Hunan Huayuan display technology CO.,LTD

TFT153A

3.5inchTFT
SPECIFICATION

Standard code	Department	Rev No.
HY480320-3.5TP02		A/0
Checked by	**Written by**	**Date**
		2015-03

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2. Revision Record

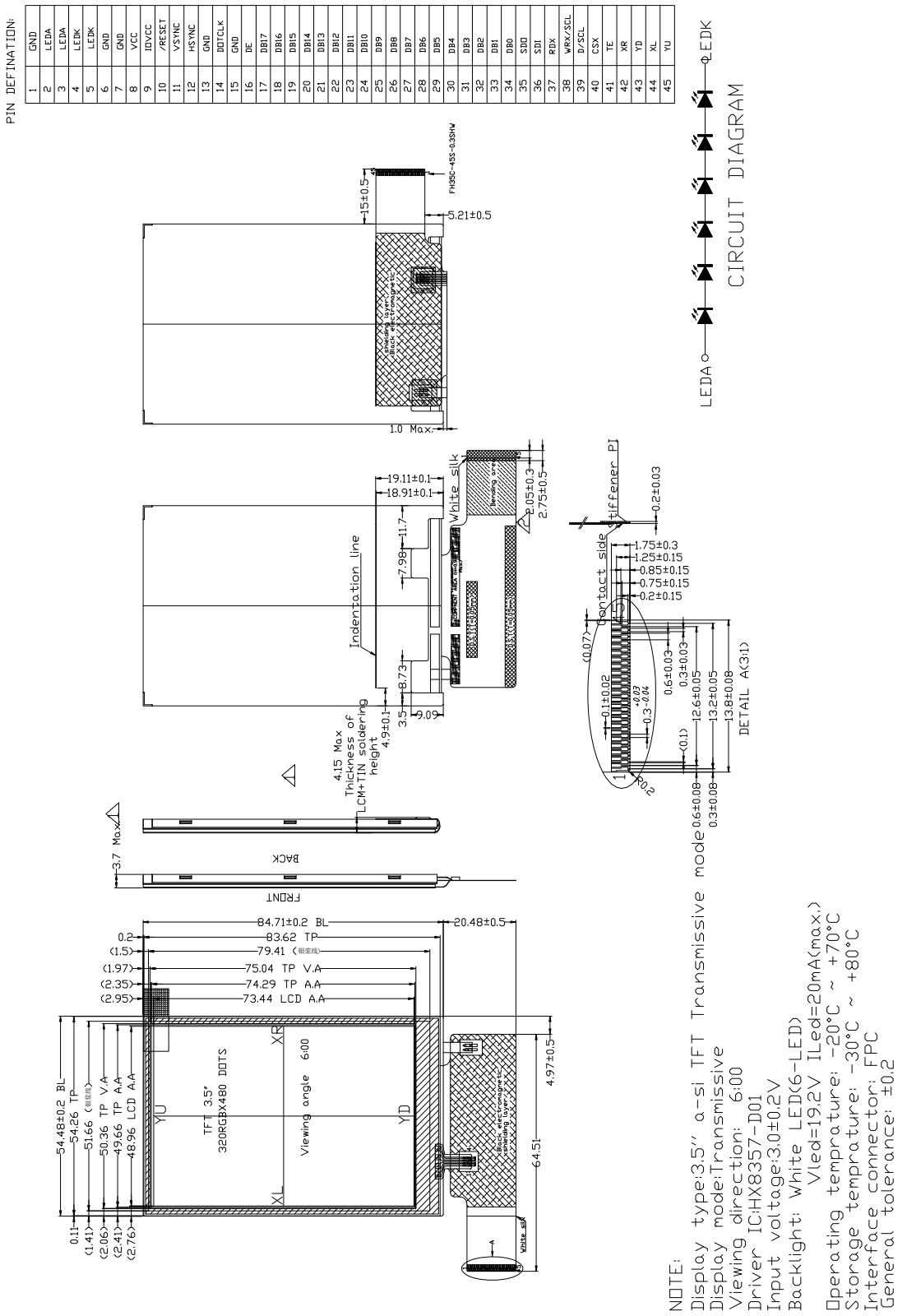
Date	Rev.No.	Page	Revision Items	Prepared
2014-04-16	**V0**		**The first release**	
2014-05-15	**V1**	**4**	**Update the White silk of FPC**	
2014-07-24	**V2**	**8**	**Add Interface description of choice**	
2014-08-11	**V3**		**Change the interface of definition**	

3. General Specifications

TFT153A is a TFT-LCD module. It is composed of a TFT-LCD panel, driver IC, FPC, a back light unit. The 3.5″ display area contains 320 x 480pixels and can display up to 16.7M colors. This product accords with RoHS environmental criterion.

Item	Contents	Unit	Note
LCD Type	TFT	-	
Display color	16.7M		
Viewing Direction	6	O'Clock	
Grey scale inversion	12	O'Clock	
Operating temperature	-20~+70	℃	
Storage temperature	-30~+80	℃	
Module size	Refer to outline drawing	mm	
Active Area(W×H)	48.96X73.44	mm	
Number of Dots	320×480	dots	
Controller	HX8357D01	-	
Power Supply Voltage	2.8	V	
Outline Dimensions	Refer to outline drawing	-	
Backlight	6-LEDs (white)	pcs	
Weight	---	g	
Interface	RGB666	-	

4. Outline Drawing



5. Absolute Maximum Ratings(Ta=25℃)

5.1 Electrical Absolute Maximum Ratings.(Vss=0V ,Ta=25℃)

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{CC}	2.6	3.3	V	1，2
Logic Signal Input /Output Voltage	V_{IOVCC}	1.8	3.3	V	

Notes:

1. If the module is above these absolute maximum ratings. It may become permanently damaged. Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability.
2. V_{CC} >V_{SS} must be maintained.

5.2 Environmental Absolute Maximum Ratings.

Item	Storage		Operating		Note
	MIN.	MAX.	MIN.	MAX.	
Ambient Temperature	-30℃	80℃	-20℃	70℃	1,2
Humidity	-	-	-	-	3

1. The response time will become lower when operated at low temperature.
2. Background color changes slightly depending on ambient temperature.
   The phenomenon is reversible.
3. Ta<=40℃:85%RH MAX.
   Ta>=40℃:Absolute humidity must be lower than the humidity of 85%RH at 40℃.

6. Electrical Specifications and Instruction Code

6.1 Electrical characteristics(Vss=0V ,Ta=25℃)

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Note
Power supply		VCC	Ta=25℃	2.6	2.8	3.3	V	
Input voltage	'H'	V_{IH}	V_{CC}=2.8V	0.8V_{CC}	-	V_{CC}	V	
	'L'	V_{IL}	V_{CC}=2.8V	0	-	0.2V_{CC}	V	
Current Consumption		I_{CC1}	Normal mode	-	20	30	mA	1
		I_{CC2}	Sleep mode	-	0.05	0.1	mA	1

Note:

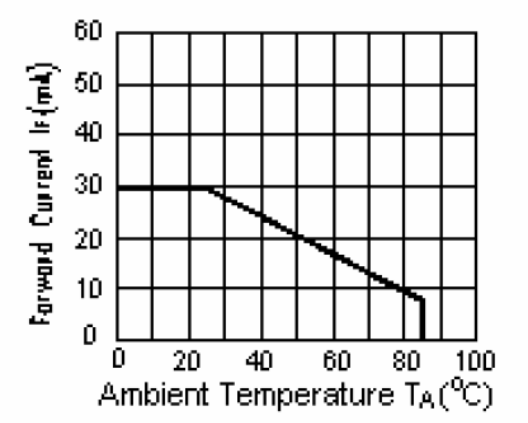
1: Tested in 1×1 chessboard pattern.

6.2 LED backlight specification(VSS=0V ,Ta=25℃)

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Supply voltage	Vf	If=20mA	-	18	-	V	
Uniformity	∆ Bp	If=20mA	80			%	
Luminance for LCD(w/o TP)	Lv	If=20mA		320		Cd/m2	
Life Time	time	If=20mA		30000		hours	1

Note:

1：The"LED Life time" is defined as the module brightnees decrease to 50% original brightness at T=25℃ and I_{LED} =20mA. TheLED Life time could be decreased if operating I_{LED} is larger than 20mA



ILED VS TEMP

Pin No.	Symbol	I/O	Function
1	GND	P	Ground.
2	VLED+	P	LED back light(Anode)
3	VLED+	P	LED back light(Anode)
4	VLED-	P	LED back light(Cathode)
5	VLED-	P	LED back light(Cathode)
6	GND	P	Ground.
7	GND	P	Ground.
8	VCC	P	Power supply
9	IOVCC	P	Power supply
10	RESET	I	Reset the display
11	VSYNC	I	Frame sync signal
12	HSYNC	I	Line sync signal
13	GND	P	Ground.
14	DLK	I	Data clock
15	GND	P	Ground.
16	DE	I	Data enable pin
17-22	DB17-DB12	I	Red data bus
23-28	DB11-DB6	I	Green data bus
29-34	DB5-DB0	I	Blue data bus
35	SDO	I	Serial data output pin
36	SDI	I	Serial data input pin
37	RDX	-	NC
38	SCL	I	Serial clock siginal
39	RS	I	Data or command select signal
40	CSX	I	Chip select signal
41	TE	I	Tearing effect output
42	XR	O	Touch Panel Control pin
43	YD	O	
44	XL	O	
45	YU	O	

6.3 Interface signals

NOTE:

Interface description of choice on the FPC:

When R_3 R_6 R_7=0 and R_4 R_5 R_8=NC, Select SPI+RGB interface;
When R_3 R_5 R_8=0 and R_4 R_6 R_7=NC, Select i80-system 8bit DB7-DB0 is used;
When R_4 R_5 R_8=0 and R_3 R_6 R_7=NC, Select i80-system 16bit DB15-DB0 is used;
When R_4 R_6 R_7=0 and R_3 R_5 R_8=NC, Select i80-system 9bit DB8-DB0 is used;
When R_4 R_6 R_8=0 and R_3 R_5 R_7=NC, Select i80-system 18bit DB17-DB0is used;

7.Optical Characteristics

Item	Symbol		Condition	Min.	Typ.	Max.	Unit	Note
Brightness (with TP)	Bp		θ=0° Φ=0°	-	280	-	Cd/m^2	1
Uniformity	⊿Bp			80		-	%	1,2
Viewing Angle	3:00		Cr≥10	-	70	-	Deg	3
	6:00			-	70	-		
	9:00			-	70	-		
	12:00			-	60	-		
Contrast Ratio	Cr		θ=0° Φ=0°	300	500		-	4
Response Time	T_r			-	10	-	ms	5
	T_f			-	10	-	ms	
Color of CIE Coordinate	W	x	θ=0° Φ=0°		0.30		-	1,6
		y			0.33		-	
	R	x			0.63		-	
		y			0.33		-	
	G	x			0.28		-	
		y			0.55		-	
	B	x			0.14		-	
		y			0.12		-	
NTSC Ratio	S			-	60	-	%	

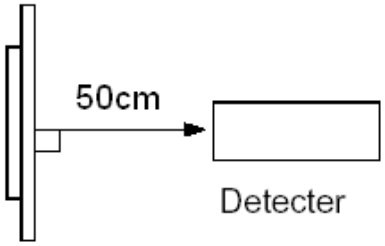
Note：The parameter is slightly changed by temperature, driving voltage and materiel

Note 1: The data are measured after LEDs are turned on for 5 minutes. LCM displays full white. The brightness is the average value of 9 measured spots. Measurement equipment PR-705 (Φ8mm)

Measuring condition:

- Measuring surroundings: Dark room.
- Measuring temperature: Ta=25℃.
- Adjust operating voltage to get optimum contrast at the center of the display.

Measured value at the center point of LCD panel after more than 5 minutes while backlight turning on.

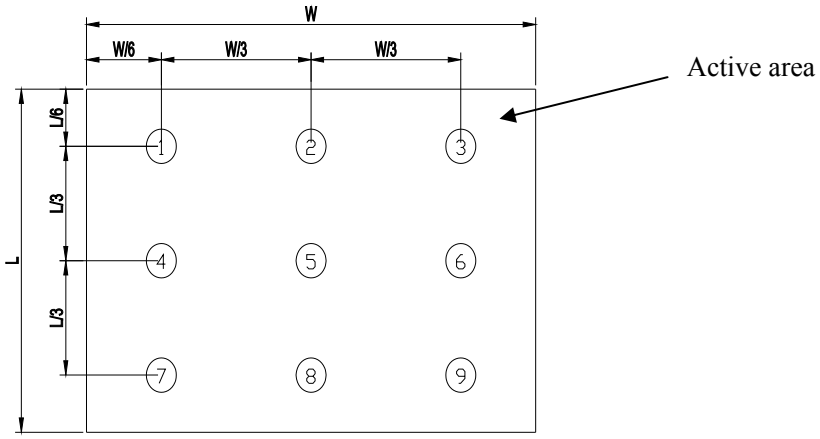


Note 2: The luminance uniformity is calculated by using following formula.

⊿Bp = Bp (Min.) / Bp (Max.)×100 (%)

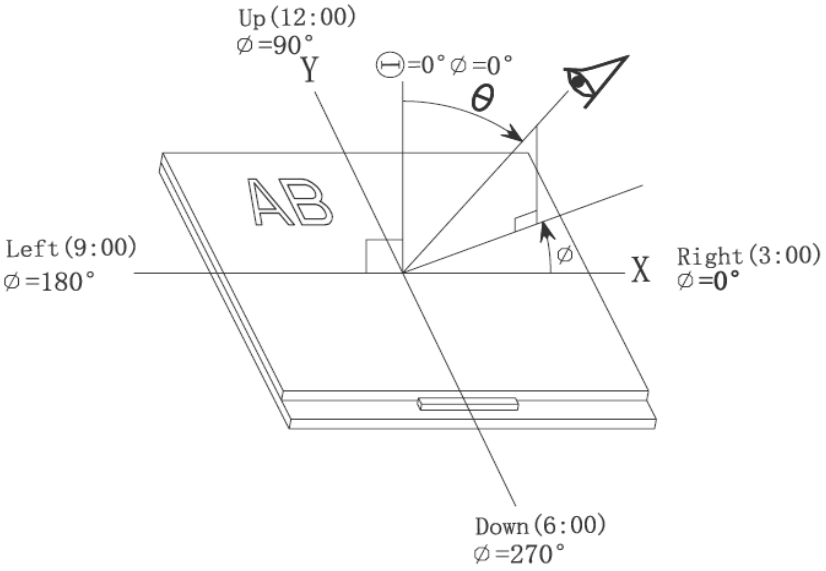
Bp (Max.) = Maximum brightness in 9 measured spots

Bp (Min.) = Minimum brightness in 9 measured spots.

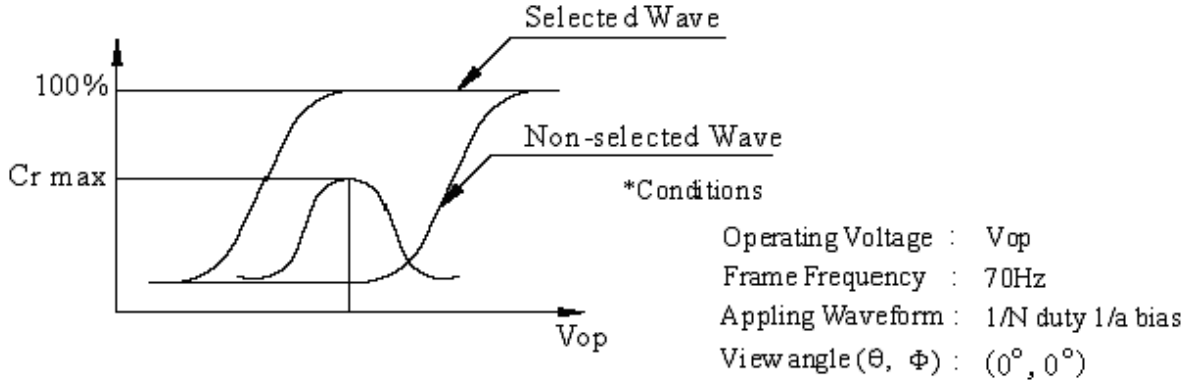


Note 3: The definition of viewing angle:

Refer to the graph below marked by *θ* and *Φ*



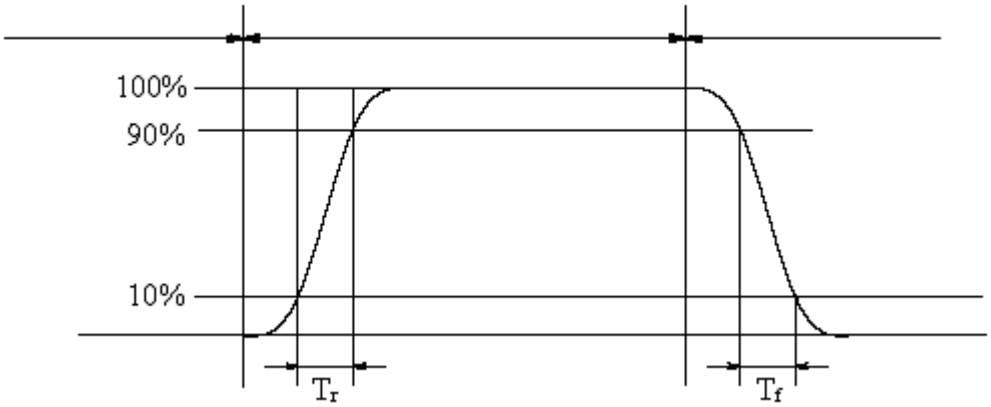
Note 4: Definition of contrast ratio.(Test LCD using DMS501)



$$Contrast\ ratio(Cr) = \frac{Brightness\ of\ selected\ dots}{Brightness\ of\ non-selected\ dots}$$

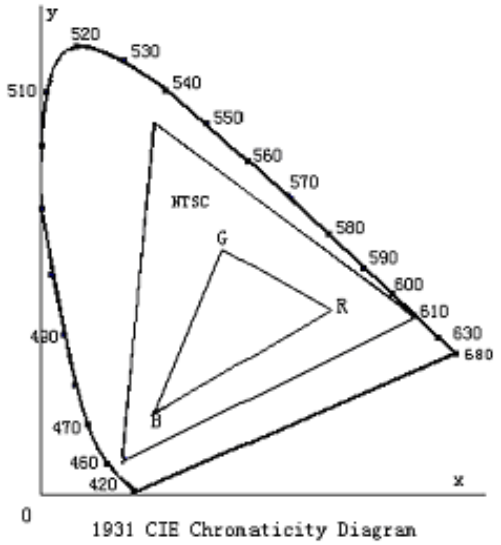
Note 5: Definition of Response time. (Test LCD using DMS501):

The output signals of photo detector are measured when the input signals are changed from “black” to “white”(falling time) and from “white” to “black”(rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes.Refer to figure as below.



The definition of response time

Note 6: Definition of Color of CIE Coordinate and NTSC Ratio.



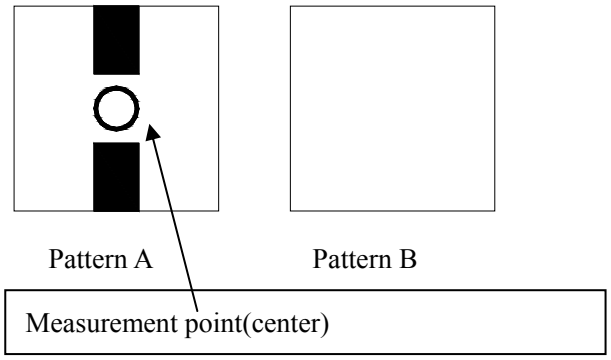
1931 CIE Chromaticity Diagran

Color gamut:

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

Note 7: Definition of cross talk.

Cross talk ratio(%)=|pattern A Brightness-pattern B Brightness|/pattern A Brightness*100



Electric volume value=3F+/-3Hex

8. Reliability Test Items and Criteria

No	Test Item	Test condition	Criterion
1	High Temperature Storage	80℃±2℃ 96H Restore 2H at 25℃ Power off	1. After testing, cosmetic and electrical defects should not happen. 2. Total current consumption should not be more than twice of initial value.
2	Low Temperature Storage	-30℃±2℃ 96H Restore 2H at 25℃ Power off	
3	High Temperature Operation	70℃±2℃ 96H Restore 2H at 25℃ Power on	
4	Low Temperature Operation	-20℃±2℃ 96H Restore 4H at 25℃ Power on	
5	High Temperature/Humidity Operation	60℃±2℃ 90%RH 96H Power on	
6	Temperature Cycle	-30℃←→80℃ 30min 5min 30min after 5 cycle, Restore 2H at 25℃ Power off	
7	Vibration Test	10Hz~150Hz, 100m/s^2, 120min	Not allowed cosmetic and electrical defects.
8	Shock Test	Half- sine wave,300m/s^2,11ms	

Note: Operation: Supply 2.8V for logic system.

The inspection terms after reliability test, as below

ITEM	Inspection
Contrast	CR>50%
IDD	IDD<200%
Brightness	Brightness>60%
Color Tone	Color Tone+/-0,05

9 Quality level

9.1 Classification of defects

Major defects (MA): A major defect refers to a defect that may substantially degrade usability for product applications, including all functional defects(such as no display, abnormal display, open or missing segment, short circuit, missing component), outline dimension beyond the drawing, progressive defects and those affecting reliability.

Minor defects (MI): A minor defect refers to a defect which is not considered to be able to substantially degrade the product application or a defect that deviates from existing standards almost unrelated to the effective use of the product or its operation, such as black spot, white spot, bright spot, pinhole, black line, white line, contrast variation, glass defect, polarizer defect, etc.

9.2 Definition of inspection range

For dot defect of TFT LCD which is not smaller than 3 inches, dividing three areas to make a judgment (according to figure 1).

A area : center of viewing area

B area : periphery of viewing area

C area : Outside viewing area

For other defects, dividing two areas to make a judgment (according figure 2).

A zone : Inside Viewing area

B zone : Outside Viewing area

X1(A.A~V.A): 2mm X2(A.A~V.A): 2mm

Y1(A.A~V.A): 2mm Y2(A.A~V.A): 2mm

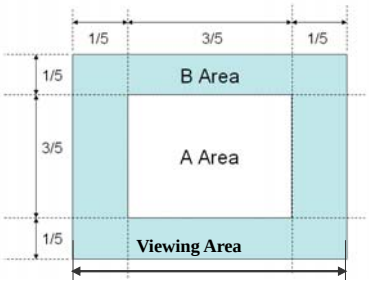


Figure 1

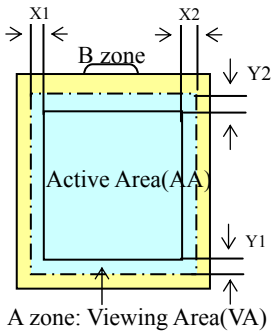


Figure 2

9.3 Inspection items and general notes

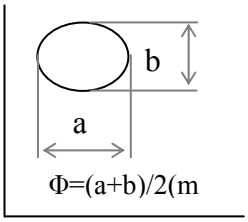
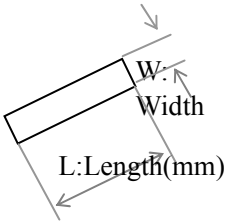
General notes	Should any defects which are not specified in this standard happen, additional standard shall be determined by mutual agreement between customer and TIANMA. Viewing area should be the area which TIANMA guarantees. Limit sample should be prior to this Inspection standard. Viewing judgment should be under static pattern. Inspection conditions Inspection distance: 250 mm (from the sample) Temperature : 25±5 ºC Inspection angle : 45 degrees in 6 o'clock direction (all defects in viewing area should be inspected from this direction)	
Inspection items	Pinhole, Bright spot, Black spot, White spot, Black line, White Line, Foreign particle, Bubble	The color of a small area is different from the remainder. The phenomenon doesn't change with voltage
	Contrast variation	The color of a small area is different from the remainder. The phenomenon changes with voltage
	Polarizer defect	Scratch, Dirt, Particle, Bubble on polarizer or between polarizer and glass

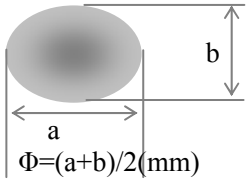
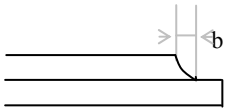
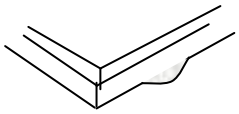
	Dot defect (TFT LCD)	The pixel appears bright or dark abnormally when display
	Functional defect	No display, Abnormal display, Open or missing segment, Short circuit, False viewing direction
	Glass defect	Glass crack, Shaved corner of glass, Surplus glass
	PCB defect	Components assembly defect

9.4 Outgoing Inspection level

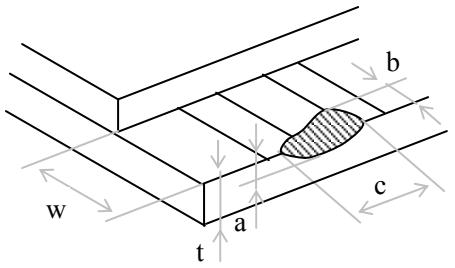
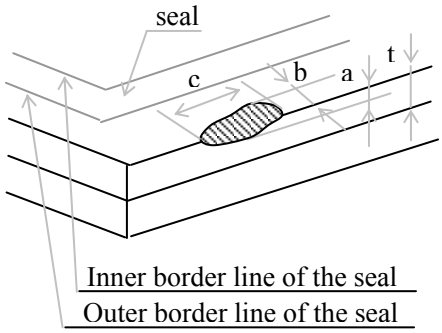
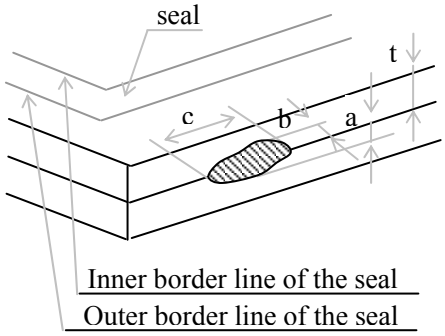
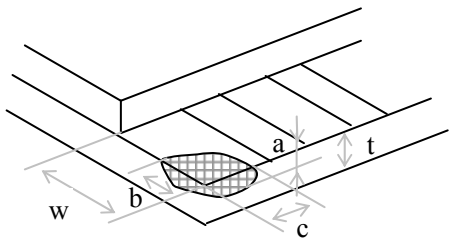
Outgoing Inspection standard	Inspection conditions	Inspection				
		Min.	Max.	Unit	IL	AQL
Major Defects	See 9.3 general notes	See 9.5			II	0.65
Minor Defects	See 9.3 general notes	See 9.5			II	0.65
Note：Sampling standard conforms to GB2828						

9.5 Inspection Items and Criteria

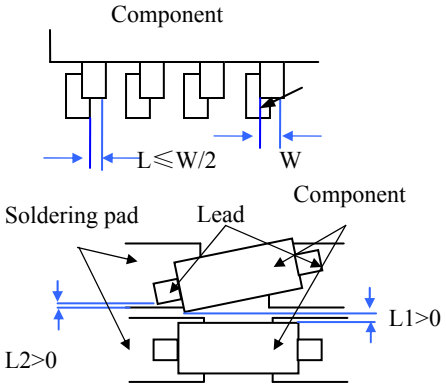
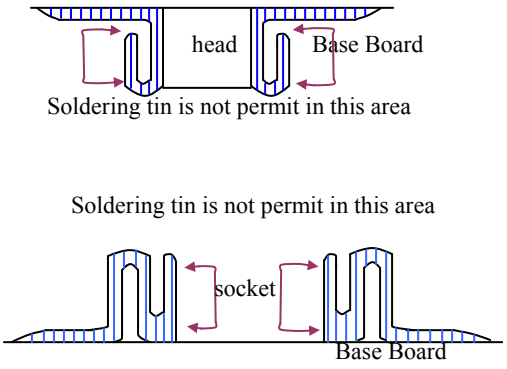
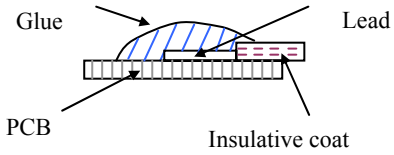
Inspection items			Judgment standard			
			Category		Acceptable number	
					A zone	B zone
1	Black spot, White spot, Pinhole, Foreign Particle, Particle in or on glass, Scratch on glass		A	Φ<=0.10	Neglected	Neglected
			B	0.10<Φ<=0.2	1	
			C	0.2<Φ	0	
			D	-	-	
			Total defective point(B,C)		1	
2	Black line, White line, and Particle Between Polarizer and glass, Scratch on glass		A	W<=0.02	Neglected	Neglected
			B	0.02<W<=0.03 L<=1.0	1	
			C	0.03<W<=0.05 L>1.0	0	
			D	0.05<W, 1.0<L	0	
			Total defective point(B,C)		1	
3	Bright spot		any size		none	none
4	Contrast		A	Φ<0.2	Neglected	Neglecte

	variation		B	0.2<Φ<=0.3	2	d
			C	0.3<Φ<=0.4	1	
			D	0.4<Φ	0	
			Total defective point(B,C)		3	
5	Bubble inside cell		any size		none	none
6	Polarizer defect (if Polarizer is used)	Scratch ,damage on polarizer, Particle on polarizer or between polarizer and glass.	Refer to item 1 and item 2.			
		Bubble, dent and convex	A	Φ<=0.1	Neglected	Neglected
			B	0.1 <Φ<=0.2	1	
			C	0.2 <Φ	0	
7	Surplus glass	Stage surplus glass 	B<=0.3mm			
		Surrounding surplus glass 	Should not influence outline dimension and assembling.			
8	Open segment or open common		Not permitted			
9	Short circuit		Not permitted			
10	False viewing direction		Not permitted			
11	Contrast ratio uneven		According to the limit specimen			
12	Crosstalk		According to the limit specimen			
13	Black /White spot(display)		Refer to item 1			
14	Black /White line(display)		Refer to item 2			

Inspection items	Judgment standard	
	Category(application: B zone)	Acceptable number

15	Glass defect crack	i) The front of lead terminals 	A	a≤ t, b≤1/5W, c≤3mm	Max.3 defects allowed
			B	Crack at two sides of lead terminals should not cover patterns and alignment mark	
		ii) Surrounding crack-non-contact side 	b < Inner borderline of the seal		
		iii) Surrounding crack- contact side 	b < Outer borderline of the seal		
		iv) Corner 	A	a <= t, b <= 3.0, c <= 3.0	
			B	Glass crack should not cover patterns u and alignment mark and patterns.	

Inspection items	Judgment standard
	Category(application: B zone)

16	PCB defect	Component soldering: No cold soldering、short、open circuit、burr、tin ball The flat encapsulation component position deviation must be less than 1/3 width of the pin (Pic.1)； the sheet component deviation: Pin deviates from the pad and contact with the near components is not permitted（Pic.2）	
		lead defect: The lead lack must be less than 1/3 of its width; The lead burr must be less than 1/3 of the seam; Impurities connect with the near leads is not permitted	
		Connector soldering: Soldering tin is at contact position of the plug and socket is not permitted No foundation is scald Serious cave distortion on plug and socket contact pin is not permitted	
		Glue on root of the speaker receiver and motor lead: The insulative coat of the lead must join into the PCB; the protected glue must envelop to the insulative coat.	

10. Precautions for Use of LCD Modules

10.1 Handling Precautions

10.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

10.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

10.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

10.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

10.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

— Isopropyl alcohol

— Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

— Water

— Ketone

— Aromatic solvents

10.1.6 Do not attempt to disassemble the LCD Module.

10.1.7 If the logic circuit power is off, do not apply the input signals.

10.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

a. Be sure to ground the body when handling the LCD Modules.

b. Tools required for assembly, such as soldering irons, must be properly ground.

c. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

d. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

10.2 Storage precautions

10.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

10.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : 0℃ ～ 40℃

Relatively humidity: ≤80%

10.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

10.3 The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.