

# Beverly Display Solutions

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## PRODUCT SPECIFICATIONS

For Customer: \_\_\_\_\_  : APPROVAL FOR SPECIFICATION

Customer Model No. \_\_\_\_\_  : APPROVAL FOR SAMPLE

Module No.: BD-T101BAH-01

Date : 2014-12-04

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### For Customer's Acceptance:

Approved By	Comment

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

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## 2. Revision Record

Date	Rev.No.	Page	Revision Items	Prepared
<b>2014-12-04</b>	<b>V0</b>		<b>The first release</b>	<b>ZHP</b>

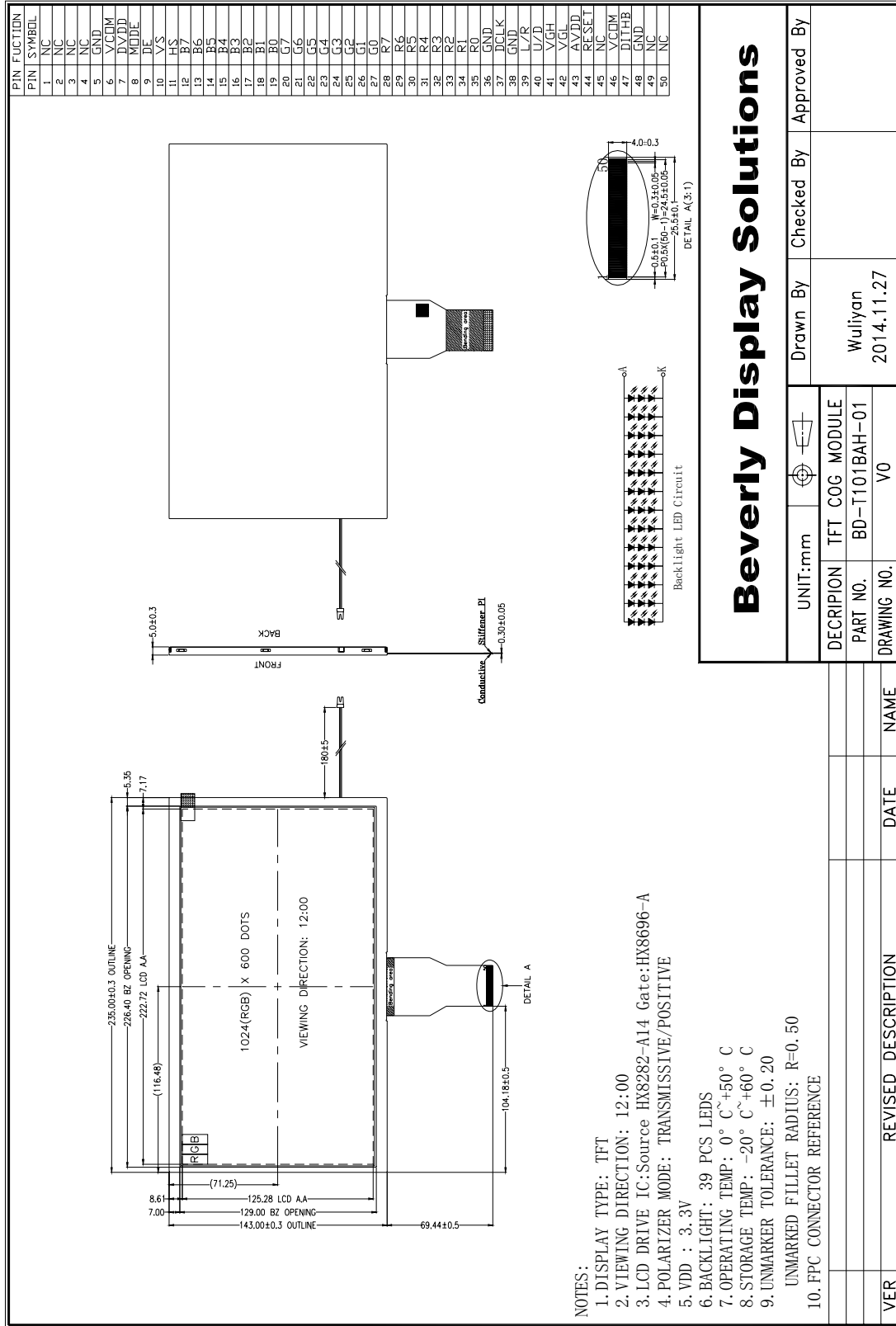
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## 3. General Specifications

BD-T101BAH-01 is a TFT-LCD module. It is composed of a TFT-LCD panel, driver IC, FPC, a back light unit. The 10.1" display area contains 1024 x 600 pixels 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	12	O'Clock	
Gray scale inversion direction	6	O'Clock	
Operating temperature	-20~+70	°C	
Storage temperature	-30~+80	°C	
Module size	Refer to outline drawing	mm	
Active Area(W×H)	222.27X125.28	mm	
Number of Dots	1024×600	dots	
Controller	HX8282A14+HX8696	-	
Power Supply Voltage	3.3	V	
Outline Dimensions	Refer to outline drawing	-	
Backlight	3X13-LEDs (white)	pcs	
Weight	---	g	
Interface	RGB888	-	

## 4. Outline Drawing



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UNIT:mm	Drawn By	Checked By	Approved By
TFT COG MODULE			
DECRIPION	Wuliyuan		
PART NO.	BD-T101BAH-01		
DRAWING NO.	V0		
VER	REVISED DESCRIPTION	DATE	NAME

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## 5. Absolute Maximum Ratings(Ta=25°C)

### 5.1 Electrical Absolute Maximum Ratings.(Vss=0V ,Ta=25°C)

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V <sub>DD</sub>	-0.3	5.0	V	1, 2
	AV <sub>DD</sub>	6.5	13.5	V	
	V <sub>GH</sub>	-0.3	42.0	V	
	V <sub>GL</sub>	-20	0.3	V	
	V <sub>GH</sub> -V <sub>GL</sub>	-	40.0	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<sub>CC</sub> > V<sub>SS</sub> must be maintained.

### 5.2 Typical operation conditions

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Power voltage	VDD	3.0	3.3	3.6	V	
	AVDD	10.2	10.5	10.8	V	
	VGH	20	21	22	V	
	VGL	-5.0	-5.5	-6.0	V	
Input signal voltage	VCOM	3.3	3.7	4.2	V	
Input logic high voltage	VIH	0.7 VDD	-	VDD	V	
Input logic low voltage	VIL	0	-	0.3VDD	V	

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## 5.3 Environmental Absolute Maximum Ratings.

Item	Storage		Operating		Note
	MIN.	MAX.	MIN.	MAX.	
Ambient Temperature	-30°C	80°C	-20°C	70°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.  $T_a \leq 40^\circ\text{C}$ : 85%RH MAX.

$T_a > 40^\circ\text{C}$ : Absolute humidity must be lower than the humidity of 85%RH at  $40^\circ\text{C}$ .

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## 6. Electrical Specifications and Instruction Code

### 6.1 Electrical characteristics(V<sub>SS</sub>=0V ,T<sub>a</sub>=25°C)

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Note	
Power supply	V <sub>CC</sub>	T <sub>a</sub> =25°C	3.0	3.3	3.6	V		
Input voltage	'H'	V <sub>IH</sub>	V <sub>CC</sub> =3.3V	0.8V <sub>CC</sub>	-	V <sub>CC</sub>	V	
	'L'	V <sub>IL</sub>	V <sub>CC</sub> =3.3V	0	-	0.2V <sub>CC</sub>	V	
Current Consumption	I <sub>CC1</sub>	Normal mode	-	25	50	mA	2	
	I <sub>CC2</sub>	Sleep mode	-	0.05	0.1	mA	2	
Clock Frequency	f <sub>CLK</sub>	-	-	30	50	MHz		

Note:

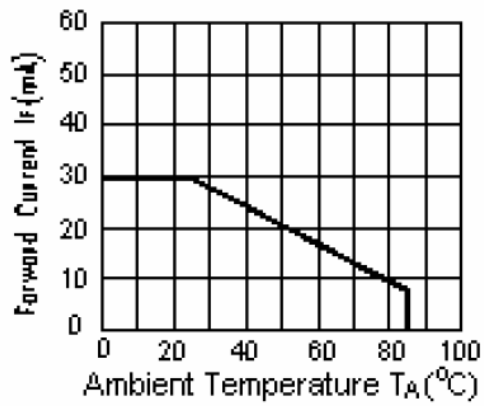
1:When an optimum contrast is obtained in transmissive mode.

2: Tested in 1×1 chessboard pattern.

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

Item	Symb ol	Condition	Min	Typ	Max	Unit	Note
Supply voltage	Vf	If=20X13mA	-	9.0	-	V	
Uniformity	Δ Bp	If=20X13mA	75			%	
Luminance for LCD	Lv	If=20X13mA	-	380		Cd/m2	
Life Time	T	If=20X13mA	-	30000		Hours	



I<sub>LED</sub> VS TEMP



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## 6.3 Interface signals

Pin No.	Symbol	I/O	Function
1-2	VLED+	P	LED back light(Anode)
3-4	VLED-	P	LED back light(Cathode)
5	GND	P	Ground.
6	VCOM	I	VCOM input
7	VDD	P	Power for Digital Circuit
8	MODE	I	DE or HV mode control
9	DE	I	Data Enable
10	VS	I	Vsync signal input
11	HS	I	Hsync signal input
12-19	B7-B0	I	Blue data input
20-27	G7-G0	I	Normal display and Standby mode select pin
28-35	R7-R0	I	Frame sync signal
36	GND	P	Power ground
37	DCLK	I	Sample clock
38	GND	P	Power ground
39	L/R	I	Select left to right scanning direction
40	U/D	I	Select up or down scanning direction
41	VGH	I	Positive power for scan driver
42	VGL	I	Negative power for scan driver
43	AVDD	P	Power for Analog Circuit
44	RESET	I	Reset
45	NC	-	No Connector
46	VCOM	I	VCOM input
47	DITHB	I	Dithering function enable control.
48-50	NC	-	No connection.

### NOTE:

Setting of scan control input		Scanning direction
U/D	L/R	
DV <sub>DD</sub>	DV <sub>DD</sub>	Up to down, left to right
GND	DV <sub>DD</sub>	Down to up, left to right
DV <sub>DD</sub>	GND	Up to down, right to left
GND	GND	Down to up, right to left

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## 7. Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Brightness	Bp	$\theta=0^\circ$	-	380	-	Cd/m <sup>2</sup>	1
Uniformity	$\Delta Bp$	$\Phi=0^\circ$	75	-	-	%	1,2
Viewing Angle	3:00	Cr $\geq$ 10	-	60	-	Deg	3
	6:00		-	45	-		
	9:00		-	60	-		
	12:00		-	60	-		
Contrast Ratio	Cr	$\theta=0^\circ$ $\Phi=0^\circ$	300	500	-	-	4
Response Time	T <sub>r</sub>		-	10	-	ms	5
	T <sub>f</sub>		-	10	-	ms	
Color of CIE Coordinate	W	x	$\theta=0^\circ$ $\Phi=0^\circ$	0.28	-	-	1,6
		y		0.33	-	-	
	R	x		0.51	-	-	
		y		0.34	-	-	
	G	x		0.31	-	-	
		y		0.56	-	-	
	B	x		0.15	-	-	
		y		0.14	-	-	
NTSC Ratio	S	50	60	-	%		

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 ( $\Phi$ 8mm)

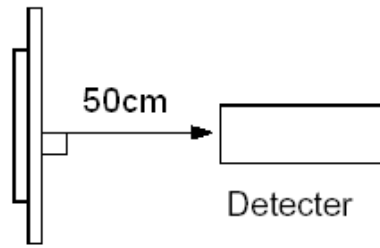
Measuring condition:

- Measuring surroundings: Dark room.
- Measuring temperature: Ta=25°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.

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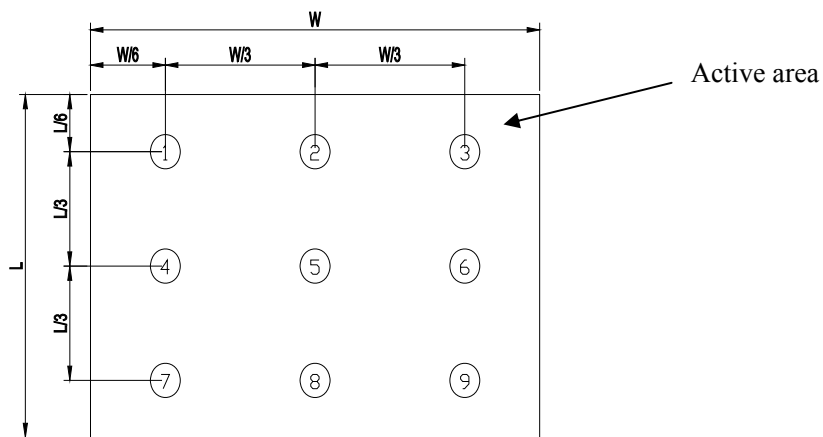


Note 2: The luminance uniformity is calculated by using following formula.

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

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

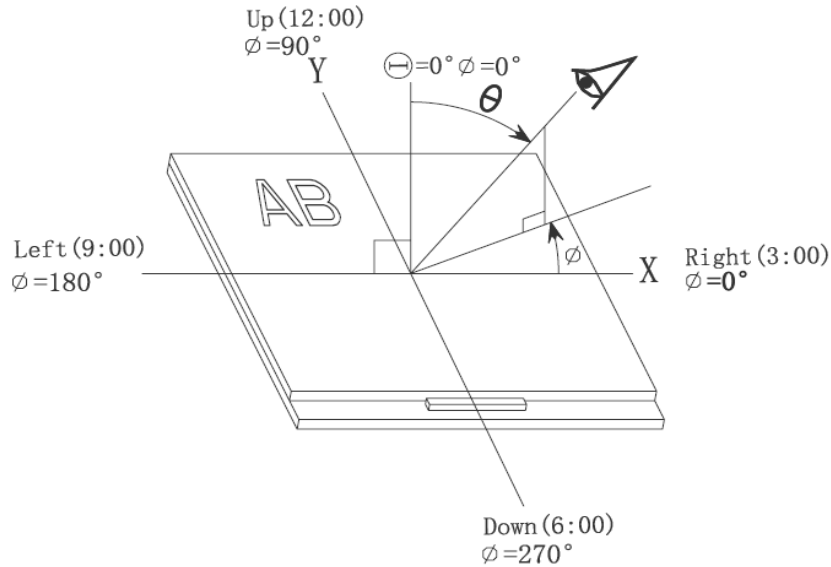
$Bp (\text{Min.})$  = Minimum brightness in 9 measured spots.



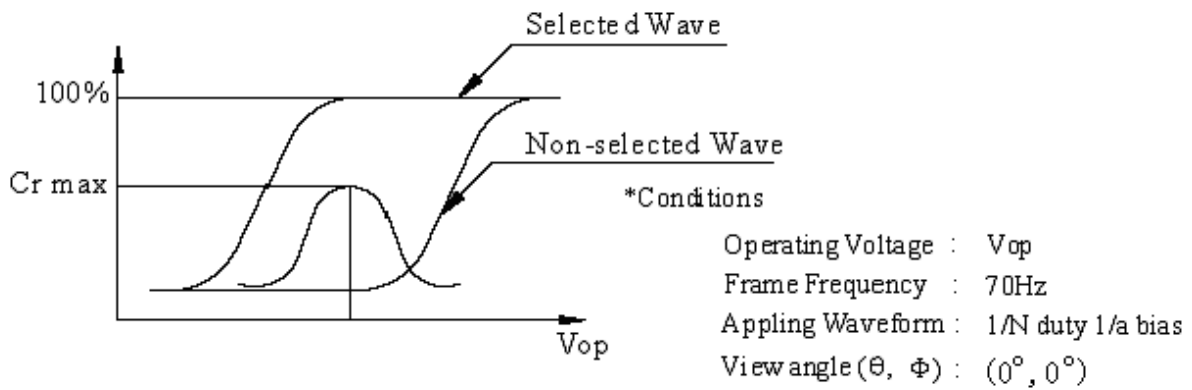
Note 3: The definition of viewing angle:

Refer to the graph below marked by  $\theta$  and  $\phi$

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

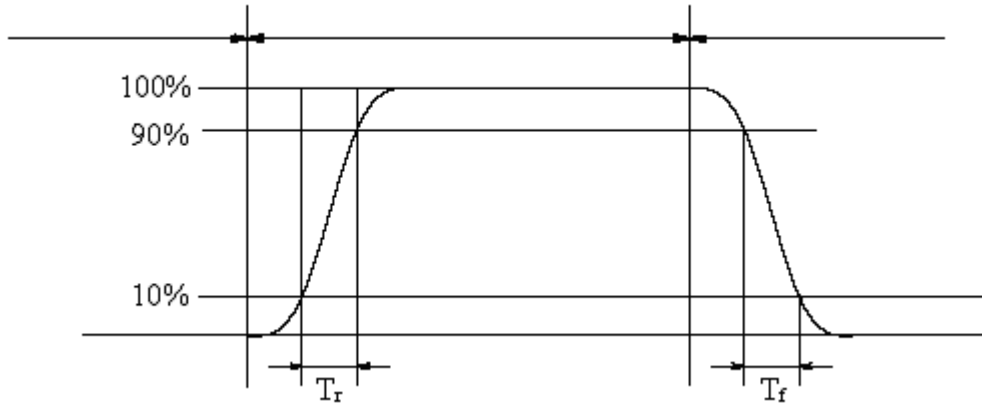


$$\text{Contrast ratio}(Cr) = \frac{\text{Brightness of selected dots}}{\text{Brightness of non-selected dots}}$$

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

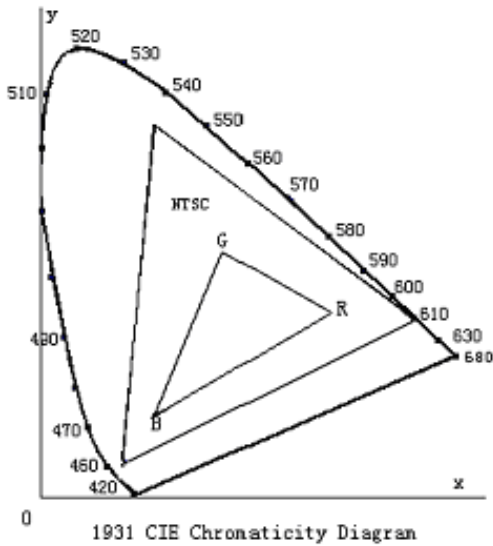
The output signals of photo detector are measured when the input signals are changed from “black” to “white”(falling time) and from “white” to “black”(rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes.Refer to figure as below.

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The definition of response time

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

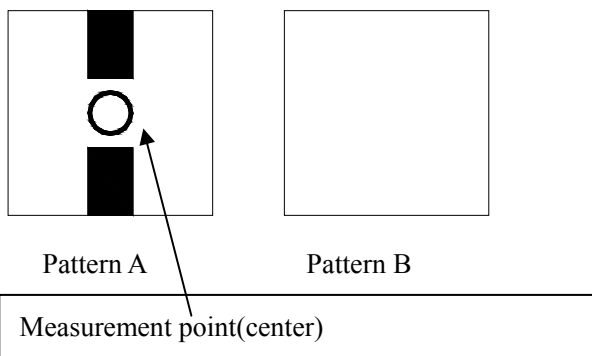


Color gamut:

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

Note 7: Definition of cross talk.

$$\text{Cross talk ratio(\%)} = \frac{|\text{pattern A Brightness} - \text{pattern B Brightness}|}{\text{pattern A Brightness}} \times 100$$



Electric volume value=3F+/-3Hex

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## 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	
7	Vibration Test	10Hz~150Hz, 100m/s <sup>2</sup> , 120min	Not allowed cosmetic and electrical defects.
8	Shock Test	Half- sine wave, 300m/s <sup>2</sup> , 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

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## 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>Should any defects which are not specified in this standard happen, additional standard shall be determined by mutual agreement between customer and our company.</p> <p>Viewing area should be the area which our company guarantees.</p> <p>Limit sample should be prior to this Inspection standard.</p> <p>Viewing judgment should be under static pattern.</p> <p>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

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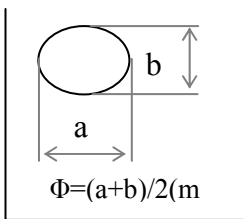
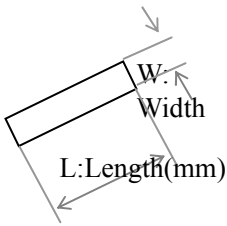
	Dot defect (TFT LCD)	The pixel appears bright or dark abnormally when display
	Functional defect	No display, Abnormal display, Open or missing segment, Short circuit, False viewing direction
	Glass defect	Glass crack, Shaved corner of glass, Surplus glass
	PCB defect	Components assembly defect

## 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

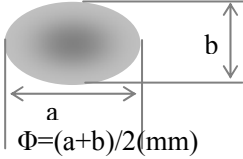
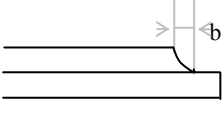
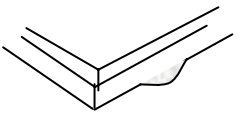
Note: Sampling standard conforms to GB2828

## 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	$\Phi \leq 0.10$	Neglected			
			B	$0.10 < \Phi \leq 0.2$	1			
			C	$0.2 < \Phi$	0			
			D	-	-			
			Total defective point(B,C)		1		Neglected	
2	Black line, White line, and Particle Between Polarizer and glass, Scratch on glass		A	$W \leq 0.02$	Neglected			
			B	$0.02 < W \leq 0.03$ $L \leq 1.0$	1			
			C	$0.03 < W \leq 0.05$ $L > 1.0$	0			
			D	$0.05 < W, 1.0 < L$	0			
			Total defective point(B,C)		1		Neglected	
3	Bright spot	any size		none	none			

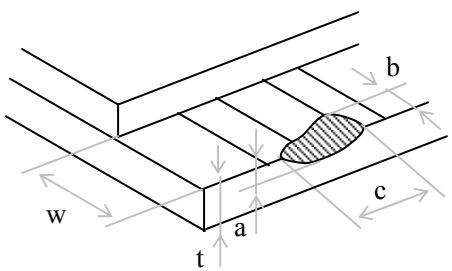
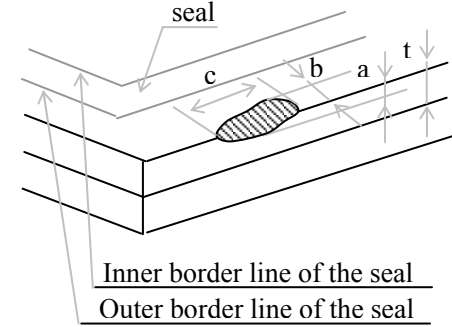
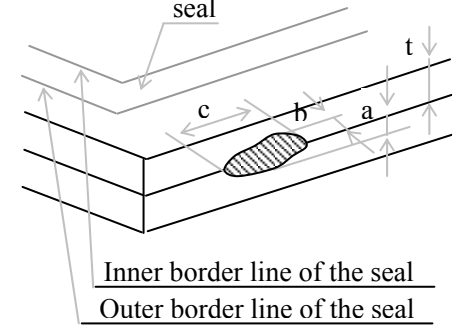
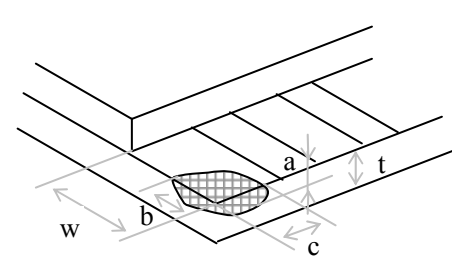


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4	Contrast variation		A	$\Phi < 0.2$	Neglected	Neglected
			B	$0.2 < \Phi \leq 0.3$	2	
			C	$0.3 < \Phi \leq 0.4$	1	
			D	$0.4 < \Phi$	0	
			Total defective point(B,C)			3
5	Bubble inside cell		any size		none	none
6	Polarizer defect (if Polarizer is 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
		B		$0.1 < \Phi \leq 0.2$	1	
		C		$0.2 < \Phi$	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
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		Category(application: B zone)	Acceptable number	
15	Glass defect crack	i ) The front of lead terminals 	A $a \leq t, b \leq 1/5W, c \leq 3\text{mm}$ B Crack at two sides of lead terminals should not cover patterns and alignment mark	Max.3 defects allowed
		ii ) Surrounding crack-non-contact side 	$b < \text{Inner borderline of the seal}$	
		iii ) Surrounding crack- contact side 	$b < \text{Outer borderline of the seal}$	
		iv ) Corner 	A $a \leq t, b \leq 3.0, c \leq 3.0$ B Glass crack should not cover patterns u and alignment mark and patterns.	

Inspection items	Judgment standard
	Category(application: B zone)

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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>The diagram illustrates two types of component soldering defects. The top part shows a component with leads on a pad, with dimensions <math>L \leq W/2</math> and <math>W</math>. The bottom part shows a component with a lead on a soldering pad, with dimensions <math>L1 &gt; 0</math> and <math>L2 &gt; 0</math>.</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>The diagram illustrates two types of connector soldering defects. The top part shows a head and base board with soldering tin not permitted in a specific area. The bottom part shows a socket and base board with soldering tin not permitted in a specific area.</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>	<p>The diagram shows a lead on a PCB with glue and an insulative coat. The labels are Glue, Lead, PCB, and 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.

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- 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.**