ORIENT DISPLAY
MAKE THINGS POSSIBLE

Specification for TFT

AFY240320B0-2.4INTH

Revision A

A	Orient Display
FY	TFT Type
240320	Resolution 240 x 320
B0	Serial B0
2.4	2.4”, Module Dimension 42.72x58.5x2.15 mm
I	IPS Display
N	Top: -20~+70°C; Tstr: -30~+80°C
T	Transmissive
H	Hight Brightness, 1000cd/m2
/	No Touch Panel
/	ST7789VI OR COMPATIBLE
/	MCU8/16BIT RGB18BIT SPI 3/4-wire interface

Table of Contents

Revision History

Rev	Issued Date	Description	Page	Editor
A	24. 09, 2024	First release	All	

Orient Display (N.A.) Ltd.
220 Royal Crest Court,Unit 06,Markham,ON,Canada L3R 9Y2
Tel: 905-477-1166 Fax: 905-477-1782

Orient Display (USA) Corp.
14925 SE Allen Road, Suite 203 B, Bellevue, WA 98006
Tel: (425)698-1938 Fax: (425)698-1852

1.0 GENERAL DESCRIPTION

Item	Specification	Unit
Screen Size	2.4 inch	Diagonal
Number of Pixel	240RGB(H)x320(V)	Pixels
Display area	36.72(H)x48.96(V)	mm
Pixel pitch	0.153(H)x0.153(V)	mm
Outline Dimension	42.72x58.5x2.15	mm
Pixel arrangement	RGB Vertical Stripe	— —
Display mode	Normally Black	— —
Viewing Direction(eye)	ALL	— —
Gray inversion direction	--	
Display Color	262K	— —
Luminance(cd/m^2)	1000	nit
Contrast Ratio	800:1	— —
Surface treatment	— —	— —
Interface	MCU8/16BIT RGB18BIT SPI 3/4-wire	
Back-light	LED Side-light type	— —
Drive IC	ST7789VI	
Operation Temperature	-20~70	℃
Storage Temperature	-30~80	℃
Weight	— —	g

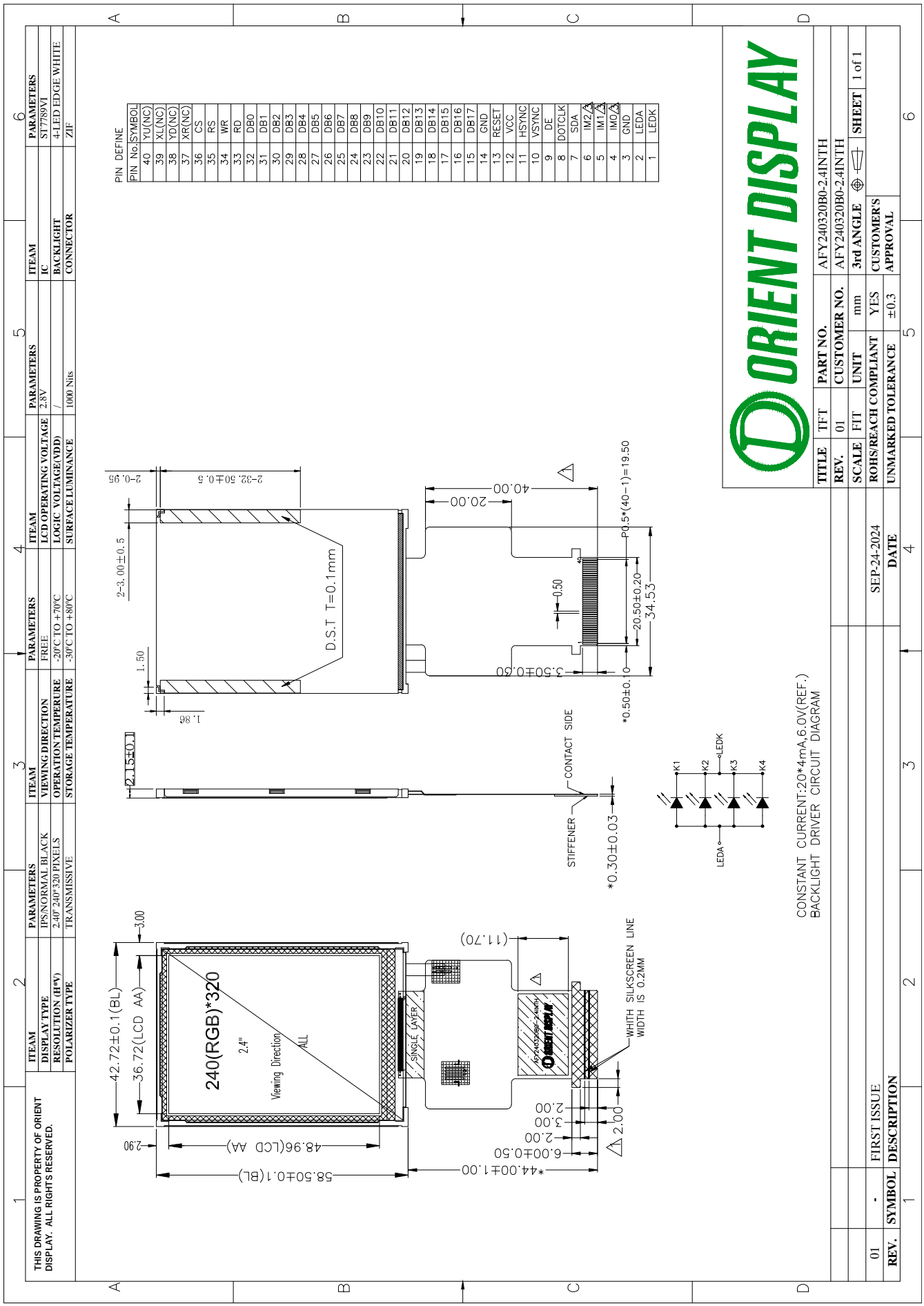
1.1 Features

- MCU8/16BIT RGB18BIT SPI 3/4-wire interface.

1.2 Applications

- MPOS Device.
- Personal Navigation Device.
- Other devices which require high quality displays.

2 . OUTINE DIMENSION



ITEAM	PARAMETERS
DISPLAY TYPE	IPS/NORMAL BLACK
RESOLUTION (H*V)	2.40" 240*320 PIXELS
POLARIZER TYPE	TRANSMISSIVE

ITEAM	PARAMETERS
VIEWING DIRECTION	FREE
OPERATION TEMPERURE	-20°C TO +70°C
STORAGE TEMPERATURE	-30°C TO +80°C

ITEAM	PARAMETERS
LCD OPERATING VOLTAGE	2.8V
LOGIC VOLTAGE(VDD)	/
SURFACE LUMINANCE	1000 Nits

ITEAM	PARAMETERS
IC	ST7789VI
BACKLIGHT	4-LED EDGE WHITE
CONNECTOR	ZIF

3 INPUT INTERFACE PIN ASSIGNMENT

FPC connector is used for electronics interface.

PinNo.	Symbol	Function
1	LEDK	LED back light(Cathode)
2	LEDA	LED back light(Anode)
3	GND	Ground
4	IM0	Select the interface mode
5	IM1	Select the interface mode
6	IM2	Select the interface mode
7	SDA	SPI interface input/output pin.
8	DOTCLK	Dot clock signal for RGB interface operation
9	DE	Data enable signal for RGB interface operation
10	VSYNC	Frame synchronizing signal for RGB interface operation
11	HSYNC	Line synchronizing signal for RGB interface operation
12	VCC	Power Supply. 2.8~3.2V
13	RESET	External reset input.
14	GND	Ground
15~32	DB17~DB0	parallel interface data bus.
33	RD	Read enable in 8080 MCU parallel interface.
34	WR	Write enable in 8080 MCU parallel interface the 4-wire system command or parameter Selection
35	RS	Display data/command selection pin in parallel This pin is used as the serial interface clock in 3-wire 9-bit/4-wire 8-bit serial data interface
36	CS	Chip select input pin
37~40	NC	NC

4 OPTICAL CHARACTERISTICS

4.1 Optical specification

Item		Symbol	Condition	Min	Type	Max	Unit	Note
White luminance (Center)		Lv	Θ=0 Normal Viewing Angle I_{BL}=80mA	--	1000	--	cd/m^2	(4)(5)(7)
Response time		Tr+Tf		--	30	35	ms	(5)
Contrast ratio		CR		500	800	--	--	(2)
Color Chromaticity (CIE1931)	white	Wx		0.288	0.303	0.318		(4)
		Wy		0.314	0.329	0.344		
Viewing Angle	Hor	ΘL	CR≥10	70	80	--		(1)
		ΘR		70	80	--		
	Ver	ΘU		70	80	--		
		ΘD		70	80	--		
Brightness uniformity		Avg	Θ=0	80	90	--	%	(5)
Color Gamut		NTSC	Θ=0	65	70	--	%	C-light
Optima View Direction		ALL						(5)

4.2 Measuring Condition

- Measuring surrounding: dark room
- LED current IL: 80mA
- Ambient temperature: 25±2℃
- 15min. warm-up time

4.3 Measuring Equipment

- FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-7 for other optical characteristics.
- Measuring spot size：20 ~ 21 mm

Note 1: Definition of viewing angle range

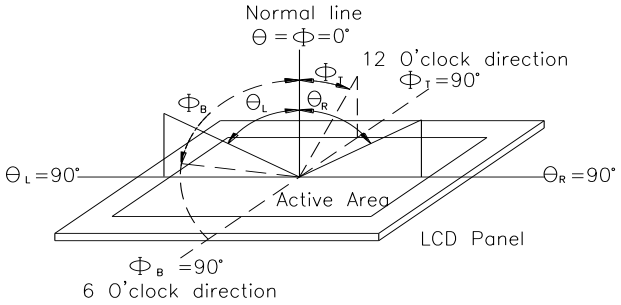


Fig. 8.1. Definition of viewing angle

Note 2: Test equipment setup:
After stabilizing and leaving the panel alone at a driven temperature for 10 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7orBM-5 luminance meter 1.0° field of view at a distance of 50cm and normal direction.

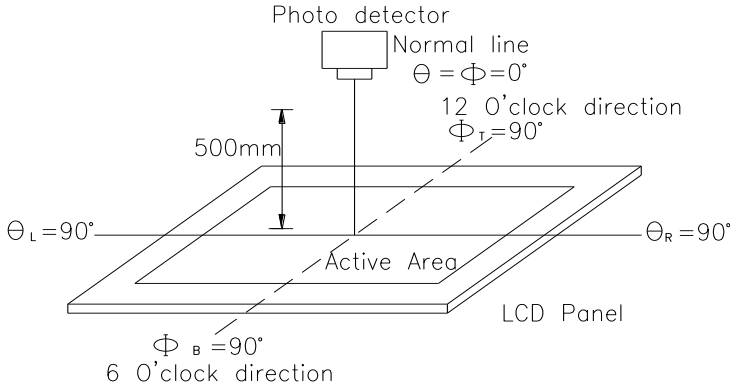
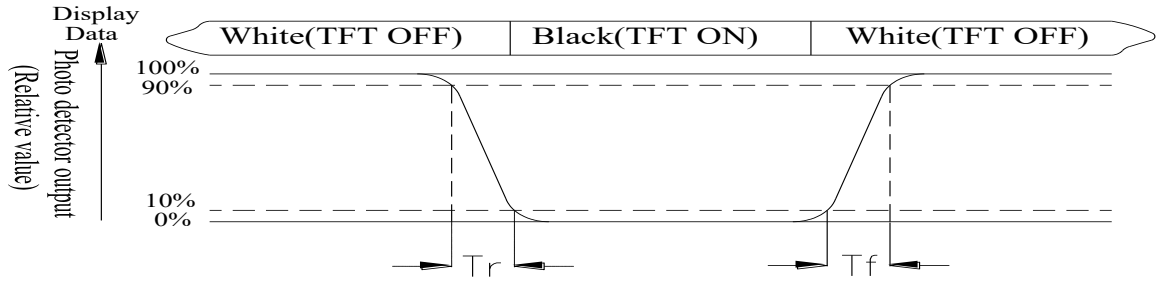


Fig. 8.2. Optical measurement system setup

Note 3: Definition of Response time:

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time, Tr, is the time between photo detector output intensity changed from 90% to 10%. And fall time, Tf, is the time between photo detector output intensity changed from 10% to 90%.



Note 4: Definition of contrast ratio:
The contrast ratio is defined as the following expression.

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

Note 5: Definition of Luminance Uniformity
Active area is divided into 9 measuring areas (reference the picture in below). Every measuring point is placed at the center of each measuring area.
Luminance Uniformity (U) = Lmin/Lmax x100%
L = Active area length
W = Active area width

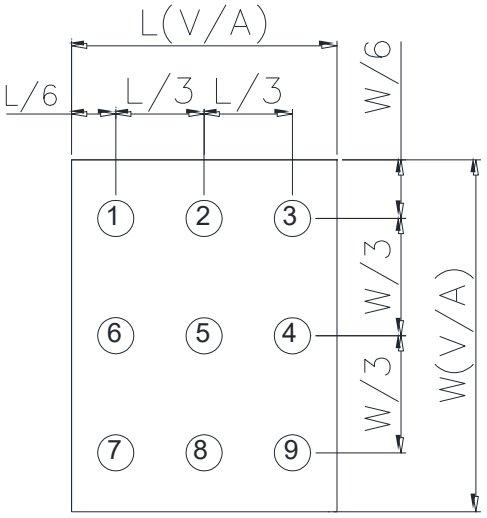


Fig.8.3. Definition of uniformity

Note 6: Definition of color chromaticity (CIE 1931)
Color coordinates measured at the center point of LCD

Note 7: Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

5 ELECTRICAL CHARACTERISTICS

5.1 TFT LCD Module

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Analog supply voltage	VCC	2.4	2.8	3.2	V	
Digital supply voltage	VDDI	-	-	-		
Input signal Voltage	VIH	0.7VDDI	-	VDDI	V	
	VIL	GND	-	0.3VDDI	V	

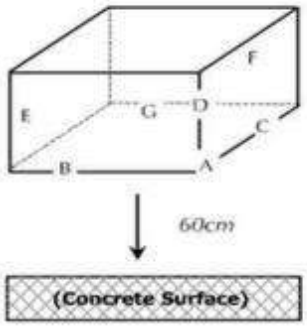
5.2 Back-Light Unit

The backlight system is an edge-lighting type with 4 LED Dies.
The characteristics of the LED are shown in the following tables.

Item	Symbol	Min	Typ	Max	Unit	Note
LED current	IL	-	60	80	mA	(2)
LED voltage	VL	-	5.8	6	V	
Operating LED life time	Hr	-	20000	15000	Hour	(1)(2)

Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25±3 ℃, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note (2) The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25℃and IL=80mA. The LED lifetime could be decreased if operating IL is larger than 100mA. The constant current driving method is suggested.

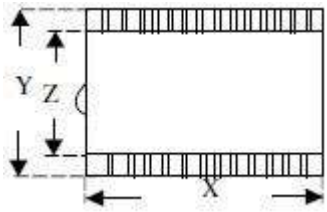
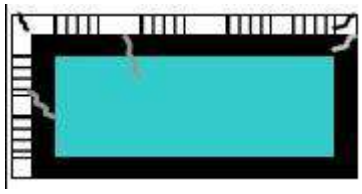
No.	Item	Conditions	Note
1	High Temperature Operation	70 C±2 C, 120 hrs	
2	Low Temperature Operation	-20 C±2 C, 120 hrs	
3	High Temperature Storage	80 C±2 C, 120 hrs	
4	Low Temperature Storage	-30 C±2 C, 120 hrs	
5	High Temperature /Humidity Operation	60 C±2 C, 90% RH, 120 hrs	
6	Temperature Cycling	-10°C→25°C→60°C→25°C→-10°C 30min 5min 30min 5min 30min 10 cycle.	
7	Vibration Test	Total fixed amplitude:1.5mm. Vibration Frequerncy:10~55Hz One cycle 60 seconds to 3 direction of X,Y,Z each 15 minutes.	
8	ESD Test	Air Discharge:Apple ±4KV with 5 times.	
		Contact Discharge:Apple ±2KV with 5 times.	
9	Drop Test	To be measured after dropping from 60cm high on the concrete surface in packing state.  Dropping method corner dropping: A corner: Once edge dropping. B, C, D edge: Once face dropping. E, F, G face: Once.	

Note:
No charge on display and in operation under the following test condition.
Please note that the reliability test project requires the use of virgin samples
Condition : Unless otherwise specified ,tests will be conducted under the following condition.
Temperature:20C±5C
Humidity:65±5%RH.
Tests will be not conducted under functioning state.

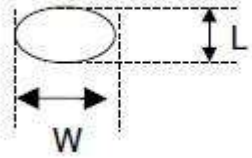
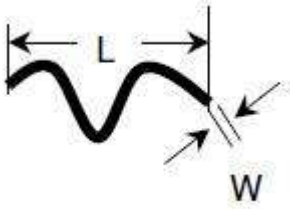
7. Quality Inspection Criteria：

7.1 Visual inspection criterion in cosmetic

(1) Glass defect

Glass defect			
NO	Defect	Criteria	Remark
1	Dimension(Minor)	By engineering diagram	
2	Cracks(Major)	Extensive crack 【Reject】	

(2) LCM appearance defect

NO	Defect	Criteria		Remark
1	Round type(Minor)	Spec	Permissible Qty	1.ψ=(L+W)/2, L: Length, W: Width 2. Disregard if out of A.A. 
		ψ≦0.10mm	Disregard	
		0.10mm<ψ ≦ 0.20mm	**3**	
		0.20mm<ψ	**0**	
2	Line type(Minor)	Spec	Permissible Qty	1. L: Length, W: Width 2. Disregard if out of A.A. 
		W≦0.03mm	Disregard	
		L≦3.0mm and 0.03mm<W≦0.05mm	2	
		L≦3.0mm and 0.05mm<W≦0.10mm	1	
		W>0.10mm orL>3.0mm	0	
3	Polarizer	Spec.	Permissible Qty	1.ψ=(L+W)/2 , L: Length, W: Width 2.Disregard if out of A.A.
		ψ≦0.20mm	Disregard	
		0.20mm<ψ≦ 0.30mm	2	
	dent(Minor)	0.30mm<ψ≦ 0.50mm	1	

NO	Defect	Criteria	Remark
1	Copper peeling(Minor)	Copper peeling 【Reject】	
2	Golden finger	FPC golden finger broken, dead fold, indentation makes FPC surface broken 【Reject】 Tin plating layer(or gold plating) scratch, but not hurt circuit 【Accept】 Except circuit, other position scratch but not expose metal wire 【Accept】	
3	Pin	FPC PI layer delamination 【Reject】 Material and color are inconsistent with sample, FPC burrs 【Reject】 FPC Pin deformation but not affect function. 【Accept】 FPC Pin area is dirty 【Reject】 Other than FPC Pin area is dirty but not affect function 【Accept】	
4	Golden finger	Golden finger edge has burrs,foreign material【Reject】 Golden finger oxidation (dark), uneven electroplating, pinhole, foreign material 【Reject】 Golden finger soldering pad crack exceeds 1/3 length of soldering pad, and soldering pad crack exceed 2 Pins【Reject】 Golden finger tin plating(or gold plating)scratch, but not hurt circuit 【Accept】 Other than golden finger area scratch but not expose metal circuit 【Accept】	
5	FPC Silk printing	Ghosting, incomplete silk printing, wrong printing 【Reject】	
6	FPC Circuit line width	Line width deviation exceed 1/3 line width【Reject】	

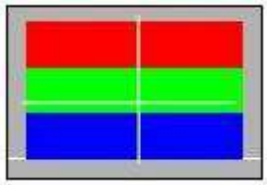
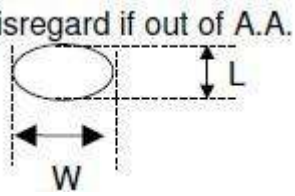
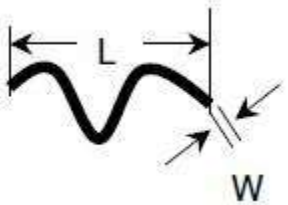
(4) Black tape

NO	Defect	Criteria	Remark
1	Shift(Minor)	IC exposed 【Reject】	
2	No black tape(Minor)	No black tape【Reject】	

(5) Silicon

NO	Defect	Criteria	Remark
1	Amount of silicon (Minor)	ITO exposed 【Reject】	

7.3 Visual inspection criterion in electrical display

<table>
<tr><th>NO</th><th>Defect</th><th colspan="3">Criteria</th><th>Remark</th></tr>
<tr><td>1</td><td>No display (Major)</td><td colspan="3">Not allowed</td><td>  </td></tr>
<tr><td>2</td><td>Missing line (Major)</td><td colspan="3">Not allowed</td><td>  </td></tr>
<tr><td>3</td><td>Darker or lighter Line (Major)</td><td colspan="3">Not allowed</td><td>  </td></tr>
<tr><td>4</td><td>Weak line(Major)</td><td colspan="3">By limited sample</td><td></td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">Bright / Dark point (Minor)</td><td>Spec.</td><td colspan="2">Permissible Qty</td><td rowspan="3">1:1sub-pixel: 1R or 1G or1B
2:Point defect area≧1/2 sub pixel.</td></tr>
<tr><td>Bright point</td><td colspan="2">1</td></tr>
<tr><td>Dark point</td><td colspan="2">2</td></tr>
<tr><td rowspan="4">6</td><td rowspan="4">Round type (Minor)</td><td colspan="2">Spec</td><td>Permissible Qty</td><td rowspan="4">1.ψ=(L+W)/2, L: Length, W: Width
2. Disregard if out of A.A.
  </td></tr>
<tr><td colspan="2">ψ≦0.10mm</td><td>Disregard</td></tr>
<tr><td colspan="2">0.10mm<ψ≦ 0.20mm</td><td>3</td></tr>
<tr><td colspan="2">0.20mm<ψ</td><td>0</td></tr>
<tr><td rowspan="5">7</td><td rowspan="5">Line type (Minor)</td><td colspan="2">Spec.</td><td>Permissible Qty</td><td rowspan="5">1. L: Length, W: Width
2. Disregard if out of A.A.
  </td></tr>
<tr><td colspan="2">W≦0.03mm</td><td>Disregard</td></tr>
<tr><td colspan="2">L≦3.0mm and 0.03mm<W≦0.05mm</td><td>2</td></tr>
<tr><td colspan="2">L≦3.0mm and 0.05mm<W≦0.10mm</td><td>1</td></tr>
<tr><td colspan="2">W>0.10mm or L>3.0mm</td><td>0</td></tr>
<tr><td>8</td><td>Mura (Minor)</td><td colspan="3">By 5% ND filter invisible</td><td></td></tr>
</table>

1. Handling Precautions

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

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.

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

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

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

Do not attempt to disassemble the LCD Module.

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

To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

Be sure to ground the body when handling the LCD Modules.

Tools required for assembly, such as soldering irons, must be properly ground.

To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

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.

Storage precautions

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

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:

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

2 Transportation Precautions

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

9. WARRANTY

1) From the date of shipment by ODNA, customers need to go online and use it within 6 months.

2) According to ODNA TFT LCD quality standards, ODNA will provide a one-year warranty or replacement for products with functional defects.

3)It is strictly prohibited for the display screen to display a fixed image on the entire machine for a long time (the display screen is judged according to the LCD residual image standard); It is recommended that the entire machine automatically enter sleep mode without using LCM for more than 2 minutes, and force LCM into sleep mode without using the system for more than 30 minutes.

4)Please take the module with electrostatic protection in place.

5) Contact us in advance to confirm the use of LCM in special scenarios such as high concentration chemicals, strong magnetic fields, extreme cold, etc.