PALM TECHNOLOGY CO., LTD.

The LCD(M) Specialist

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PART NO. : PT0242432T-B707-S

FOR MESSRS. : _____

CONTENTS

龐誼科技
14.05.28
發行

ACCEPTED BY : _____ PROPOSED BY : _____

RECORD OF REVISION

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2014/05/28	ALL	-

1. General Description

This display module is a transmissive type color active matrix TFT(Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This module is composed of a TFT LCD module, a driver circuit, and a back-light unit.

The resolution of a 2.4” contains 240(RGB)X320 dots and can display up to 262k colors.

2. Module Parameter

Features	Details	Unit
Display Size(Diagonal)	2.4”	-
LCD type	α-Si TFT	-
Display Mode	TN / Transmissive / Normally white	-
Resolution	240RGB x 320	-
View Direction	6 O’clock	Best image
Grayscale Inversion Direction	N/A	-
Module Outline	42.72 (H) ×60.26(V)×3.75(T) (Note1)	mm
TP Outline	42.22(H)X59.66(V)	mm
TP Viewing Area	38.52(H)X54.36(V)	mm
TP Active Area	37.52(H)X53.36(V)	mm
Active Area	36.72(H)x48.96(V)	mm
Viewing Area	N/A	mm
Pixel Size	0.153(H) x0.153(V)	mm
Pixel Arrangement	Stripe	-
Display Colors	262K	-
Interface	MCU parallel interface	-
Driver IC	ILI9341V	-
Operating Temperature	-20～70	ºC
Storage Temperature	-30～80	ºC
Weight	TBD	g

3. Absolute Maximum Ratings

V_{SS}=0V, Ta=25ºC

Item		Symbol	Min.	Max.	Unit
Supply Voltage	Power supply	VDD	-0.3	+4.6	V
	Analog	-	-	-	V
	IO	-	-	-	V
Input Voltage		*Vi*	-0.3	VDD+0.3	V
Storage temperature		T_{stg}	-30	+80	ºC
Operating temperature		T_{op}	-20	+70	ºC
Storage humidity		H_{stg}	10	Note 1	%RH
Operating humidity		H_{op}	10	Note 1	%RH

Note 1: 90%RH max, If Ta is below 50ºC; 60%RH max, If Ta is over 60ºC.

4. DC Characteristics

Item		Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	Power supply	VDD	2.3	2.8	3.3	V
	Analog	-	-	-	-	V
	IO	-	-	-	-	V
Logic Low input voltage		V_{IL}	VSSD	-	0.3* VDD	V
Logic High input voltage		V_{IH}	0.7* VDD	-	VDD	V
Logic Low output voltage		V_{OL}	VSSD-	-	0.2*VDD	V
Logic High output voltage		V_{OH}	0.8* VDD	-	VDD	V
Current Consumption	Normal display			TBD	-	mA
	Standby mode			TBD		uA
Frame Frequency		f_{FR}	-	TBD	-	Hz

5. Backlight Touch Panel Characteristics

5.1. Backlight Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	V_f	Ta=25 ºC,I_F=15mA	3.0	3.2	3.6	V
Forward Current	I_f	Ta=25 ºC, V_F=3.2V	-	60	-	mA
Luminance	L_V		4000			cd/m^2
Uniformity	Avg		80	85	-	%
CIE	X	-	0.26	-	0.30	-
	Y	-	0.26	-	0.30	-
Power dissipation	P_d		-	192	-	mW
Backlight Driving Voltage	V_{AK}		-	3.2	3.6	V
Drive method	Constant current					
LED Configuration	4 White LEDs in parallel					

Note: 1：Test condition I_f =60mA, Ta=25ºC.

2: JUFEI LED (JT.CBS206W 色塊: C/E ，亮度檔:35)

5.2. Touch Panel Characteristics

5.2.1. Electrical Characteristics

Item	Min.	Typ.	Max.	Unit	Note
Linearity	-1.5	-	1.5	%	Analog X/Y directions
Terminal Resistance	200	-	600	Ω	X
	250	-	900	Ω	Y
Insulation Resistance	20	-	-	MΩ	DC 25V
Voltage	-	5	-	V	DC
Chattering	-	-	10	ms	100K pull-up
Transparency	80	-	-	%	JIS-K7105,ASTM D1003, @550nm

Caution: Don't operate it with a thing except a polyacetal pen(tip R0.8mm or more) or a finger, especially those with hard or sharp tips such as a ball point pen or a mechanical pencil.

5.2.2 Mechanical & Reliability Characteristics

Item	Min.	Typ.	Max.	Unit	Note
Activation Force	10	-	80	g	(1)
Durability-surface scratching	Write 100,000	-	-	characters	(2)
Durability-surface pitting	1,000,000	-	-	touches	(3)
Surface hardness	3	-	-	H	JIS-K5400,ASTM D3633

Note(1) Stylus pen input: R0.8mm polyacetal pen or finger

(2) Measurement for surface area

-Scratch 100,000 times straight line on the film with a stylus change every 20,000 times

-Force: 250gf

-Speed: 60mm/sec

(3) Pit 1,000,000 times on the film with a stylus rubber

- Force: 250gf

-Speed: 2 times/sec

6. Optical Characteristics

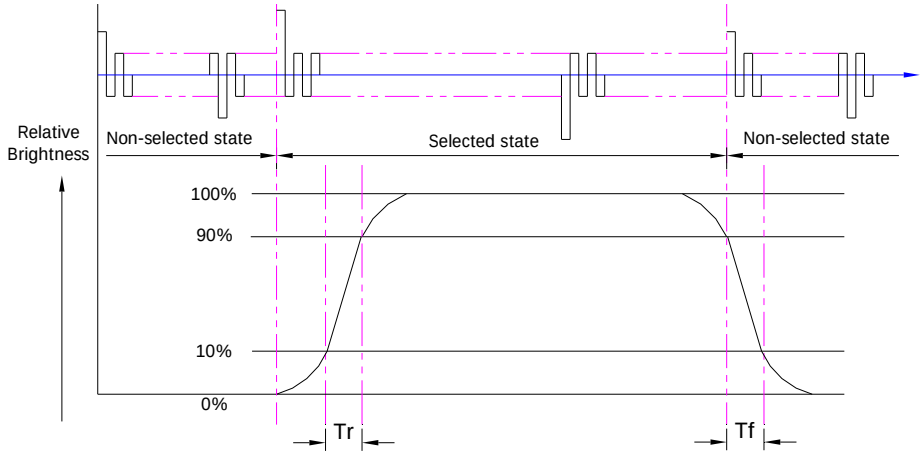
6.1. Optical Characteristics

Ta=25ºC, VDD=3.3V, TN LC+ Polarizer

	Item		Symbol	Condition	Specification			Unit
					Min.	Typ.	Max.	
Backlight On (Transmissive Mode)	Luminance on TP surface(I_f =60mA)		*Lv*	Normally viewing angle $\theta_X = \theta_Y$ =0º	144	176	-	cd/m²
	Contrast ratio(See 6.3)		*CR*		-	300	-	
	Response time (See 6.2)		*TR*			10	-	ms
			TF			15	-	
	Chromaticity Transmissive (See 6.5)	Red	*XR*		0.596	0.656	0.716	
			YR		0.291	0.351	0.411	
		Green	*XG*		0.271	0.331	0.391	
			YG		0.589	0.649	0.709	
		Blue	*XB*		0.093	0.153	0.213	
			YB		0.024	0.084	0.144	
		White	*XW*		0.249	0.309	0.369	
			YW		0.276	0.336	0.396	
	Viewing Angle (See 6.4)	Horizontal	θX+	Center CR≥10	-	60	-	Deg.
			θX-		-	60	-	
		Vertical	θY+		-	50	-	
			θY-		-	40	-	

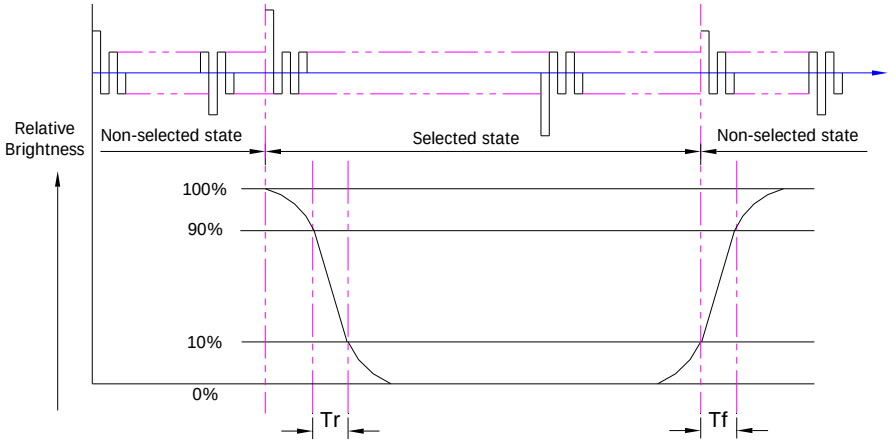
6.2. Definition of Response Time

6.2.1. Normally Black Type (Negative)



Tr is the time it takes to change form non-selected state with relative luminance 10% to selected state with relative luminance 90%;
Tf is the time it takes to change from selected state with relative luminance 90% to non-selected state with relative luminance 10%.

6.2.2. Normally White Type (Positive)



Tr is the time it takes to change form non-selected state with relative luminance 90% to selected state with relative luminance 10%;
Tf is the time it takes to change from selected state with relative luminance 10% to non-selected state with relative luminance 90%;

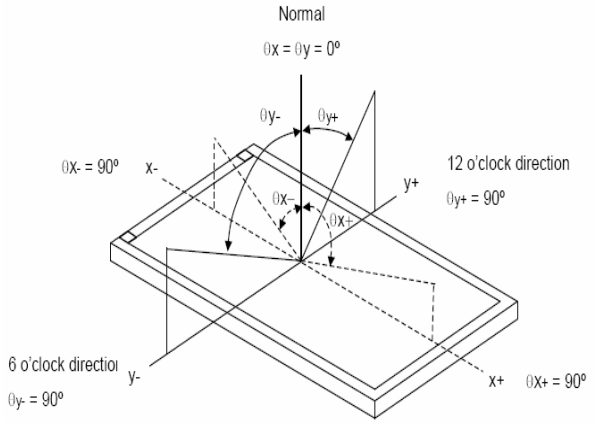
6.3. Definition of Contrast Ratio

Contrast is measured perpendicular to display surface in reflective and transmissive mode. The measurement condition is:

Measuring Equipment	BM-7 or EQUI
Measuring Point Diameter	3mm//1mm
Measuring Point Location	Active Area centre point
Test pattern	A: All Pixels white
	B: All Pixel black
Contrast setting	Maximum

Definitions: CR (Contrast) = Luminance of White Pixel / Luminance of Black Pixel

6.4. Definition of Viewing Angles



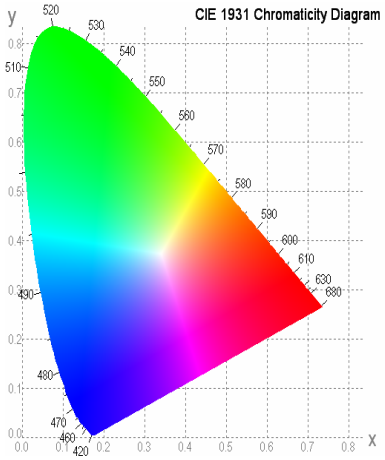
Measuring machine: LCD-5100 or EQUI

6.5. Definition of Color Appearance

R,G,B and W are defined by (x, y) on the IE chromaticity diagram

NTSC=area of RGB triangle/area of NTSC triangleX100%

Measuring picture: Red, Green, Blue and White (Measuring machine: BM-7)



6.6. Definition of Surface Luminance, Uniformity and Transmittance

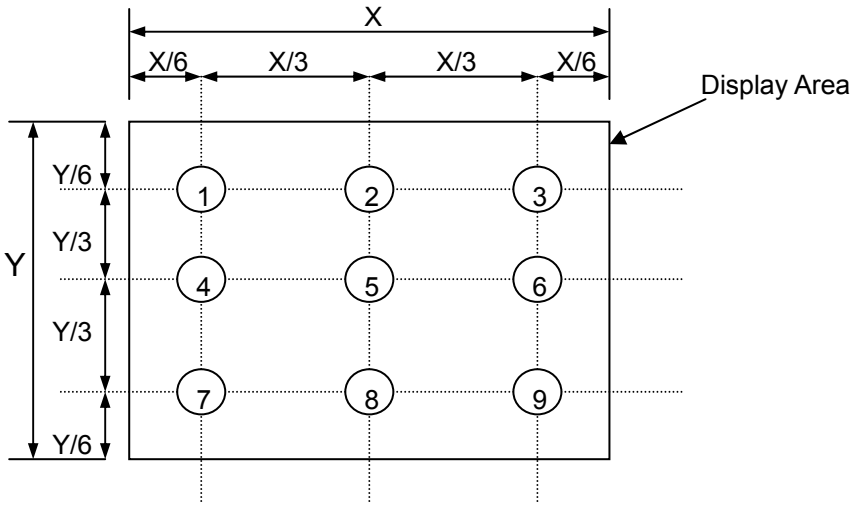
Using the transmissive mode measurement approach, measure the white screen luminance of the display panel and backlight.

6.6.1. Surface Luminance: L_V = average (L_{P1}:L_{P9})

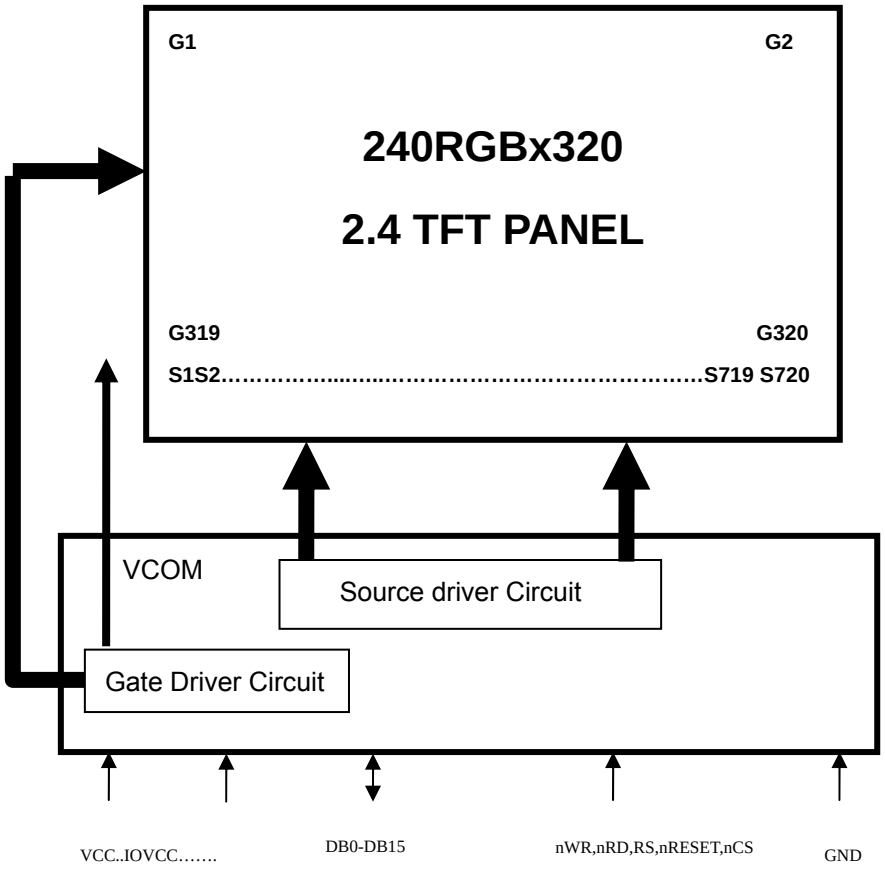
6.6.2. Uniformity = Minimal (L_{P1}:L_{P9}) / Maximal (L_{P1}:L_{P9}) * 100%

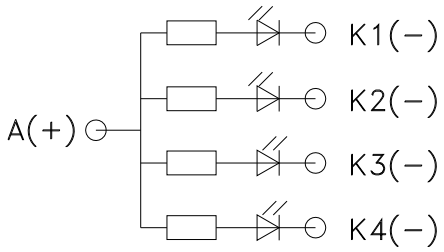
6.6.3. Transmittance = L_V on LCD / L_V on Backlight * 100%

Note : Measuring machine: BM-7



7. Block Diagram and Power Supply





背光电路图 (CIRCUIT DIAGRAM)

8. Interface Pins Definition

8.1. Module interface

No.	Symbol	I/O	DESCRIPTION
1	NC	-	NC
2-3	VDD	P	Power supply
4	CS	I	chip selection,active low
5	RS	I	Command/Data for the MPU interface
6	WR	I	Write signal, active low
7	RD	I	Read signal, active low
8	RESET	I	LCD driver IC reset, active low
9-24	DB00-DB15	I/O	LCD Data BUS
25	NC	-	NC
26	YD	-	Touch panel interface
27	XR	-	Touch panel interface
28	YU	-	Touch panel interface
29	XL	-	Touch panel interface
30	LEDA	LED driver	LED ANODE
31	LEDK1	LED driver	LED CATHODE
32	LEDK2	LED driver	LED CATHODE
33	LEDK3	LED driver	LED CATHODE
34	LEDK4	LED driver	LED CATHODE
35	GND	P	Ground
36	GND	P	Ground
37	NC	-	NO Connection

9. AC Characteristics

9.1. Reset timing

Please refer to IC datasheet.

9.2. interface timing

9.2.1 interface timing requirement

Please refer to IC datasheet

10. Command Table

Please refer to IC datasheet.

11. Recommended Setting and Initialization Flow for Reference

Please refer to attached file.

12. Quality Assurance

12.1. Purpose

This standard for Quality Assurance assures the quality of LCD module products supplied to customer by Palm Tech display.

12.2. Agreement Items

Palm Tech and customer shall negotiate if the following situation occurs:

12.2.1 Discrepancies between Palm Tech's QA standards and customer's QA standards.

12.2.2 Additional requirement to be added in product specification.

12.2.3 Any other special problem.

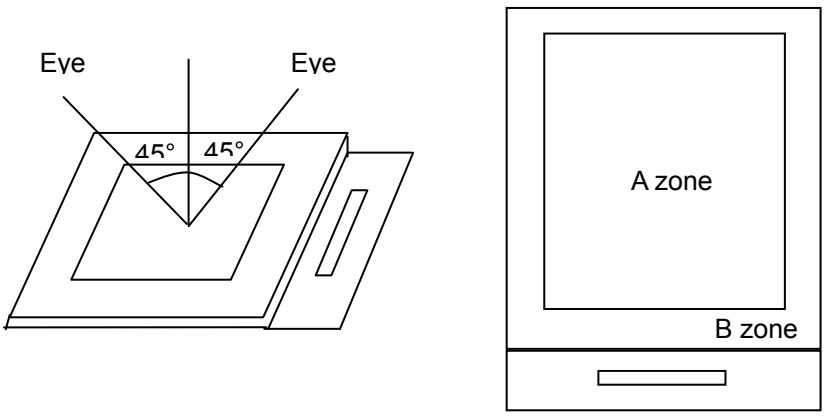
12.3. Standard of the Product Visual Inspection

12.3.1 Appearance inspection:

12.3.1.1 The inspection must be under illumination about 1000 – 1500 lx, and the distance of view must be at 30cm ± 2cm.

12.3.1.2 The viewing angle should be 45° from the vertical line without reflection light or follows customer's viewing angle specifications.

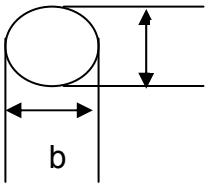
12.3.1.3 Definition of area: A Zone: Active Area, B Zone: Viewing Area,

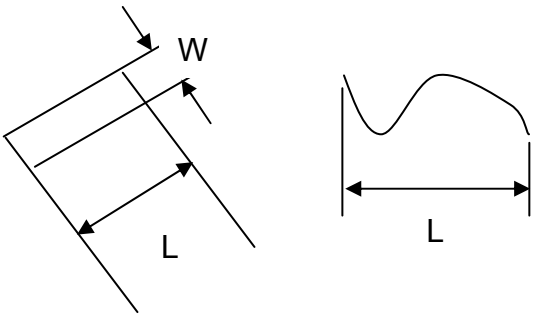


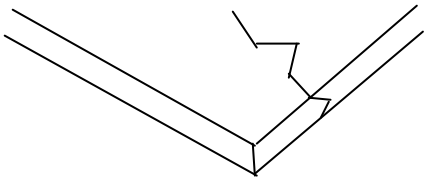
12.3.2 Basic principle:

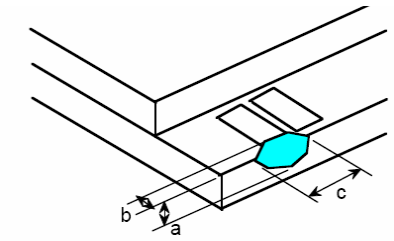
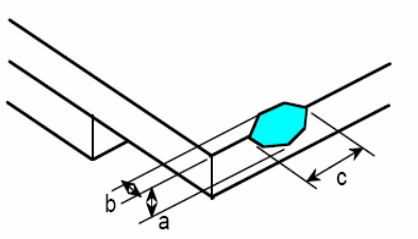
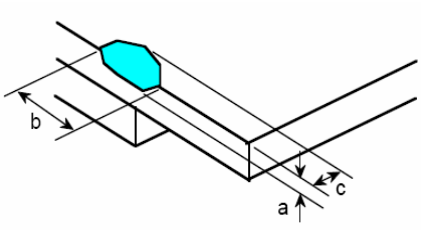
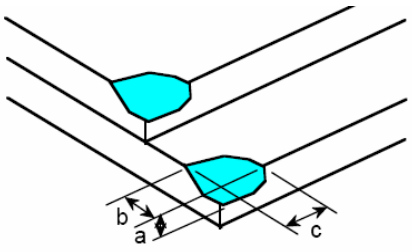
12.3.2.1 A set of sample to indicate the limit of acceptable quality level must be discussed by both Palm Tech and customer when there is any dispute happened.

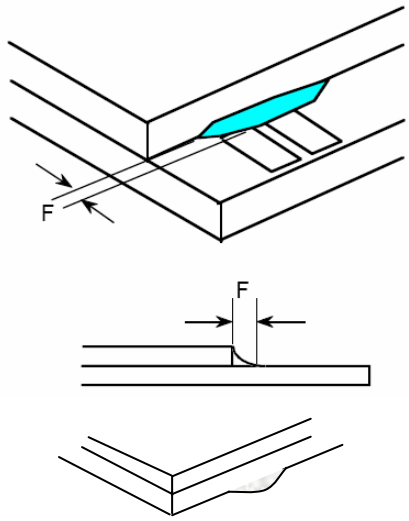
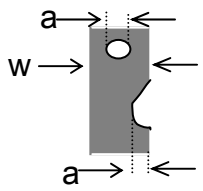
12.4. Inspection Specification

<table>
<tr><th>No.</th><th>Item</th><th>Criteria (Unit: mm)</th></tr>
<tr><td>01</td><td>Black / White spot
Foreign material
(Round type)
Pinholes
Stain
Particles inside cell.
(Minor defect)</td><td>


<table>
<tr><th>Area / Size</th><th>Acc. Qty</th></tr>
<tr><td>φ≤0.10</td><td>Ignore</td></tr>
<tr><td>0.10<φ≤0.20</td><td>2</td></tr>
<tr><td>0.20<φ≤0.25</td><td>1</td></tr>
<tr><td>0.25<φ</td><td>0</td></tr>
<tr><td>Total</td><td>2 no include
φ≤ 0.10</td></tr>
</table>
φ= (a + b) /2
Distance between 2 defects should more than 3mm apart.
</td></tr>
<tr><td>02</td><td>Black and White line
Scratch
Foreign material
(Line type)
(Minor defect)</td><td>


<table>
<tr><th>Length</th><th>Width</th><th>Acc. Qty</th></tr>
<tr><td>/</td><td>W ≦ 0.03</td><td>Ignore</td></tr>
<tr><td>L ≦ 2</td><td>0.03 < W ≦ 0.05</td><td>1</td></tr>
<tr><td>/</td><td>0.05 < W</td><td>0</td></tr>
<tr><td colspan="2">Total</td><td>1</td></tr>
</table>
Distance between 2 defects should more than 3mm apart. Scratches not viewable through the back of the display are acceptable.
</td></tr>
<tr><td>03</td><td>Glass Crack
(Minor defect)</td><td>

LCD with extensible crack line is unacceptable(When press the cracked LCD area, the line will expand, we define it is extensible crack line)
</td></tr>
</table>

<table>
<tr>
<td>04</td>
<td>Glass Chipping Pad Area:
(Minor defect)
 
</td>
<td>
<table>
<tr><th>Length and Width</th><th>Acc. Qty</th></tr>
<tr><td>c ＜ 5.0, b< 0.4</td><td>Ignore</td></tr>
<tr><td colspan="2">a<Glass Thickness</td></tr>
</table>
</td>
</tr>
<tr>
<td>05</td>
<td>Glass Chipping Rear of Pad Area:
(Minor defect)
 
</td>
<td>
<table>
<tr><th>Length and Width</th><th>Acc. Qty</th></tr>
<tr><td>c > 3.0, b< 1.0</td><td>1</td></tr>
<tr><td>c< 3.0, b< 1.0</td><td>2</td></tr>
<tr><td>c< 3.0, b< 0.5</td><td>4</td></tr>
<tr><td colspan="2">a<Glass Thickness</td></tr>
</table>
</td>
</tr>
<tr>
<td>06</td>
<td>Glass Chipping Except Pad Area:
(Minor defect)
 
</td>
<td>
<table>
<tr><th>Length and Width</th><th>Acc. Qty</th></tr>
<tr><td>c ≤0.6, b< 5.0</td><td>Ignore</td></tr>
<tr><td colspan="2">a<Glass Thickness</td></tr>
</table>
</td>
</tr>
<tr>
<td>07</td>
<td>Glass Corner Chipping:
(Minor defect)
 
</td>
<td>
<table>
<tr><th>Length and Width</th><th>Acc. Qty</th></tr>
<tr><td>c < 2.0, b< 1.5</td><td>Ignore</td></tr>
<tr><td>c < 1.5, b< 2</td><td>Ignore</td></tr>
<tr><td colspan="2">a<Glass Thickness</td></tr>
</table>
</td>
</tr>
</table>

<table>
<tr><td>08</td><td>Glass Burr:
(Minor defect)
 
</td><td><table><tr><th>Length</th><th>Acc. Qty</th></tr><tr><td>F < 0.5</td><td>Ignore</td></tr></table>
Glass burr don’t affect assemble and module dimension.</td></tr>
<tr><td>09</td><td>FPC Defect:
(Minor defect)
 
</td><td>9.1 Dent, pinhole width a<w/3.
(w: circuitry width.)
9.2 Open circuit is unacceptable.
9.3 No oxidation, contamination and distortion.</td></tr>
<tr><td>10</td><td>Bubble on Polarizer
(Minor defect)</td><td colspan="2"><table><tr><th>Diameter</th><th>Acc. Qty</th></tr><tr><td>φ≤0.20</td><td>Ignore</td></tr><tr><td>0.20 <φ≤0.30</td><td>2</td></tr><tr><td>0.30 < φ</td><td>None</td></tr></table></td></tr>
<tr><td>11</td><td>Dent on Polarizer
(Minor defect)</td><td colspan="2"><table><tr><th>Diameter</th><th>Acc. Qty</th></tr><tr><td>φ≤0.20</td><td>Ignore</td></tr><tr><td>0.20 <φ≤0.30</td><td>2</td></tr><tr><td>0.30 < φ</td><td>None</td></tr></table></td></tr>
<tr><td>12</td><td>Bezel</td><td colspan="2">12.1 No rust, distortion on the Bezel.
12.2 No visible fingerprints, stains or other contamination.</td></tr>
</table>

13	Touch Panel	D: Diameter W: width L: length 13.1 Spot: D≤0.20 is acceptable 0.20<D≤0.3, acceptable QTY, 3 2dots are acceptable and the distance between defects should more than 10 mm. D>0.3 is unacceptable 13.2 Dent: D>0.30 is unacceptable 13.3 Scratch: W≤0.03, L≤10 is acceptable, 0.03<W≤0.10, L≤10 ,acceptable QTY, 3 Distance between 2 defects should more than 10 mm. W>0.10 is unacceptable.
14	PCB	14.1 No distortion or contamination on PCB terminals. 14.2 All components on PCB must same as documented on the BOM/component layout. 14.3 Follow IPC-A-600F.
15	Soldering	Follow IPC-A-610C standard
16	Electrical Defect (Major defect)	The below defects must be rejected. 16.1 Missing vertical / horizontal segment, 16.2 Abnormal Display. 16.3 No function or no display. 16.4 Current exceeds product specifications. 16.5 LCD viewing angle defect. 16.6 No Backlight. 16.7 Dark Backlight. 16.8 Touch Panel no function. 16.9 Dark Dot –one Allowed. 16.10 Bright Dot – one Allowed. Remark: 1. A pixel defect is acceptable if one color is none functional and causes a bright dot. The display may have one case where one color is out and cause a dark dot. 2. Bright dot caused by scratch and foreign object accords to item 1.

Remark: Visual and cosmetic defects are rejectable only if these fall within the LCD viewing area.

12.5. Classification of Defects

12.5.1 Visual defects (Except no / wrong label) are treated as minor defect and electrical defect is major.

12.5.2 Two minor defects are equal to one major in lot sampling inspection.

12.6. Identification/marking criteria

Any unit with illegible / wrong /double or no marking/ label shall be rejected.

12.7. Packing

12.7.1 There should be no damage of the outside carton box, each packaging box should has label in the correct location per packing drawing requirement.

12.7.2 All direct package materials shall offer ESD protection.

13. Reliability Specification

Item	Condition	Cycle Time	Quantity	Remark
Constant Temp. and Constant Humidity Operation Test	+40 ± 3ºC,90 ± 3%RH	240hrs	--	*1
Constant Temp. and Constant Humidity Storage Test	+50 ± 3ºC,90 ± 3%RH	240hrs	--	
High Temp. Operation Test	+70 ± 3ºC	240hrs	--	
Low Temp. Operation Test	-20 ± 3ºC	240hrs	--	
Thermal Shock Test	-30 ± 3ºC (30min) +80 ± 3ºC (30min)	10cycles	--	
High Temp. Storage Test	+80 ± 3ºC	240hrs	--	
Low Temp. Storage Test	-30 ± 3ºC	240hrs	--	
ESD Test(end product)	150pF, 330Ω, ±2KV, Contact	10times	--	*2, *3
	150pF, 330Ω, ±6KV, Air			
Vibration Test (for packaging)	Frequency: 10Hz to 55Hz to 10Hz, Swing:1.5mm,time：X,Y,Z each 2H.	6hrs	One inner carton	*4

Note 1. For humidity test, DI water should be used.

Inspection Standard: Inspect after 1-2hrs storage at room temperature, the sample shall be free from the following defects:

- Air bubble in the LCD
- Seal Leakage
- Non-display
- Missing Segment
- Glass Crack
- IDD is greater than twice initial value.
- Others as per QA Inspection Criteria

Note 2. No defect is allowed after testing

The End Product ESD value is only indicative and depends on customer ESD protection design for the whole system

Note 3. ESD should be applied to LCD glass panel, not other areas (such as on IC and so on)

IDD should be within twice initial value.

In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.

Note 4. Only upon request.

14. Precautions and Warranty

14.1. Safety

14.1.1 The liquid crystal in the LCD is poisonous. Do not put it in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.

14.1.2 Since the liquid crystal cells are made of glass, do not apply strong impact on them. Handle with care.

14.2. Handling

14.2.1 Reverse and use within ratings in order to keep performance and prevent damage.

14.2.2 Do not wipe the polarizer with dry cloth, as it might cause scratch. If the surface of the LCD needs to be cleaned, wipe it swiftly with cotton or other soft cloth soaked with petroleum IPA, do not use other chemicals.

14.3. Operation

14.3.1 Do not drive LCD with DC voltage

14.3.2 Response time will increase below lower temperature

14.3.3 Display may change color with different temperature

14.3.4 Mechanical disturbance during operation, such as pressing on the display area, may cause the segments to appear “fractured”.

14.4. Static Electricity

14.4.1 CMOS LSIs are equipped in this unit, so care must be taken to avoid the electro-static charge, by ground human body, etc.

14.4.2 The normal static prevention measures should be observed for work clothes and benches.

14.4.3 The module should be kept into anti-static bags or other containers resistant to static for storage.

14.5. Limited Warranty

14.5.1 Unless otherwise agreed between Palm Tech and customer, Palm Tech will replace or repair any of its LCD and LCM which Palm Tech found to be defective electrically and visually when inspected in accordance with Palm Tech Quality Standards, for a period of one year from date of shipment.

14.5.2 The warranty liability of Palm Tech is limited to repair and/or replacement. Palm Tech will not be responsible for any consequential loss.

14.5.3 If possible, we suggest you use up all modules in six months. If the module storage time over twelve months, we suggest that recheck it before the module be used.

15. Packaging

TBD.

16. Assembly Drawing