Thin-Film-Transistor LCD Module
Model: XTPQ20NN08-01

Acceptance

Approved and Checked by

Approved by	Checked by		Made by

Revise Records

Rev.	Date	Contents	Written	Approved
A	2017/03/06	Preliminary Specification	GAO	JACK

Special Notes

Note1.	
Note2.	
Note3.	
Note4.	
Note5.	

1.General Description and Features

XTPQ20NN08-01 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 i s composed of a TFT-LCD module, a driver circuit and a back-light unit . The resolution of a 2.0" contains 240RGBx320 dots and can display up to 262 colors. The following table described the features of XTPQ20NN08-01.

LCD Module

Item	Specification	Unit
Screen Size	2.0inches	Diagonal
Display Resolution	176GB(H)x220(W)	Dot
Active Area	39.6(H) x31.68 (W)	mm
Display Mode	Normally white/Transmissive	--
Pixel Arrangement	RGB-Vertical Stripe	--
Display Color	262K	--
Viewing Direction	6 o'clock	--
Gray viewing Direction	12 o'clock	--
Drive IC	IL9225G	--

2.Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	--	41.5	--	mm	--
	Vertical (V)	--	49.3	--	mm	(1)
	Thickness (T)	--	2.4	--	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
Storage temperature	T_{STG}	-30	80	°C	(1)
Operating temperature	T_{OPR}	-20	70	°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	0	4.5	V	--

3.2.2 Back-Light Unit

(Ta=25±2°C)

Item	Symbol	Min.	Max.	Unit	Note
Forward current	I_f	--	30	mA	(1)
Reverse 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 TFT-LCD Module (DC Characteristics)

Item	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Supply Voltage	Vcc	2.5	3.0	3.3	V	
Input High Threshold Voltage	V_{IH}	0.7 VDD	-	VDD	V	
Input Low Threshold Voltage	V_{IL}	0	-	0.3 VDD	V	
Power Supply Current	I_{CC}	-	-	-	mA	(1)
Power Consumption	P_L	-	-	-	mW	(1)

Note (1) The specified power consumption is under the conditions at VDD=3.3V , F_V=60Hz, whereas a Power dissipation check pattern below is displayed.

Black Pattern / 0 Gray

Active Area

4.2 Backlight Unit

The back-light system is an edge-lighting type with3 white LEDs (Light Emitting Diode).

(Ta=25±2°C)

Item	Symbol	Value			Unit	Condition
		Min.	Typ.	Max.		
LED Voltage	VF	2.7	3.1	3.3	V	
LED Current	IF	-	40	--	mA	
Power Consumption	P_{BL}	-	124	-	mW	

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

5 Input Terminal Pin Assignment

5.1 Pin Assignment (LCD)

Pin No.	Symbol	I/O /P	Description
1	GND	P	POWER GROUND
2	LED-	P	System Ground For Backlight
3	VCC33	P	Power supply for logic circuits
4	GND	P	POWER GROUND
5	RST	I	A reset pin. Initializes the ILI9225G with a low input. Be sure to execute a power-on reset after supplying power.
6	RS	I	A register select signal. Low: select an index or status register High: select a control register **Fix to GND level when not in use.**
7	MOSI	I	In the 24-bit 4 wires serial peripheral interface, this pin is used as input pin. In the 8/9-bit serial peripheral interface, this pin is used as bi-directional data pin.
8	SCK	I	In 68-system mode, this is used to select operation, read or write. (RW) In 80-system mode, this serves as a write strobe signal (nWR). In SPI mode, it serves as a synchronous clock (SCL).
9	VCC33	P	Power supply for logic circuits
10	CS	I	A chip select signal. Low: the ILI9225G is selected and accessible High: the ILI9225G is not selected and not accessible **Fix to IOVCC level when not in use.**

11	GND	P	POWER GROUND

6 Optical Characteristics

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (1).
Measuring equipment: BM-5A, BM-7,

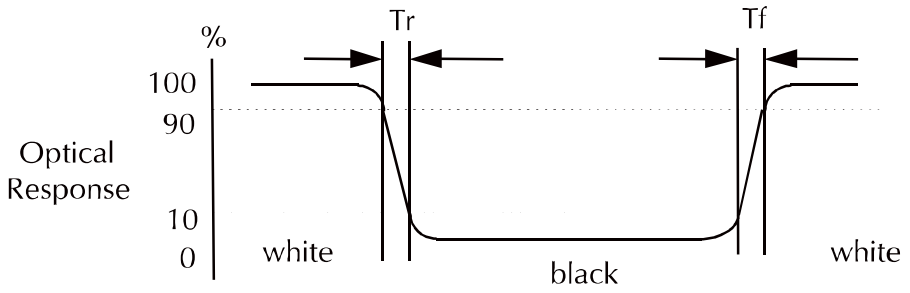
Item		Symbol	Condition	Min	Type	Max	Unit	Note
Brightness		B		--	150	--	cd/m^2	
Response time		$T_{r+}T_f$	θ=0° T=25°C	--	20	40	ms	.
Contrast ratio		CR		200	300	--	--	
Color Gamut		NTSC %	--	--	60	--	%	
Luminance Uniformity		△L		--	80	--	%	
Color Chromaticity (CIE 1931)	White	Wx	θ=0° Normal Viewing Angle	0.206	0.308	0.31	--	BM-7A
		Wy		0.325	0.327	0.329		
Viewing Angle	Hor.	θ_R	--	40	45	--	Degree	
		θ_L		40	45	--		
	Ver.	θ_U		40	45	--		
		θ_D		15	20	--		

a. Test equipment setup

After stabilizing and leaving the panel alone shall be warmed up for the stable operation of LCM, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7(fast) with a viewing angle of 2° at a distance of 50cm and normal direction.

b. Definition of response time: Tr and Tf

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".

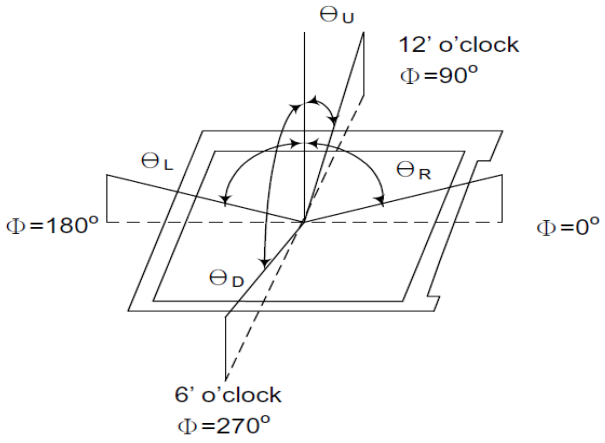


c. Definition of contrast ratio:

$$\text{Contrast Ratio (CR)} = \frac{\text{Brightness measured when LCD is at "white state"}}{\text{Brightness measured when LCD is at "black state"}}$$

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

e. View Angle



f. Definition of Luminance of White: Luminance of white at the center points

Light Source of Back-Light Unit	LED Type

g. Definition of White Uniformity

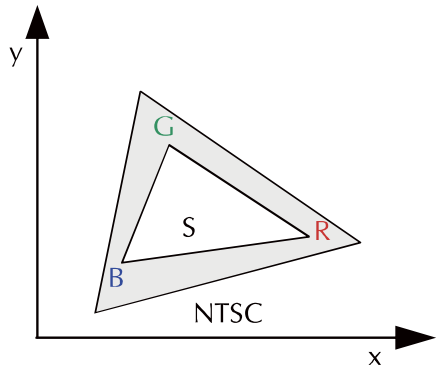
$$\frac{\text{Min. luminance of white among 9-points}}{}$$

$$\text{White Uniformity} = \frac{\text{Max. luminance of white among 9-points}}{\text{Max. luminance of white among 9-points}} \times 100\%$$

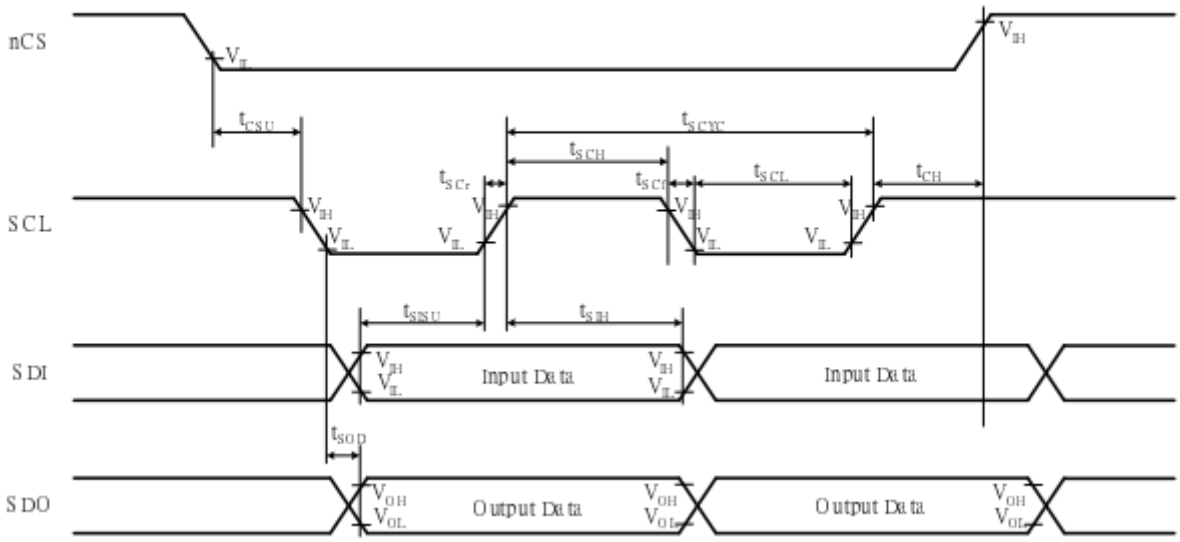
h. The definition of Color Gamut -Color Chromaticity CIE 1931

Color coordinate of white & red, green, blue at center point.

Color Gamut : NTSC(%) = (RGB Triangle Area / NTSC Triangle Area) x 100



7 Interface Timing



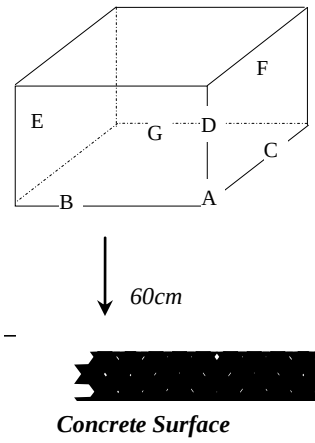
8 Reliability Condition for LCD

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*	--

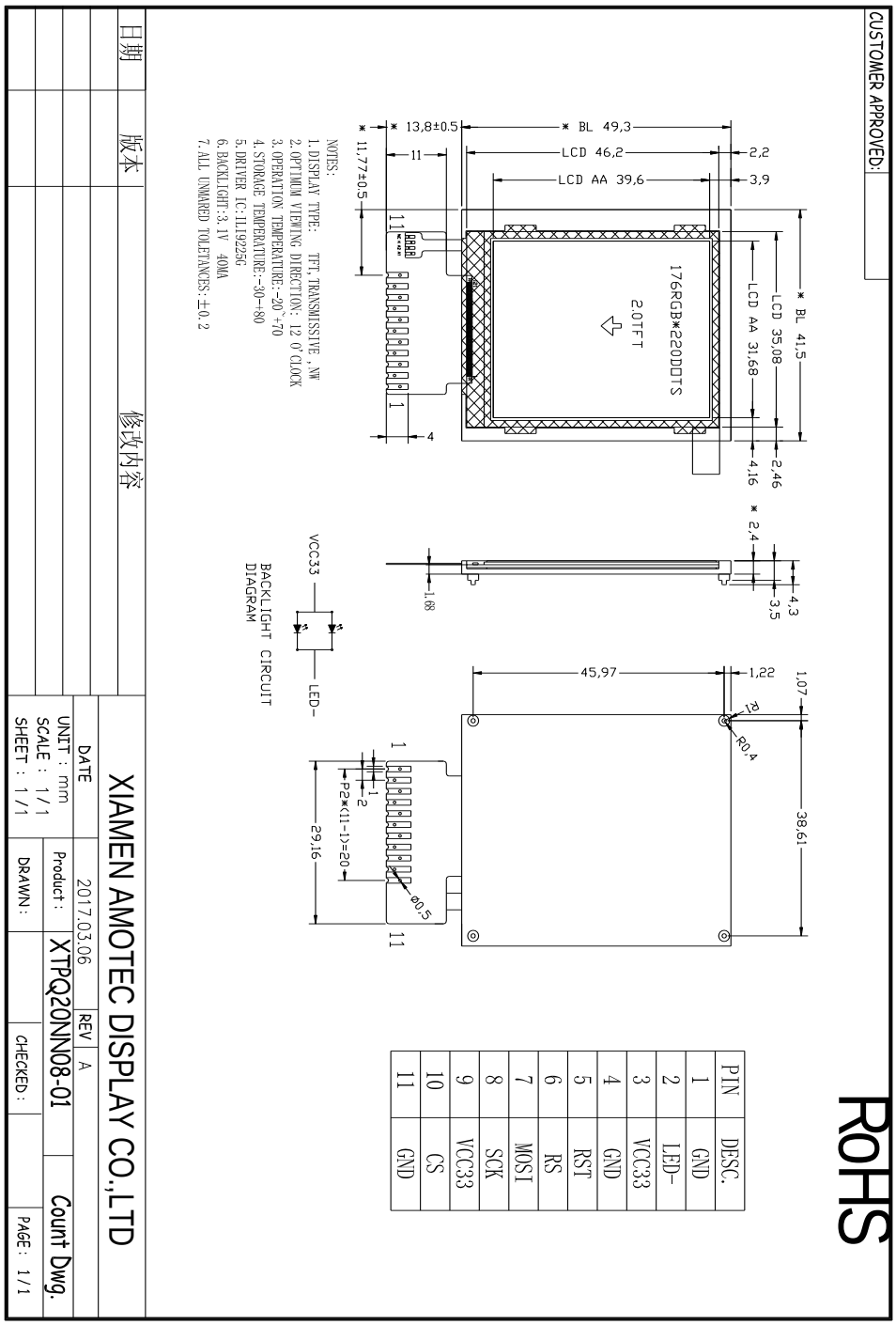
Notes: 1. No dew condensation to be observed.

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



10.1 VISUAL & FUNCTION INSPECTION STANDARD

10.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

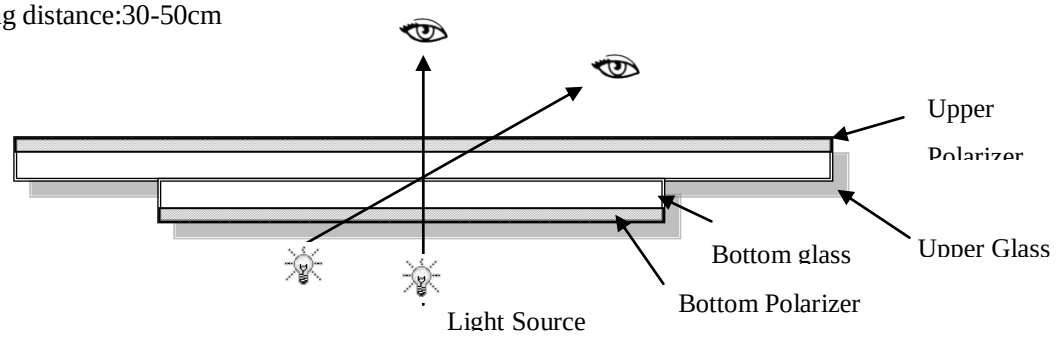
Temperature : 25±5℃

Humidity : 65%±10%RH

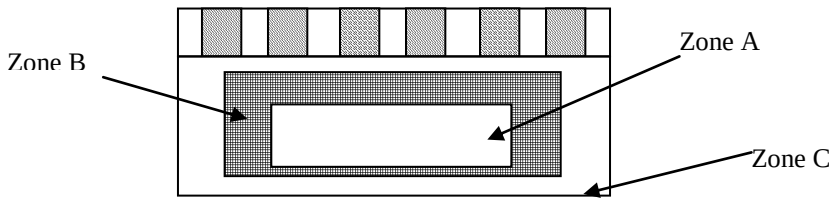
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance:30-50cm



10.1.2 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.

10.1.3 Sampling Plan

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

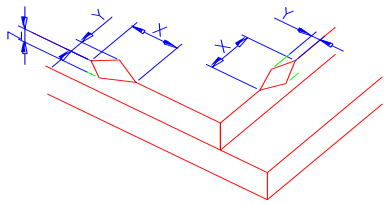
AQL:

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.	

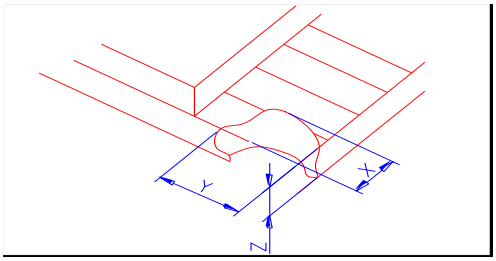
10.1.4 Criteria (Visual)

Number	Items	Criteria(mm)
1.0 LCD Crack/Broken	(1) The edge of LCD broken	

NOTE:
X: Length
Y: Width
Z: Height
L: Length of ITO,
T: Height of LCD

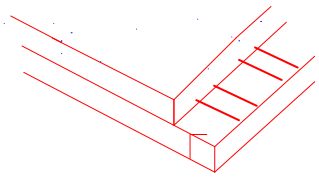
X	Y	Z
≤3.0mm	<Inner border line of the seal	≤T

(2)LCD corner broken

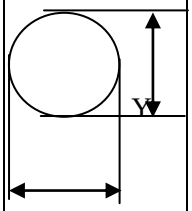


X	Y	Z
≤3.0mm	≤L	≤T

(3) LCD crack



Crack
Not allowed

<table>
<tr><th>Number</th><th>Items</th><th>Criteria (mm)</th></tr>
<tr><td>2.0</td><td>Spot defect
 

X
Φ=(X+Y)/2</td><td>
① light dot（LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain）
<table>
<tr><th rowspan="2">Zone
Size (mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.10</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.10<Φ≤0.15</td><td colspan="2">3(distance≧10mm)</td></tr>
<tr><td>0.15<Φ≤0.2</td><td colspan="2">1</td></tr>
<tr><td>0.2<Φ</td><td colspan="2">0</td></tr>
</table>
②Dim spot（LCD/TP/Polarizer dim dot, light leakage、dark spot）
<table>
<tr><th rowspan="2">Zone
Size (mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.1</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.1<Φ≤0.2</td><td colspan="2">2(distance≧10mm)</td></tr>
<tr><td>0.2<Φ≤0.3</td><td colspan="2">1</td></tr>
<tr><td>Φ＞0.3</td><td colspan="2">0</td></tr>
</table>
③ Polarizer accidented spot
<table>
<tr><th rowspan="2">Zone
Size (mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.2</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.2<Φ≤0.5</td><td colspan="2">2(distance≧10mm)</td></tr>
<tr><td>Φ>0.5</td><td colspan="2">0</td></tr>
</table>
</td></tr>
</table>

<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="4">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></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>