TFT-LCD Module Specification

Module NO.： TB040-I4008G70A-00

Version： A0

☐ APPROVAL FOR SPECIFICATION ☐ APPROVAL FOR SAMPLE

For Customer’s Acceptance：	
Approved by	**Comment**

Team Source Display：		
Presented by	**Reviewed by**	**Approved by**

Record of Revision

Version	Revise Date	Page	Content
Pre-spec.A	2022/10/18		Initial Release

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1.0 General Description

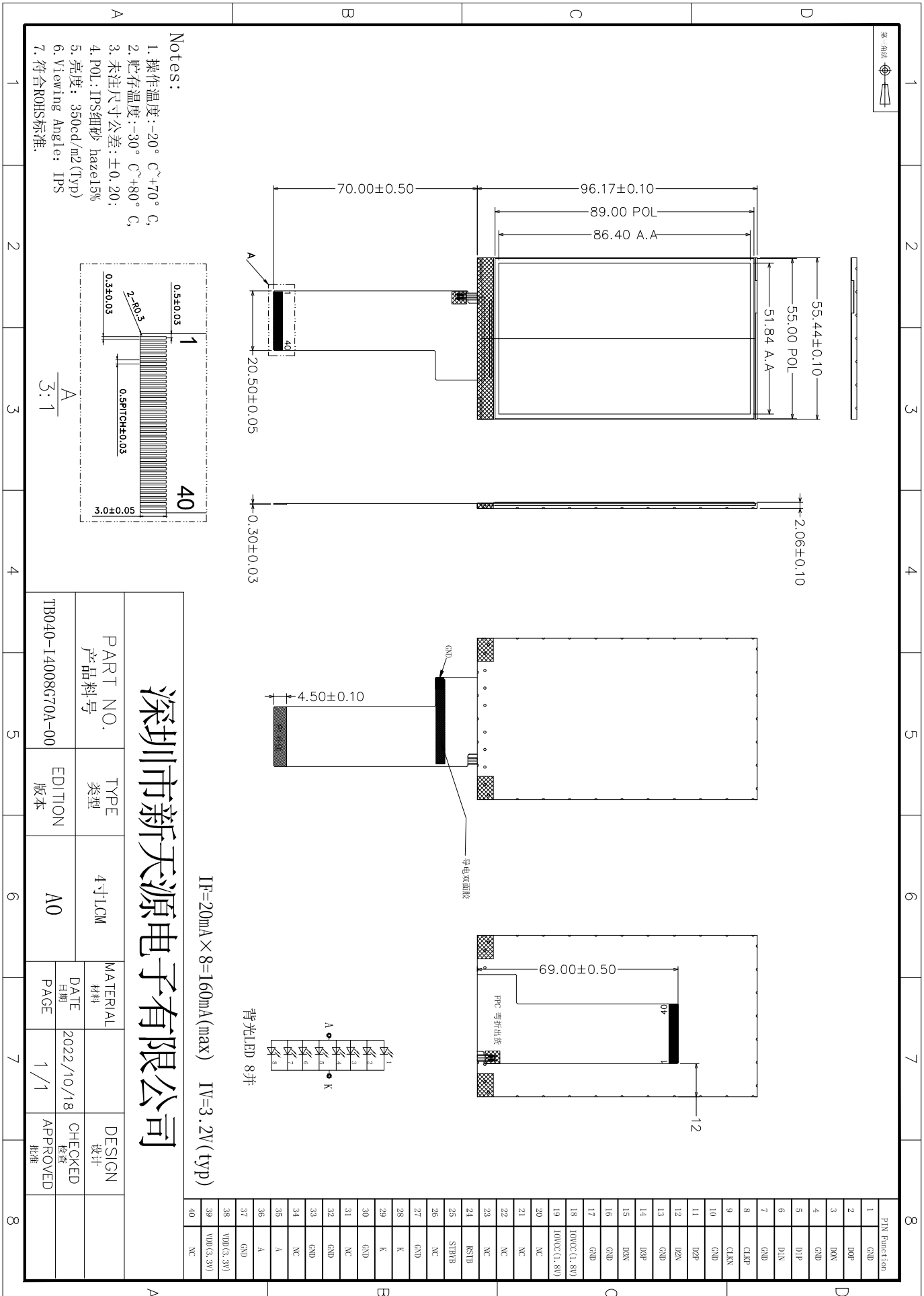
1.1 Introduction

The 3.97" LCM is a color active matrix TFT LCD single cell using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This module has a 3.97 inch diagonally measured active area with WVGA resolutions (480 horizontal by 800 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16.7M colors. The TFT-LCD panel used for this module isadapted for a low reflection and higher color type.

1.2 FEATURES:

No.	Item	Specification	Unit
1	Panel Size	3.97	inch
2	Number of Pixels	480(H) ×800(V)	pixels
3	Active Area	51.84 (H) x86.40 (V)	mm
4	Pixel Pitch	0.108(H) × 0.108(V)	mm
5	Outline Dimension	55.44(H)×96.17 (V)×2.06 (D)	mm
6	Number of Colors	16.7M	-
7	Display Mode	Transmission mode, normally black	-
8	Viewing Direction	Full viewing	-
9	Display Format	RGB vertical stripe	-
10	Driver IC	GC9503CV	-
11	Interface	MIPI	-
12	Backlight	White LED	-
13	Operation Temperature	-20~70	℃
14	Storage Temperature	-30~80	℃
15	Weight	20	g

2. MECHANICAL SPECIFICATION



3. Pin Description

FPC Connector is used for the module electronics interface.

No.	Symbol	Function	Remark
1	GND	Ground	
2	D0P	Positive MIPI differential data input	
3	D0N	Negative MIPI differential data input	
4	GND	Ground	
5	D1P	Positive MIPI differential data input	
6	D1N	Negative MIPI differential data input	
7	GND	Ground	
8	CLKP	Positive MIPI differential clock input	
9	CLKN	Negative MIPI differential clock input	
10	GND	Ground	
11	D2P	Positive MIPI differential data input	
12	D2N	Negative MIPI differential data input	
13	GND	Ground	
14	D3P	Positive MIPI differential data input	
15	D3N	Negative MIPI differential data input	
16	GND	Ground	
17	GND		
18	IOVCC1.8V	A power supply for the analog power.	
19	IOVCC1.8V		
20	NC	No connection	
21	NC	No connection	
22	NC	No connection	
23	NC	No connection	
24	RSTB	Reset pin.	
25	STBYB	Standby mode control.	
26	NC	No connection	
27	GND	Ground	
28	K	LED Cathode	
29	K		
30	GND	Ground	
31	NC	No connection	
32	GND	Ground	
33	GND	Ground	
34	NC	No connection	
35	A	LED Anode	
36	A		
37	GND	Ground	
38	VDD 3.3V	A power supply for the analog power.	
39	VDD 3.3V		
40	NC	No connection	

4. ELECTRICAL CHARACTERISTICS

4.1 ABSOLUTE MAXIMUM RATINGS

Parameter of absolute maximum ratings 参数	**Symbol** 符号	**Min** 最小值	**Max** 最大值	**Unit** 单位
Operating temperature 操作温度	T_{op}	-20	70	°C
Storage temperature 储存温度	T_{st}	-30	80	°C
Humidity 湿度	RH	-	90%(Max60 °C)	RH

4.2 ELECTRICAL CHARACTERISTICS

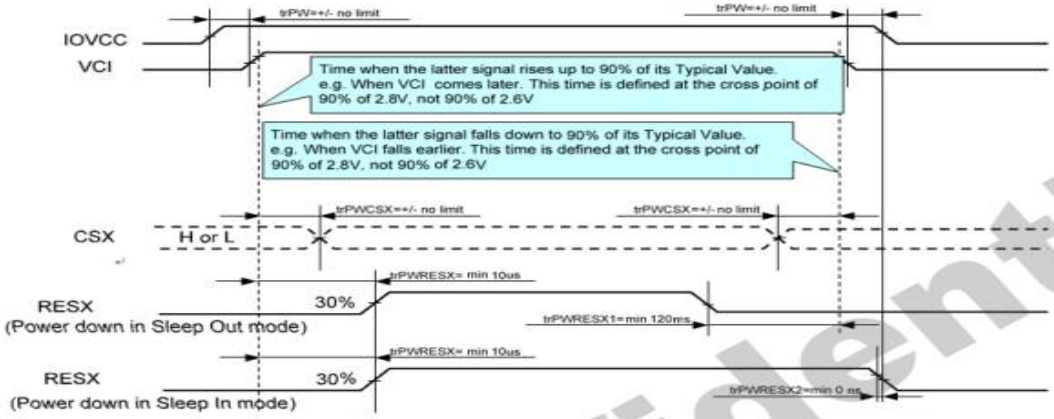
Parameter of DC characteristics 参数	**Symbol** 符号	**Min** 最小值	**Typ** 典型值	**Max** 最大值	**Unit** 单位
Supply voltage for logic 逻辑电压	VCI	2.5	2.8	3.6	V
I/O power supply 接口电压	IOVCC	1.65	1.8	3.6	V
Input Current 输入电流	I_{dd}	-	38	-	mA
Input voltage 'H' level输入高电平	V_{IH}	0.7IOVCC	-	IOVCC	V
Input voltage 'L' level 输入低电平	V_{IL}	-0.3	-	0.3IOVCC	V
Output voltage 'H' level 输出高电平	V_{OH}	0.8IOVCC	-	IOVCC	V
Output voltage 'L' level 输出低电平	V_{OL}	0	-	0.2IOVCC	V

4.3. Backlight Characteristics

Item of backlight characteristics 项目	**Symbol**	**Min.**	**Typ.**	**Max.**	**Unit**	**Condition**
Forward voltage 正向电压	Vf	-	3.2	-	V	If=20mA
Number of LED LED数量	-	-	8	-	Piece	-
Connection mode 连接类型	-	-	并联	-	-	-

4.4 POWER ON/OFF SEQUENCE

If the RESX line is held Low (and stable) by the host during Power On, then the RESX must be held low for minimum 10µsec after both VDD and VDDI have been applied.



trPWRESX1 is applied to RESX falling in the Sleep Out Mode
trPWRESX2 is applied to RESX falling in the Sleep In Mode

Figure 99 Case 2 – RESX line is held Low by Host at Power ON

Note: 1. Unless otherwise specified, timings herein show cross point at 50% of signal power level.

5. Optical Characteristics

5.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance ≤1lux and temperature = 25±2℃) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0°. We refer to θØ=0 (=θ3) as the 3 o‟clock direction (the “right”), θØ=90 (= θ12) as the 12 o‟clock direction (“upward”), θØ=180 (= θ9) as the 9 o‟clock direction (“left”) and θØ=270(= θ6) as the 6 o‟clock direction (“bottom”). While scanning θ and/or Ø, the center of the measuring spot on the Display surface shall stay fixed. Optimum viewing angle direction is 6 ‟clock.

5.2 Optical Specifications

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	Θ_3	CR > 10	80	85	-	Deg.	Note 1
		Θ_9		80	85	-	Deg.	
	Vertical	Θ_{12}		80	85	-	Deg.	
		Θ_6		80	85	-	Deg.	
Contrast ratio		CR	Θ = 0°	600	900	-		Note 2
Luminance (center)		L		-	350	-	cd / m 2	Without APF Note 3
White Chromaticity		x_w		0.277	0.292	0.307		Note 4 CF Glass Base on C Light
		y_w		0.318	0.333	0.348		
Reproduction of color (C light)	Red	R_x		0.650	0.665	0.680		
		R_y		0.308	0.323	0.338		
	Green	G_x		0.257	0.272	0.287		
		G_y		0.573	0.588	0.613		
	Blue	B_x		0.119	0.134	0.149		
		B_y		0.106	0.121	0.136		
Response Time (Rising + Falling)		$T_r + T_f$	Ta= 25° C Θ = 0°	-	35	-	ms	Note 5

6.0 Reliablity Test

No	Test Items	Conditions
1	High temperature storage test	Ta = 70℃, 96 hrs
2	Low temperature storage test	Ta = -30 ℃, 96 hrs
3	High temperature & high humidity (operation test)	Ta = 60 ℃, 90%RH, 48hrs
4	High temperature operation test	Ta = 70 ℃, 96hrs
5	Low temperature operation test	Ta = -20 ℃, 96hrs
6	Thermal shock	Ta = -30 ℃ ↔70 ℃ (0.5 hr), 24 cycle
7	Cold Bubble	Ta= -20℃, Drop Iron Ball 5 times(Height 10cm), 48hrs
8	ESD	150pF 330Ω Contact ±4kV 10points (1time/point) Air ±8KV 10points (1time/point)

7. General Precaution

7.1 Safety

1. Do not swallow any liquid crystal, even if there is no proof that liquid crystal is poisonous.
2. If the LCD panel breaks, be careful not to get liquid crystal to touch your skin.
3. If skin is exposed to liquid crystal, wash the area thoroughly with alcohol or soap.

7.2 Storage Conditions

1. Store the panel or module in a dark place where the temperature is 23±5°C and The humidity is below 50±20%RH.
2. Store in anti-static electricity container.
3. Store in clean environment, free from dust, active gas, and solvent.
4. Do not place the module near organics solvents or corrosive gases.
5. Do not crush, shake, or jolt the module.

7.3 Handling Precautions

1. Avoid static electricity which can damage the CMOS LSI.
2. The polarizing plate of the display is very fragile. So, please handle it very carefully.
3. Do not give external shock.
4. Do not apply excessive force on the surface.
5. Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the Surface of plate.
6. Do not use ketonics solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.
7. Do not operate it above the absolute maximum rating.
8. Do not remove the panel or frame from the module.
9. When the module is assembled, it should be attached to the system firmly, Be careful not to twist and bend the module.
10. Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining and discoloration may occur.
11. If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth in case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.

7.4 Warranty

1. The period is within twelve months since the date of shipping out under normal using and storage conditions.
2. Do not repaired or modified the LCM. It may cause function to lose efficacy, Starry does not warrant the LCM.
3. All process and material comply ROHS.

8. Inspection Standard

8.1 Incoming inspection right

(1) The Incoming Inspection Standard will be agreed and signed by both sides(Customer an starry)

8.2 Inspection condition is as follows

(1) Viewing distance is approximately 35~40 cm
(2) Viewing angle is normal to the LCD panel as Fig-1(30°)
(3) Ambient temperature is approximately 25±5℃
(4) Ambient humidity is 60±5%RH
(5) Ambient illuminance is from 300~500 Lux
(6) Input signal timing should be typical value
(7) Mura & Light leakage inspection an ND-Filter 5%

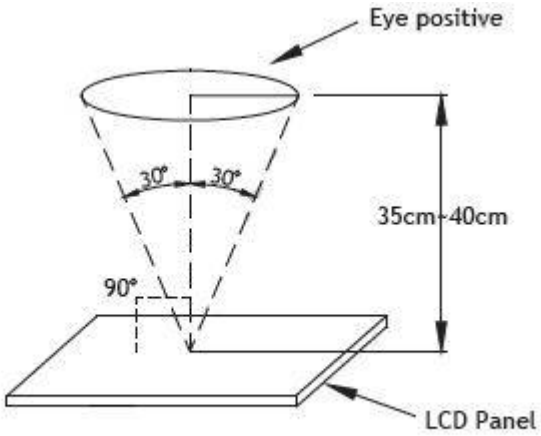


Fig-1

8.3 Special condtion

(1) Viewing distance is close for inspection of adjacent dots and distance between defect Dots
(2) Viewing condition of " Shot block non-uniformity from oblique angle"is as Fig-2
(3) Exceptional case:Veiw angle±40°while inspected image-sticking

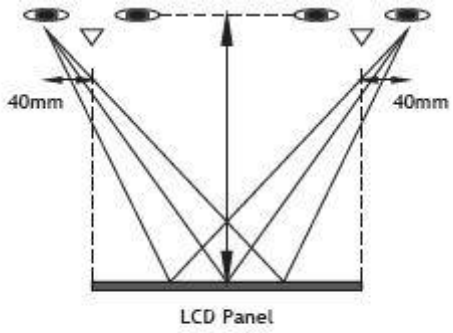
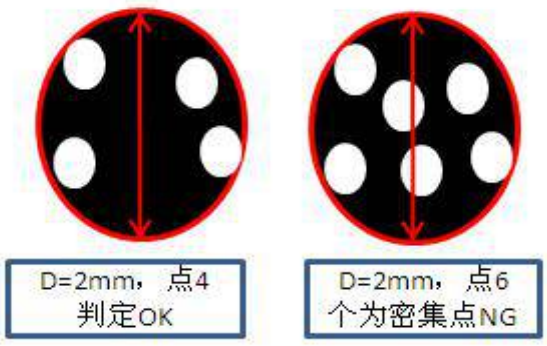
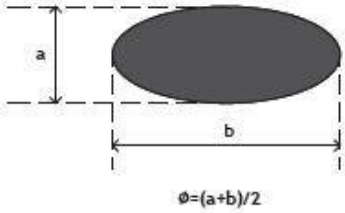


Fig-2

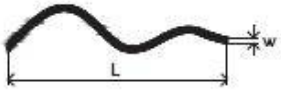
8.4 INSPECTION CRITERIA

<table>
<tr><th colspan="3">Defecttype</th><th colspan="3">Limit</th><th>Note</th></tr>
<tr><td rowspan="11">Visual defect</td><td colspan="2" rowspan="3">Scratch</td><td colspan="2">W≦0.05mm</td><td>Ignore</td><td rowspan="3">Note1</td></tr>
<tr><td colspan="2">0.05mm≦w≦0.1m
L≦10mm</td><td>N≦3</td></tr>
<tr><td colspan="2">20mm < l，0.1mm < w</td><td>N=0</td></tr>
<tr><td rowspan="8">Internal</td><td rowspan="3">Spot</td><td colspan="2">Φ < 0.3mm</td><td>Ignore</td><td rowspan="3">Note 1</td></tr>
<tr><td colspan="2">0.3mm≦φ≦0.4mm</td><td>N≦3</td></tr>
<tr><td colspan="2">0.4≦φ</td><td>N=0</td></tr>
<tr><td rowspan="2">Fiber</td><td colspan="2">0.1mm≦w≦0.2m
L≦2.5mm</td><td>N≦4</td><td rowspan="2">Note 1</td></tr>
<tr><td colspan="2">0.2mm < w，2.5mm < l</td><td>N=0</td></tr>
<tr><td rowspan="3">Polarizer bubble</td><td colspan="2">Φ < 0.3mm</td><td>Ignore</td><td rowspan="3">Note 1</td></tr>
<tr><td colspan="2">0.25mm≦φ≦0.5mm</td><td>N≦2</td></tr>
<tr><td colspan="2">0.5≦φ</td><td>N=0</td></tr>
<tr><td rowspan="3">Dent</td><td colspan="2">Φ < 0.25mm</td><td>Ignore</td><td rowspan="3">Note 1</td></tr>
<tr><td colspan="2">0.25mm≦φ≦0.5mm</td><td>N≦4</td></tr>
<tr><td colspan="2">0.5≦φ</td><td>N=0</td></tr>
<tr><td rowspan="4">Electrical Defect</td><td colspan="2" rowspan="2">Bright dot</td><td>C area</td><td>O area</td><td>Total</td><td rowspan="4">Note 2
Note 3
use of ND5 % invisible OK</td></tr>
<tr><td>N≦1</td><td>N≦2</td><td>N≦3</td></tr>
<tr><td colspan="2">Dark dot</td><td>N≦2</td><td>N≦4</td><td>N≦4</td></tr>
<tr><td colspan="2">Total dot</td><td>N≦3</td><td>N≦4</td><td>N≦4</td></tr>
<tr><td colspan="2">Dense point</td><td colspan="3">Using ND5 % visible by intensive foreign standard judgement, ND5 % invisible OK
 
</td><td>Note 4</td></tr>
<tr><td colspan="6">(1) One pixel consists of 3 sub-pixel,including r,g,ang b dot.(sub-pixel=dot)
(2) Panel is acceptable if distance between 2 dot defects are greater or equal to 5mm.</td></tr>
</table>

Note1 : W : Width[mm], L : Length[mm], N : Number, φ: Average Diameter

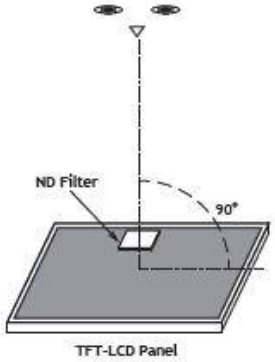


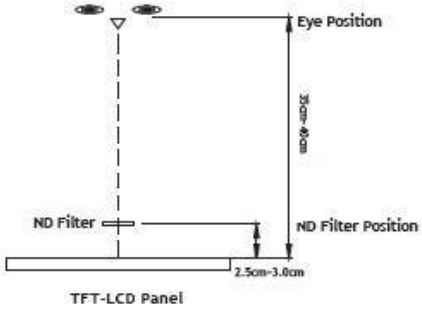
1.(White ,Black) Spot
2.Polarizer Bubble



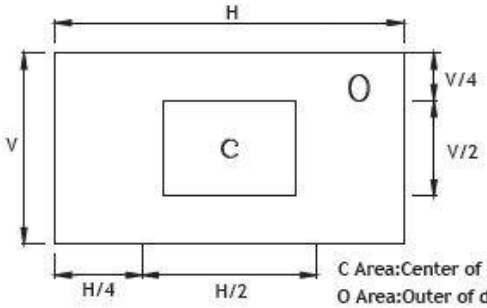
Scratch & Fiber

Note2 : Bright dot is defined as the defective area of the dot is larger than 50% of one sub-pixelarea.



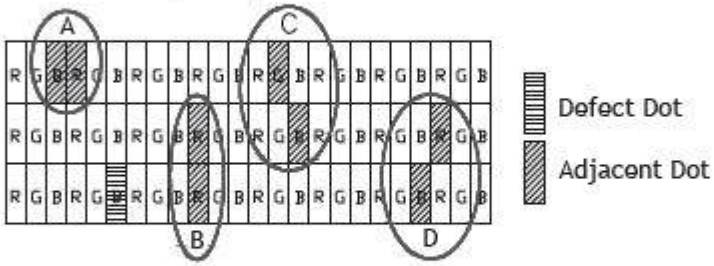


Note3 :



C Area:Center of display area
O Area:Outer of display area

Note4 : Judge defect dot and adjacent dot as following. Allow below (as A, B, C and D status) adjacent defect dots, including bright and dart adjacent dot. And they will be counted 2defect dots in total quantity.



Note5 : Other condition

(1) The defects that are not defined above and considered to be problem shall be reviewed anddiscussed by both parties.

(2) Defects on the Black Matrix, out of Display area, are not considered as a defect or counted.

8.5 . HANDLING PRECAUTION

(1) Don't disassemble and reassemble the module by self.
(禁止自行拆解)
(2) Acid, alkali, alcohol or touched directly by hand will damage the display.
(酸性、碱性、酒精或手的直接接触将会损伤显示面)
(3) Static electricity will damage the module. Please configure grounding device.
(静电会损伤模组，请装配接地设备)
(4)The strong vibration, shock, twist or bend will cause material damage, even module broken.
(强烈的撞击、震动、扭转或弯曲将会造成原材损伤，甚至面板破裂)
(5) It is easy to cause image sticking while displaying the same pattern for very long time.
(长期显示同一画面会造成影像残留)
(6) The response time, brightness and performance will vary from different temperature.
(响应时间、亮度与均匀性会因温度而有所改变)
(7)The Period is within 12 months since the date of shipping out under normal using and Storage conditions.
(从出货之日开始,在正常使用和存储条件下，产品保质期为 12 个月)