Project Size.	3.2 inch
Model No.	P032H005-RTP
Samples No.	
Product type.	240xRGBx320 MCU SPI mode
Signature by customer:	

Prepared	Checked	Approved

Shenzhen P&O Technology Co.,Limited

Email: polcd@polcd.com

Mobile: 86-136 0019 7172

1.0 GENERAL DESCRIPTION

Item	Specification	Unit
Screen Size	3.2 inch	Diagonal
Number of Pixel	240RGB(H)x320(V)	Pixels
Display area	48.60(H)x64.80(V)	mm
Pixel pitch	0.2025(H)x0.2025(V)	mm
Outline Dimension	55.04x77.50x3.70	mm
Pixel arrangement	RGB Vertical Stripe	——
Display mode	Normally White	——
Viewing Direction(eye)	12 0'CLOCK	——
Gray inversion direction	--	
Display Color	262K	——
Luminance(cd/m^2)	300	nit
Contrast Ratio	500:1	——
Surface treatment	——	——
Interface	MCU 8/16bit SPI 3/Wire	
Back-light	LED Side-light type	——
Drive IC	ILI9341V	
Operation Temperature	-20~70	℃
Storage Temperature	-30~80	℃
Weight	——	g

1.1 Features

- MCU 8/16bit SPI 3/Wire interface.

1.2 Applications

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

2.0 INPUT INTERFACE PIN ASSIGNMENT

FPC connector is used for electronics interface.

PinNo.	Symbol	Function
1	XL	Touch the left line
2	YU	Touch the upper circuit
3	XR	Touch the right end line
4	YD	Touch the lower line
5	GND	Ground
6	IOVCC	Power Supply. 1.8V
7	VCC	Power Supply. 2.8V
8	FMARK	Frame synchronization signal
9	CS	Chip select input pin (active low)
10	RS	Display data/command selection pin in parallel
11	WR	Write enable in 8080 MCU parallel interface.
12	RD	Read enable in 8080 MCU parallel interface.
13	SDA	SPI interface input/output pin.
14	SDO	SPI interface output pin.
15	RESET	External reset input.
16	GND	Ground
17-32	DB0-DB15	MCU parallel interface data bus.
33	LEDA	LED back light(Anode)
34-36	LEDK	LED back light(Cathode)
37	NC	NC
38	IM0	Select the MCU interface mode
39	IM1	Select the MCU interface mode
40	IM2	Select the MCU interface mode

3.0 OPTICAL CHARACTERISTICS

3.1 Optical specification

Item		Symbol	Condition	Min	Type	Max	Unit	Note
White luminance (Center)		Lv	Θ=0 Normal Viewing Angle I_{BL}=120mA	--	300	--	cd/m^2	(4)(5)(7)
Response time		Tr+Tf		--	16	32	ms	(3)
Contrast ratio		CR		400	500	--	--	(2)(4)
Color Chromaticity (CIE1931)	white	Wx		0.283	0.303	0.323		(6)
		Wy		0.305	0.325	0.345		
Viewing Angle	Hor	ΘL	CR≥10	35	45	--		(1)
		ΘR		35	45	--		
	Ver	ΘU		35	50	--		
		ΘD		10	20	--		
Brightness uniformity		Avg	Θ=0	80	90	--	%	(5)
Color Gamut		NTSC	Θ=0	--	60	--	%	(6)
Optima View Direction		12 O’ clock						(1)

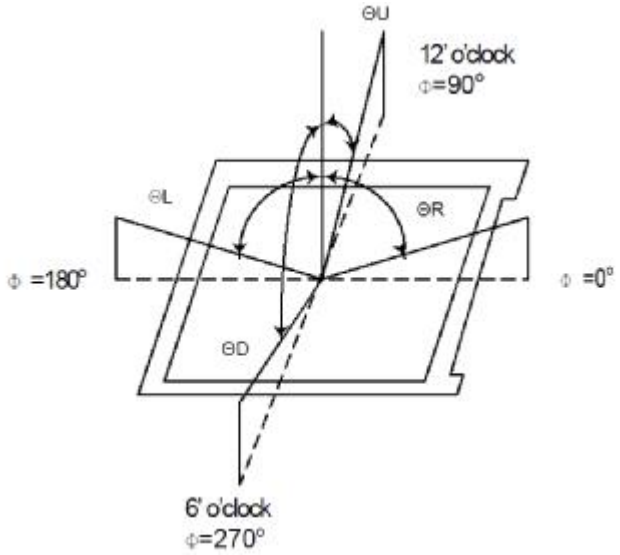
4.2 Measuring Condition

- Measuring surrounding: dark room
- LED current IL: 120mA
- 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

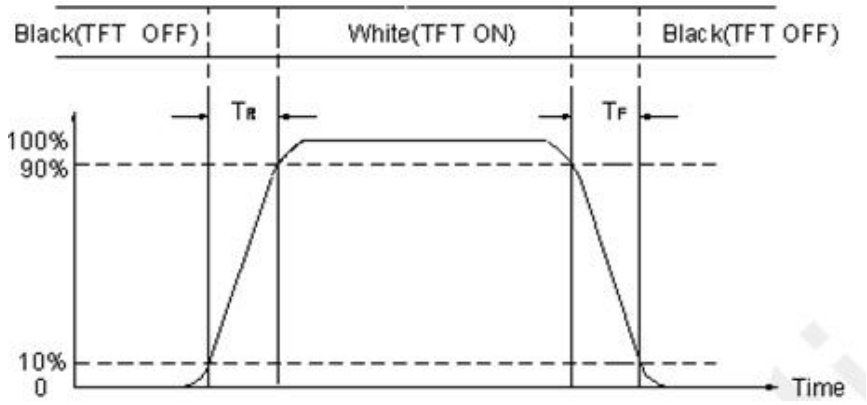


Note (2) Definition of Contrast Ratio(CR):

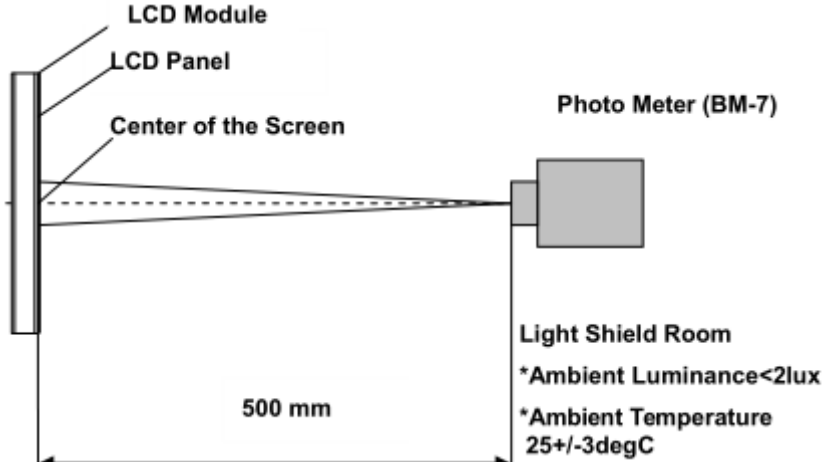
Measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note (3) Definition of Response Time: Sum of TR and TF



Note (4) Definition of optical measurement setup



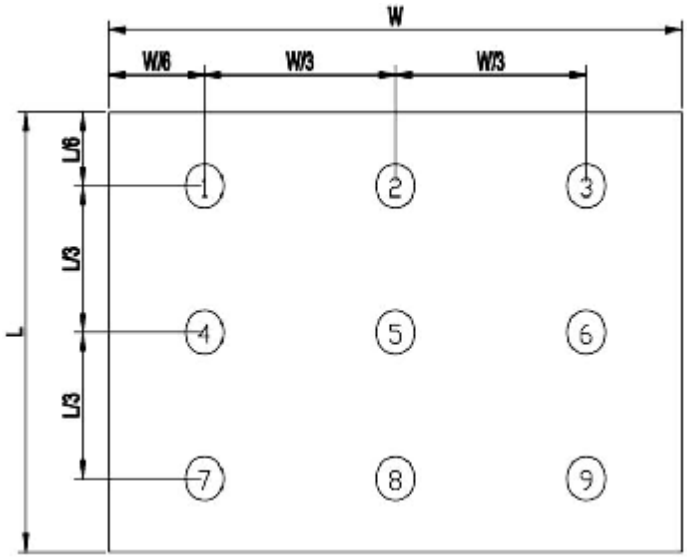
Note (5) Definition of brightness uniformity

The luminance uniformity is calculated by using following formula.

△Bp = Bp (Min.) / Bp (Max.)×100 (%)

Bp (Max.) = Maximum brightness in 9 measured spots

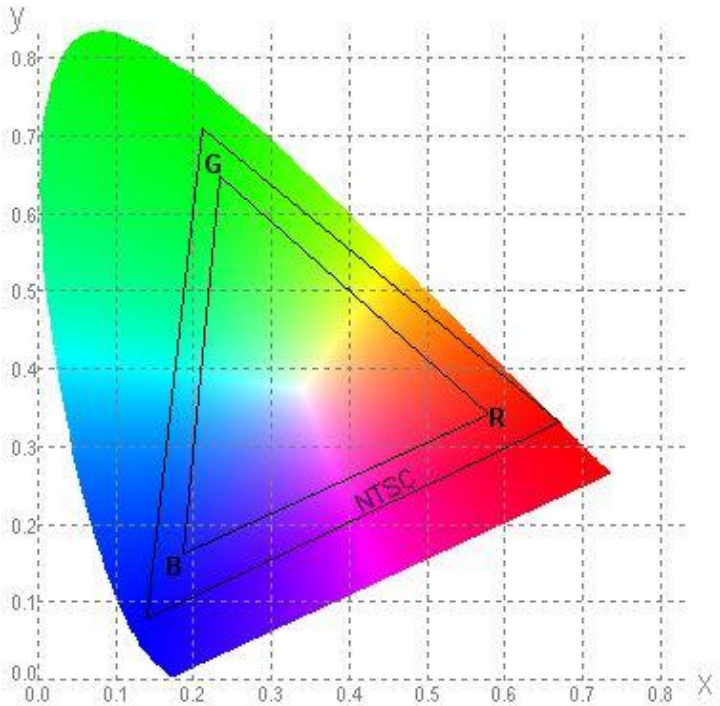
Bp (Min.) = Minimum brightness in 9 measured spots .



Note (6) Definition of Color of CIE1931 Coordinate and NTSC Ratio.

Color gamut:

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



Note (7) Measured the luminance of white state at center point.

4.0 ELECTRICAL CHARACTERISTICS

4.1 TFT LCD Module

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Analog supply voltage	VDD	2.4	2.8	3.3	V	
Digital supply voltage	VDDI	1.65	1.8	3.3		
Input signal Voltage	VIH	0.7VDDI	-	VDDI	V	
	VIL	GND	-	0.3VDDI	V	

4.2 Back-Light Unit

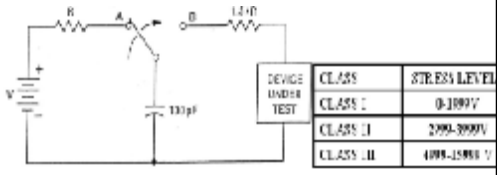
The backlight system is an edge-lighting type with 6 LED Dies.
The characteristics of the LED are shown in the following tables.

Item	Symbol	Min	Typ	Max	Unit	Note
LED current	IL	-	90	120	mA	(2)
LED voltage	VL	-	2.8	3.2	V	
Operating LED life time	Hr	-	6000	6500	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%.

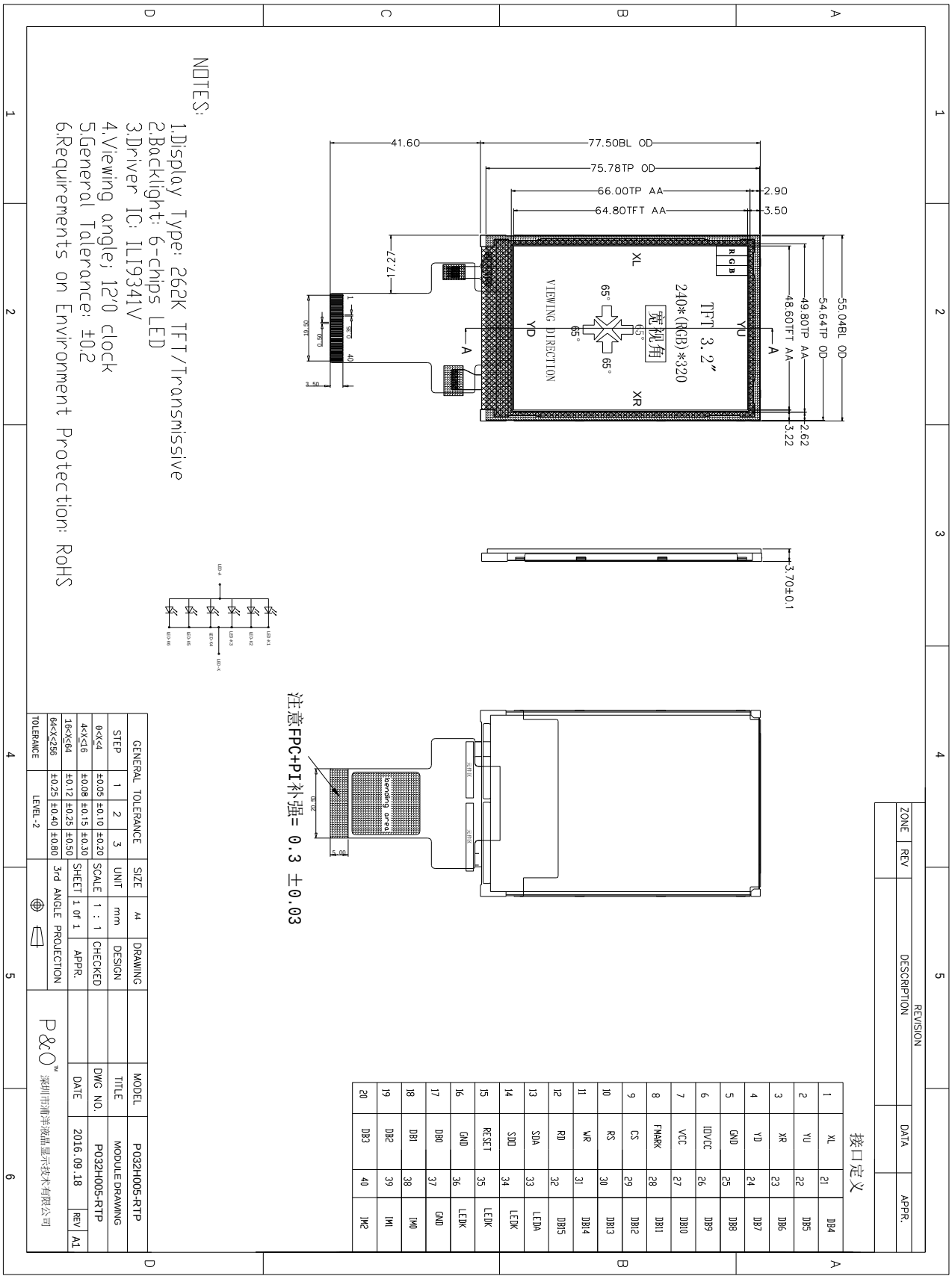
Note (2) The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25℃and IL=80mA. The LED lifetime could be decreased if operating IL is larger than 100mA. The constant current driving method is suggested.

5.0 Reliability conditions

NO	Item	Conditions	Notes
1	High Temperature Storage	Ta=80℃±2℃, 72hrs	
2	Low Temperature Storage	Ta=-30℃±2℃, 72hrs	
3	High Temperature Operation	Ta=70℃±2℃, 72hrs(Operation state)	
4	Low Temperature Operation	Ta=-20℃±2℃, 72hrs(Operation state)	
5	High Temperature and High Humidity (Storage)	Ta=+60℃, 90%RH, 72hrs	
6	Thermal Cycling Test (non operation)	-20℃(30min) → +70℃(30min), 10cycles	
7	Electro static Discharge	Human Body Mode 100pF±10%/1500Ω±1% Air±8kV / contact±6kV Consecutive 10times/ Each discharge 	
8	Vibration test(with carton)	Total fixed amplitude:15mm Vibration Frequency :10~55Hz One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes	
9	Drop (with carton)	Height: 60cm 1 corner, 3 edges, 6 surfaces	

Note: There is no display function NG issue occurred, all the cosmetic specification is judged before the reliability stress.

6.0 OUTINE DIMENSION



1	XL	DB4
2	YU	DB5
3	XR	DB6
4	YD	DB7
5	GND	DB8
6	IDVCC	DB9
7	VCC	DB10
8	FMARK	DB11
9	CS	DB12
10	RS	DB13
11	WR	DB14
12	RD	DB15
13	SDA	LEDA
14	SDO	LEDK
15	RESET	LEDK
16	GND	LEDK
17	DB0	GND
18	DB1	IM0
19	DB2	IM1
20	DB3	IM2

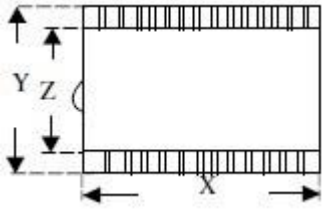
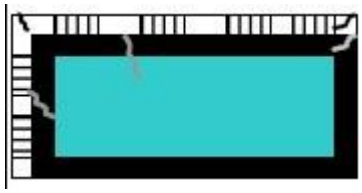
7.0 Items and Criteria：

7.1 Guarantee

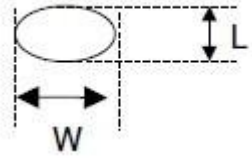
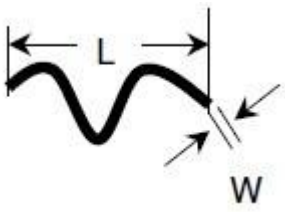
APEX warrants the quality of our products for ***1 year*** (from the date of delivery). If there are functional defects found during the period of warranty, the defective products would be replaced on a one-to-one basis. Apex would not be responsible for any direct /indirect liabilities consequential to any parties.All the products sh ould be stored or used as specified conditions described in these sheets. If module productions are not stored or used as specified conditions, herein, it will be void the ***1 year*** warranty(guarantee).

7.2 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 dent(Minor)	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	
		0.30mm<ψ≦ 0.50mm	1	

(3) FPC

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】	

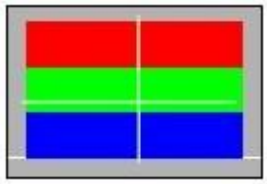
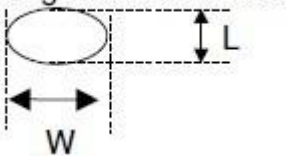
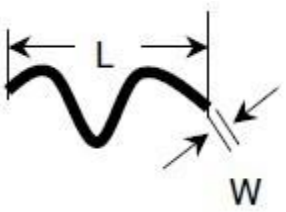
(4) Black tape

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>