

Note (6) Reference C-light Spectrum

Figure 5 C-light Spectrum
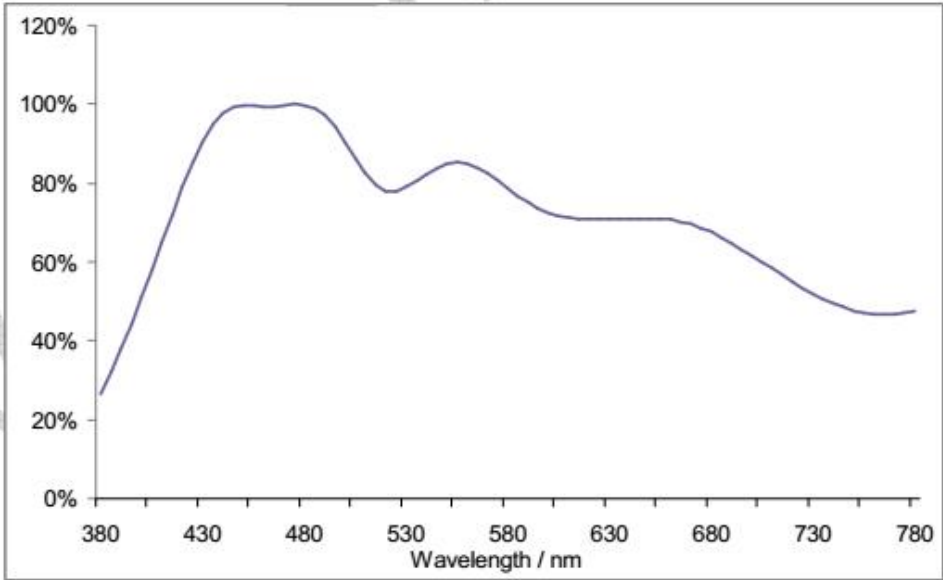
Note (7) The polarizer type: Samsung/CF, Samsung /Array.

Note (8) All optical data based on IVO given polarizer & C-light& testing machine in this document.
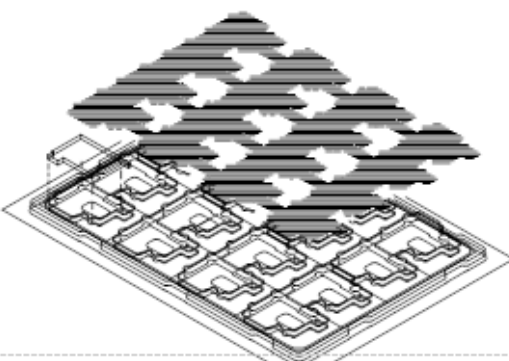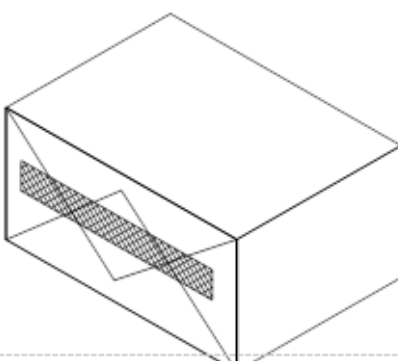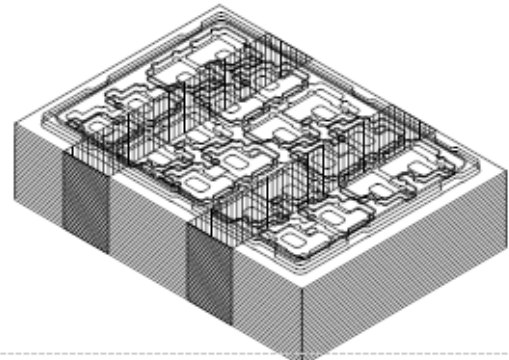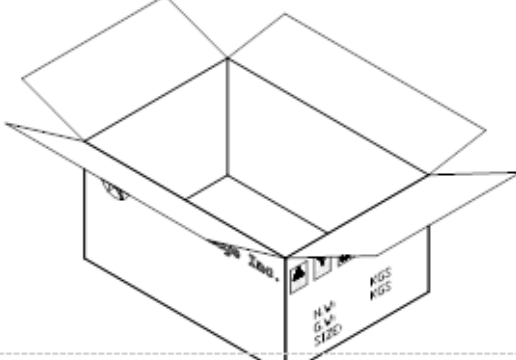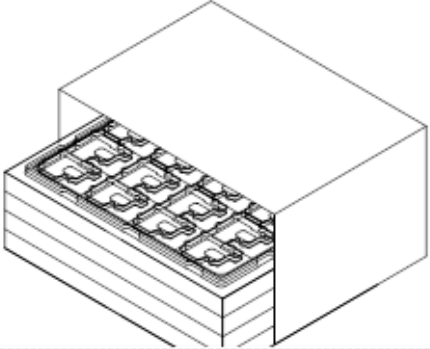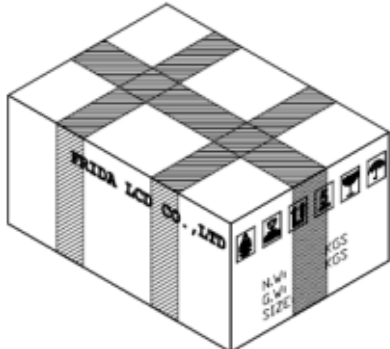
10.Reliability Test Items

Item	Test Condition		Criterion
High Temperature Storage	80 ℃, 120 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 ℃, 120 hrs		
High Temp. & High Humidity Storage	60 ℃, 90％ RH, 120 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 ℃, 120 hrs		
Low temperature Operation	-20 ℃, 120 hrs		
High Temperature & High Humidity (Operating)	50 ℃, 90％ RH, 120 hrs		
FPC Peeling Strength Test	Pull speed: 50 mm/min, +90 °,		> 400gf/cm

11. Package

1	4
16 pcs per tray + 1 cover (EPE)	Packing bag
2	**5**
25 trays + 1 dummy tray = 400 ps	Putting bag into carton Protected by 6 pieces of cushion EPE sheet
3	**6**
Putting trays into anti-electrostatic bag	

12.Precautions

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

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.

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.

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.

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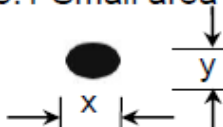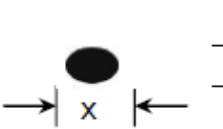
(d) Mounting example:
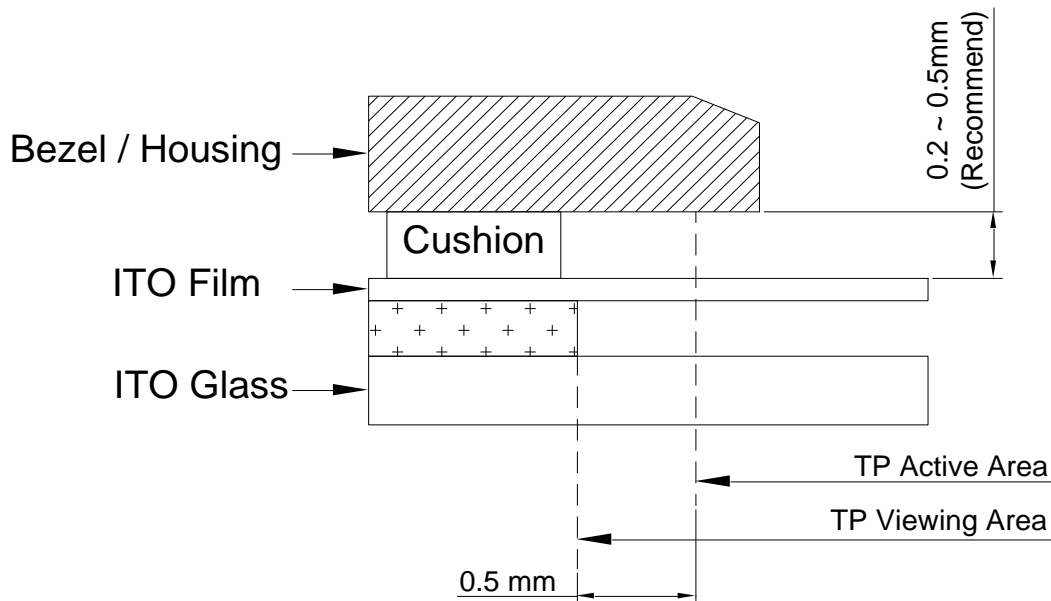
The corner part has conductivity. Do not touch any metal part after mounting.
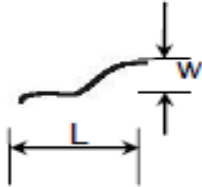
Others

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. Inspection standard

No	Item	Criterion	
01	Outline Dimension	In accord with drawing	
02	Position-finding Dimension Assemble Dimension	In accord with drawing	
03	LCD black spots, white spots (Round type)	Round type: non display 3.1 Small area LCD Unit : mm | Dimension	Qualified Quantity
---	---
D≤0.1	Ignore
0.1<D≤0.15	2
D>0.15	0 | 3.2 Large area LCD | Dimension	Qualified Quantity
---	---
D≤0.1	Ignore
0.1<D≤0.15	2
0.15<D≤0.20	1
D>0.20	0	 C-STN : if D>0.1 , unqualified	
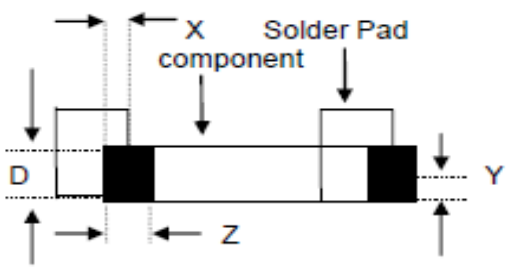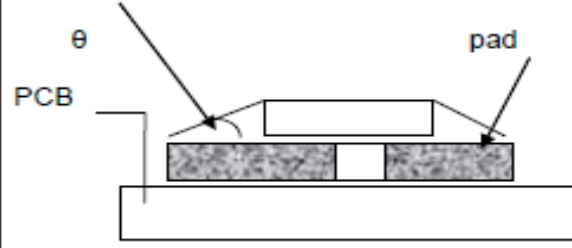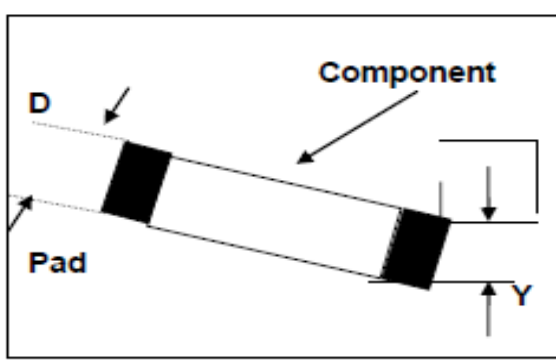
04	LCD black spots, white spots (Line Style)	4.1 Small area LCD Unit : mm		

4.1 Small area LCD

Length	Width	Qualified Quantity
-	≤0.015	Ignore
≤1.0	0.015<W≤ 0.025	2
≤2.0		1
≤1.0	0.025<W≤ 0.05	1
-	D>0.05	According to circle

4.2 Large area LCD

Length	Width	Qualified Quantity
-	≤0.015	Ignore
≤2.0	0.015<W≤ 0.025	2
≤1.0	0.025<W≤ 0.05	1
-	D>0.05	According to circle

CSTN : If W ≥ 0.015 , unqualified
Ignore beyond viewing area

05	LCD Scratch 、 Threadlike Fiber	Same to NO.3 circle sightline and surface of LCD is vertical (2)Same to NO.3 line style
06	POL	It is not admissible that POL is beyond the edge of glass, else, unqualified. It is essential that POL is over the 50 percent of width of frame , else ,unqualified. According to the drawing in case of special definition.
07	IC/FPC Bonding	Scratch	Reject

		Intensity Of Adhesion	If lower than specification, reject	
		Gold Fold Twist	Reject	
07	IC/FPC Bonding	Silicon	According to outline, no gold outside, seal can not be higher than LCD	
		FPC Gold Sever	Reject	
08	SMT	Lack of Component、Polarity Inverse	If exist, reject	
		Leak Solder、Virtual Solder	If exist, reject	
		Short Circuit In Solder Point	If exist, reject	
		Tin Ball	If exist, reject	
		Tin Acumination	If visual, reject	
		Height Solder Point	If higher 0.5mm than component. reject	
		Height of component	Either side higher 0.5mm than component, reject	

		Component Shift	 X<3/4Z　　　reject y＞1/3D　　　reject	
08	SMT	Few Tin	 If　θ≤20°　reject	
		Component Deflection	 If　Y>1/3D　reject	
		Component Carcass Sideways	Reject	

		Component Carcass Sideways	If exist with visual inspection , reject	
		Lot Tin	A: Tin accrete the solder side completely , hollowly ,Ok B: Tin accrete the solder side completely , full circle arc , ok C: Jointing include whole solder side, height of tin>50 percent of height of component, reject	
		Few Tin	A: Tin accrete the solder side completely , hollowly ,Ok B: height of tin > 1/3 of solder side of component , ok C: height of tin ⩽ 1/3 of solder side of component, reject	
08	SMT	Normal Jointing side		
09	Light	Short circuit 、Open circuit	Forbid	
		Quality of CSTN Display	1、Rolling strake with visual inspection, forbid 2、Differentness of color in viewing area with visual inspection (full white、red、green、blue), forbid 3、Display change with visual inspection , forbid	