

IIDWay Technology Co. Ltd

PRODUCT SPECIFICATIONS

For Customer: _____

: APPROVAL FOR SPECIFICATION

Customer Model No. _____

: APPROVAL FOR SAMPLE

Module No.: GZ70121-DTT039TH

Date : 2021-08-30

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For Customer's Acceptance:

Approved By	Comment

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

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3. General Specifications

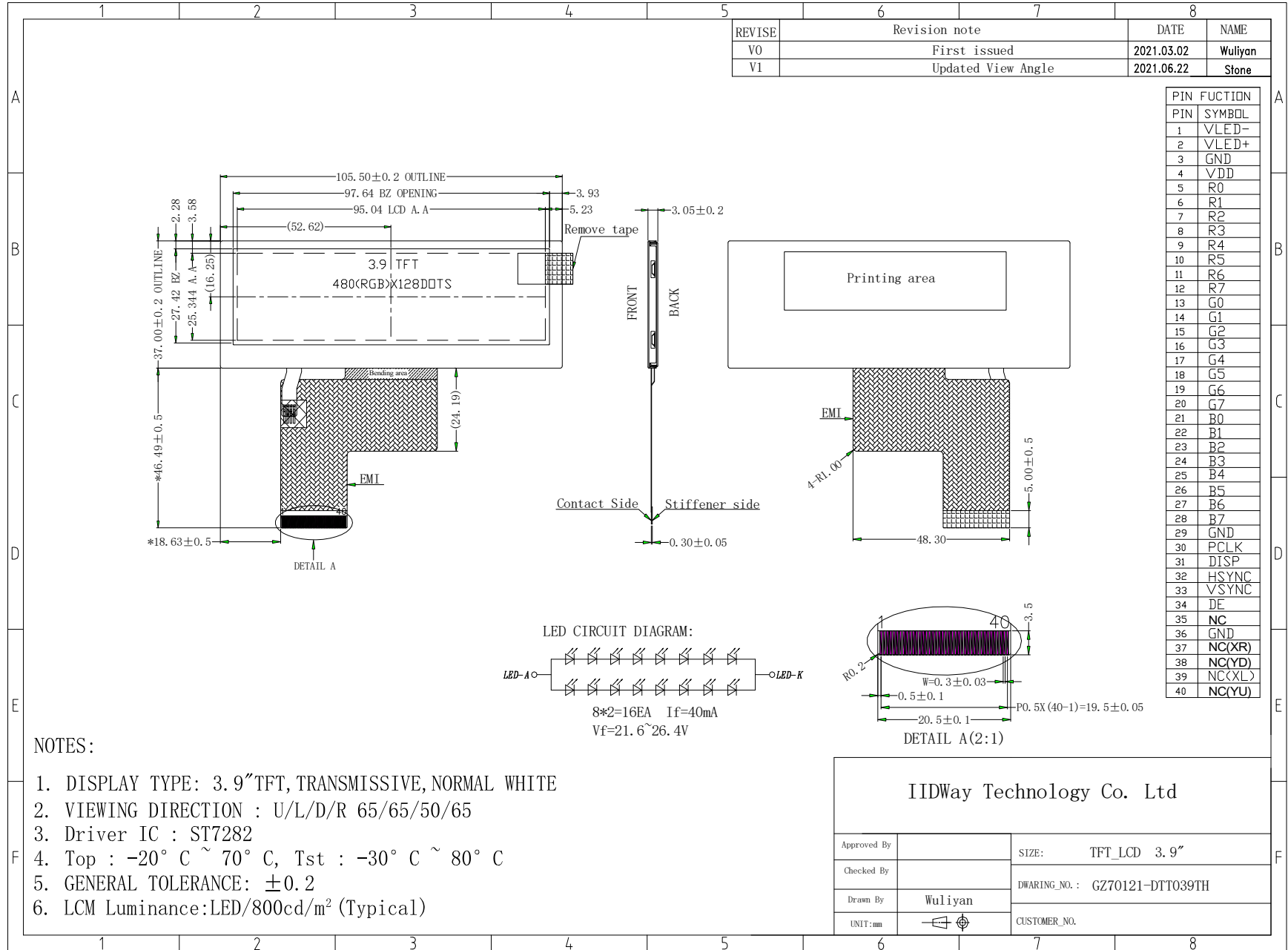
GZ70121-DTT039TH is a TFT-LCD module. It is composed of a TFT-LCD panel, driver IC, FPC, a back light unit . The 3.9" display area contains 480 x (RGB) x 128 pixels and can display up to 16.7M colors. This product accords with ROHS environmental criterion.

Item	Contents	Unit	Note
LCD Type	TFT	-	
Display color	16.7M	color	1
Viewing Direction	12	O'Clock	
Grey scale inversion direction	6	O'Clock	
Operating temperature	-20~+70	°C	
Storage temperature	-30~+80	°C	
Module size	105.50 X 37.00 X 3.05	mm	2
Active Area(W×H)	95.04 X 25.344	mm	
Number of Dots	480 X 128	dots	
Controller	ST7282	-	
Power Supply Voltage	3.3	V	
Backlight	8S2P-LEDs (white)	pcs	
Weight	---	g	
Interface	RGB888	-	

Note 1: Color tune is slightly changed by temperature and driving voltage.

Note 2: Without FPC and Solder.

4.Outline.Drawing



5. Absolute Maximum Ratings($T_a=25^\circ\text{C}$)

5.1 Electrical Absolute Maximum Ratings.($V_{SS}=0\text{V}$, $T_a=25^\circ\text{C}$)

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	VDD	-0.3	4.6	V	1, 2

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. $V_{DD} > V_{SS}$ must be maintained.

5.2 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°C .

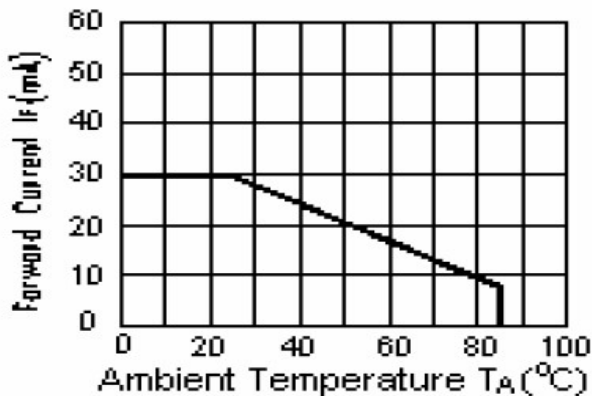
6. Electrical Specifications

6.1 Electrical characteristics ($V_{SS}=0V, T_a=25^\circ C$)

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Note
Power supply	VDD	$T_a=25^\circ C$	3.0	3.3	3.6	V	
Input voltage	'H'	$V_{DD}=3.3V$	$0.7V_{DD}$	-	V_{DD}	V	
	'L'	$V_{DD}=3.3V$	0	-	$0.3V_{DD}$	V	

6.2 LED backlight specification ($V_{SS}=0V, T_a=25^\circ C$)

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Supply voltage	Vf	$I_f=40mA$	21.6	24.0	26.4	V	
Uniformity	ΔB_p	$I_f=40mA$	75	80	-	%	
Life Time	time	$I_f=40mA$	20K	50K	-	hours	1



Note 1: Brightness to be decreased to 50% of the initial value at ambient temperature $T_A=25^\circ C$

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6.3 Interface signals

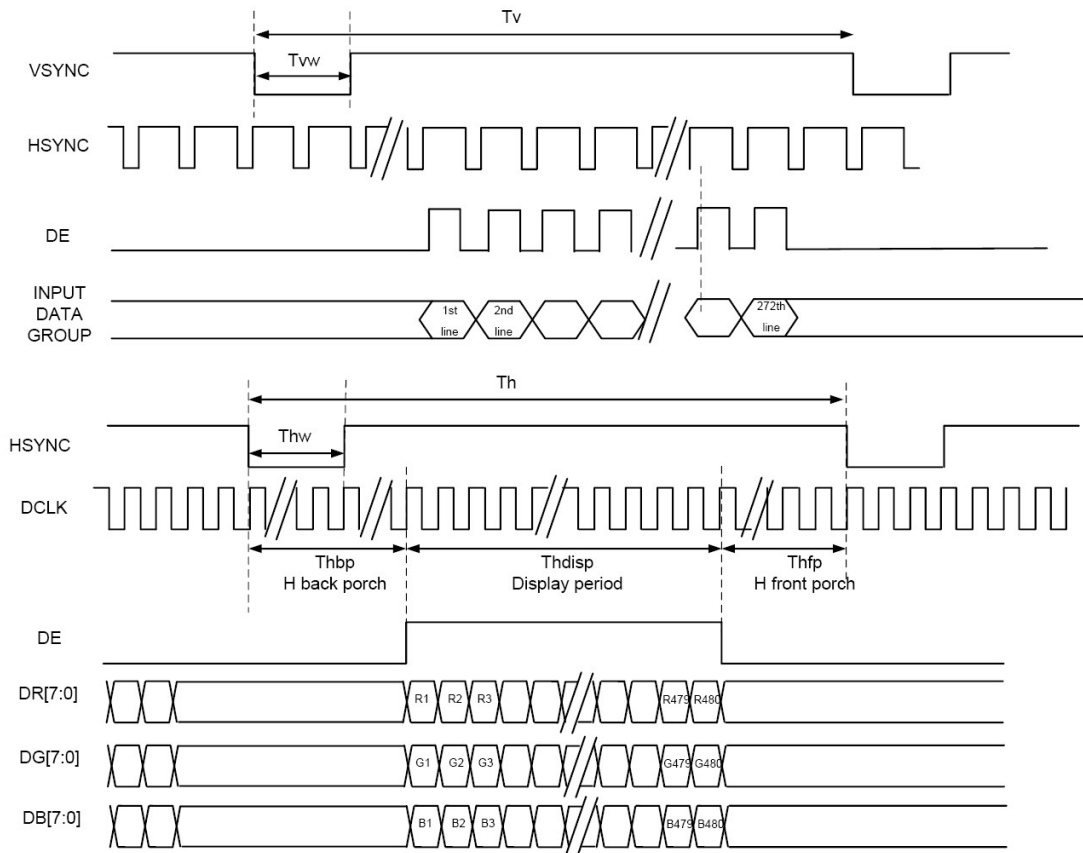
Pin No.	Symbol	I/O	Function
1	VLED -	P	LED back light(Cathode)
2	VLED +	P	LED back light(Anode)
3	GND	P	Ground.
4	VDD	P	Power supply
5-12	R0~R7	I	Red data bus
13-20	G0~G7	I	Green data bus
21-28	B0~B7	I	Blue data bus
29	GND	P	Ground.
30	PCLK	I	Data clock
31	DISP	I	Normal display and Standby mode select pin
32	HSYNC	I	Horizontal sync signal
33	VSYNC	I	Vertical sync signal
34	DE	I	Data enable pin
35	NC	-	No connection.
36	GND	P	Ground.
37	NC(XR)	-	No connection.
38	NC(YD)	-	No connection.
39	NC(XL)	-	No connection.
40	NC(YU)	-	No connection.

6.4 AC Characteristics

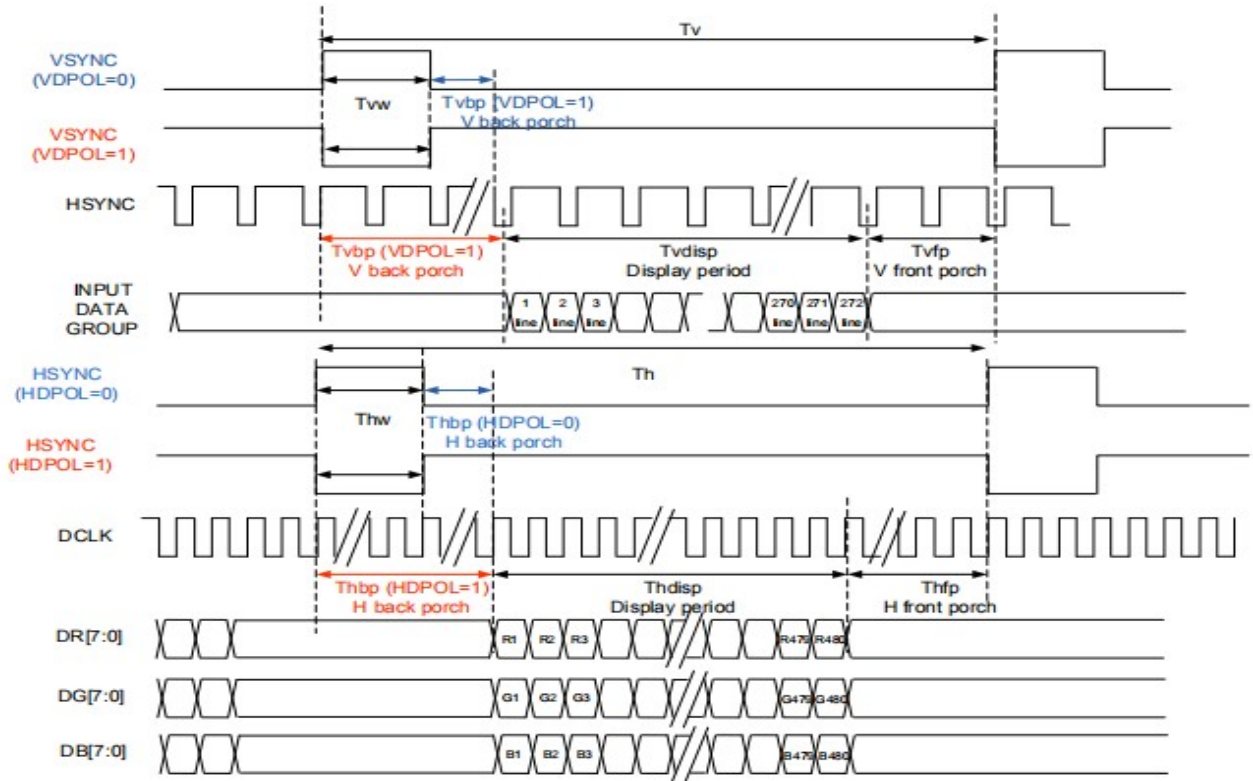
6.4.1 Parallel 24-bit RGB Timing Table

Item	Symbol	Min.	Typ.	Max.	Unit	Remark	
DCLK Frequency	Fclk	8	9	12	MHz		
DCLK Period	Tclk	83	111	125	ns		
HSYNC	Period Time	Th	485	531	598	DCLK	
	Display Period	Thdisp		480		DCLK	
	Back Porch	Thbp	3	43	43	DCLK	By H_Blanking setting
	Front Porch	Thfp	2	8	75	DCLK	
	Pulse Width	Thw	2	4	75	DCLK	
VSYNC	Period Time	Tv	276	292	321	H	
	Display Period	Tvdisp		272		H	
	Back Porch	Tvbp	2	12	12	H	By V_Blanking setting
	Front Porch	Tvfp	2	8	37	H	
	Pulse Width	Tvw	2	4	37	H	

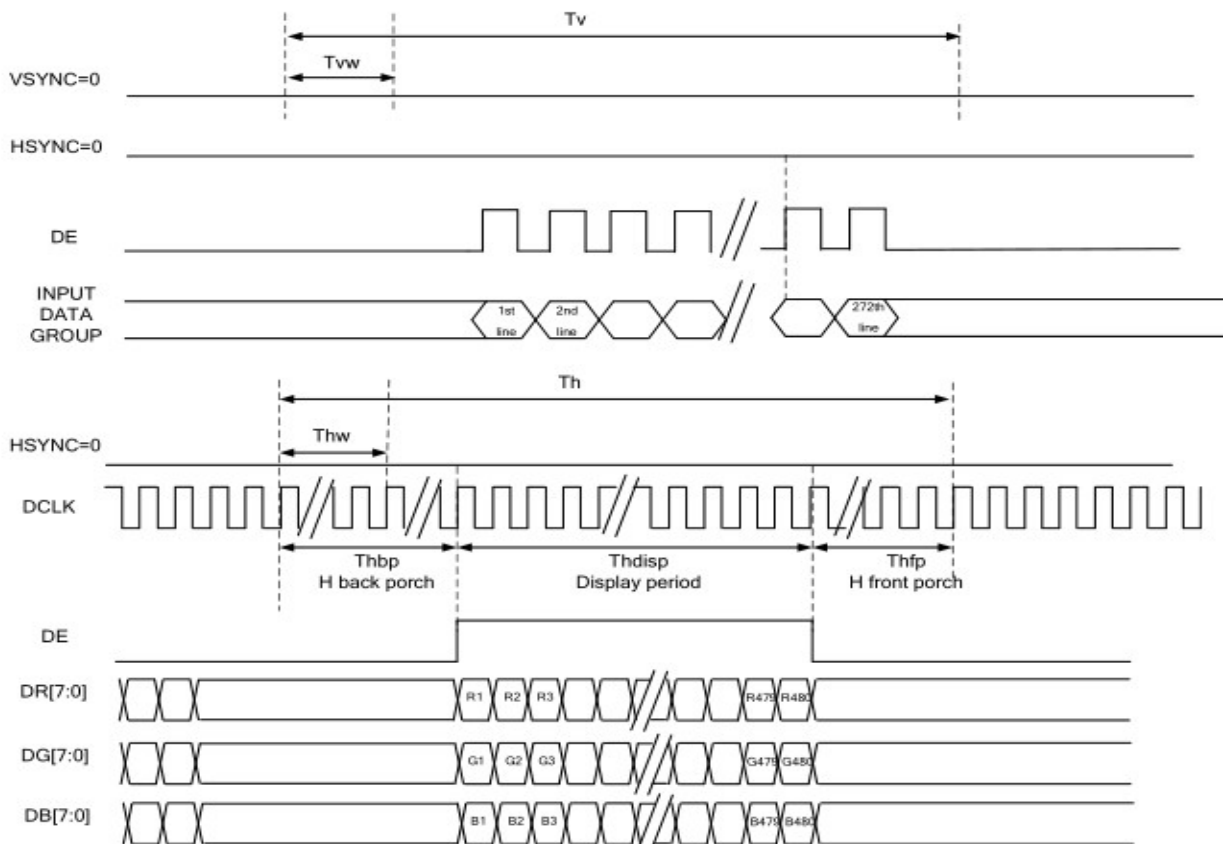
SYNC-DE Mode Timing Diagram



SYNC Mode Timing Diagram



DE Mode Timing Diagram



6.4.2 Clock and Data Input Timing Diagram

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7. Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Brightness	Bp	$\theta=0^\circ$ $\Phi=0^\circ$	-	800	-	Cd/m ²	1	
Uniformity	\triangle Bp		75	80	-	%	1,2	
Viewing Angle	3:00	Cr \geq 10	-	65	-	Deg	3	
	6:00		-	50	-			
	9:00		-	65	-			
	12:00		-	65	-			
Contrast Ratio	Cr	$\theta=0^\circ$ $\Phi=0^\circ$	-	500	-	-	4	
Response Time	T _r +T _f		-	25	35	ms	5	
Color of CIE Coordinate	W	x	$\theta=0^\circ$ $\Phi=0^\circ$	Typ. -0.05	TBD	Typ. +0.05	-	1,6
		y			TBD		-	
	R	x			TBD		-	
		y			TBD		-	
	G	x			TBD		-	
		y			TBD		-	
	B	x			TBD		-	
		y			TBD		-	
NTSC Ratio	S	-	52	-	%			

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

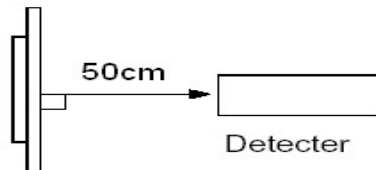
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Note 1: The data are measured after LEDs are turned on for 5 minutes. LCM displays full white. The brightness is the average value of 9 measured spots. Measurement equipment PR-705 (Φ8mm)

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.

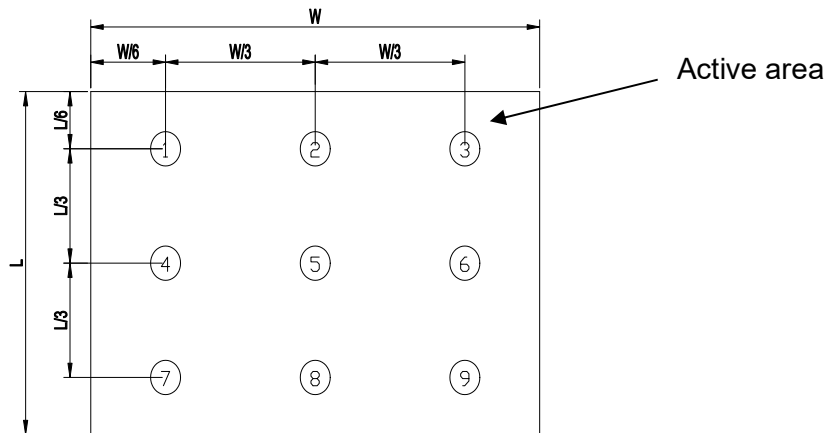


Note 2: The luminance uniformity is calculated by using following formula.

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

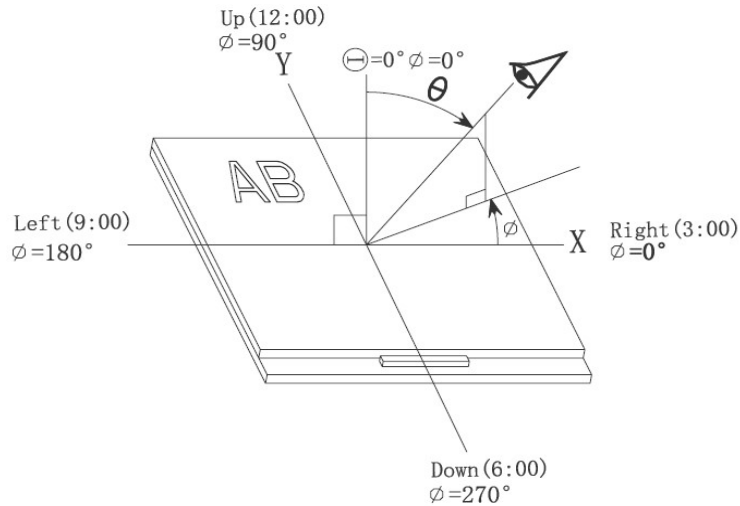
$B_p (\text{Max.})$ = Maximum brightness in 9 measured spots

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

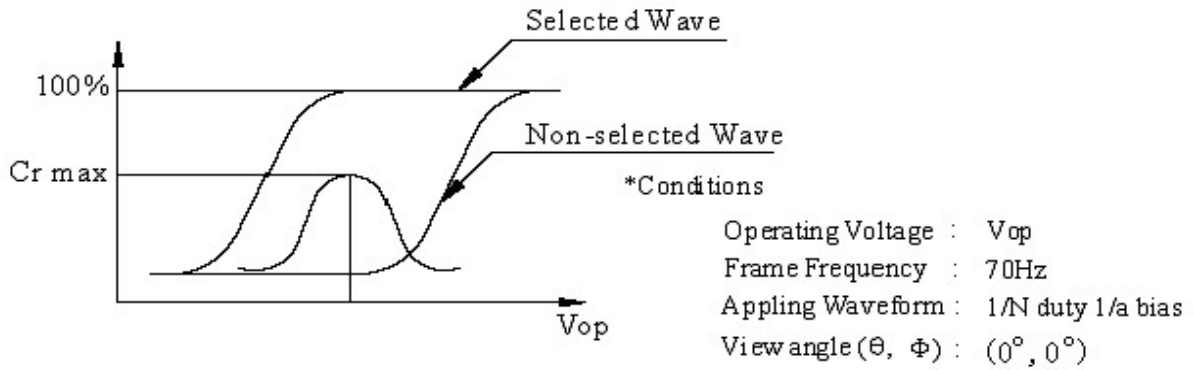


Note 3: The definition of viewing angle:

Refer to the graph below marked by θ and Φ



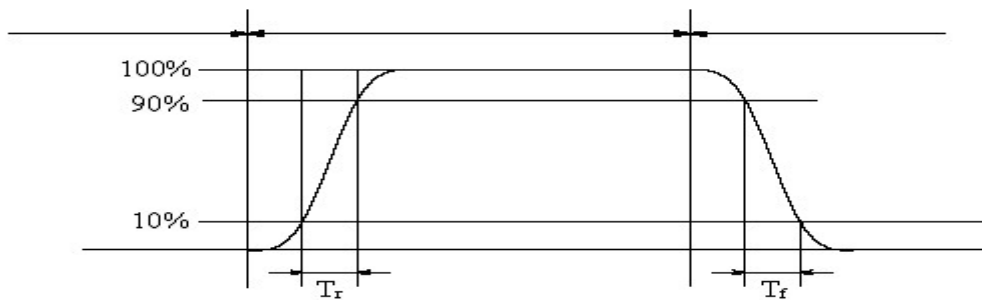
Note 4: Definition of contrast ratio.(Test LCD using DMS501)



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

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

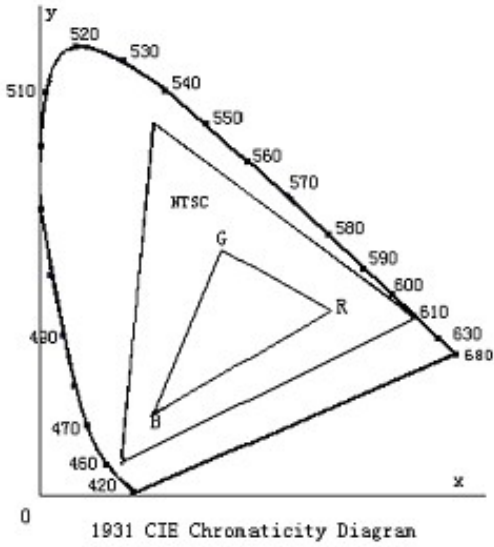
The output signals of photo detector are measured when the input signals are changed from “black” to “white”(falling time) and from “white” to “black”(rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.



The definition of response time

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

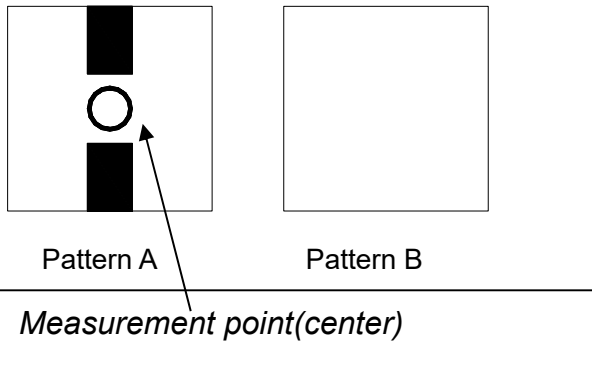


Color gamut:

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

Note 7: Definition of cross talk.

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



Electric volume value = 3F +/- 3Hex

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8. Reliability Test Items and Criteria

Test Item	Test condition	Remark
High Temperature Storage	Ta = 80°C 96hrs	Note1,Note3, 4
Low Temperature Storage	Ta = -30°C 96hrs	Note1,Note3, 4
High Temperature Operation	Ta = 70°C 96hrs	Note2,Note3, 4
Low Temperature Operation	Ta = -20°C 96hrs	Note1,Note3, 4
Operation at High Temperature/Humidity	+60°C, 90%RH 96hrs	Note3, 4
Thermal Shock	-30°C/30 min ~ +80°C/30 min for a total 10 cycles, Start with cold temperature and end with high temperature.	Note3, 4
Vibration Test	Frequency range:10~55Hz Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X. Y. Z. (6 hours for total)	
Mechanical Shock	100G 6ms,±X, ±Y, ±Z 3 times for each direction	
Package Vibration Test	Random Vibration : 0.015G*G/Hz from 5-200HZ, -6dB/Octave from 200-500HZ 2 hours for each direction of X. Y. Z. (6 hours for total)	
Package Drop Test	Height:60cm 1 corner, 3 edges, 6 surfaces	
Electro Static Discharge	±2KV, Human Body Mode, 100pF/1500Ω	

Note 1: Ta is the ambient temperature of samples.

Note 2: Ts is the temperature of panel's surface.

Note 3: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

Note 4: Before cosmetic and function test, the product must have enough recovery time,at least 2 hours at room temperature

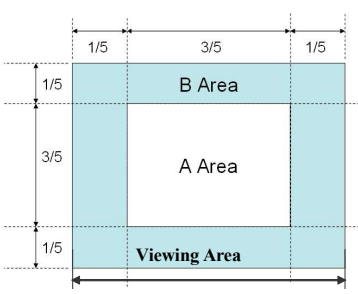
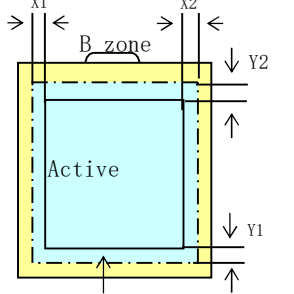
9 Quality level

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 style="text-align: center;">Figure 1</p>  <p style="text-align: center;">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 us.</p> <p>Viewing area should be the area which us 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
	Dot defect (TFT LCD)	The pixel appears bright or dark abnormally when display

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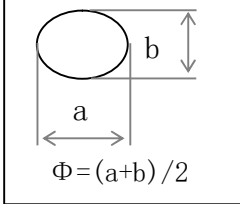
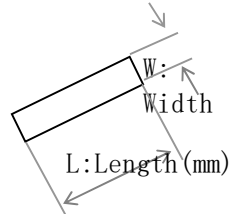
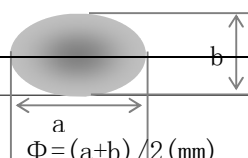
	Functional defect	No display, Abnormal display, Open or missing segment, Short circuit, False viewing direction
	Glass defect	Glass crack, Shaved corner of glass, Surplus glass
	PCB defect	Components assembly defect

9.4 Outgoing Inspection level


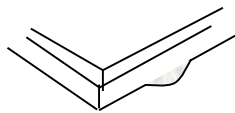
Outgoing Inspection standard	Inspection conditions	Inspection				
		Min.	Max.	Unit	IL	AQL
Major Defects	See 9.3 general notes	See 9.5			II	0.65
Minor Defects	See 9.3 general notes	See 9.5			II	1.0

Note: Sampling standard conforms to GB2828

9.5 Inspection Items and Criteria

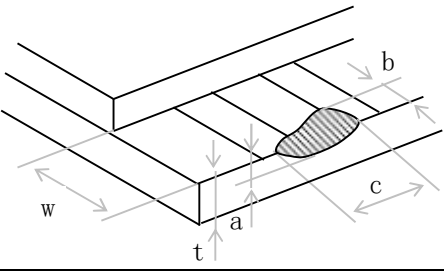
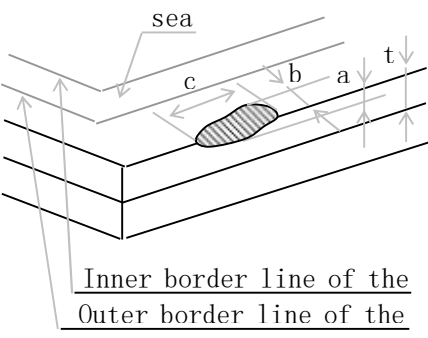
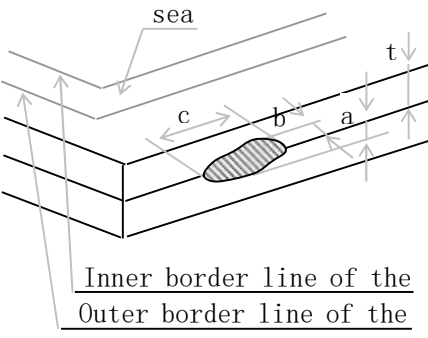
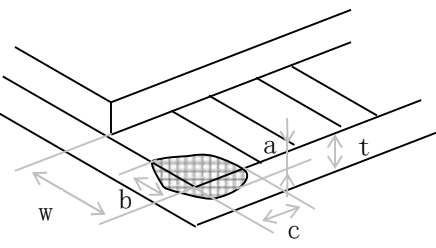
Inspection items			Judgment standard					
			Category		Acceptable number			
					A zone	B zone		
1	Black spot, White spot, Bright spot, Pinhole, Foreign Particle, Particle in or on glass, Scratch on glass		A	$\Phi \leq 0.10$	Neglected			
			B	$0.10 < \Phi \leq 0.25$	2			
			C	$0.25 < \Phi$	0			
			D	-	-			
			Total defective point(B,C)		1		Neglected	
2	Black line, White line, and Particle Between Polarizer and glass, Scratch on glass		A	$W \leq 0.03$	Neglected			
			B	$0.03 < W \leq 0.05$ $L \leq 3.0$	1			
			C	$0.05 < W \leq 0.1$ $L > 3.0$	0			
			Total defective point(B,C)		1			
3	Contrast variation		A	$\Phi < 0.25$	Neglected			
			B	$0.25 < \Phi \leq 0.3$	2		Neglected	

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			C	$0.3 < \Phi \leq 0.4$	1	
			D	$0.4 < \Phi$	0	
			Total defective point(B,C)		3	
4	Bubble inside cell		any size		none	none
5	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	$\Phi \leq 0.3$	Neglected	Neglected
			B	$0.3 < \Phi \leq 0.4$	1	
			C	$0.4 < \Phi$	0	
6	Surplus glass	Stage surplus glass 	$B \leq 0.3\text{mm}$			
		Surrounding surplus glass 	Should not influence outline dimension and assembling.			
7	Open segment or open common	Not permitted				
8	Short circuit	Not permitted				
9	False viewing direction	Not permitted				
10	Contrast ratio uneven	According to the limit specimen				
11	Crosstalk	According to the limit specimen				
12	Black /White spot(display)	Refer to item 1				
13	Black /White line(display)	Refer to item 2				

Inspection items	Judgment standard
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		Category(application: B zone)	Acceptable number	
14	Glass defect crack	i) The front of lead terminals 	A $a \leq t, b \leq 1/5W, c \leq 3\text{mm}$	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 	$b < \text{Inner borderline of the seal}$	
		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.		

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Inspection items		Judgment standard	
		Category(application: B zone)	
15	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>Component</p> <p>Component</p> <p>Soldering pad Lead Component</p> <p>$L \leq W/2$</p> <p>$L > 0$</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>hea Base Board</p> <p>Soldering tin is not permit in</p> <p>Soldering tin is not permit in</p> <p>socket Base Board</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>	<p>Glue Lead</p> <p>PCB Insulative</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 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°C ~ 40°C

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.*

END