
PRODUCT SPECIFICATIONS

For Customer: _____ ☐ : APPROVAL FOR SPECIFICATION

Customer Model No. _____ ☐ : APPROVAL FOR SAMPLE

Module No.: 070B305E-L401

Date : 2017.12.12

Version :0

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For Customer's Acceptance:

Approved By	Comment

PREPARED	CHECKED	VERIFIED BY QA DEPT	VERIFIED BY R&D DEPT

2. Revision Record

Date	Rev.N o.	Page	Revision Items	Prepared
2017.12.12	V0		The first release	

3. General Specifications

SQ070B305E-L401 is a color active matrix TFT LCD single cell using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This panel has a 7 inch diagonally measured active area with WSVGA resolutions (1024 horizontal by 600 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16.7M colors.

The followings are general specifications at the single cell.

<Table 1. General Specifications>

Parameter	Specification	Unit	Remarks
Active area	154.2144(H) × 85.92(V)	mm	
CF size	159(H) × 91(V)	mm	
Number of pixels	1024 (H) × 600 (V)	pixels	
Pixel pitch	0.0502(H) × 0.143.2(V)	mm	
Pixel arrangement	RGB Vertical stripe		
Display colors	16.7M	colors	
Color Gamut	50	%	
Display mode	Normally White		
Panel Size	162.2 (H) x 95.7 (V)	mm	

4.Outline.Drawing

[illegible]

5. Absolute Maximum Ratings(Ta=25°C)

Environmental Absolute Maximum Ratings

Item	Storage		Operating		Note
	MIN.	MAX.	MIN.	MAX.	
Ambient Temperature	-20°C	70°C	-10°C	60°C	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°C:85%RH MAX.

Ta>40°C:Absolute humidity must be lower than the humidity of 85%RH at 40°C.

6. Electrical Specifications and Instruction Code

6.1 Electrical Characteristics(Vss=0V,Ta=25°C)

Item	Symbol	Min.	TYPE	Max.	Unit	Note
Power Supply Voltage	V _{DD}	3.0	3.3	3.6	V	1, 2
	AVDD	9.3	9.6	9.8		
	VGH	18	20	22		
	VGL	-7.4	-6.8	-6.2		
	VCOM	3.6	3.8	4.0	V	
Logic Signal Input /Output Voltage	V _{I/OVCC}	-0.3	1.8	2.0	V	1, 2
Current of LED	I _{LED}	0	140		mA	

Note1: Please adjust VCOM to make the flicker level be minimum.

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

Item		Symbol	Condition	Min	Typ	Max	Unit	Note
Supply voltage		-	-	-	9.6	-	V	1
Supply current		I _f	-	-	140	-	mA	2
Forward current	Normal	I _{pn}	3-chip series x 7	-	140	-	mA	
	Dimming	I _{pd}		-	-	-		

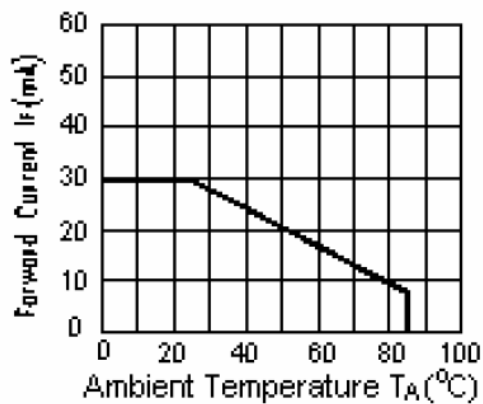
Note:

1: $V_{LED} = V_{LED(+)} - V_{LED(-)}$.

2: The current of LED is 20mA.

A LED drive in constant current mode is recommended.

3: LED power consumption is around 0.297W.



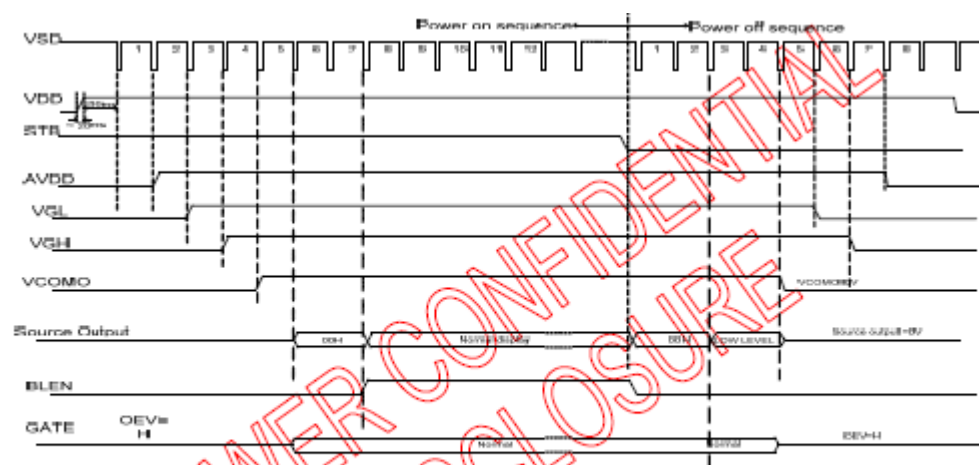
CIRCUIT DIAGRAM

I_{LED} VS TEMP

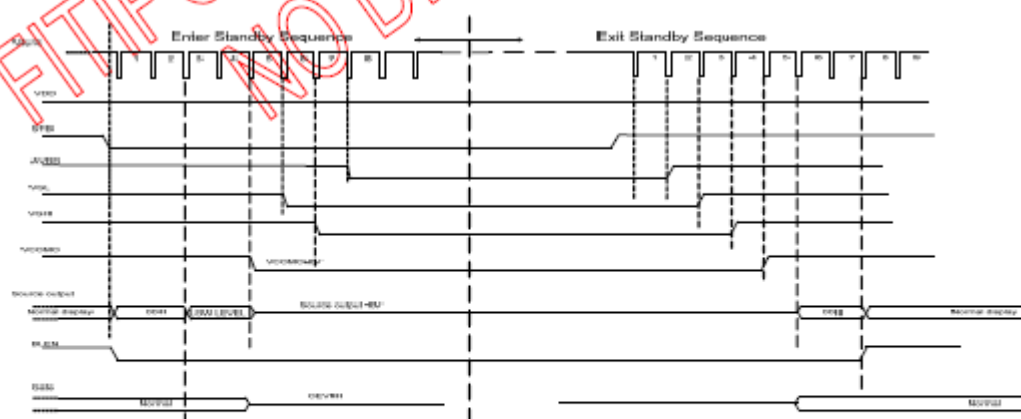
6.3 Interface signals

Pin No.	Symbol	Function
1-2	LED_A	Backlight LED Power
3-4	LED_K	Backlight LED Ground
5	GND	Ground
6	VCOM	Common voltage
7	DVDD	Power for Digital Circuit
8	MODE	DE/SYNC mode select
9	DE	Data Enable Input
10	VSYNC	Vertical Sync Input
11	HSYNC	Horizontal Sync Input
12-19	B7-B0	Blue Data Bit
20-27	G7-G0	Green Data Bit
28-35	R7-R0	Red Data Bit / DX0-DX7
36	GND	Ground
37	DCLK	Dot Data Clock
38	GND	Ground
39	L/R	Left/Right selection
40	U/D	Up/Down selection
41	VGH	Gate ON Voltage
42	VGL	Gate OFF Voltage
43	AVDD	Power for Analog Circuit
44	RESET	Reset pin, This is an active low signal
45	NC	NC
46	VCOM	Common voltage
47	DITHB	Dithering function
48	GND	Ground
49-50	NC	NC

6.4 Power On/Off Sequence



Power On/Off timing chart



Enter and Exit Standby Mode timing chart

Note: Low level=3Fh,when NBW=L(Normally white)
Low level=00h,when NBW=H(Normally black)

6.5 OPTICAL SPECIFICATION

The test of Optical specifications shall be measured in a dark room (ambient luminance $\leq 1\text{lux}$ and temperature = $25 \pm 2^\circ\text{C}$) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and ϕ equal to 0° . We refer to $\theta=0$ ($=\theta_3$) as the 3 o'clock direction (the "right"), $\theta=90$ ($=\theta_{12}$) as the 12 o'clock direction ("upward"), $\theta=180$ ($=\theta_9$) as the 9 o'clock direction ("left") and $\theta=270$ ($=\theta_6$) as the 6 o'clock direction ("bottom"). While scanning θ and/or ϕ , the center of the measuring spot on the Display surface shall stay fixed.
Optimum viewing angle direction is 12 "clock.

< Table 6. Optical Specifications >

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	Θ_3	CR > 10	-	80	-	Deg.	WV-Pol Note 1
		Θ_9		-	80	-	Deg.	
	Vertical	Θ_{12}		-	60	-	Deg.	
		Θ_6		-	70	-	Deg.	
Luminance Contrast ratio		CR	$\Theta = 0^\circ$	600	800	-		Note 2
Cell Transmittance		Tr		3.9	4.2	-	%	Base on C Light Note 3
White Chromaticity		x_w		TYP. - 0.03	0.303	TYP. + 0.03		Note 4 Base on MDL
		y_w			0.339			
Reproduction of color (C light)	Red	R_x			0.605			
		R_y			0.326			
	Green	G_x			0.297			
		G_y			0.568			
	Blue	B_x			0.144			
		B_y			0.175			
Color Gamut (C light)				-	50	-	%	
Response Time (Rising + Falling)		T_{RT}	Ta= 25° C $\Theta = 0^\circ$	-	25	40	ms	Note 5

Note :

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIGURE 5).
2. Contrast measurements shall be made at viewing angle of $\Theta = 0$ and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state . (see FIGURE 5) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Transmittance is the Value with Polarizer.
4. The color chromaticity coordinates specified in Table 6 shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.
5. The electro-optical response time measurements shall be made as FIGURE 6 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr, and 90% to 10% is Td.

7. Optical Characteristics

Item	Symbol		Condition	Min.	Typ.	Max.	Unit	Note
Brightness	Bp		$\theta=0^{\circ}$ $\Phi=0^{\circ}$	-	180	-	Cd/m ²	1
Uniformity	△Bp			75	80	-	%	1,2
Viewing Angle	3:00		Cr≥10	60	70	-	Deg	3
	6:00			60	70	-		
	9:00			60	70	-		
	12:00			50	60	-		
Contrast Ratio	Cr		$\theta=0^{\circ}$ $\Phi=0^{\circ}$	350	500		-	4
Response Time	T _r +T _f				25		ms	5
Color of CIE Coordinate	W	x	$\theta=0^{\circ}$ $\Phi=0^{\circ}$	0.269	0.299	0.329	-	1,6
		y		0.308	0.338	0.368	-	
		Y		-	-	-		
	R	x		0.562	0.592	0.622	-	
		y		0.289	0.319	0.349	-	
		Y		-	-	-		
	G	x		0.279	0.309	0.339	-	
		y		0.537	0.567	0.597	-	
		Y		-	-	-		
	B	x		0.117	0.147	0.177	-	
		y		0.120	0.150	0.180	-	
		Y		-	-	-		
NTSC Ratio	S			-	50	-	%	

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

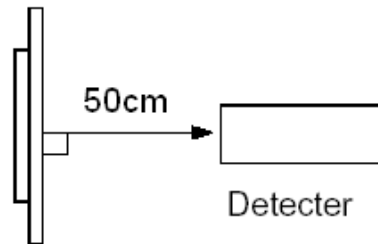
Note 1: The data are measured after LEDs are turned on for 5 minutes. LCM displays full white.

The brightness is the average value of 9 measured spots. Measurement equipment PR-705 (Φ8mm)

Measuring condition:

- Measuring surroundings: Dark room.
- Measuring temperature: $T_a=25^{\circ}\text{C}$.
- 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.

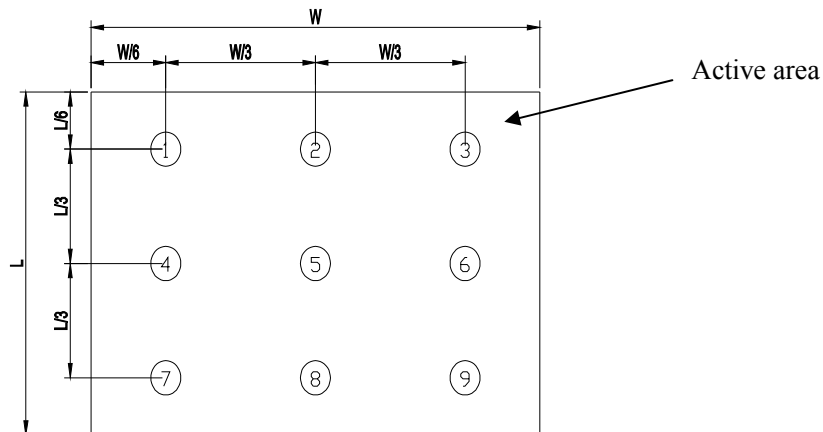


Note 2: The luminance uniformity is calculated by using following formula.

$$\Delta B_p = B_p (\text{Min.}) / B_p (\text{Max.}) \times 100 (\%)$$

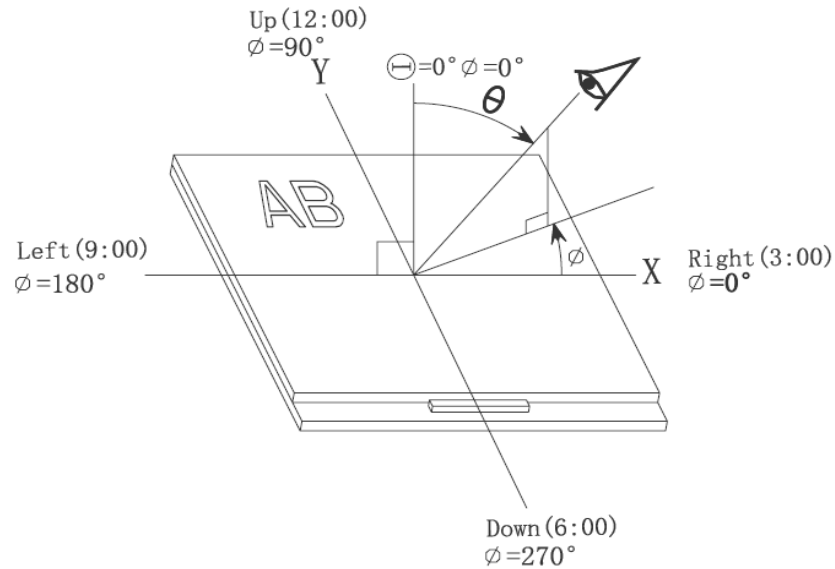
$B_p (\text{Max.})$ = Maximum brightness in 9 measured spots

$B_p (\text{Min.})$ = Minimum brightness in 9 measured spots.

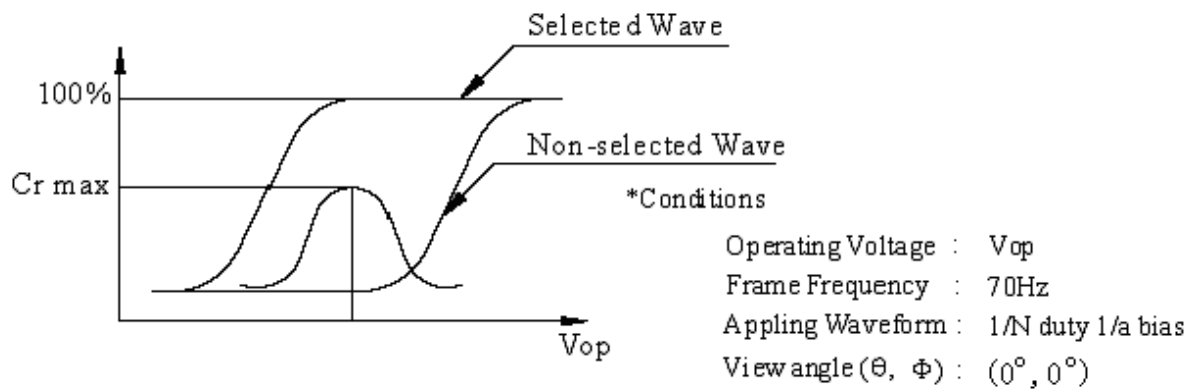


Note 3: The definition of viewing angle:

Refer to the graph below marked by θ and ϕ



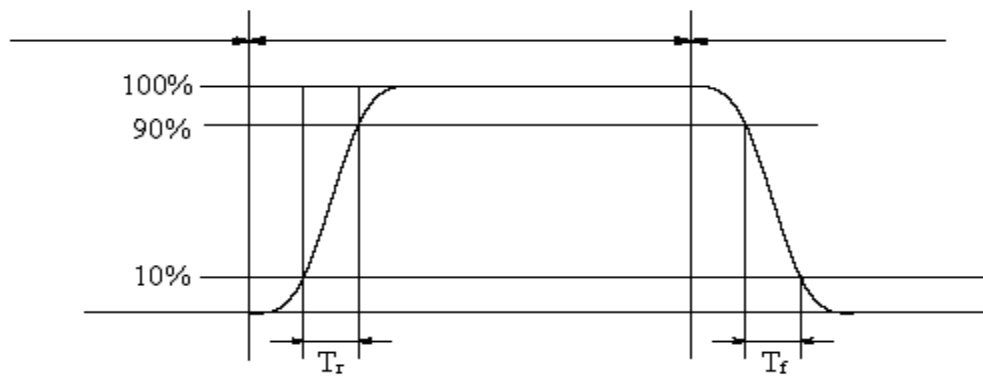
Note 4: Definition of contrast ratio.(Test LCD using DMS501)



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

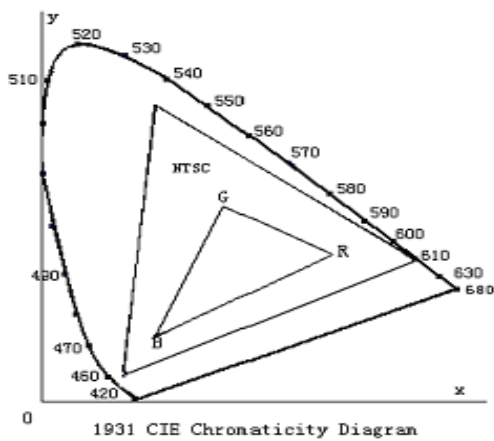
Note 5: Definition of Response time. (Test LCD using DMS501):

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.

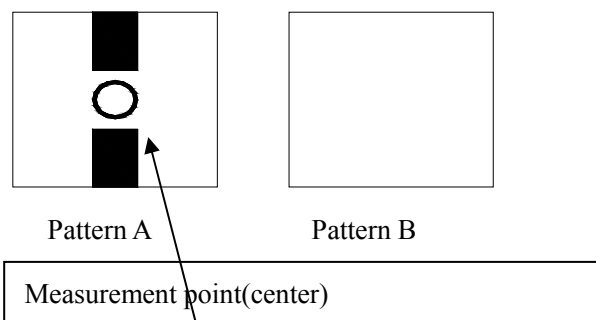


Color gamut:

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

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°C±2°C 96H Restore 2H at 25°C 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°C±2°C 96H Restore 2H at 25°C Power off	
3	High Temperature Operation	70°C±2°C 96H Restore 2H at 25°C Power on	
4	Low Temperature Operation	-20°C±2°C 96H Restore 4H at 25°C Power on	
5	High Temperature/Humidity Operation	60°C±2°C 90%RH 96H Power on	
6	Temperature Cycle	-30°C → 80°C 30min 5min 30min after 5 cycle, Restore 2H at 25°C Power off	Not allowed cosmetic and electrical defects.
7	Vibration Test	10Hz~150Hz, 100m/s ² , 120min	
8	Shock Test	Half- sine wave, 300m/s ² , 11ms	
9	ESD Test	Air discharge: +/-8KV, Contact discharge: 4KV	

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

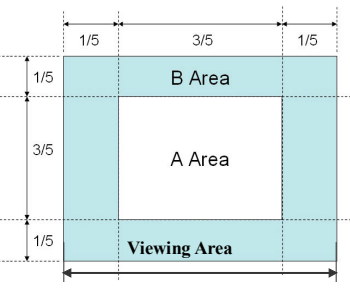
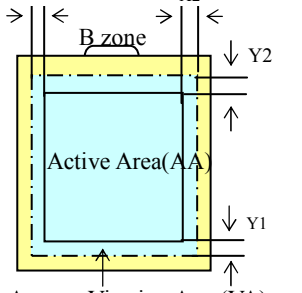
9 Quality level

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

<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): 2mm X2(A.A~V.A): 2mm Y1(A.A~V.A): 2mm Y2(A.A~V.A): 2mm</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</p> <p>Inspection distance: 250 mm (from the sample) Temperature : 25±5 °C</p> <p>Inspection angle : 45 degrees in 6 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

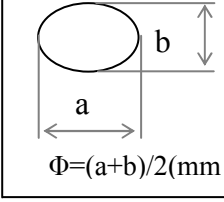
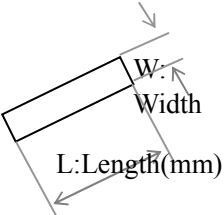
	Dot defect (TFT LCD)	The pixel appears bright or dark abnormally when display
	Functional defect	No display, Abnormal display, Open or missing segment, Short circuit, False viewing direction
	Glass defect	Glass crack, Shaved corner of glass, Surplus glass
	PCB defect	Components assembly defect

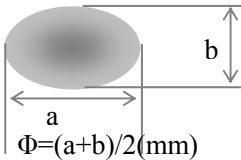
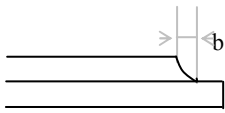
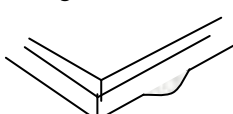
9.4 Outgoing Inspection level

Outgoing Inspection standard	Inspection conditions	Inspection				
		Min.	Max.	Unit	IL	AQL
Major Defects	See 8.3 general notes	See 8.5			II	0.065
Minor Defects	See 8.3 general notes	See 8.5			II	0.065

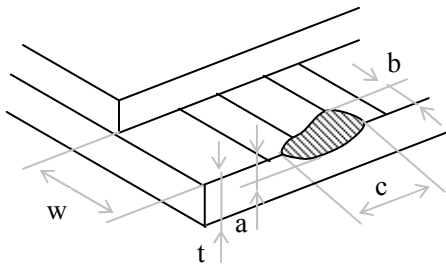
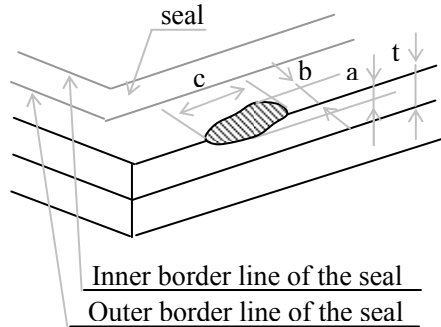
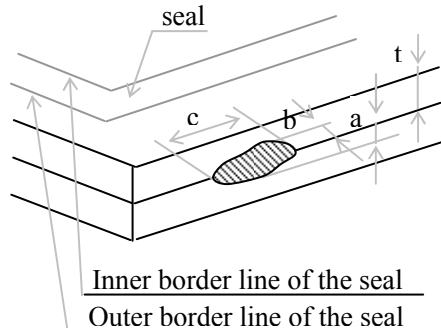
Note: Sampling standard conforms to GB2828

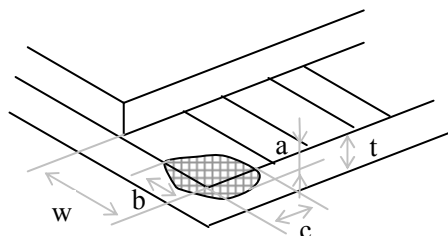
9.5 Inspection Items and Criteria

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	 $\Phi = (a+b)/2(\text{mm})$	A	$\Phi \leq 0.20$	Neglected	Neglected
			B	$0.20 < \Phi \leq 0.25$	3	Neglected
			C	$0.25 < \Phi \leq 0.3$	2	Neglected
			D	$0.3 < \Phi \leq 0.4$	1	3
			E	$0.4 < \Phi \leq 0.5$	0	2
			Total defective point(B,C)		1	-
		(a/b<2.5)				
2	Black line, White line, and Particle Between Polarizer and glass, Scratch on glass	 $L/W \geq 2.5$	A	$W \leq 0.03$	Neglected	Neglected
			B	$0.03 < W \leq 0.05$ $L \leq 3.0$	3	Neglected
			C	$0.05 < W \leq 0.1$ $L \leq 3.0$	2	Neglected
			D	$0.05 < W \leq 0.1$ $L \leq 4.0$	1	3
			E	$W > 0.1$ $L > 4.0$	0	2

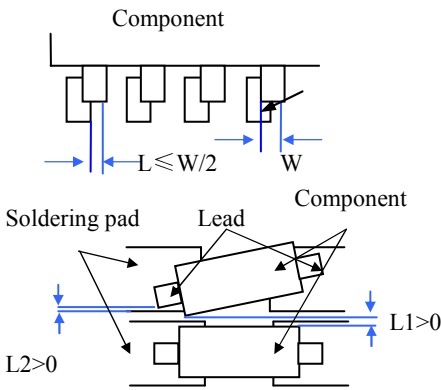
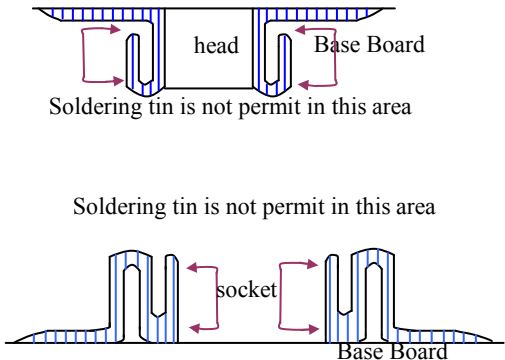
			Total defective point(B,C)		1	-
3	Bright spot		any size		none	none
4	Contrast variation		A	$\Phi < 0.2$	Neglected	Neglected
			B	$0.2 < \Phi \leq 0.3$	2	
			C	$0.3 < \Phi \leq 0.4$	1	
			D	$0.4 < \Phi$	0	
			Total defective point(B,C)		3	
5	Bubble inside cell		any size		none	none
6	Polarizer defect (if 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	$\Phi \leq 0.1$	Neglected	Neglected
			B	$0.1 < \Phi \leq 0.2$	2	Neglected
			C	$0.2 < \Phi \leq 0.3$	1	2
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			

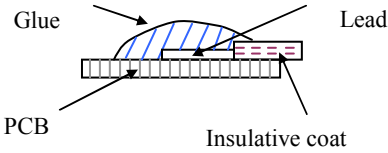
14	Black /White line(display)	Refer to item 2
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Inspection items			Judgment standard		
			Category(application: B zone)	Acceptable number	
15	Glass defect crack	i) The front of lead terminals	A	$a \leq t, \quad b \leq 1/5W, \quad c \leq 3\text{mm}$	Max.3 defects allowed
			B	Crack at two sides of lead terminals should not cover patterns and alignment mark	
		ii) Surrounding crack-non-contact side	b < Inner borderline of the seal		
			b < Outer borderline of the seal		
		iii) Surrounding crack- contact side	b < Outer borderline of the seal		
	b < Outer borderline of the seal				
iv) Corner		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.	
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Inspection items			Judgment standard	
			Category(application: B zone)	
16	PCB defect	<p>Component soldering:</p> <p>No cold soldering、short、open circuit、burr、tin ball</p> <p>The flat encapsulation component position deviation must be less than 1/3 width of the pin (Pic.1);</p> <p>the sheet component deviation:</p> <p>Pin deviates from the pad and contact with the near components is not permitted (Pic.2)</p>		
		<p>lead defect:</p> <p>The lead lack must be less than 1/3 of its width;</p> <p>The lead burr must be less than 1/3 of the seam;</p> <p>Impurities connect with the near leads is not permitted</p>		
		<p>Connector soldering:</p> <p>Soldering tin is at contact position of the plug and socket is not permitted</p> <p>No foundation is scald</p> <p>Serious cave distortion on plug and socket contact pin is not permitted</p>		

		<p>Glue on root of the speaker receiver and motor lead:</p> <p>The insulative coat of the lead must join into the PCB; the protected glue must envelop to the insulative coat.</p>	
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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 : $0^{\circ}\text{C} \sim 40^{\circ}\text{C}$

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.

