Microtips
T E C H N O L O G Y

Model No: ŒŸ ŸÏÈHGECGI €VHÍ Þ€Ì

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Revision Record

Date	Rev. No.	Page	Revision Items	Prepared
2018-11-01	A	All	The first release.	TOM
2018-11-19	B	5	2. Outline Drawing: 2.1. Modified drawing version from A to B. 2.2. Modified the backlight dimension and LED circuit diagram. 2.3. Modified the FPC appearance and dimension.	TOM

Table of Contents

1. General Specifications

AWY-320240T35N08 is a TFT-LCD module. It is composed of a TFT-LCD panel, driver IC, FPC, a backlight unit. The 3.5′′ display area contains 320X240 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	ALL	O'Clock	
Operating temperature	-20~+70	℃	
Storage temperature	-30~+80	℃	
Module size	Refer to outline drawing	mm	
Active Area(W×H)	70.08X52.56	mm	
Number of Dots	320x240	dots	
Controller	ST7272A	-	
Power Supply Voltage	3.3	V	
Outline Dimensions	Refer to outline drawing	-	
Backlight	6-LEDs (white)	pcs	
Interface	RGB	-	

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

Note 2:   Without FPC and Solder.

2. Outline Drawing

NOTES:

1. DISPLAY TYPE : 3.5" TFT, NORMALLY BLACK
2. VIEWING DIRECTION : U/L/D/R 80/80/80/80
3. Driver IC : ST7272A
4. Top : -20°C ~ 70°C, Tst : -30°C ~ 80°C
5. GENERAL TOLERANCE : ±0.2
6. LCM Luminance:LED/300cd/m² (Typical)

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3. Absolute Maximum Ratings (Ta=25˚C)

3.1 Electrical Absolute Maximum Ratings (Vss=0V ,Ta=25˚C)

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{CC}	-0.3	4.0	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_{CC}>GND must be maintained.

3. Please be sure users are grounded when handing LCD Module

3.2 Environmental Absolute Maximum Ratings

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

1. The response time will become lower when operated at low temperature.

2. Background color changes slightly depending on ambient temperature.
   The phenomenon is reversible.

3. Ta<=40 ℃:90%RH MAX.
   Ta>=40 ℃:Absolute humidity must be lower than the humidity of 90%RH at 40 ℃.

4. Electrical Specifications and Instruction Code

4.1 Electrical characteristics (Vss=0V ,Ta=25°C)

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Note
Power supply		VCC	Ta=25℃	3.0	3.3	3.6	V	
Input voltage	'H'	V_{IH}	V_{CC}=3.3V	0.8V_{CC}	-	V_{CC}	V	
	'L'	V_{IL}	V_{CC}=3.3V	0	-	0.2V_{CC}	V	

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

Item	Symbol	Min	Typ	Max	Unit	Note
Supply voltage	Vf	16.8	18	21	V	Note 1
Supply Current	If	-	20	-	mA	Note 2
Uniformity	△Bp	80	-	-	%	
Life Time	-	-	20000	-	Hr	Note 3,4

Note 1: The LED Supply Voltage is defined by the number of LED at Ta=25 ℃ and If =20mA.

Note 2: LED current is measured by utilizing a high frequency current meter as shown below:
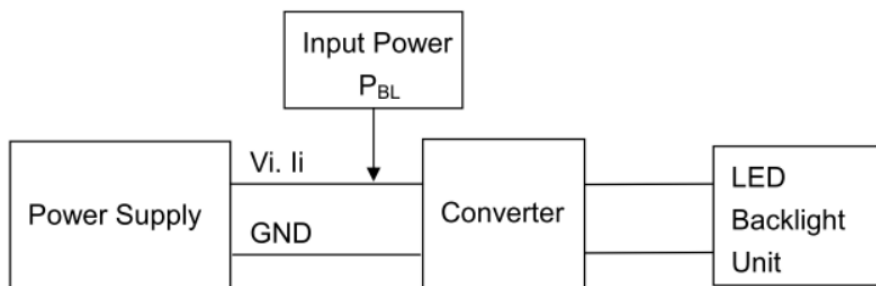
Note 3: The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25 ℃ and If =20mA. The LED lifetime could be decreased if operating If is larger than 20mA.
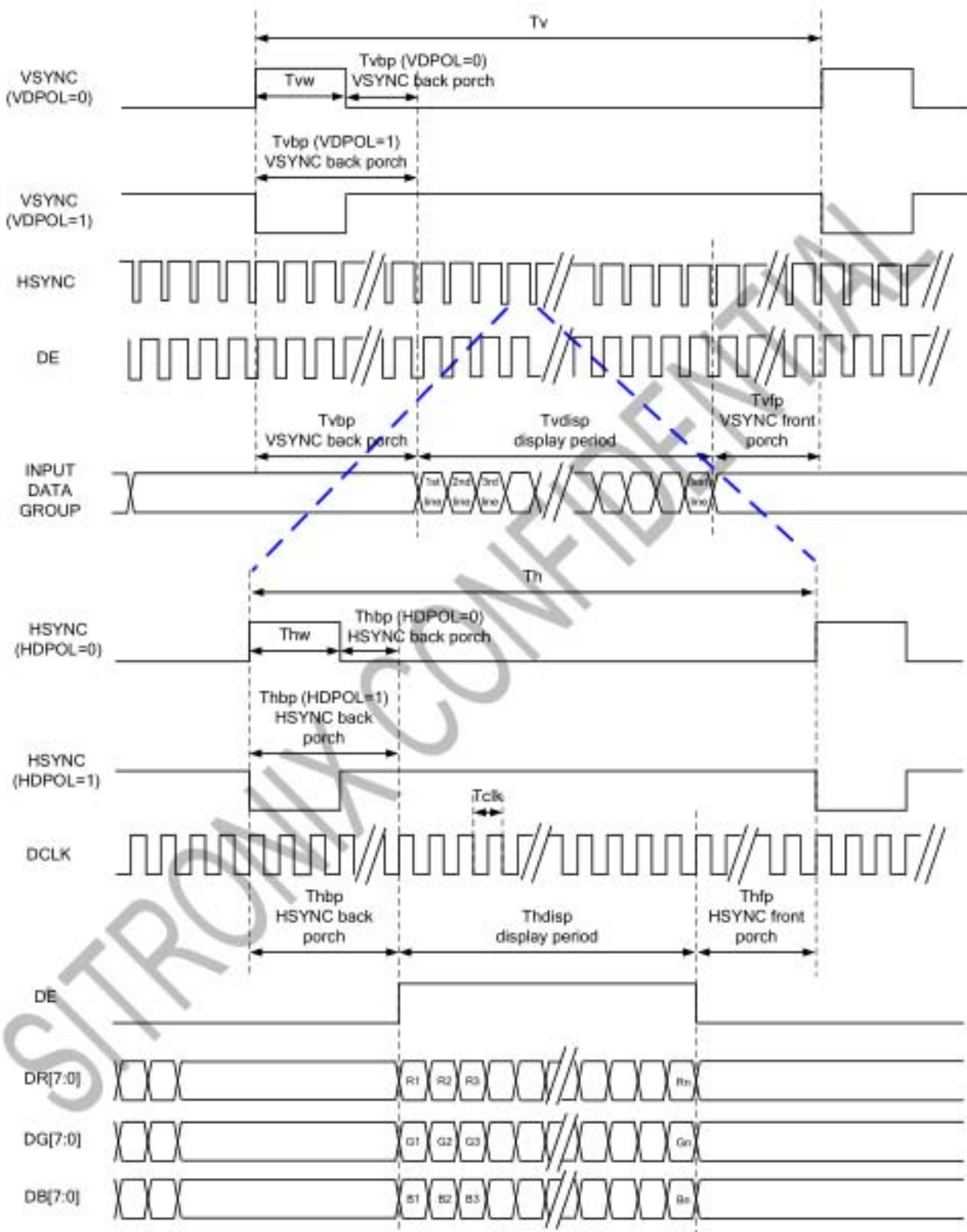
Note 4: LED light bar circuit:
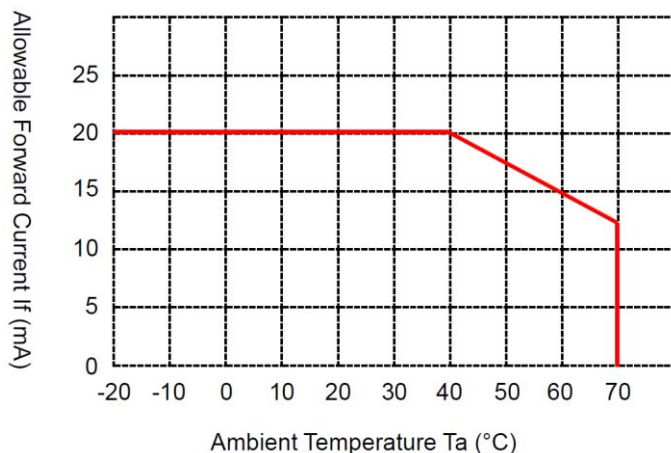
4.3 Interface signals

Pin No.	Symbol	I/O	Function
1-2	LED-	P	LED power cathode
3-4	LED+	P	LED power anode
5	(NC)YU	O	No connection
6	(NC)XR	O	No connection
7	NC	-	No connection
8	RESET	I	Reset pin
9	SPENA	I	SPI interface data enable signal
10	SPCLK	I	SPI interface clock
11	SPDAT	I	SPI interface data
12-19	B0-B7	I	Blue data bus
20-27	G0-G7	I	Green data bus
28-35	R0-R7	I	Red data bus
36	HSYNC	I	Horizontal sync input
37	VSYNC	I	Vertical sync input
38	DCLK	I	Data clock input
39-40	NC	-	No connection
41-42	VCC	P	System power
43	(NC)YD	O	No connection
44	(NC)XL	O	No connection
45-46	NC	-	No connection
47	VD	I	Vertical scan direction control pin. This pin must be connected to "H" or "L" according to system application.
48	HD	I	Horizontal scan direction control pin. This pin must be connected to "H" or "L" according to system application.
49	PS	I	Set parallel or serial RGB interface L Serial 8 bit RGB interface H Parallel 24 bit RGB interface
50	DISP	I	DISP sets the display mode. L Standby mode H Normal display mode
51	NC	-	No connection
52	DE	I	Data enable pin
53-54	GND	P	Ground

4.4 SYNC-DE Mode

4.5 Parallel 24bit RGB Input Timing Table

Parallel 24-bit RGB Input Timing Table							
Item		Symbol	Min.	Typ.	Max.	Unit	Note
DCLK Frequency		Fclk	5	6	8	MHz	
DCLK Period		Tclk	125	167	200	ns	
HSYNC	Period Time	Th	325	371	438	DCLK	
	Display Period	Thdisp		320		DCLK	
	Back Porch	Thbp	3	43	43	DCLK	SYNC mode back porch control by H_BLANKING[7:0] setting Thbp= H_BLANKING[7:0]
	Front Porch	Thfp	2	8	75	DCLK	
	Pulse Width	Thw	2	4	43	DCLK	
VSYNC	Period Time	Tv	244	260	289	HSYNC	
	Display Period	Tvdisp		240		HSYNC	
	Back Porch	Tvbp	2	12	12	HSYNC	SYNC mode back porch control by V_BLANKING[7:0] setting Tvbp= V_BLANKING[7:0]
	Front Porch	Tvfp	2	8	37	HSYNC	
	Pulse Width	Tvw	2	4	12	HSYNC	

4.6 Serial 8bit RGB Input Timing Table

Serial 8-bit RGB Input Timing Table							
Item		Symbol	Min.	Typ.	Max.	Unit	Remark
DCLK Frequency		Fclk	15	18	21	MHz	
DCLK Period		Tclk	47	55	66	ns	
HSYNC	Period Time	Th	965	1011	1078	DCLK	
	Display Period	Thdisp		960		DCLK	
	Back Porch	Thbp	3	43	43	DCLK	SYNC mode back porch control by H_BLANKING[7:0] setting Thbp= H_BLANKING[7:0]
	Front Porch	Thfp	2	8	75	DCLK	
	Pulse Width	Thw	2	4	43	DCLK	
VSYNC	Period Time	Tv	244	260	289	HSYNC	
	Display Period	Tvdisp		240		HSYNC	
	Back Porch	Tvbp	2	12	12	HSYNC	SYNC mode back porch control by V_BLANKING[7:0] setting Tvbp= V_BLANKING[7:0]
	Front Porch	Tvfp	2	8	37	HSYNC	
	Pulse Width	Tvw	2	4	12	HSYNC	

5. Optical Characteristics

Item	Symbol		Condition	Min.	Typ.	Max.	Unit	Note
Brightness	Bp		θ=0° Φ=0°	250	300	-	Cd/m^2	1
Uniformity	$\triangle$Bp			80	-	-	%	1,2
Viewing Angle	3:00		Cr≥10	70	80	-	Deg	3
	6:00			70	80	-		
	9:00			70	80	-		
	12:00			70	80	-		
Contrast Ratio	Cr		θ=0° Φ=0°	640	800		-	4
Response Time	T_r+T_f			-	30	40	ms	5
Color of CIE Coordinate	W	x	θ=0° Φ=0°	TBD	TBD	TBD	-	1,6
		y		TBD	TBD	TBD	-	
NTSC Ratio	S			55	60	-	%	

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

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

> *Measuring condition:*
> - *Measuring surroundings: Dark room.*
> - *Measuring temperature: Ta=25 ℃.*
> - *Adjust operating voltage to get optimum contrast at the center of the display.*
>
> *Measured value at the center point of LCD panel after more than 5 minutes while backlight turning on.*
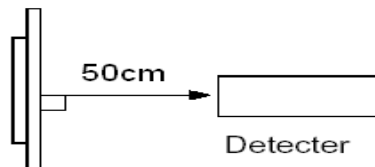
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Note 2: The luminance uniformity is calculated by using following formula.

$\angle Bp = Bp\,(Min.)\,/\,Bp\,(Max.)\times100\,(\%)$

Bp (Max.) = Maximum brightness in 9 measured spots
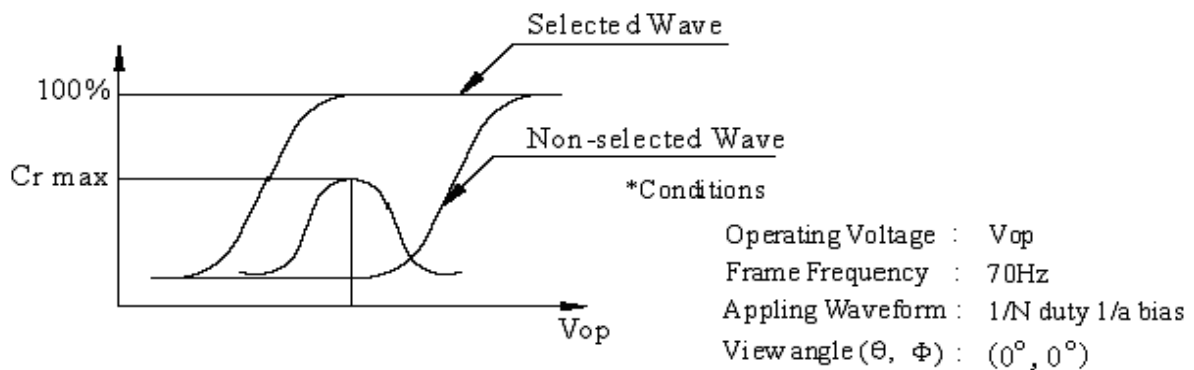
Bp (Min.) = Minimum brightness in 9 measured spots.
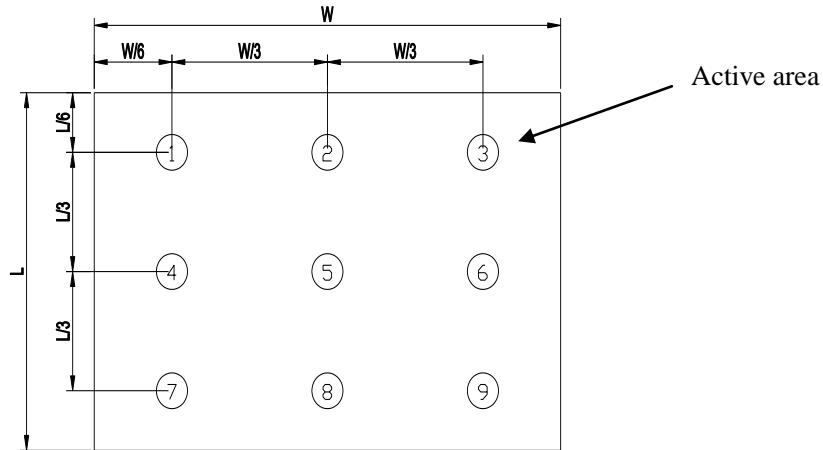
Note 3: The definition of viewing angle:

Refer to the graph below marked by ϑ and Φ

![Microtips TECHNOLOGY]
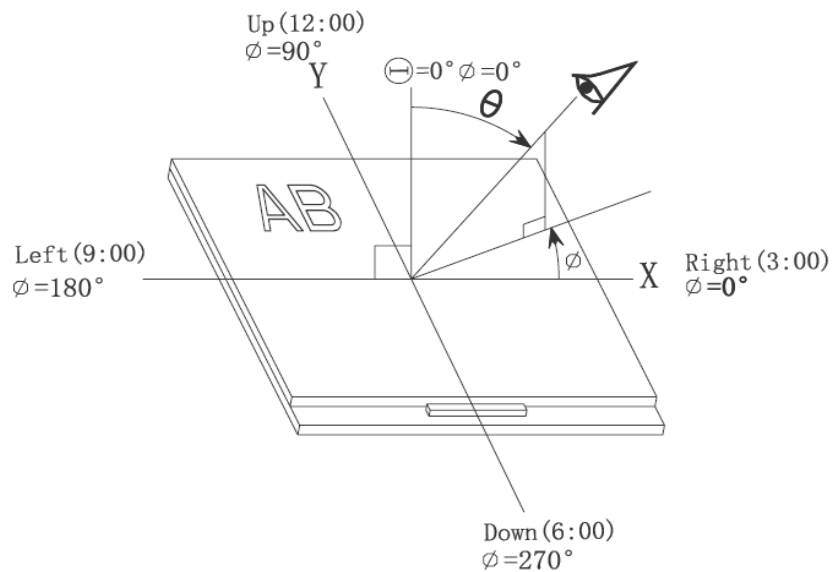
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Note 4: Definition of contrast ratio.(Test LCD using DMS501)

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

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

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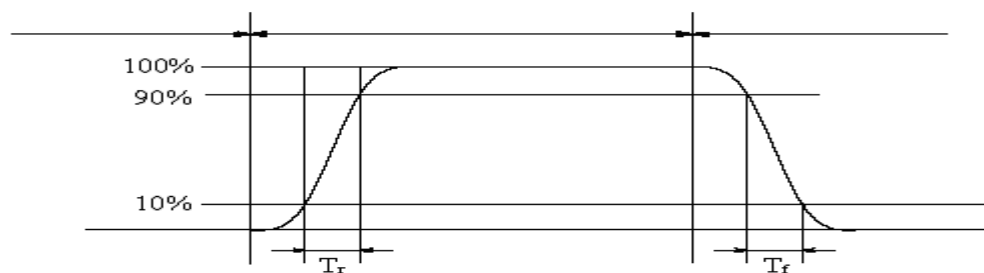
The definition of response time

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

Color gamut:

$$S = \frac{\textbf{area of RGB triangle}}{\textbf{area of NTSC triangle}} \times \textbf{100\%}$$
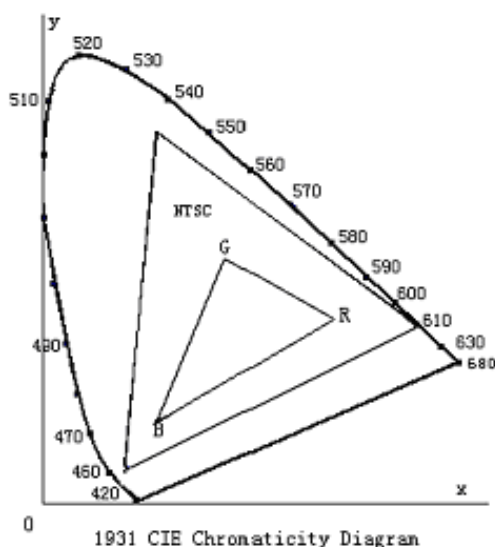
1931 CIE Chromaticity Diagram

Note 7: Definition of cross talk.

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

Pattern A   Pattern B

Measurement point(center)
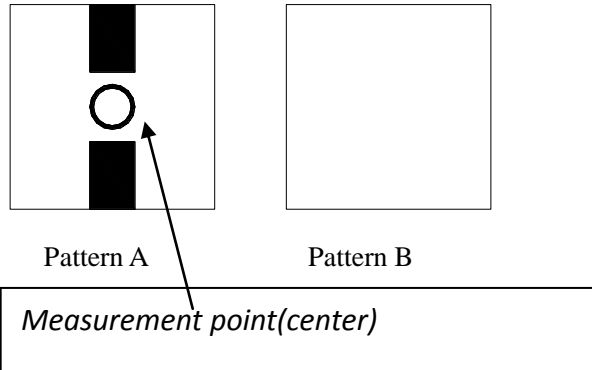
Electric volume value=3F+/-3Hex

6. Reliability Test Items and Criteria

No	Test Item	Test condition	Criterion
1	High Temperature Storage	80℃±2℃ 96H Restore 2H at 25℃ Power off	1. After testing, cosmetic and electrical defects should not happen. 2. Total current consumption should not be more than twice of initial value.
2	Low Temperature Storage	-30℃±2℃ 96H Restore 2H at 25℃ Power off	
3	High Temperature Operation	70℃±2℃ 96H Restore 2H at 25℃ Power on	
4	Low Temperature Operation	-20℃±2℃ 96H Restore 4H at 25℃ Power on	
5	High Temperature/Humidity Operation	60℃±2℃ 90%RH 96H Power on	
6	Temperature Cycle	−30℃ ⟵————⟶ 80℃ 30min 5min 30min after 5 cycle, Restore 2H at 25℃ Power off	

Note: Operation: Supply 3.3V 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

7. Inspection Standard

7.1 Scope

Specifications contain

7.1.1 Display Quality Evaluation

7.1.2 Mechanics Specification

7.2 Sampling Plan

Unless there is other agreement, the sampling plan for incoming inspection shall follow MIL-STD-105E.

7.2.1 Lot size: Quantity per shipment as one lot (different model as different lot).

7.2.2 Sampling type: Normal inspection, single sampling.

7.2.3 Sampling level: Level II.

7.2.4 AQL: Acceptable Quality Level

 Major defect: AQL=0.65

 Minor defect: AQL=1.5

7.3 Panel Inspection Condition

7.3.1 Environment:

 Room Temperature: 25±5°C.

 Humidity: 65±5% RH.

 Illumination: 300 ~ 700 Lux.

7.3.2 Inspection Distance:

 35±5 cm

7.3.3 Inspection Angle:

 The vision of inspector should be perpendicular to the surface of the Module.

7.3.4 Inspection time：

 Perceptibility Test Time: 20 seconds max.

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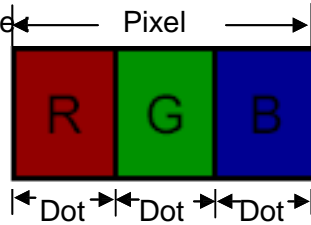
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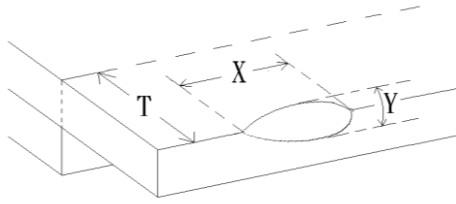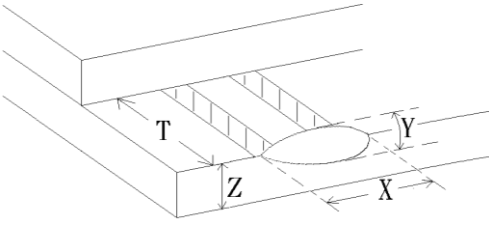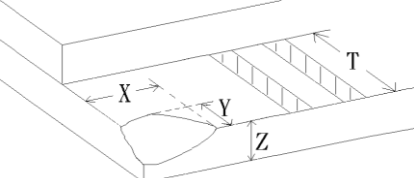## 7.4 Inspection Plan
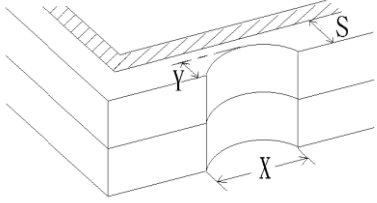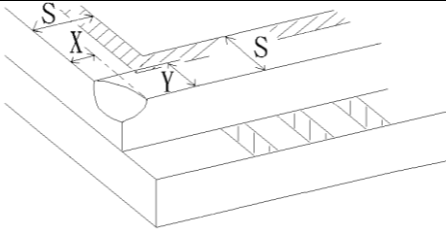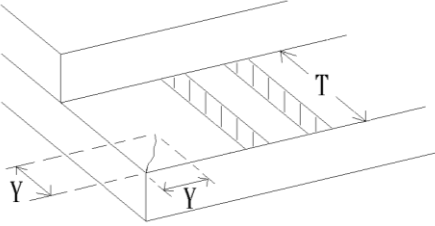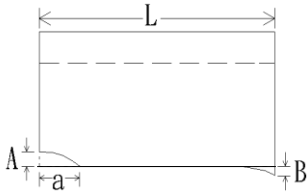
Class	Item	Judgment	Class
Packing & Indicate	1. Outside and inside package.	"MODEL NO.", "LOT NO." and "QUANTITY" should indicate on the package.	Minor
	2. Model mixed and quantity.	Other model mixed.....................Rejected. Quantity short or over.................Rejected.	Critical
	3. Product indication.	"MODEL NO." should indicate on the product.	Major
Assembly	4. Dimension, LCD glass scratch and scribe defect.	According to specification or drawing.	Major
Appearance	5. Viewing area.	Polarizer edge or LCD's sealing line is visable in the viewing area…….Rejected.	Minor
	6. Blemish, black spot, white spot in the LCD and LCD glass cracks.	According to standard of visual inspection.(inside viewing area)	Minor
	7. Blemish, black spot, white spot and scratch on the polarizer.	According to standard of visual inspection.(inside viewing area)	Minor
	8. Bubble in polarizer.	According to standard of visual inspection.(inside viewing area)	Minor
	9. LCD's rainbow color.	Strong deviation color (or newton ring) of LCD……………………….......Rejected. Or according to limited sample.(if needed, and inside viewing area)	Minor
Electrical	10. Electrical and optical characteristics.(contrast Vop chromaticity….etc)	According to specification or drawing.(inside viewing area)	Critical
	11. Missing line.	Missing dot line character……..Rejected.	Critical
	12.Short circuit. Wrong pattern display.	No display, wrong pattern display, current consumption. Out of specification...................Rejected.	Critical
	13. Dot defect.(for color and TFT)	According to standard of visual Inspection.	Minor

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7.5 Standard Of Visual Inspection

No.	Class	Item	Judgment
11.5.1	Minor	Black and white spot. Foreign materiel. Dust. Blemish. Scratch.	(A) Round type: Unit: mm 	Diameter (mm.)	Acceptable Q'ty
---	---
Φ≦0.2	Disregard
0.2 < Φ≦0.25	2(Distance>5mm)
0.25 < Φ	0 | Note: Φ = (length+width)/2 (B) Linear type: Unit: mm | Length	Width (mm.)	Acceptable Q'ty
---	---	---
--	W≦0.03	Disregard
L≦5.0	0.03 < W≦0.07	2(Distance>5mm)
--	0.05 < W	FOLLOW ROUND	
11.5.2	Minor	Dent on polarizer.	Unit: mm. 	Diameter	Acceptable Q'ty
---	---
Φ≦0.2	Disregard
0.2 < Φ≦0.5	2(Distance>5mm)
0.5 < Φ	0	
11.5.3	Minor	Bubble in polarizer.	Unit: mm. 	Diameter	Acceptable Q'ty
---	---
Φ≦0.2	Disregard
0.2 < Φ≦0.5	2(Distance>5mm)
0.5 < Φ	0	
11.5.4	Minor	Dot defect		Items	Acceptable Q'ty
---	---
Bright dot	N ≦1
Dark dot	N ≦1
Total dot	N ≦2	 Pixel define ← Pixel → R G B Dot Dot Dot Note1: The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot. Note 2: Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern. Note 3: The bright dot defect must be visible through 2% ND filter Note 4: Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue pattern.

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No.	Class	Item	Judgment
11.5.5	Minor	LCD glass chipping.	Y>S Reject
11.5.6	Minor	LCD glass chipping.	X or Y>S Reject
11.5.7	Major	LCD glass crack.	Y>(1/2) T Reject
11.5.8	Major	LCD glass scribe defect.	1. a>L/3, A>1.5mm Reject 2. B : According to dimension
11.5.9	Minor	LCD glass chipping. (on the terminal area)	Φ = (x+y)/2>2.5mm Reject
11.5.10	Minor	LCD glass chipping. (on the terminal surface)	Y>(1/3)T Reject
11.5.11	Minor	LCD glass chipping.	Y>T Reject

8. Precautions for Use of LCD Modules

8.1 Handling Precautions

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

8.1.2 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.

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

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

8.1.5 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

8.1.6 Do not attempt to disassemble the LCD Module.

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

8.1.8 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.

8.2 Storage precautions

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

8.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be

stored for a long time, the recommend condition is:

Temperature :   0℃ ～ 40℃

Relatively humidity: ≤80%

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

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

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