



# SPECIFICATION FOR LCD Module PV022004T0250E

<b>MODULE:</b>	<b>PV022004T0250E</b>
<b>CUSTOMER:</b>	

KT	INITIAL	DATE
<b>PREPARED BY</b>	單光亮	<b>2014-7-2</b>
<b>DATE CHECKED BY</b>	凌传谦	<b>2014-7-2</b>
<b>APPROVED BY</b>		

CUSTOMER	INITIAL	DATE
<b>APPROVED BY</b>		



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**REVISION STATUS**

Version	Revise Date	Page	Content	Modified by
V1.0	2014-7-2	-	First Issued.	



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2. Mechanical Characteristics
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## 1. General Description

### \* DESCRIPTION

PV022004T0250E is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silicon TFT as a switching device. This model is composed of a Transmissive type TFT-LCD Panel, driver circuit, back-light unit. The resolution of a 2.2" TFT-LCD contains 320 x 240 pixels, and can display up to 262K colors.

### \* Features

- Low Input Voltage: VCI: 2.5~3.3V; VDD: 1.65~3.3V
- Display Colors of TFT LCD: 262K colors
- CPU Interface: RGB
- Internal Power Supply Circuit.

General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	44.64(H) *33.48(V)	mm	-
Driver element	a-Si TFT active matrix	-	-
Display colors	262K	colors	-
Number of pixels	320(RGB) *240	dots	-
Pixel arrangement	RGB vertical stripe	-	-
Pixel pitch	0.1395(H) *0.1395(V)	mm	-
Viewing angle	12:00	o'clock	-
Drive IC	ILI9488	-	-
Display mode	Transmissive/ Normally White	-	-
Operating temperature	-20~+70	°C	-
Storage temperature	-30~+80	°C	-

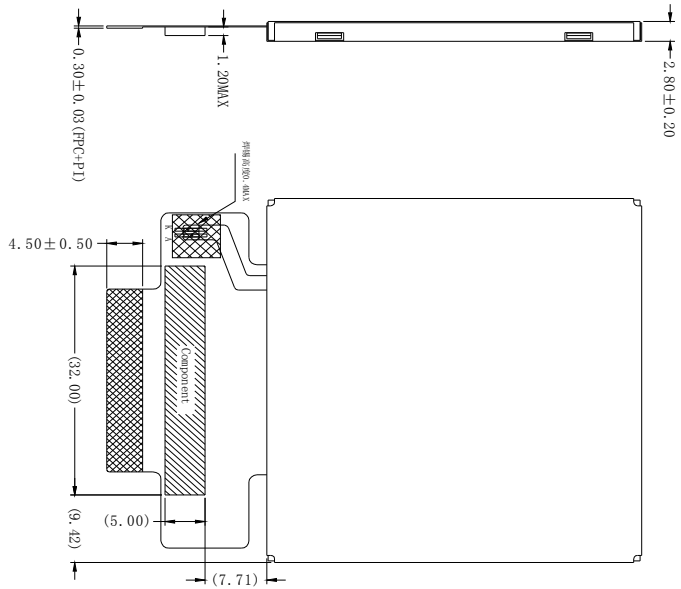
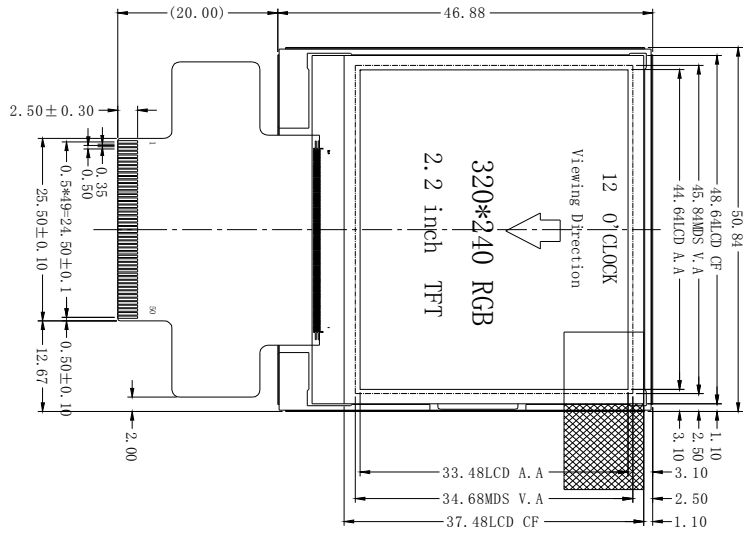
### Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)	-	50.84	-	mm	±0.2
	Vertical(V)	-	46.88	-	mm	±0.2
	Depth(D)	-	2.8	-	mm	±0.1
Weight		-	TBD	-	g	-



## 2. MECHANICAL SPECIFICATION

- 1、 Display type: TFT/Normal white
- 2、 Display mode: Transmissive
- 3、 Interface: RGB 18bit / Driver IC: ILI9488
- 4、 The best Viewing direction: 12 O'CLOCK
- 5、 Backlight: White LED(4-LED) / V=11.6~13.2V / I=20mA
- 6、 LCM Luminance: 180cd/m TYP
- 7、 Operating temperature: -20° C ~ +70° C
- 8、 Storage temperature: -30° C ~ +80° C
- 9、 建议以MDS VA为机壳开窗尺寸，泡棉视窗单边小于LCD CF0.5mm以上
- 10、 ROHS REQUEST



NO.	DESCRIPTION
1	GND
2	RESSET
3	GND
4	SP1_CS
5	GND
6	SP1_SCLK
7	SP1_SCLK
8	GND
9	SP1_SDI
10	SP1_SDI
11	GND
12	PLCK
13	GND
14	DE
15	GND
16	B0
17	B1
18	B2
19	B3
20	B4
21	B5
22	GND
23	G0
24	G1
25	G2
26	G3
27	G4
28	G5
29	GND
30	R0
31	R1
32	R2
33	R3
34	R4
35	R5
36	GND
37	HSYNC
38	GND
39	VSYNC
40	GND
41	NC
42	10VCC
43	NC
44	NC
45	K
46	NC
47	A
48	A
49	NC
50	GND

Rev.		Revision content description		Date	
A		First Issue		2014.04.12	
<b>Kingtech Group Co., Ltd</b>					
TOLERANCE		Mod. Name		PART. Name	
DIMENSIONS ±0.2		PV022004T0250E		///	
UNIT		DESIGN(DRAWING)		APPROVED	
mm					
				SCALE	
				FIT	
				SHEET	
				1/1	
				DRAWING NAME	
				LCM	



### 3. PIN DESCRIPTION

Pin NO.	Symbol	Level	Function
1	GND	L	Power ground
2	RESET	H/L	Hardware reset pin
3	GND	L	Power ground
4	SPI_CS	H/L	Chip select input pin
5	GND	L	Power ground
6-7	SPI_SCLK	H/L	SPI Serial clock input pin
8	GND	L	Power ground
9-10	SPI_SDI	H/L	Serial input signal
11	GND	L	Power ground
12	PCLK	H/L	Clock signal in RGB interface
13	GND	L	Power ground
14	DE	H/L	Display enable pin
15	GND	L	Power ground
16-21	B0-B5	H/L	Blue Data Input
22	GND	L	Power ground
23-28	G0-G5	H/L	Green Data Input
29	GND	L	Power ground
30-35	R0-R5	H/L	Red Data Input
36	GND	L	Power ground
37	HSYNC	H/L	Horizontal Synchronous Signal
38	GND	-	Power ground
39	VSYNC	H/L	Vertical Synchronous Signal
40	GND	L	Power ground
41	VCC	H	Power supply 2.5-3.3V
42	IOVCC	H	Power supply 1.65-3.3V
43	NC	-	Not connected
44-45	K	L	Backlight Cathode
46	NC	-	Not connected
47-48	A	H	Backlight Anode
49	NC	-	Not connected
50	GND	L	Power ground



## 4. ELECTRICAL CHARACTERISTICS

### 4.1 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Values		Unit	Remark
		Min	Max.		
Supply Voltage for Logic circuit	IOVCC	-0.3	4.6	V	
				V	
Supply Voltage for analog circuit	VCI	-0.3	4.6	V	

### 4.2 DC ELECTRICAL CHARACTERISTICS

#### 4.2.1 OPERATING CONDITIONS

Typical Operating Conditions (Ta=25°C)

Item	Symbol	Values			Unit	Remark
		Min	Typ	Max.		
Power Supply	VCI	2.5	2.8	3.3	V	
Power Supply	IOVCC	1.65	1.8	3.3	V	
Normal mode Current consumption	I <sub>cc</sub>	-	15	-	mA	V <sub>cc</sub> =2.8V
TFT Gate ON Voltage	V <sub>GH</sub>	10	-	20	V	
TFT Gate OFF Voltage	V <sub>GL</sub>	-15	-	-6.0	V	

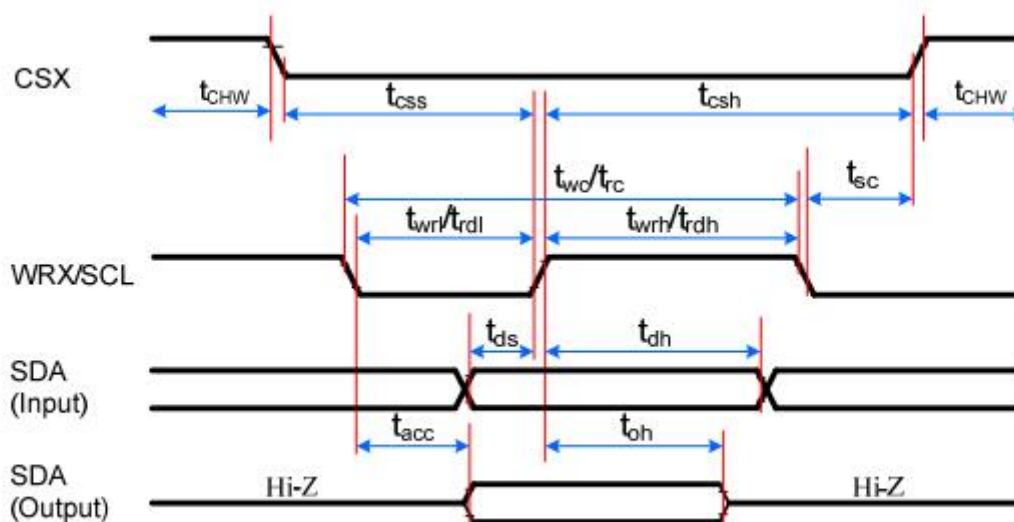
#### 4.2.2 BACKLIGHT UNIT (GND=0V)

Item	Symbol	Values			Unit	Remark
		Min	Typ	Max.		
Forward supply Voltage	V <sub>f</sub>	11.6	-	13.2	V	
Forward supply Current	I <sub>f</sub>	-	20	-	mA	
LCM Luminance	LV	-	180	-	cd/m <sup>2</sup>	I <sub>B</sub> =20mA
Uniformity	/	80			%	-



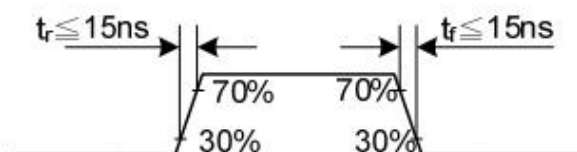
## 4.3 TIMING CHARACTERISTICS

### 4.3 .1 DBI TYPE C OPTION 1 (3-LINE SPI SYSTEM) TIMING CHARACTERISTICS



Signal	Symbol	Parameter	min	max	Unit	Description
CSX	tsc	SCL-CSX	15	-	ns	
	tchwh	CSX H Pulse Width	40	-	ns	
	tcSS	Chip select time (Write)	60	-	ns	
	tcsh	Chip select hold time (Read)	65	-	ns	
SCL	twc	Serial Clock Cycle (Write)	66	-	ns	
	twrh	SCL H Pulse Width (Write)	15	-	ns	
	twrl	SCL L Pulse Width (Write)	15	-	ns	
	trc	Serial Clock Cycle (Read)	150	-	ns	
	trdh	SCL H Pulse Width (Read)	60	-	ns	
	trdl	SCL L Pulse Width (Read)	60	-	ns	
SDA (Input)	tds	Data setup time (Write)	10	-	ns	
	tdh	Data hold time (Write)	10	-	ns	
SDA/SDO (Output)	tacc	Access time (Read)	10	50	ns	For maximum CL=30pF
	toh	Output disable time (Read)	15	50	ns	For minimum CL=8pF

**Note:** Ta = -30 to 70 °C, IOVCC = 1.65V to 3.6V, VCI = 2.5V to 3.6V, AGND = DGND = 0V, T = 10+/-0.5ns







## 5. OPTICAL CHARACTERISTICS

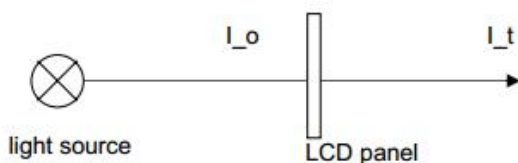
The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note.1.

Item	Symbol	Specifications			Unit	Note
		Min.	Typ.	Max.		
Transmittance (Without Polarizer) *	T%	-	9.5	-	%	*[1]Here the data are design value. [2]Chromaticity measuring machine: CFT-01. <b>Reference Only</b>
Contrast ratio*	Cr (Θ=0°)	150	300	-		
Response time (25℃)*	T <sub>r</sub> +T <sub>f</sub>	-	25	50	ms	
Viewing angle (Cr≥ 10)*	Θ21	-	15	-	deg	
	Θ22	-	35	-		
	Θ12	-	45	-		
	Θ11	-	45	-		
Chromaticity of CF	Red	x	0.604	0.624	0.644	
		y	0.302	0.322	0.342	
		Y	15.6	20.6	25.6	
	Green	x	0.268	0.288	0.308	
		y	0.54	0.56	0.58	
		Y	53.6	58.6	63.6	
	Blue	x	0.127	0.147	0.167	
		y	0.097	0.117	0.137	
		Y	8.3	13.3	18.3	
	White	x		0.307		
y			0.328			
Y			30.8			
Color gamut of CF (NTSC%)	S		58		%	

### 5.2 Definitions and measuring methods

#### [1]Transmittance (T%)

The transmittance of the panel including polarizers is measured without electrical driving.



The Transmittance is defined as:

$$Tr = \frac{I_t}{I_o} \times 100\%$$

here,

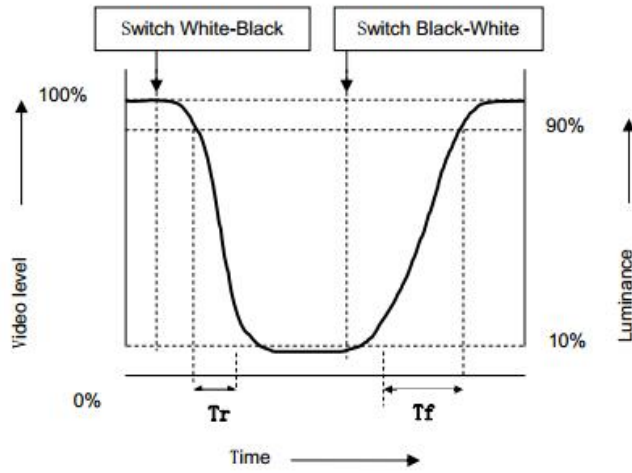
I<sub>o</sub>: the brightness of the light source.

I<sub>t</sub>: the brightness after panel transmission.



**[2] Response Time(Tr、 Tf)**

The rise time 'Tr' is defined as the time for luminance to change from 90% to 10% as a result of a change of the electrical condition. The fall time 'Tf' is defined as the time for luminance to change from 10% to 90% as a result of a change of the electrical condition.

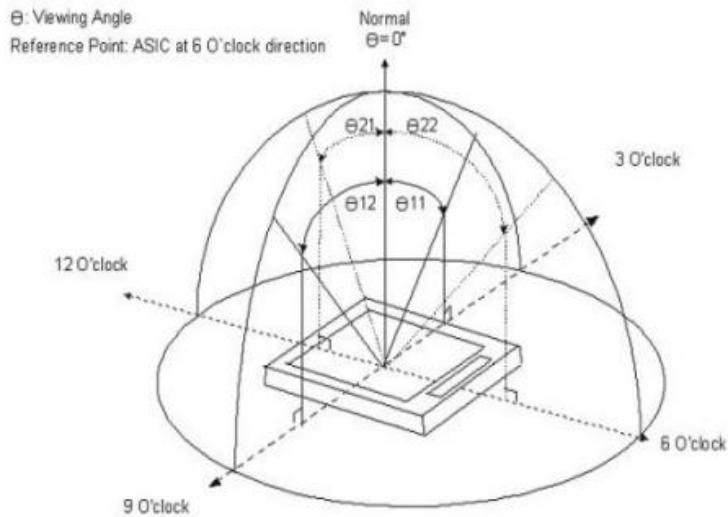


**[3] Contrast ratio (Cr)**

The contrast ratio (Cr), measured on a module, is the ratio between the luminance (L\_w) in a full white area (R=G=B=1) and the luminance (L\_d) in a dark area (R=G=B=0):

$$Cr = \frac{L_w}{L_d}$$

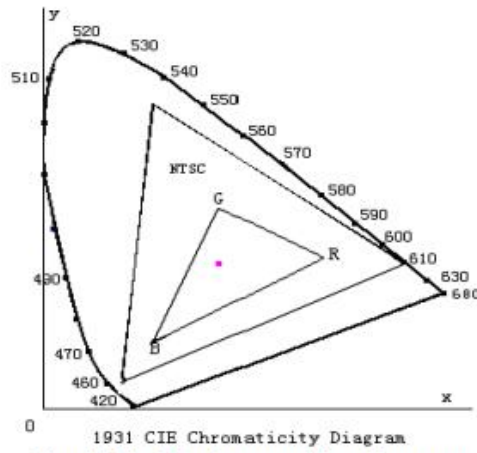
**[4] Viewing angle diagram**





**[5] Definition of color gamut**

Measuring machine: CFT-01. NTSC'S Primaries: R(x,y,Y), G(x,y,Y), B(x,y,Y).



**Fig. 1931 CIE chromaticity diagram**

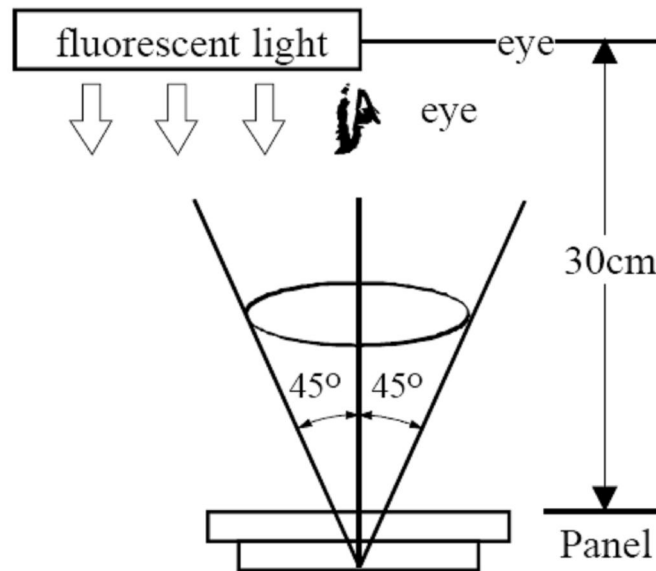
$$\text{Color gamut: } S = \frac{\text{Area of RGB triangle}}{\text{Area of NTSC triangle}} \times 100\%$$



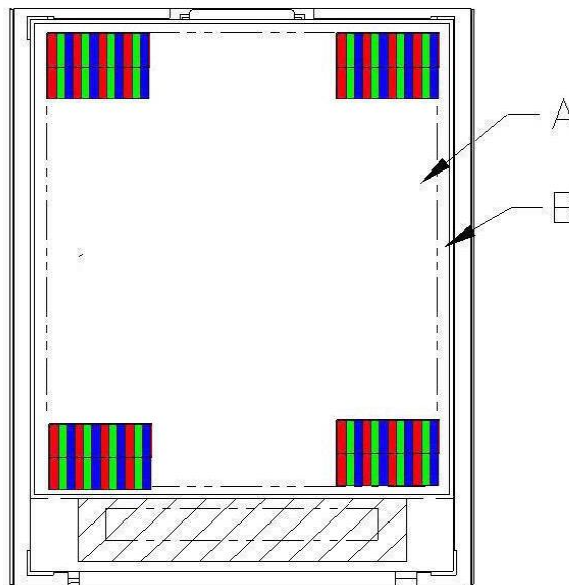
## 6. QUALITY SPECIFICATIONS

### 6.1 INSPECTION CONDITION

- (1) Inspect under 300~500Lux fluorescent light, leaving 30~35cm between panels and eyes, and between panels and lights.
- (2) Inspection condition is  $23 \pm 5^{\circ}\text{C}$ ,  $50 \pm 20\% \text{RH}$  maximum.



### 6.2 DEFINITION OF AREA

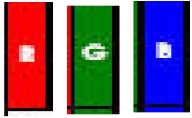



A Area : Viewing area.


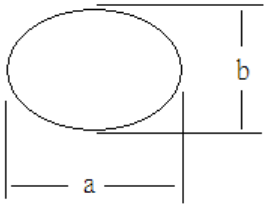
B Area : Out of viewing.(outside viewing area)



**6.3 INSPECTION SPECIFICATION**

NO	Item	Acceptable specification	Judgment Criterion
1	Electrical Testing	<p><b>1-1 sub pixel classification</b></p> <ul style="list-style-type: none"> <li>● Sub Pixel: Number of sub pixel doesn't exceed one dot.</li> </ul> <div style="text-align: center;">  <p>Sub Pixel (Dot)</p> </div> <p>a&gt; Dark dot ----one Allowed b&gt; Bright dot ---- one Allowed</p> <ul style="list-style-type: none"> <li>● Pixel : Three dots link together doesn't exceed ones</li> </ul> <div style="text-align: center;">  <p>Pixel</p> </div> <p><b>1-2 Leakage to light</b></p> <ul style="list-style-type: none"> <li>● Leakage to light be not allowed.</li> </ul> <p><b>1-3 Picture to shake</b></p> <ul style="list-style-type: none"> <li>● Picture had shake, twinkle and noise etc. instable of defect that be not allowed.</li> </ul> <p><b>1-4 Function</b></p> <ul style="list-style-type: none"> <li>● No display or No function.</li> <li>● Source Line, Gate Line.</li> <li>● Contrast Ratio</li> <li>● Current consumption exceeds product specifications.</li> <li>● Display malfunction.</li> </ul>	<p><math>N \leq 1</math></p> <p><math>N \leq 0</math></p> <p><math>N=0</math></p> <p><math>N=0</math></p> <p><math>N=0</math></p>
2	Mechanical Dimension	<p>2-1 Mechanical Dimension exceeds product specifications.</p> <p>2-2 Out of frame and boss of plastic changed shape that be not allowed.</p>	<p><math>N=0</math></p>



NO	Item	Acceptable specification	Judgment Criterion																																												
3	Cosmetic Inspection	<p><b>3-1 Blemish: Line shapes of defect</b></p> <table border="1" data-bbox="368 405 1318 757"> <thead> <tr> <th>Length</th> <th>Width</th> <th>Acceptable number</th> <th>Mini. space</th> </tr> </thead> <tbody> <tr> <td>---</td> <td><math>W \leq 0.03</math></td> <td>Ignore</td> <td rowspan="3">5 m m</td> </tr> <tr> <td><math>L \leq 2.5</math></td> <td><math>0.03 &lt; W \leq 0.05</math></td> <td>3</td> </tr> <tr> <td><math>L \leq 2.5</math></td> <td><math>0.05 &lt; W \leq 0.1</math></td> <td>2</td> </tr> <tr> <td>--</td> <td><math>W &gt; 0.1</math></td> <td>Not allowed</td> <td>---</td> </tr> </tbody> </table> <p>L: length(mm) W: width(mm)</p>  <p><b>3-2 Blemish: dot shapes of defect.</b></p> <table border="1" data-bbox="440 1014 1287 1249"> <thead> <tr> <th>Dimension</th> <th>Acceptable number</th> <th>Mini. Space</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.10</math></td> <td>Ignore</td> <td>---</td> </tr> <tr> <td><math>0.10 &lt; \Phi \leq 0.15</math></td> <td>2</td> <td rowspan="2">5 m m</td> </tr> <tr> <td><math>0.15 &lt; \Phi \leq 0.25</math></td> <td>1</td> </tr> <tr> <td><math>\Phi &gt; 0.25</math></td> <td>0</td> <td>---</td> </tr> </tbody> </table> <p><b>3-3 Polarizer Bubble</b></p> <table border="1" data-bbox="440 1321 1287 1480"> <thead> <tr> <th>Dimension</th> <th>Acceptable number</th> <th>Mini. Space</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.20</math></td> <td>Ignore</td> <td>---</td> </tr> <tr> <td><math>0.20 &lt; \Phi \leq 0.30</math></td> <td>2</td> <td>15 m m</td> </tr> <tr> <td><math>\Phi &gt; 0.30</math></td> <td>0</td> <td>---</td> </tr> </tbody> </table> <p>Foreign Substances</p>  <p style="text-align: right;"><math>\Phi = (a+b)/2</math></p>	Length	Width	Acceptable number	Mini. space	---	$W \leq 0.03$	Ignore	5 m m	$L \leq 2.5$	$0.03 < W \leq 0.05$	3	$L \leq 2.5$	$0.05 < W \leq 0.1$	2	--	$W > 0.1$	Not allowed	---	Dimension	Acceptable number	Mini. Space	$\Phi \leq 0.10$	Ignore	---	$0.10 < \Phi \leq 0.15$	2	5 m m	$0.15 < \Phi \leq 0.25$	1	$\Phi > 0.25$	0	---	Dimension	Acceptable number	Mini. Space	$\Phi \leq 0.20$	Ignore	---	$0.20 < \Phi \leq 0.30$	2	15 m m	$\Phi > 0.30$	0	---	
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$\Phi > 0.30$	0	---																																													



NO	Item	Acceptable specification	Judgment Criterion			
3	Cosmetic Inspection	<b>3-4 Scratch</b> ● Sensate scratch not allowed. ● Impassive scratch as below. <div style="text-align: right; color: red;">Unit:mm</div>				
		Length		Width	Acceptable number	Mini. space
		-----		$W \leq 0.03$	Ignore	5 m m
		$L \leq 2.5$		$0.03 < W \leq 0.05$	3	
		$L \leq 2.5$		$0.05 < W \leq 0.1$	2	
		----		$0.1 < W$	Not allowed	---
		$L > 2.5$		----	Not allowed	
		4		Package	4-1 Mixed product types 4-2 Shipping q'ty should be the same as "shipping notice form" q'ty. 4-3 Outer box can't broken.	N=0



## 7. RELIABILITY

Test Item	Test Condition
High Temperature Operation	70°C for 96 hours
Low Temperature Operation	-20°C for 96 hours
High Temperature Storage	80°C for 96 hours
Low Temperature Storage	-30°C for 96 hours
High Temperature Operation Humidity Operation	60°C, 90%RH for 96 hours
Thermal Shock	-20°C (30min) ~+25°C (5min)~ +70°C (30min) for 10 cycles
Vibration Test (No Operation)	Frequency: 10~55Hz Amplitude:1.0mm Sweep Time: 11min Test Period: 6 Cycles for each direction of X, Y, Z
Static electricity test	Touch ±4KV,air touch ±8KV





## 8. HANDLING PRECAUTION

### 8.1 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.

### 8.2 STORAGE CONDITIONS

- (1) Store the panel or module in a dark place where the temperature is  $23\pm 5^{\circ}\text{C}$  and the humidity is below  $50\pm 20\% \text{RH}$ .
- (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.

### 8.3 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 ketonic 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.

### 8.4 WARRANTY

- (1) The product within six months since the date of shipping out must be used up.
- (2) According to Kingtech TFT LCD quality standard, Kingtech will rework or exchange for functional defect goods since within one year.