Thin-Film-Transistor LCD Module
Model:XTPQ20NN02-02

Acceptance

Approved and Checked by

Approved by	Checked by		Made by

Revise Records

Rev.	Date	Contents	Written	Approved
A	2017/06/26	Preliminary Specification	LUO	JACK

Special Notes

Note1.	
Note2.	
Note3.	
Note4.	
Note5.	

1.General Description and Features

XTPQ20NN02-02 is a TM (Transmissive) type color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT-LCD module, a driver circuit and a back-light unit . The resolution of a 2.0" contains 320RGBx240dots and can display up to 262K colors. The following table described the features of XTPQ20NN02-02.

LCD Module

Item	Specification	Unit
Screen Size	2.0 inches	Diagonal
Display Resolution	320RGB(H)x240(V)	Dot
Active Area	40.8 (H) x 30.6V)	mm
Outline Dimension	46.2 (W) x 41.2(H) x 2.7 (D)	mm
Display Mode	Normally white/Transmissive	--
Pixel Arrangement	RGB-Vertical Stripe	--
Display Color	262K	--
Gray scale inversion Direction	12 o'clock	
Viewing Direction	6 o'clock	--
Drive IC	ILI9342C	--

2.Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	--	46.2	--	mm	--
	Vertical (V)	--	41.2	--	mm	(1)
	Thickness (T)	--	2.7	--	mm	(2)
Weight		--	N/A	--	g	--

Note (1) Not include FPC.
Refer to the Outline Dimension for further information.
(2) Back-light unit are included.

3.Electrical Specifications

3.1 Absolute Max. Ratings

3.1.1 Absolute Ratings of Environment

If the operating condition exceeds the following absolute maximum ratings, the TFT LCD module may be damaged permanently.

(Ta=25±2°C, V_{SS}=GND=0)

Item	Symbol	Min.	Max.	Unit	Note
Operating temperature	T_{OPR}	-20	70	°C	(1)
Storage temperature	T_{STG}	-30	80	°C	(1,2,3)

Note (1) 95 % RH Max. (40 °C ≥ Ta). Maximum wet-bulb temperature at 39 °C or less. (Ta > 40 °C)
No condensation.

Note (2) In case of below 0°, the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one. Level of retardation depends on temperature, because of LC's character

Note (3) Only operation is guarantied at operating temperature. Contrast, response time, another display quality are evaluated at +25°C.

3.2 Electrical Absolute Rating

3.2.1 TFT-LCD Module

(Voltage Referenced to VSS)

Item	Symbol	Value		Unit	Condition
		Min.	Max.		
Digital Power Supply Voltage	VDD	VSS-0.3	5.0	V	--

3.2.2 Back-Light Unit

(Ta=25±2°C)

Item	Symbol	Min.	Max.	Unit	Note
Current(1LED)	I_f	--	30	mA	(1)
voltage	V_R	--	5.0	V	(1)

Note (1) Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded. Functional operation should be restricted to the conditions described under normal operating conditions.

4 Electrical Characteristics

4.1 Backlight Unit

The back-light system is an edge-lighting type with two white LEDs (Light Emitting Diode).

(Ta=25±2°C)

Item	Symbol	Value			Unit	Condition
		Min.	Typ.	Max.		
LED Voltage	VF	2.7	3.0	3.3	V	If=40mA
LED Current	IF	-	40	-	mA	
Power Consumption	P_{BL}	-	-	-	mW	
Brightness through TFT	Lv	-	200	-	nit	If=40mA
Color coordinate(TFT Surface)	Y	0.25<x<0.29				
	X	0.25<x<0.29				
Uniformity(TFT Surface)		>=80%				

Note (1) $P_{BL} = V_F \times I_F$

5 Input Terminal Pin Assignment

Pin	Symbol	Description.
1	VGL	Power supply for the gate driver. Adjust the VGL level with the BT[3:0] bits. Connect this pad with a stabilizing capacitor.
2	VGH	Power supply for the gate driver. Adjust the VGH level with the BT[3:0] bits. Connect this pad with a stabilizing capacitor.
3	C1N	Connect the charge-pumping Capacitor on C1N/C1P for
4	C2N	Connect the charge-pumping Capacitor on C2N/C2P for
5	C1P	Connect the charge-pumping Capacitor on C1P/C1N for
6	C2P	Connect the charge-pumping Capacitor on C2P/C2N for
7	GND	Ground
8	VDD3	Charge-pump circuit reference voltage. Please connect the capacitor between VDD3 and VSS.
9	VDD_25V	Intermediate voltage for charge Pump. Please connect the capacitor between VDD_25V and VSS.
10	VCAC	Define the amplitude of the VCOM swing
11	C3N	Connect the charge-pumping capacitor on C3N/C3P for
12	C3P	
13	DB0	Data input
14	LEDK	LED backlight (Cathode).
15	DB1	Data input
16	LEDA	LED backlight (Anode).
17	NC	Dummy
18	GND	Ground
19	NC	Dummy
20	VDD	Power voltage input
21	NC	Dummy
22	GND	Ground
23	VSYNC	Vertical sync input
24	HSYNC	Horizontal sync input
25	GND	Ground
26	DCLK	Data clock input
27	DB2	Data input
28	DB3	Data input

29	DB4	Data input
30	DB5	Data input
31	DB6	Data input
32	DB7	Data input
33	NC	Dummy
34	NC	Dummy
35	SDA	Serial communication data input
36	SCL	Serial communication clock input
37	GND	Ground
38	CS	Serial communication chip select
39	RESET	This signal will reset the device and must be applied to properlyinitialize the chip.

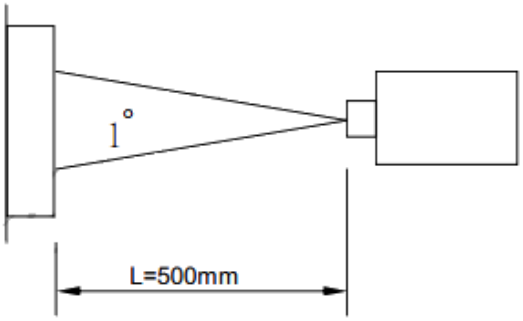
6 LCD Optical Characteristics

(Note1、Note2)
(Taransmittance, contrast ratio, response time, viewing angle results are using CPT LC + EWV Polarizer + Corresponding Backlight, reference only)

ITEM		SYMBOL		CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
Transmittance		T			4.3	5.0	--	%	
Contrast Ratio		CR		$\theta = \phi = 0°$	450	690	--	--	Note 3
Response Time		Tr		$\theta = \phi = 0°$	--	6	12	ms	Note 4
		Tf		$\theta = \phi = 0°$		15	30		
Viewing Angle	Vertical	U	θ*2	CR≧10	50	60	--	degree	Note 5
		D			40	50	--	degree	
	Horizontal	L	ϕ*2		50	60	--	degree	
		R			50	60	--	degree	
Color Filter Chromacicity	W	x		$\theta = \phi = 0°$	(0.293)	(0.313)	(0.333)	--	Note 6
		y			(0.323)	(0.329)	(0.363)	--	
		Y			(29.8)	(30.8)	(35.8)	--	
	R	x			(0.614)	(0.634)	(0.654)	--	
		y			(0.332)	(0.352)	(0.372)	--	
		Y			(20.3)	(23.3)	(26.3)	--	
	G	x			(0.285)	(0.305)	(0.325)	--	
		y			(0.549)	(0.569)	(0.589)	--	
		Y			(56.9)	(60.9)	(64.9)	--	
	B	x			(0.113)	(0.133)	(0.153)	--	
		y			(0.105)	(0.125)	(0.145)	--	
		Y			(11.2)	(14.2)	(17.2)	--	
	NTSC				--	(57.9)	--	--	

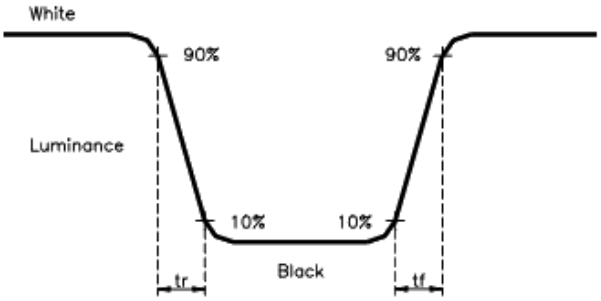
0.27
0.27

Note 1.Ambient condition：25 ± 2℃ 、60 ± 10% RH、under 10 Lunx in the darkroom。
Note 2.Measure device：BM-5AS (TOPCON)、viewing cone = 1°、I_L= 20mA。



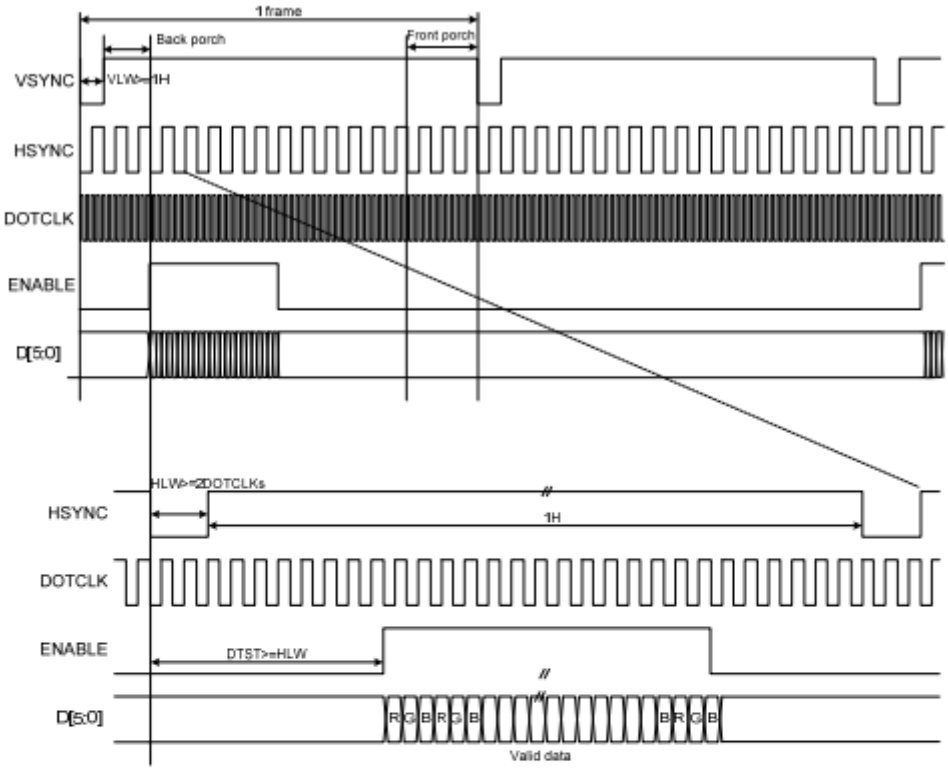
Note 3. Definition of Contrast Ratio :
CR = White Luminance (ON) / Black Luminance (OFF)

Note 4. Definition of response time : The response time is defined as the time interval between the 10% and 90% amplitudes.

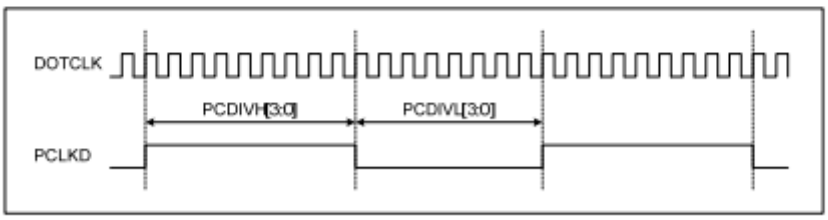


7 Interface Timing

The timing chart of 6-bit RGB interface mode is shown as below:



VLW : VSYNC Low Width
HLW : HSYNC Low Width
DTST : Data Transfer Startup Time



Note 1: The DE signal is not needed when RGB interface SYNC mode is selected.

Note 2: VSPL='0', HSPL='0', DPL='0' and EPL='1' of "Interface Mode Control (B0h)" command.

Note 3: In 6-bit RGB interface mode, each dot of one pixel (R, G and B) is transferred in synchronization with DOTCLK.

Note 4: In 6-bit RGB interface mode, set the cycles of VSYNC, HSYNC and DE to 3 multiples of DOTCLK.

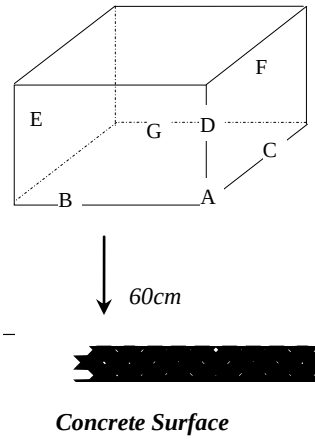
8 Reliability Condition for LCD

No change on display and in operation under the following test condition.

Condition: Unless otherwise specified, tests will be conducted under the following condition.

Temperature: 20±5°C Humidity: 65±5%RH

Tests will be not conducted under functioning state.

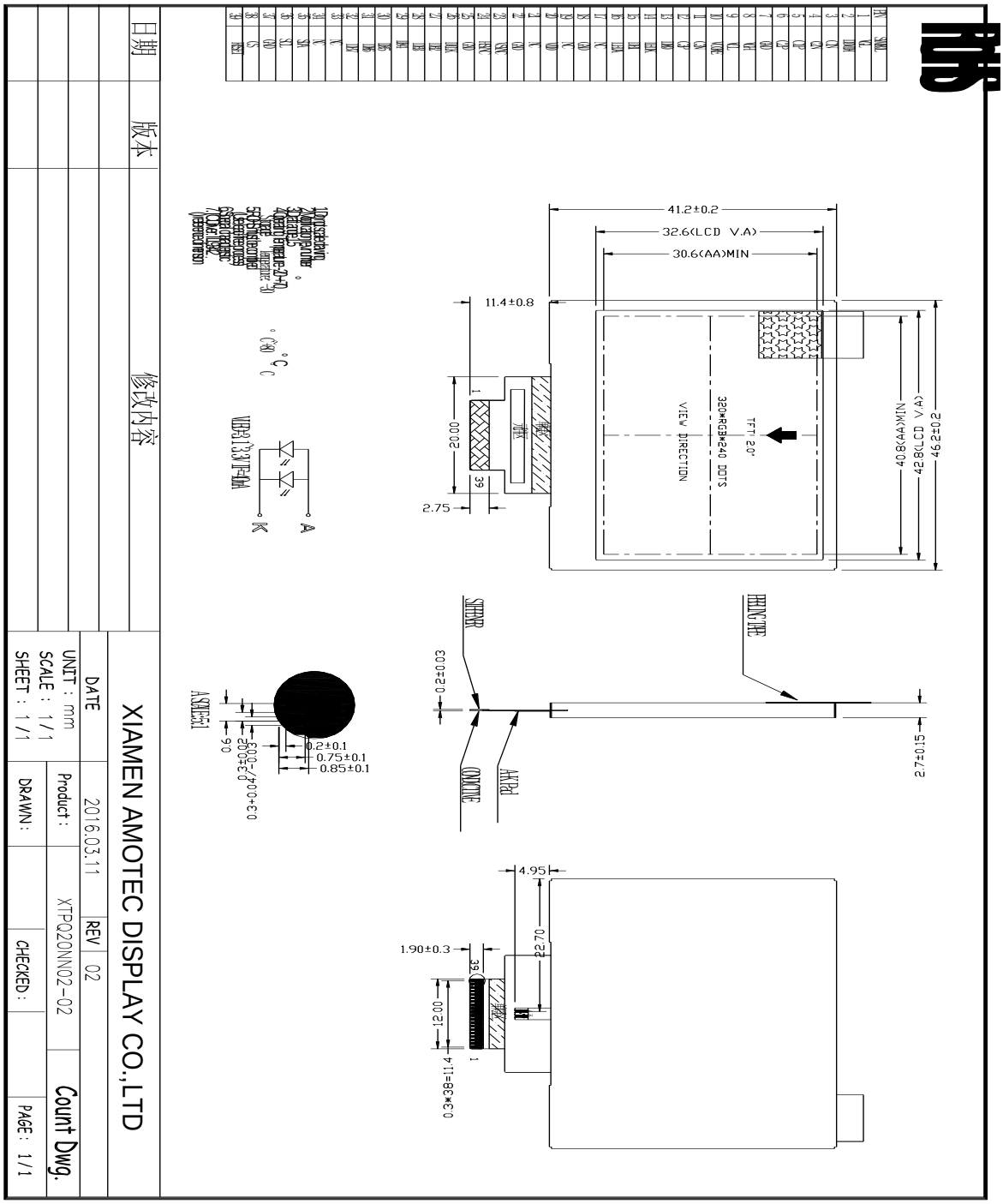
No.	Parameter	Condition	Notes
1	High Temperature Operating	70°C±2°C, 240hrs (Operation state)	--
2	Low Temperature Operating	-20°C±2°C, 240hrs (Operation state)	--
3	High Temperature Storage	80°C±2°C, 240hrs	--
4	Low Temperature Storage	-30°C±2°C, 240hrs	--
5	High Temperature and High Humidity Operation Test	60°C±2°C, 90%, 240hrs	--
6	Vibration Test	Total fixed amplitude: 1.5mm Vibration Frequency: 10~55Hz One cycle 60 seconds to 3 direction of X, Y, Z each 15 minutes.	--
7.	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*	--

Notes: 1. No dew condensation to be observed.

2. The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.

3. Vibration test will be conducted to the product itself without putting I in a container.

9 Dimensional outlines



10 Incoming Inspection Standards

11.1 VISUAL & FUNCTION INSPECTION STANDARD

11.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

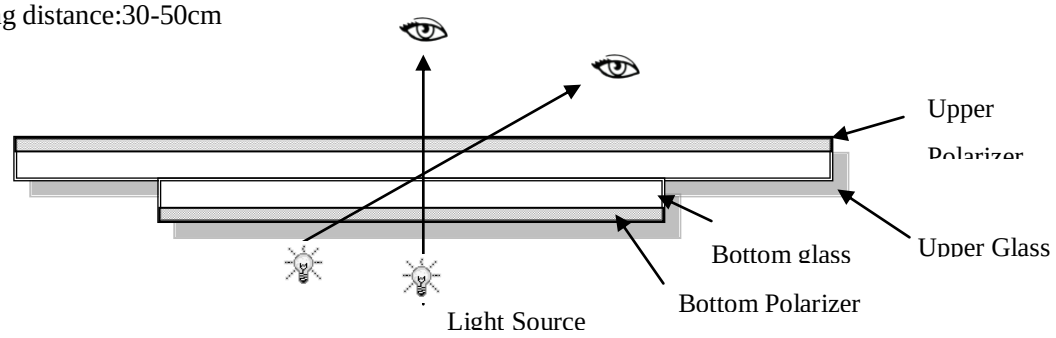
Temperature : 25±5℃

Humidity : 65%±10%RH

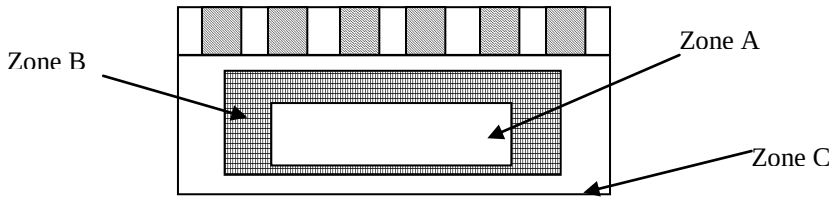
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance:30-50cm



11.1.2 Definition



Zone A : Effective Viewing Area(Character or Digit can be seen)

Zone B : Viewing Area except Zone A

Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer .)

Note:

As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer.

11.1.3 Sampling Plan

According to GB/T 2828-2003 ; , normal inspection, Class Ⅱ

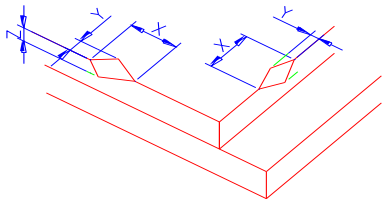
AQL:

Major defect	Minor defect
0.65	1.5

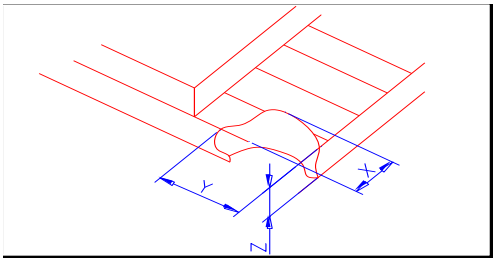
LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module

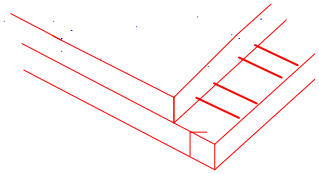
No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. 4) TP no function	Major
2	Missing	Missing component	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Soldering appearance	Good soldering , Peeling off is not allowed.	
6	LCD/Polarizer/TP	Black/White spot/line, scratch, crack, etc.	

11.1.4 Criteria (Visual)

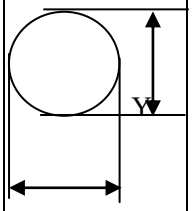
Number	Items	Criteria(mm)
1.0 LCD Crack/Broken NOTE: X: Length Y: Width	(1) The edge of LCD broken	

X	Y	Z
≤3.0mm	<Inner border line of the seal	≤T

<table>
<tr><td rowspan="2">Z: Height
L: Length of ITO,
T: Height of LCD</td><td>(2)LCD corner broken</td><td> 

<table>
<tr><td>X</td><td>Y</td><td>Z</td></tr>
<tr><td>≤3.0mm</td><td>≤L</td><td>≤T</td></tr>
</table></td></tr>
<tr><td>(3) LCD crack</td><td> 
Crack
Not allowed</td></tr>
</table>

Number	Items	Criteria (mm)
2.0	Spot defect	① light dot（LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain）



X

Φ=(X+Y)/2

Zone / Size (mm)	Acceptable Qty A	B	C
Φ≤0.10	Ignore		
0.10<Φ≤0.15	3(distance≧10mm)		Ignore
0.15<Φ≤0.2	1		
0.2<Φ	0		

②Dim spot（LCD/TP/Polarizer dim dot, light leakage、 dark spot）

Zone / Size (mm)	Acceptable Qty A	B	C
Φ≤0.1	Ignore		
0.1<Φ≤0.2	2(distance≧10mm)		Ignore
0.2<Φ≤0.3	1		
Φ＞0.3	0		

③ Polarizer accidented spot

Zone / Size (mm)	Acceptable Qty A	B	C
Φ≤0.2	Ignore		
0.2<Φ≤0.5	2(distance≧10mm)		Ignore
Φ>0.5	0		

<table>
<tr>
<td></td>
<td>Line defect (LCD/TP /Polarizer black/white line, scratch, stain)</td>
<td>
<table>
<tr><td rowspan="2">Width(mm)</td><td rowspan="2">Length(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.03</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.03<W≤0.05</td><td>L≤3.0</td><td colspan="2">N≤2</td></tr>
<tr><td>0.05<W≤0.08</td><td>L≤2.0</td><td colspan="2">N≤2</td></tr>
<tr><td>0.08<W</td><td colspan="4">Define as spot defect</td></tr>
</table>
</td>
</tr>
<tr>
<td>3.0</td>
<td>Polarizer Bubble</td>
<td>
<table>
<tr><td rowspan="2">Zone
Size (mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ<0.2</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.2<Φ<0.4</td><td colspan="2">2(distance≧10mm)</td></tr>
<tr><td>0.4<Φ≤0.6</td><td colspan="2">1</td></tr>
<tr><td>0.6<Φ</td><td colspan="2">0</td><td></td></tr>
</table>
</td>
</tr>
<tr>
<td>4.0</td>
<td>SMT</td>
<td>According to IPC-A-610C class Ⅱ standard . Function defect and missing part are major defect ,the others are minor defect.</td>
</tr>
</table>