

SPECIFICATION

FOR TFT+TP MODULE

MODEL NO:	TM070RVHG01
CUSTOMER:	
CUSTOMER P/N.	
VERSION	V0.1
CUSTOMER APPROVED	

- ☒ Preliminary specification
☐ Final specification

PREPARED BY	CHECKED BY	VERIFIED BY QA DEPT.	APPROVED BY

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TFT+TP REVISION RECORD

Version	Page	Revision Items	Name	Date
0.1		First release	JIM	2013.02.25

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1 General Specifications

TM070RVHG01 is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver IC with CABC function, FPC, a back light unit and CTP (Capacitive Touch Panel) with Multi-Touch function. The mounting method is with optical bonding . This product accords with RoHS environmental criterion.

Item	Feature	Spec	Unit	Note
TFT	Size	7	inch	--
	Resolution	800(RGB) x 480	--	--
	Interface	RGB 24 bits	--	--
	Color Depth	16.7M	--	--
	Technology Type	a-Si	--	--
	Pixel Pitch	0.1926x0.179	mm	--
	Pixel Configuration	R.G.B. Vertical Stripe	--	--
	Display Mode	TM with Normally White	--	--
	Surface Treatment(Up Polarizer)	Anti-Glare(3H)	--	--
	Viewing Direction	12 o'clock	--	1
	Gray Scale Inversion Direction	6 o'clock	--	--
	LCM (W x H x D)	164.90x100x5.7	mm	--
TP	Operation Technology	Projected capacitive	--	--
	Control IC	NT11003	--	--
	Input Method	Bare finger	--	--
	Number of simultaneous touches	2 points	--	--
	Surface hardness	---	--	--
	Minimum Touch Area	Φ6	mm	--
	Finger Pitch	13	mm	--
	Product structure	Glass Lens - Glass Sensor	--	2
	Interface	I2C		
Mechanical Characteristics	TFT Active Area	154.08x85.92	mm	--
	TP Active Area	155.24(W) x 87.12(H)	mm	--
	LED Numbers	24 LEDs	--	--
	Weight	--	g	--

Reliability Characteristics	Operation temperature	-20~70	°C	--
	Storage temperature	-30~80	°C	--

Note 1: Viewing direction for best image quality is different from Gray Scale Inversion Direction, there is a 180 degree shift.

Note 2: Requirements on Environmental Protection: RoHS

2. Input/Output Terminals

2.1 TFT CN1 pin assignment

Connector type: FH28-60S-0.5SH

PIN	Symbol	I/O	Description	Remark
1	VLED+	P	Led anode	
2	VLED+	P	Led anode	
3	VLED-	P	Led cathode	
4	VLED-	P	Led cathode	
5	GND	P	Ground	
6	VCOM	P	Common voltage input	
7	VCC	P	Digital power supply	
8	MODE	I	DE/SYNC mode select. H:DE mode, L:SYNC mode	
9	DE	I	Data enable signal, active high to enable data,if not used,please pull low	
10	VSNC	I	Vertical sync input, negative polarity,if not used,please pull High	
11	HSNC	I	Horizontal sync input, negative polarity,if not used,please pull High	
12	B7	I	Blue data (MSB)	
13	B6	I	Blue data	
14	B5	I	Blue data	
15	B4	I	Blue data	
16	B3	I	Blue data	
17	B2	I	Blue data	
18	B1	I	Blue data	
19	B0	I	Blue data (LSB)	
20	G7	I	Green data (MSB)	
21	G6	I	Green data	
22	G5	I	Green data	
23	G4	I	Green data	
24	G3	I	Green data	
25	G2	I	Green data	
26	G1	I	Green data	
27	G0	I	Green data (LSB)	
28	R7	I	Red data (MSB)	
29	R6	I	Red data	
30	R5	I	Red data	
31	R4	I	Red data	
32	R3	I	Red data	
33	R2	I	Red data	
34	R1	I	Red data	
35	R0	I	Red data (LSB)	
36	GND	P	Ground	
37	DCLK	I	Clock for input data	
38	GND	P	Ground	
39	LR	I	Source left or right sequence control	

40	UD	I	Gate up or down scan control	
41	VGH	P	Positive power of TFT	
42	VGL	P	Negative power of TFT	
43	AVDD	P	Analog power supply	
44	RESET	I	Global reset pin	
45	NC	NC		
46	VCOM	P	Common voltage input	
47	DITHB	I	Dithering setting. H: 6bit resolution, L: 8bit resolution	
48	GND	P	Ground	
49	NC	NC		
50	NC	NC		

Note1: I/O definition.

I---Input, O---Output, P--- Power/Ground, N--- No connection

Note2:

Scan control input		Scanning direction
UD	LR	
GND	VCC	Up to down, left to right
VCC	GND	Down to up, right to left
GND	GND	Up to down, right to left
VCC	VCC	Down to up, left to right

2.2 TP pin assignment

Pin No.	Symbol	I/O	Description	Remark
1	SCL	I	I2C clock input	
2	SDA	I/O	I2C data input and output	
3	GND	P	Groud	
4	GND	P	Groud	
5	ATTN	I/O	External interrupt to the host	
6	GND	P	Groud	
7	VPP	I/O	External interrupt from the host	
8	VDD	P	CTP power supply	
9	GND	P	Groud	
10	GND	P	Groud	

3. Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Remark
Power Voltage	VDD	-0.50	5.00	V	
	AVDD	-0.50	15.00	V	
	VGH	-0.30	42.00	V	
	VGL	-20.0	0.30	V	
	VGH-VGL	-0.30	40.00	V	
Backlight Forward Current	ILED	-	200	mA	
Operating Temperature	TOPR	-20	70	℃	Note2
Storage Temperature	TSTG	-30	80	℃	

Table 3.1 absolute maximum rating

Note1: The parameter is for driver IC (gate driver, source driver) only

Note2: 80℃ is the surface temperature of module

Electrical Characteristics

4.1 .1Driving TFT LCD Panel

Ta = 25℃

Item	Symbol	Min	Typ	Max	Unit	Remark
Voltage for logic circuit	VCC	3.00	3.30	3.60	V	
Analog Supply Voltage	AVDD	9.88	10.4	10.92	V	
Gate On Voltage	VGG	14.4	16	17.6	V	
Gate Off Voltage	VEE	-7.70	-7.00	-6.30	V	
Common Electrode Driving Signal	VCOM	3.68	3.70	3.72	V	
Input Signal Voltage	Low Level	VIL	0	-	0.3xVCC	V
	High Level	VIH	0.7xVCC	-	VCC	V

Table 4.1 LCD module electrical characteristics

Note1: For different LCM, the value may have a bit of difference.

Note2: To test the current dissipation, use “all Black Pattern”.

4.1.2 TFT Driving Backlight

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
Forward Voltage	VLED	I _F =160mA	--	9.6	10.8	V	Note 1
Forward Current	I _F	-	-	160	200	mA	
Backlight Power Consumption	WBL	I _F =160mA	--	1536	2160	mW	
Life Time	-	I _F =160mA	10,000	-	-	Hrs	Note 3

Table 4.2 LED backlight characteristics

Note 1: I_F is defined for one channel LED. There are total three LED channels in back light unit. Under LCM operating, the stable forward current should be inputted.

Note 2: Optical performance should be evaluated at $T_a=25^{\circ}\text{C}$ only.

Note 3: If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

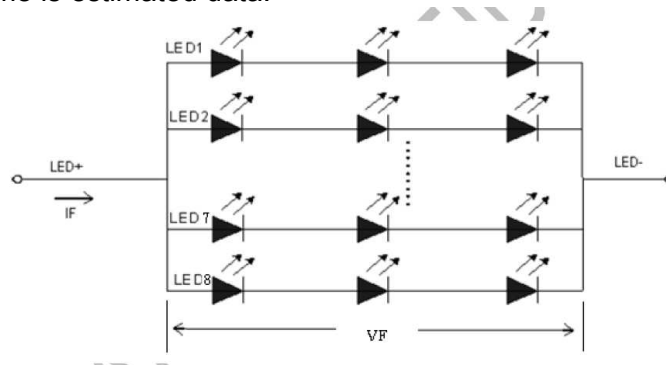


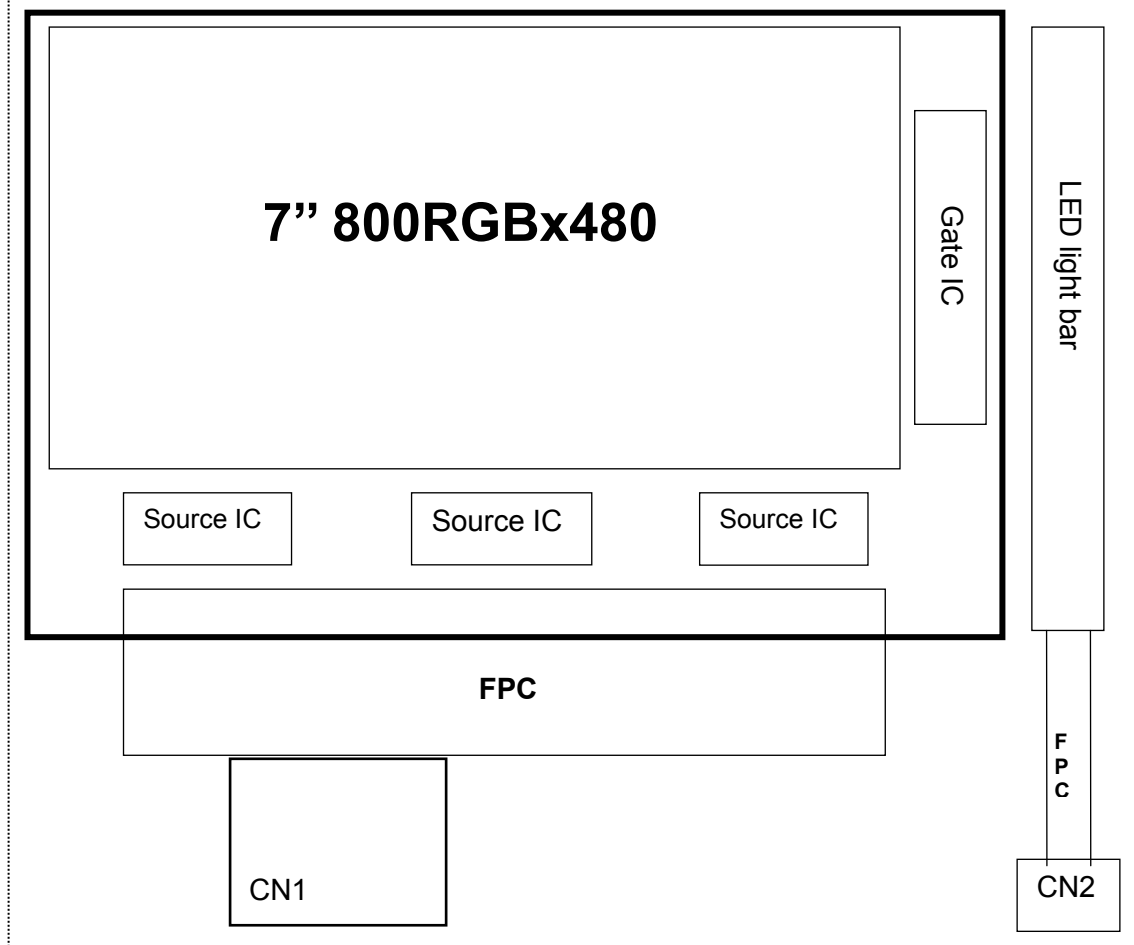
Figure 4.2 LED connection of backlight

4.2 TP DC Characteristics

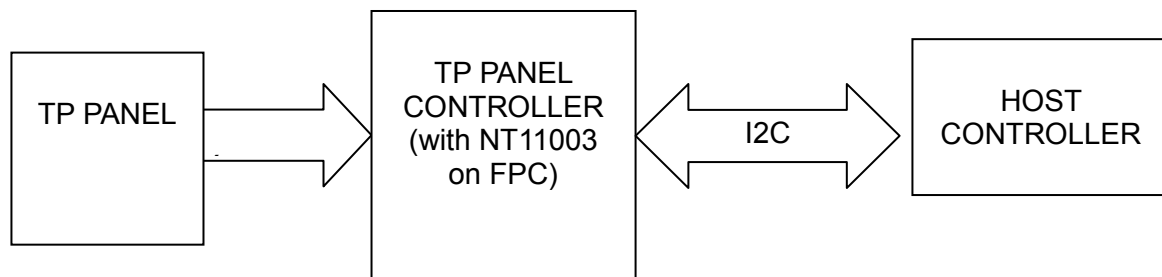
($T_A = 25^{\circ}\text{C}$, $V_{DD} = 3.3\text{V}$)

Item	Min	Typ	Max	Unit	Note
power supply voltage	2.7	3.3	3.6	V	DC(noise should be under 100mV)
Power supply current	--	--	10	mA	

4.3.1 TFT Block Diagram



4.3.2 TP Circuit Block Diagram



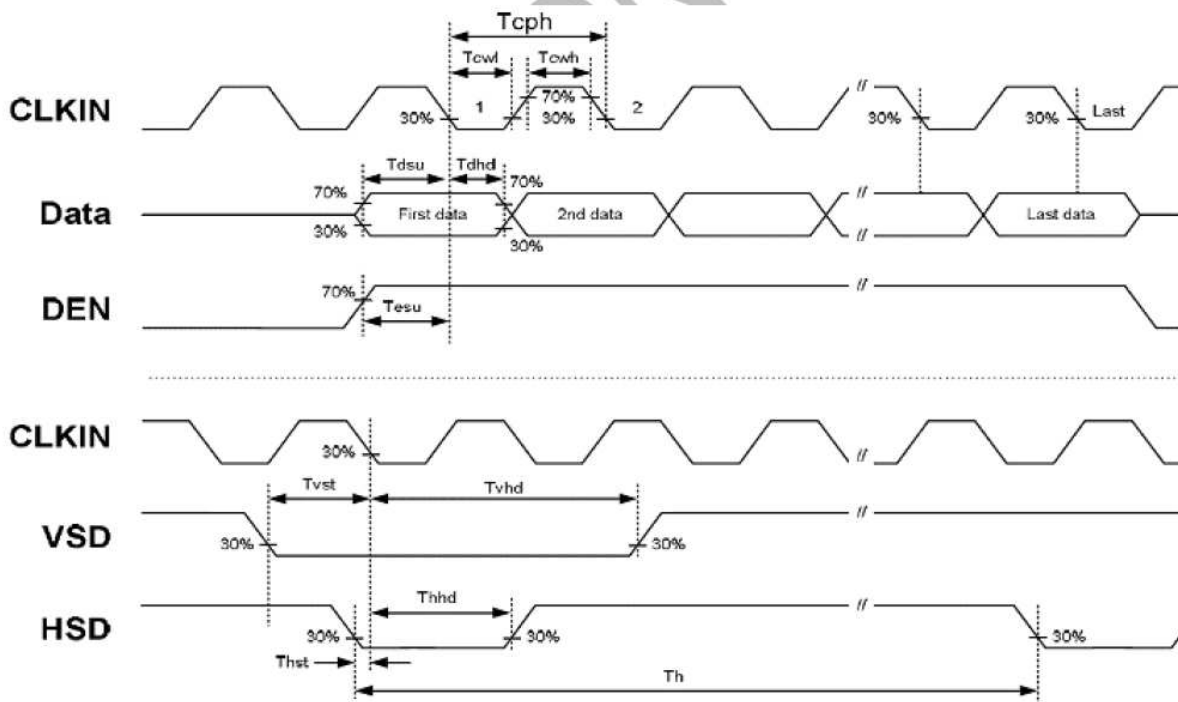
Timing Chart

5.1 TFT-LCD Input Timing

VCC=3.3V, GND=0V, Ta=25°C

Parameter	Symbol	Min	Typ	Max	Unit	Remark
DCLK frequency	F_{clk}	28	30.0	40.0	MHz	
DCLK cycle time	T_{cph}	25	33.3	36	ns	
DCLK pulse width	T_{cw}	40%	50%	60%	T_{cph}	
VS setup time	T_{vst}	8			ns	
VS hold time	T_{vhd}	8	-	-	ns	
HS setup time	T_{hst}	8			ns	
HS hold time	T_{hhd}	8	-	-	ns	
Data setup time	T_{dsu}	8			ns	Data to DCLK
Data hold time	T_{dhd}	8	-	-	ns	Data to DCLK
DE setup time	T_{esu}	8	-	-	ns	
DE hold time	T_{ehd}	8	-	-	ns	

Input Clock and Data timing Diagram:



5.2 Recommended Timing Setting Of TCON

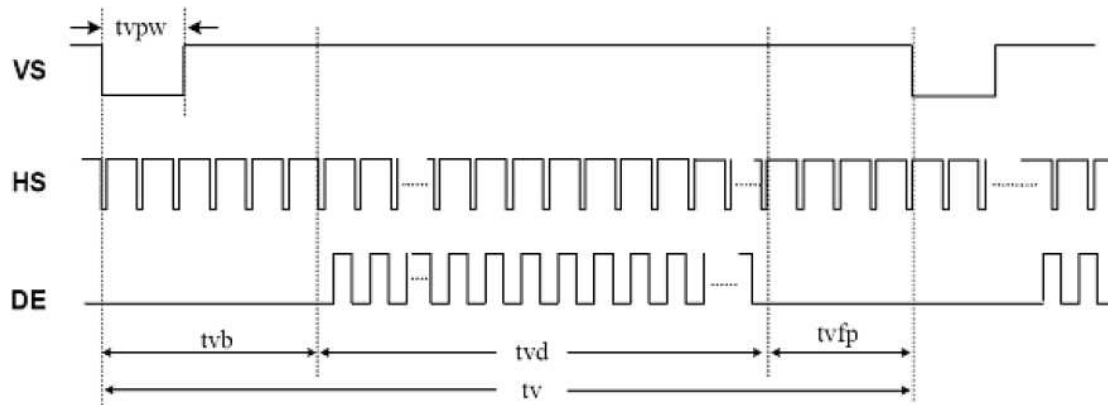
TCON (Embedded In Source IC) Input Timing (DCLK, HS, VS, DE)

VCC=3.3V, GND=0V, Ta=25°C

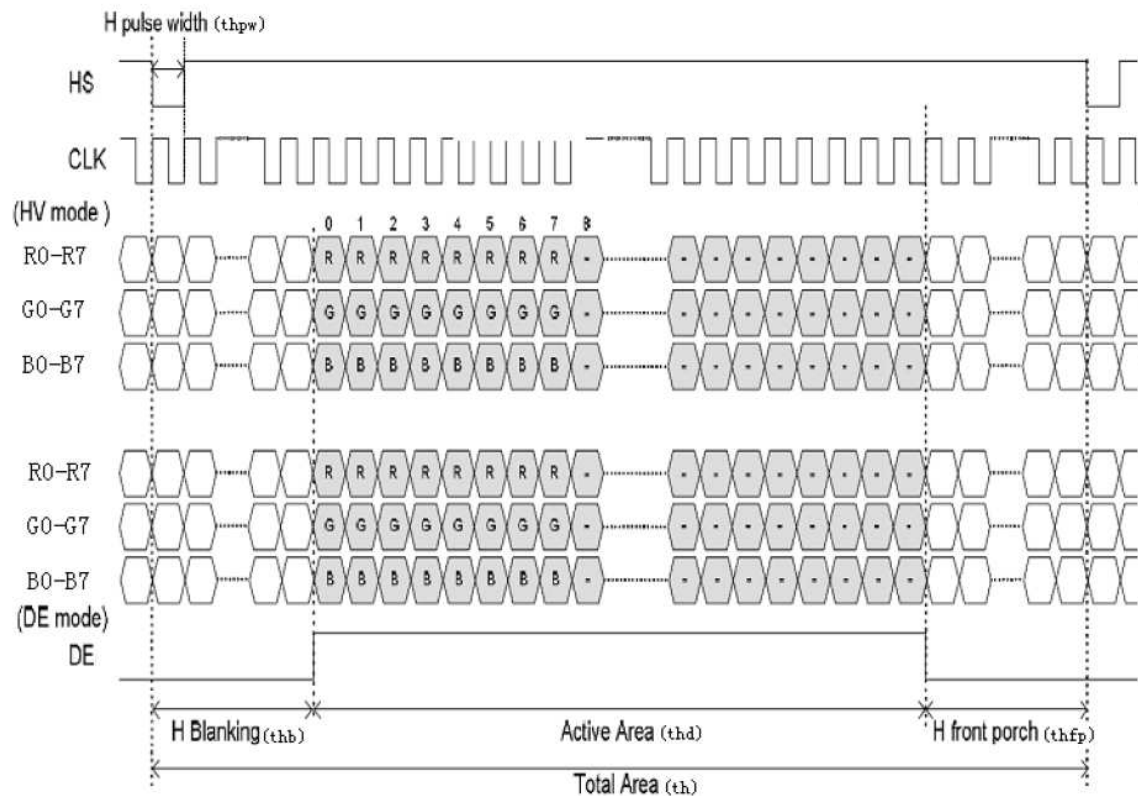
Parameter	Symbol	Min	Typ	Max	Unit	Remark
DCLK	F _{clk}	28	30	40	MHZ	
	t _{clk}	20	33.3	36	ns	
HSD	t _h	862	1056	1200	t _{clk}	
	t _{hd}	800	800	800	t _{clk}	
	t _{h_{pw}}	1	-	40	t _{clk}	
	t _{hb}	46	46	46	t _{clk}	
	t _{h_{fp}}	16	210	354	t _{clk}	
VSD	t _v	510	525	650	th	
	t _{vd}	480	480	480	th	
	t _{v_{pw}}	1	3	20	th	
	t _{vb}	23	23	23	th	
	t _{v_{fp}}	7	22	147	th	

Note 1: DE timing refer to HS, VS input timing.

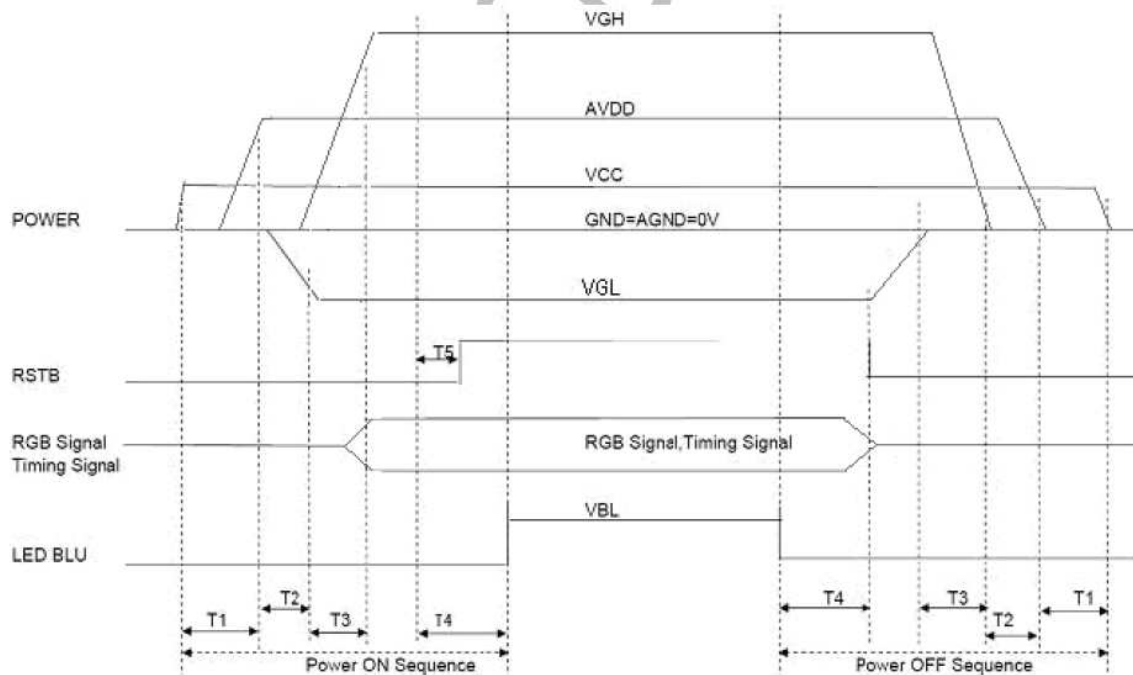
TCON Vertical Input Timing Diagram HV



TCON Horizontal Input Timing Diagram



5.3 POWER ON/OFF SEQUENCE



Note 1: $T1 \geq 20ms$, $T2 \geq 20ms$, $T3 \geq 5ms$, $T4 \geq 100ms$, $T5 \geq 5ms$.

Optical Characteristics

6.1 TFT Optical Characteristics

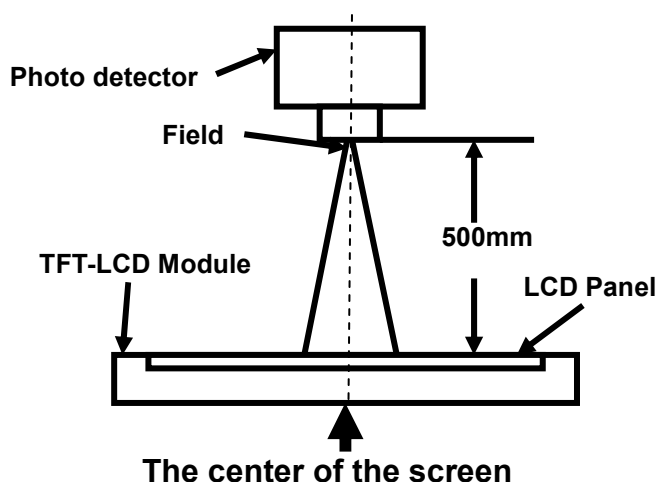
Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≧10	55	60	--	Degree	Note 2
		θB		65	70	--		
		θL		65	70	--		
		θR		65	70	--		
Contrast Ratio		CR	θ=0°	400	500	--		Left/right 0° Top/bottom 5°
Response Time		T _{ON}	25℃	--	20	30	ms	Note1 Note4
		T _{OFF}						
Chromaticity	White	x	Backlight is on	0.265	0.315	0.365		Note5 Note1
		y		0.280	0.330	0.380		
	Red	x		0.541	0.591	0.641		
		y		0.300	0.350	0.390		
	Green	x		0.298	0.348	0.388		
		y		0.521	0.571	0.621		
	Blue	x		0.101	0.151	0.211		
		y		0.051	0.101	0.151		
Uniformity		U		--	75	--	%	Note1、Note6
NTSC				--	50	--	%	
Luminance		L		240	300	--	cd/m ²	Note7

Test Conditions:

1. $I_F = 20mA$ (one channel), the ambient temperature is $25^\circ C$.
2. The test systems refer to Note 1 and Note 2.

Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 10 Minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.

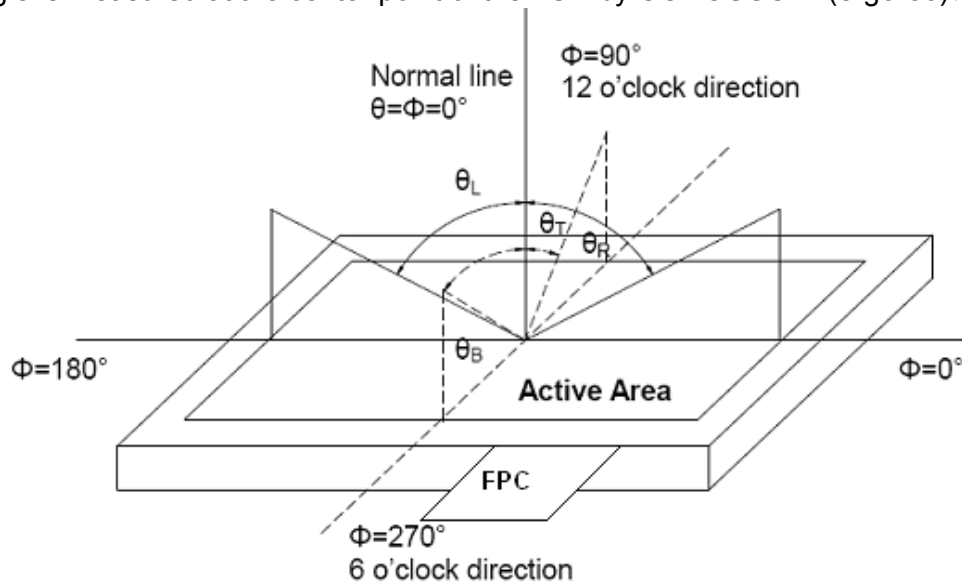


Item	Photo detector	Field
Contrast Ratio	SR-3A	1°
Luminance		
Chromaticity		
Lum Uniformity		
Response Time	BM-7A	2°

Note 2: Definition of viewing angle range and measurement system.

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viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80).



Note 3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

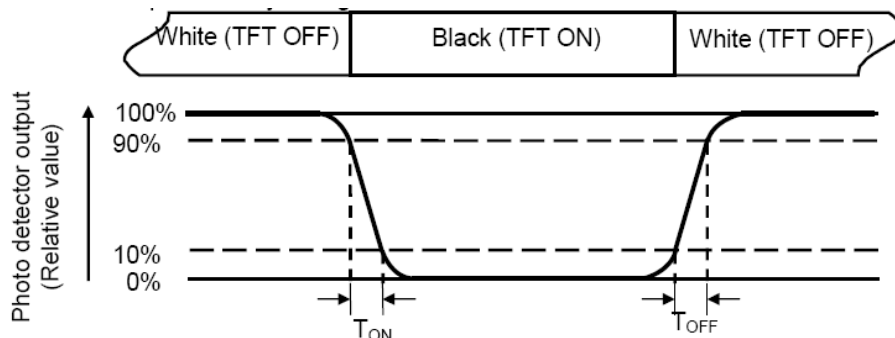
"White state ": The state is that the LCD should drive by V_{white} .

"Black state": The state is that the LCD should drive by V_{black} .

V_{white} : To be determined V_{black} : To be determined.

Note 4: Definition of Response time

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.



Note 5: Definition of color chromaticity (CIE1931)

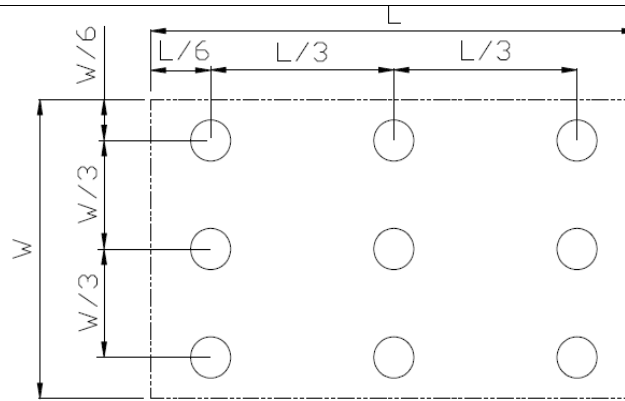
Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (U)} = L_{\text{min}} / L_{\text{max}}$$

L-----Active area length W----- Active area width



Lmax: The measured Maximum luminance of all measurement position.

Lmin: The measured Minimum luminance of all measurement position.

Note 7: Definition of Luminance:

Measure the luminance of white state at center point.

6.2 TP Optical Characteristics

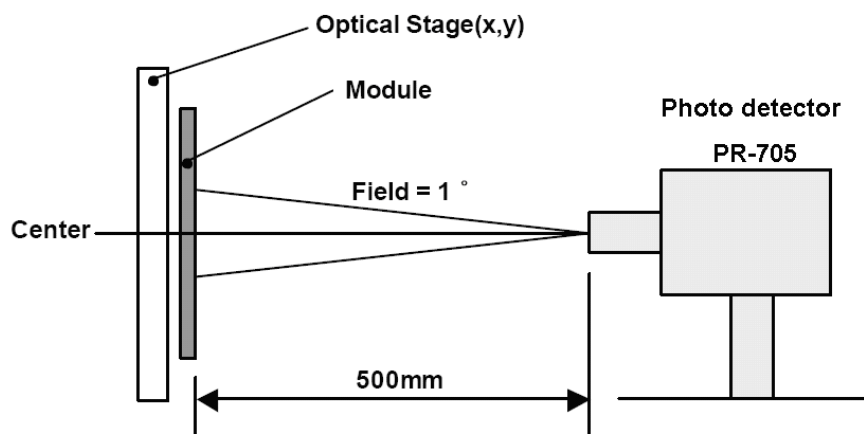
(Ta = 25 °C)

No.	Item	Min.	Typ.	Max.	Unit	Remark
1	Transmission	86	88		%	Note 1
2	Reflectivity			4	%	Note 1, Note 2
3	HAZE			2	%	

Note1: Measuring equipments: DMS-501, PR-705. @550nm

Measuring condition:

- After stabilizing and leaving the panel alone at a given temperature for 30 min, the measurement should be executed,
- Measuring surroundings: a stable, windless and dark room,
- Measuring temperature: Ta=25°C,
- 30 min after lighting the back-light.



Note2: conform to National standard GB2410—80 /ASTM D1003—61(1997)

Reliability Test

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ta = +70℃, 240 hours	Note1,Note6,Note7 IEC60068-2-1,GB2423.2
2	Low Temperature Operation	Ta = -20℃, 240 hours	Note1, Note7,IEC60068-2-1 GB2423.1
3	High Temperature Storage	Ta = +80℃, 240 hours	Note1, Note7,Note8 IEC60068-2-1 GB2423.2
4	Low Temperature Storage	Ta = -30℃, 240 hours	Note1, Note7,EC60068-2-1 GB2423.1
5	High Temperature & Humidity Storage	Ta=+65℃、RH=90%, 240 hours	Note1,Note3, Note4,Note7 IEC60068-2-78 GB/T2423.3
6	Thermal Shock/ Solder Joint Life Test	-30℃ (30min) ⇌ 80℃ (30min) ,Change Time:5min,100cycle	Note1,Note9 Start with cold temperature End with high temperature, IEC60068-2-14,GB2423.22
12	ESD	C=150pF、R=330Ω Air: ±8KV Contact:±8KV 5times (Environment:15℃~35℃, 30%~60%.86Kpa~106Kpa)	Note2,Note5, IEC61000-4-2 GB/T17626.2
13	Shock Test	Half Sine Wave 100G,6ms,±X,±Y,±Z 3times for each direction	Note2
14	Drop Test(package state)	Height:60cm, 1corner,3edges,6surfaces	Note2,IEC60068-2-32 GB/T2423.8

Notes:

1. The test result shall be evaluated after the sample has been left at room temperature and humidity for 2 hours without load. No condensation shall be accepted. The sample will not be accepted if appear these defects:

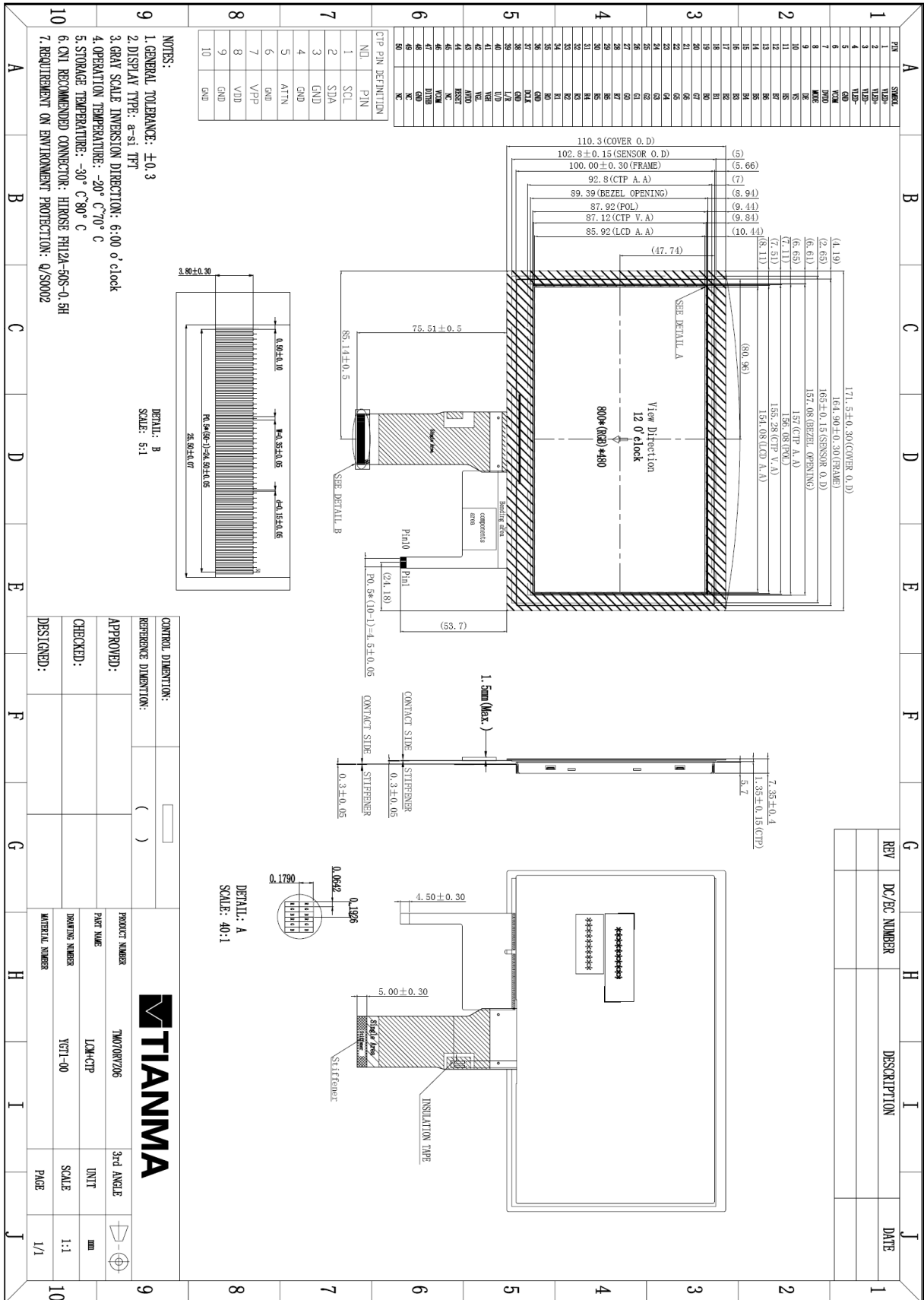
- 1).Air bubble in the LCD;
- 2).Seal leak
- 3).Non-display
- 4).missing segments
- 5).Glass crack
- 6).CR reduction >40%
- 7).IDD increase >100%
- 8).Brightness reduction >50%
- 9).Color coordinate tolerance >0.05

2. The samples of these tests will not be accepted if appear these defects:

- 1).Air bubble in the LCD;
- 2).Seal leak

-
- 3).Non-display
 - 4).missing segments
 - 5).Glass crack
3. Each test item applies for a test sample only once, The test sample can not be used again in any other test item.
- 4.For Damp Proof Test, Pure water(Resistance > 10MΩ) should be used.
- 5.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.
- 6 In the test of High Temperature Operation and High Temperature & Humidity Operation ,the operation temperature is the surface temperature of module
- 7 High Temperature Operation、 Low Temperature Operation、 High Temperature Storage、 Low Temperature Storage、 High Temperature & Humidity Operation、 High Temperature & Humidity Storage will be increased the test time to 1000hours in the same conditions to test out the ability of module, and we can not guarantee that the module will not fail during 1000hours.These items test only once
- 8.Thermal Shock will be changed the cycle to 1000cycles to test out the ability of module, and we can not guarantee that the module will not fail after the test. This item test only once

8 Mechanical Drawing



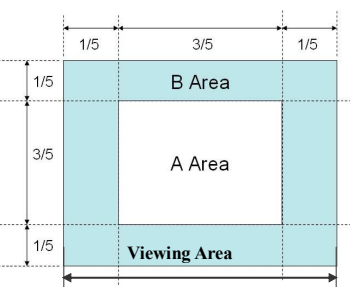
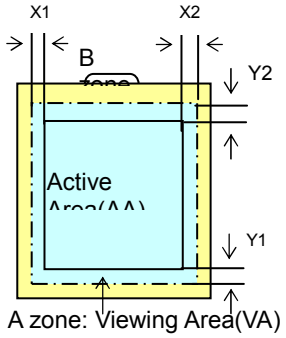
9. Product Inspection Criteria

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

<p>For dot defect of TFT LCD which is not smaller than 3 inches, dividing three areas to make a judgment (according to figure 1).</p> <p>A area : center of viewing area B area : periphery of viewing area C area : Outside viewing area</p> <p>For other defects, dividing two areas to make a judgment (according figure 2).</p> <p>A zone : Inside Viewing area B zone : Outside Viewing area</p> <p>X1(A.A~V.A): 0mm X2(A.A~V.A): 0mm Y1(A.A~V.A): 0mm Y2(A.A~V.A): 0mm</p>	 <p>Figure 1</p>  <p>Figure 2</p>
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9.3 Inspection items and general notes

General notes	<p>① Should any defects which are not specified in this standard happen, additional standard shall be determined by mutual agreement between customer and TIANMA.</p> <p>② Viewing area should be the area which TIANMA guarantees.</p> <p>③ Limit sample should be prior to this Inspection standard.</p> <p>④ Viewing judgment should be under static pattern.</p> <p>⑤ Inspection conditions Inspection distance: 250 mm (from the sample) Temperature : 25±5 °C Inspection angle : 45 degrees in 12 o'clock direction (all defects in viewing area should be inspected from this direction)</p>	
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

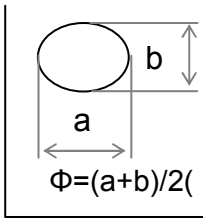
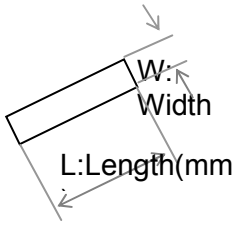
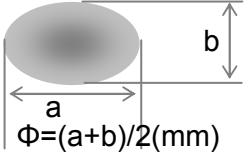
	Glass defect	Glass crack, Shaved corner of glass, Surplus glass
	PCB defect	Components assembly defect

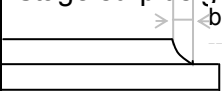
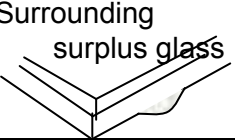
9.4 Outgoing Inspection level

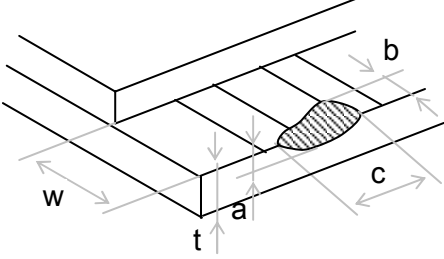
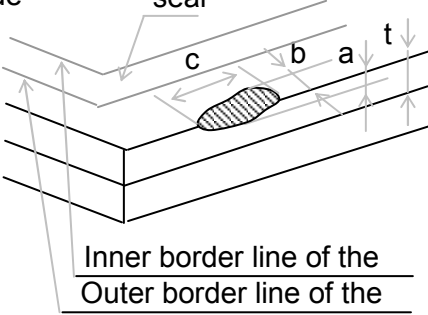
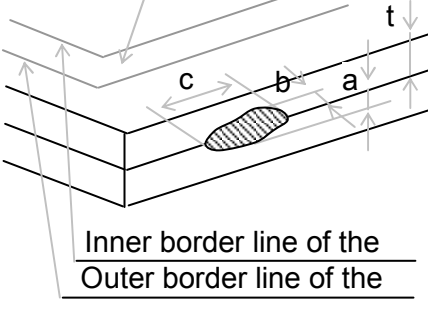
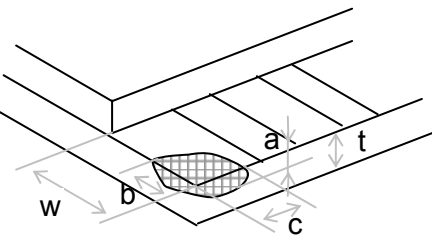
Outgoing Inspection standard	Inspection conditions	Inspection				
		Min.	Max.	Unit	IL	AQL
Major Defects	See 9.3 general notes	See 9.5			II	0.65
Minor Defects	See 9.3 general notes	See 9.5			II	1.5

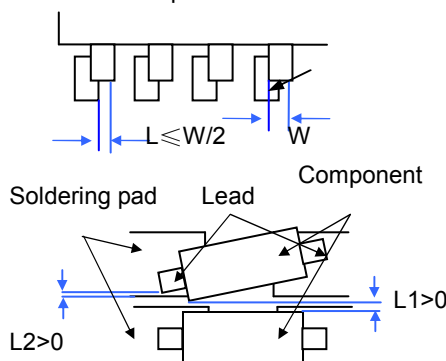
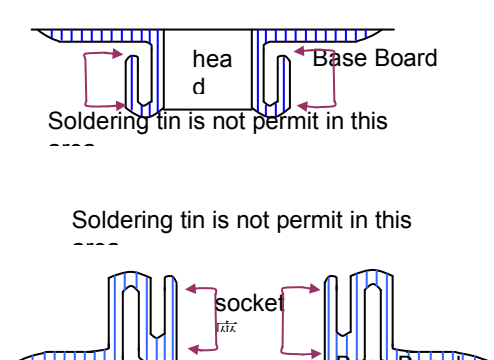
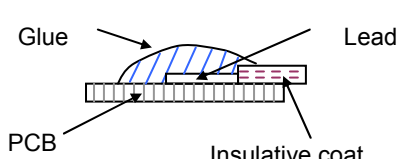
Note : Sampling standard conforms to GB2828

9.5 Inspection Items and Criteria

Inspection items			Judgment standard			
			Category		Acceptable number	
					A zone	B zone
1	Black spot, White spot, Bright Spot, Pinhole, Foreign Particle, Particle in or on glass, Scratch on glass		A	$\Phi \leq 0.10$	Neglected	Neglected
			B	$0.10 < \Phi \leq 0.15$	2	
			C	$0.15 < \Phi \leq 0.20$	1	
			D	$0.20 < \Phi$	0	
			Total defective point(B,C)		3	
2	Black line, White line, and Particle Between Polarizer and glass, Scratch on glass		A	$W \leq 0.01$	Neglected	Neglected
			B	$0.01 < W \leq 0.03$ $L \leq 3.0$	2	
			C	$0.03 < W \leq 0.05$ $L \leq 3.0$	1	
			D	$0.05 < W$	0	
			Total defective point(B,C)		3	
3	Contrast variation		A	$\Phi \leq 0.2$	Neglected	Neglected
			B	$0.2 < \Phi \leq 0.3$	2	
			C	$0.3 < \Phi \leq 0.4$	1	
			D	$0.4 < \Phi$	0	
			Total defective point(B,C)		3	
4	Dot defect (if TFT LCD is smaller than 3 inches)	TFT LCD is smaller than 3 inches	LCD Class	Defect	A area	B area
			A	Bright dot	1	Neglected

	used)		B	Dark dot	2		d	
				Total	2			
				Bright dot	2			
				Dark dot	3			
				Total	4			
		TFT LCD between 3~10.4 inches	LCD Class	Defect	A area	B area	C area	
				A	Bright dot	1	1	Neglected
			Dark dot		1	2		
			Total		4			
			B	Bright dot	2	2		
		Dark dot		2	3			
		Total		6				
Notes: Bright dot: in R、G、B or dark display figure, the pixel appears bright. Dark dot: in R、G、B or white display figure, the pixel appears dark. Defect area must be less than an half size of the dot.								
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. Bubble, dent and convex	Refer to item 1 and item 2.					
			A	$\Phi \leq 0.3$		Neglected		Neglected
			B	$0.3 < \Phi \leq 0.7$		2		
			C	$0.7 < \Phi$		0		
7	Surplus glass	Stage surplus glass 	$b \leq 0.3\text{mm}$					
		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		Acceptabl e number
			Category(application: B zone)		
15	Glass defect crack	①The front of lead terminals	A	$a \leq t, \quad b \leq 1/5W, \quad c \leq 3\text{mm}$	Max.3 defects allowed
			B	Crack at two sides of lead terminals should not cover patterns and alignment mark	
		②Surrounding crack—non-contact side	$b < \text{Inner borderline of the seal}$		
					
③ Surrounding crack— contact side	$b < \text{Outer borderline of the seal}$				
					
④Corner	A	$a \leq t, \quad b \leq 3.0, \quad c \leq 3.0$	B	Glass crack should not cover patterns u and alignment mark and patterns.	
					

Inspection items			Judgment standard
			Category(application: B zone)
16	PCB defect	<p>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)</p>	<p>Component</p> 
		<p>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</p>	
		<p>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</p>	
		<p>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.</p>	

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 alcoholSolvents 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 : $0^{\circ}\text{C} \sim 40^{\circ}\text{C}$

Relatively humidity: $\leq 80\%$

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.