

Product Specification

Product Name:BO095F120S

Product Code: BO095F120S

Rev: V1

Customer			
Approved by Customer		Approved Date	

Designed By	Check By	Approved By	
		R&D	QA

Records of Revision

Date	Rev.	Description	Page	Remarks
2018/3/26	V1	Initial Released		

Table of Contents

1	General Description.....	4
2	Module Parameter.....	4
3	Mechanical Drawings	5
4	Module Interface.....	6
5	Application Circuit.....	7
6	Absolute Maximum Ratings.....	8
7	Electrical Specification.....	8
8	AC Characteristics.....	8
9	Command Table.....	8
10	Recommended Setting and Initialization Flow for Reference.....	8
11	Optical Specifications.....	9
11.1	Optical Specifications.....	9
11.2	Definition of Response Time.....	10
11.3	Definition of Contrast Ratio.....	10
11.4	Definition of Viewing Angles.....	11
11.5	Definition of Color Appearance.....	11
11.6	Definition of Surface Luminance, Uniformity and Transmittance.....	11
12	Quality Assurance.....	12
12.1	Purpose.....	12
12.2	Agreement Items.....	12
12.3	Standard of the Product Visual Inspection.....	12
12.4	Inspection Specification.....	12
12.5	Classification of Defects.....	17
12.6	Identification/marketing criteria.....	17
12.7	Packing.....	17
13	Reliability Specification.....	17
14	Precautions and Warranty.....	18
14.1	Safety.....	18
14.2	Handling.....	18
14.3	Operation.....	18
14.4	Static Electricity.....	18
14.5	Limited Warranty.....	18
15	Packaging.....	19
16	Prior Consult Matter.....	19

1 General Description

Display Color: RGB888

Dot Matrix: 120*240

Driver IC: RM69310

Interface: 4-SPI

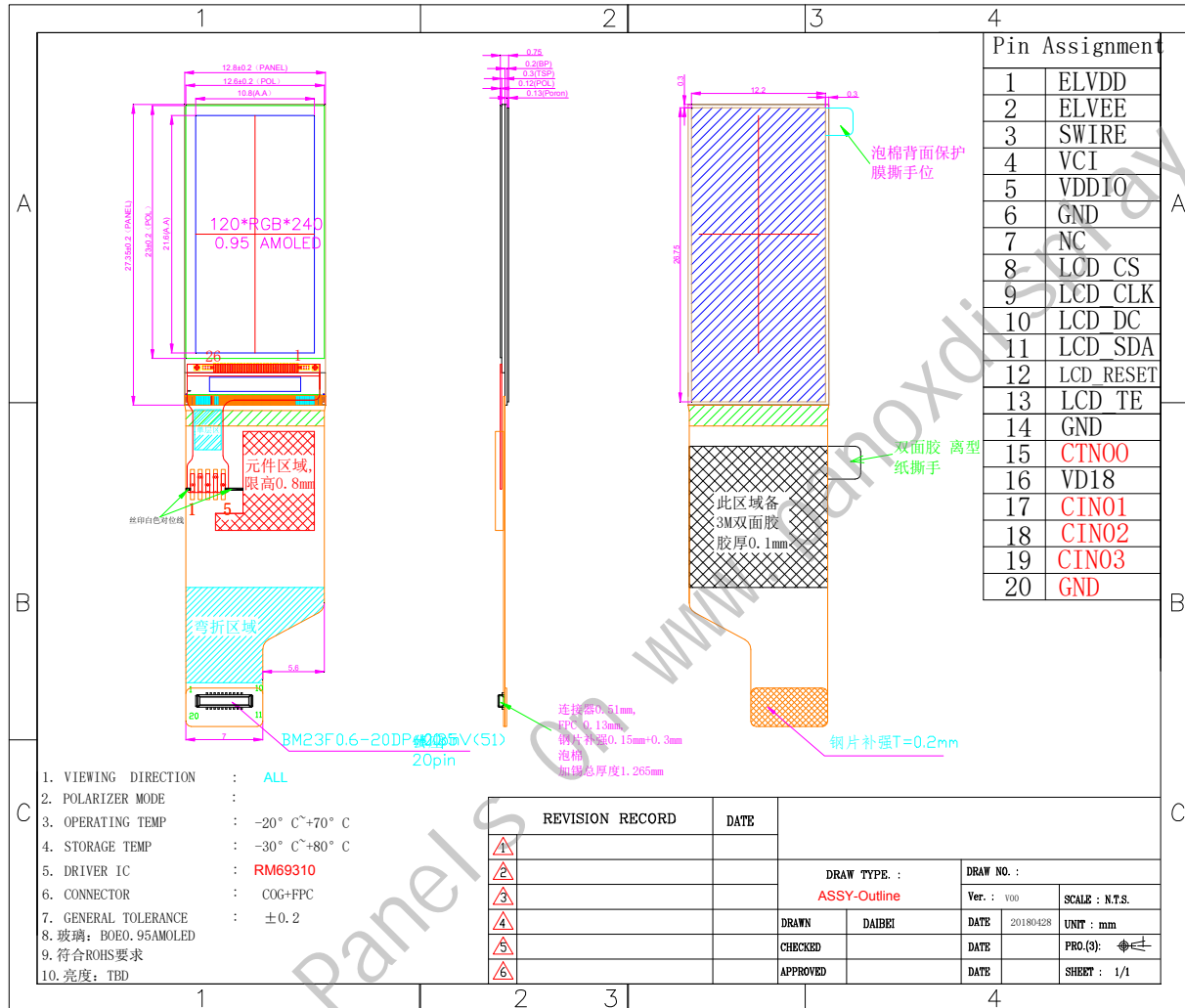
Wide range of operating temperature: -40℃ to 70℃

2 Module Parameter

Features	Details	Unit
Display Size(Diagonal)	0.95	inch
Display type	AMOLED	-
Resolution	120RGB x 240	-
View Direction	All	Best image
Module Outline	12.8(H) × 27.35(V) × 0.75(T) (Note 1)	mm
TP Outline	TBD	mm
TP Viewing Area	TBD	mm
TP Active Area	TBD	mm
Active Area	10.8 (H) × 21.6(V)	mm
Display Colors	16.7M	-
Interface	4-SPI	-
Driver IC	RM69310	-
Operating Temperature	-30 ~ 70	℃
Storage Temperature	-40 ~ 80	℃
Weight	TBD	g

Note 1: Excluding hooks, posts , FPC/FPC tail etc.

3 Mechanical Drawings

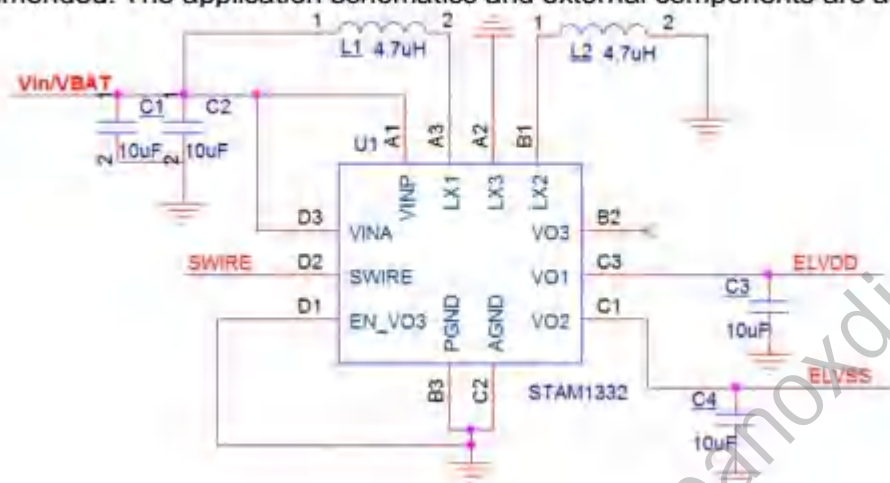


4 Module Interface

NO	SYMBOL	FUNCTION
1	ELVDD	AMOLED positive power supply
2	ELVEE	AMOLED negative power supply
3	SWIRE	Setting DC/DC Power IC output voltage
4	VCI	Analog power supply
5	VDDIO	Logic power supply
6	GND	Power ground
7	NC	Not connecting
8	LCD_CS	Chip select
9	LCD_CLK	Clock signal
10	LCD_DC	Data or command select
11	LCD_SDA	Data output line
12	LCD_RES	Reset signal
13	LCD_TE	Signal output to avoid tearing effect
14	GND	Power Ground
15-19	TP-TBD	Touch reserved
20	GND	Power Ground

5 Application Circuit

ELVDD & ELVSS power supply schematic, The Triple DC/DC converter STAM1332 is recommended. The application schematics and external components are as below.



Component	Part Number	Specification	Quantity	Manufacturer
Capacitance	LMK105CBJ106MVL	10uF/10V X5R 0402 ±20%	4	TAIYO YUDEN
	CL05A106MPSNUNC			Samsung
Inductance	KMNR201610-4R7M-S-Z	4.7uH±20% 444mΩ 0.76A	2	Ke ming
	ACPI201610PF-4R7MT			Amode

6 Absolute Maximum Ratings

VSS=0V, Ta=25°C

Item		Symbol	Min.	Max.	Unit
Supply Voltage	Power supply	VDD	-0.3	+4.6	V
	Analog	-	-	-	V
	IO	IOVDD	-0.3	+4.6	V
Input Voltage		Vi	-0.3	IOVDD+0.3	V
Storage temperature		T _{stg}	-40	+80	°C
Operating temperature		T _{op}	-30	+70	°C
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 50°C; 60%RH max, If Ta is over 60°C.

7 Electrical Specification

DC Characteristics

Item		Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	Power supply	VDD	2.4	2.8	3.3	V
	Analog	VCI	2.4	2.8	3.3	V
	IO	IOVDD	1.65	1.8/2.8	3.3	V
AMOLED positive power supply		ELVDD		+4.6		V
AMOLED negative power supply		ELVSS		-2.4		
Logic Low input voltage		V _{IL}	-0.3IOVDD	-	0.3IOVDD	V
Logic High input voltage		V _{IH}	0.7IOVDD	-	IOVDD	V
Logic Low output voltage		V _{OL}	-	-	0.2IOVDD	V
Logic High output voltage		V _{OH}	0.8IOVDD	-	-	V
Current Consumption	Normal display	Ivdd	-	-	-	mA
	Standby mode	Ivdd	-	-	-	uA
Frame Frequency		f _{FR}	-	60	-	Hz

8 AC Characteristics

Reset timing and interface timing:

Please refer to IC datasheet.

9 Command Table

Please refer to IC datasheet.

10 Recommended Setting and Initialization Flow for Reference

Please refer to attached file.

11 Optical Specifications

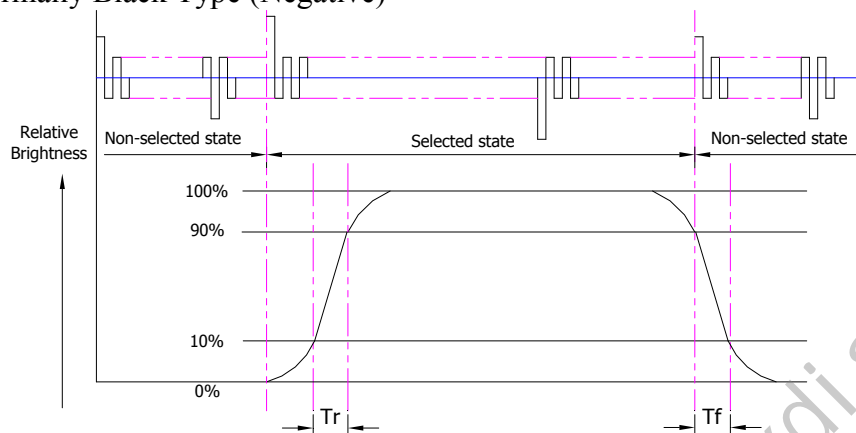
11.1 Optical Specifications

Ta=25°C, VDD=2.8V, TN LC+ Polarizer

Backlight On (Transmissive Mode)	Item		Symbol	Condition	Specification			Unit	
					Min.	Typ.	Max.		
	Luminance on surface(I_f =20mA)		L_V	Normally viewing angle $\theta_X=\theta_Y=0^\circ$	300	350	-	cd/m ²	
	Contrast ratio		CR		80,000	100,000	-	-	
	Response time		T_R		-	3	5	ms	
			T_F	-	-	3	5		
	Chromaticity Transmissive		Red	X_R	-	0.643	0.668	0.693	-
				Y_R		0.307	0.332	0.357	-
			Green	X_G		0.193	0.226	0.262	-
				Y_G		0.693	0.719	0.745	-
			Blue	X_B		0.118	0.138	0.158	-
				Y_B		0.035	0.055	0.075	-
			White	X_W		0.28	0.30	0.32	-
				Y_W		0.29	0.31	0.33	-
	Viewing Angle		Horizontal	θ_{X+}	Center $CR\geq 10$	-	80	-	Deg.
				θ_{X-}		-	80	-	
Vertical			θ_{Y+}	-		80	-		
			θ_{Y-}	-		80	-		
NTSC Ratio(Gamut)		-	-	80	85	-	%		

11.2 Definition of Response Time

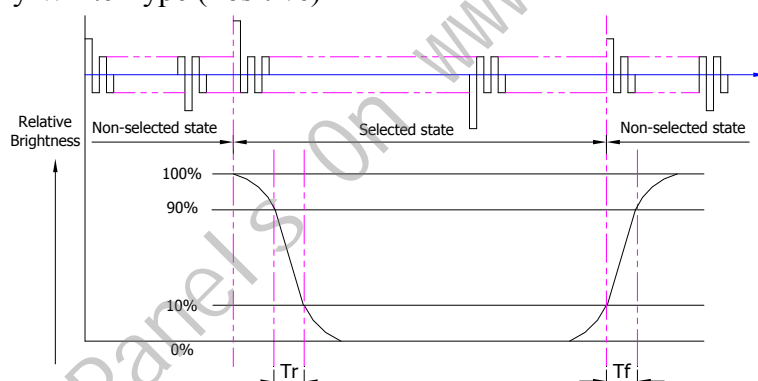
11.2.1 Normally Black Type (Negative)



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

T_f is the time it takes to change from selected state with relative luminance 90% to non-selected state with relative luminance 10%.

11.2.2 Normally White Type (Positive)



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

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

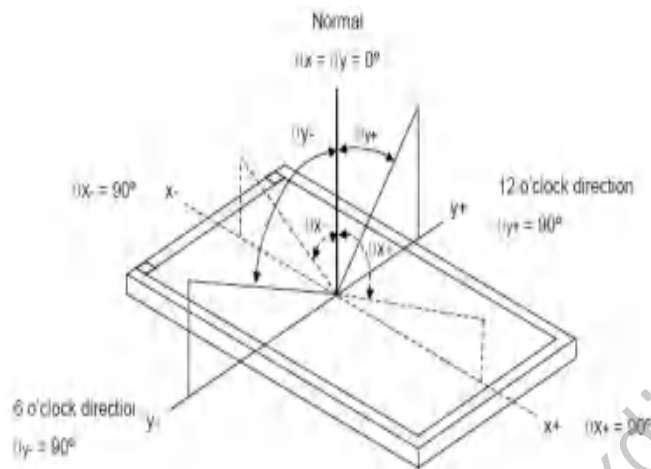
11.3 Definition of Contrast Ratio

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

11.4 Definition of Viewing Angles



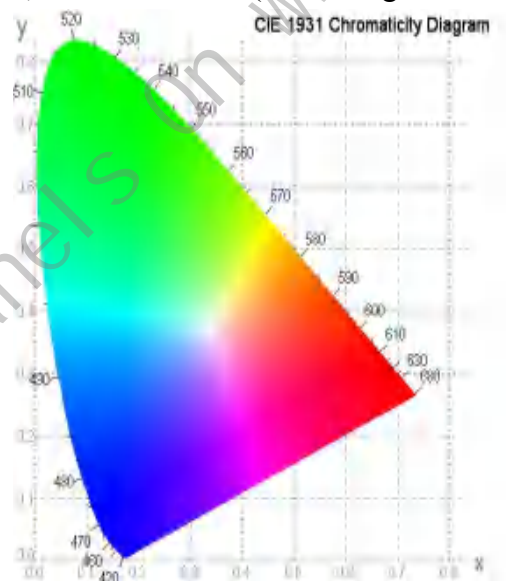
Measuring machine: LCD-5100 or EQUI

11.5 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)



11.6 Definition of Surface Luminance, Uniformity and Transmittance

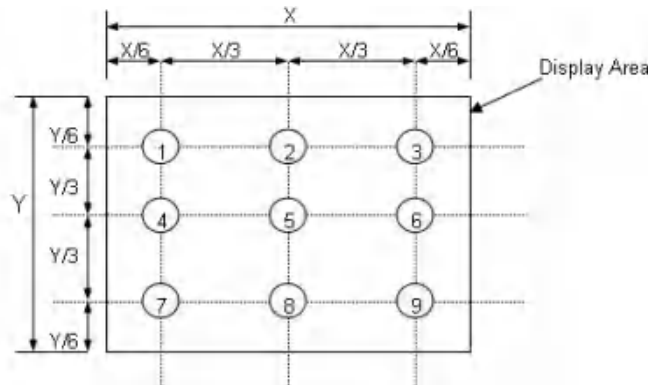
Using the transmissive mode measurement approach, measure the white screen luminance of the display panel and backlight.

11.6.1 Surface Luminance: $LV = \text{average (LP1:LP9)}$

11.6.2 Uniformity = $\text{Minimal (LP1:LP9) / Maximal (LP1:LP9) * 100\%}$

11.6.3 Transmittance = $\text{LV on LCD / LV on Backlight * 100\%}$

Note :Measuring machine:BM-7



12 Quality Assurance

12.1 Purpose

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

12.2 Agreement Items

RRJ and customer shall negotiate if the following situation occurs:

12.2.1 Discrepancies between PanoxDisplay'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.

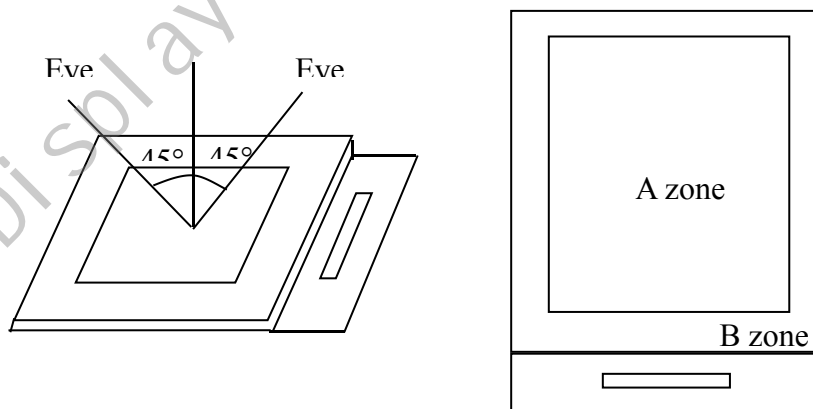
12.3 Standard of the Product Visual Inspection

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 $30\text{cm} \pm 2\text{cm}$.

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

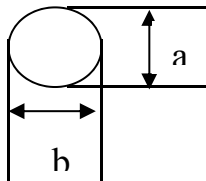
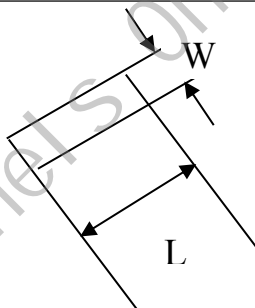
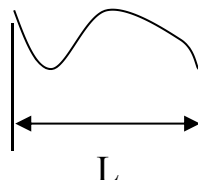
12.4 Inspection Specification

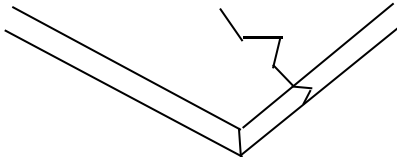
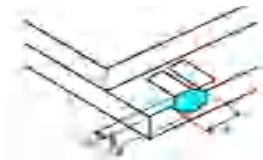
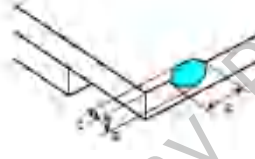
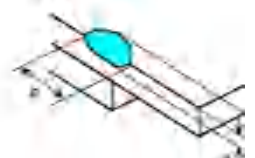
Sampling plan according to GB/T2828.1-2012/ISO 2859-1: 1999 and ANSI/ASQC

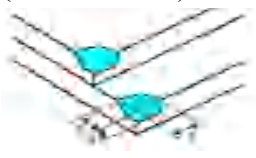
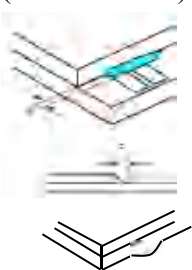
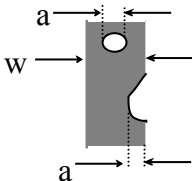
Z1.4-1993,normal level 2 and based on:

Major defect: AQL 0.65

Minor defect: AQL 1.5

No.	Item	Criteria (Unit: mm)																			
01	Black / White spot Foreign material (Round type) Pinholes Stain Particles inside cell. (Minor defect)		<table><tr><th>Size</th><th>Area</th><th>Acc. Qty</th></tr><tr><td>$\varphi \leq 0.10$</td><td></td><td>Ignore</td></tr><tr><td>$0.10 < \varphi \leq 0.15$</td><td></td><td>2</td></tr><tr><td>$0.15 < \varphi \leq 0.20$</td><td></td><td>1</td></tr><tr><td>$0.20 < \varphi$</td><td></td><td>0</td></tr><tr><td>Total</td><td></td><td>2 no include $\varphi \leq 0.10$</td></tr></table>	Size	Area	Acc. Qty	$\varphi \leq 0.10$		Ignore	$0.10 < \varphi \leq 0.15$		2	$0.15 < \varphi \leq 0.20$		1	$0.20 < \varphi$		0	Total		2 no include $\varphi \leq 0.10$
		Size	Area	Acc. Qty																	
$\varphi \leq 0.10$		Ignore																			
$0.10 < \varphi \leq 0.15$		2																			
$0.15 < \varphi \leq 0.20$		1																			
$0.20 < \varphi$		0																			
Total		2 no include $\varphi \leq 0.10$																			
		$\varphi = (a + b) / 2$																			
		Distance between 2 defects should more than 5mm apart.																			
02	Black and White line Scratch Foreign material (Line type) (Minor defect)																				
		<table><tr><th>Length</th><th>Width</th><th>Acc. Qty</th></tr><tr><td>/</td><td>$W \leq 0.03$</td><td>Ignore</td></tr><tr><td>$L \leq 2$</td><td>$0.03 < W \leq 0.05$</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>	Length	Width	Acc. Qty	/	$W \leq 0.03$	Ignore	$L \leq 2$	$0.03 < W \leq 0.05$	1	/	$0.05 < W$	0	Total		1				
Length	Width	Acc. Qty																			
/	$W \leq 0.03$	Ignore																			
$L \leq 2$	$0.03 < W \leq 0.05$	1																			
/	$0.05 < W$	0																			
Total		1																			
		Distance between 2 defects should more than 3mm apart. Scratches not viewable through the back of the display are acceptable.																			

No.	Item	Criteria (Unit: mm)										
03	Glass Crack (Minor defect)	<div></div> <p>LCD with extensible crack line is unacceptable(When press the cracked LCD area, the line will expand, we define it is extensible crack line)</p>										
04	Glass Chipping Pad Area: (Minor defect)	<div></div> <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></table>	Length and Width	Acc. Qty	$c < 5.0, b < 0.4$	Ignore						
Length and Width	Acc. Qty											
$c < 5.0, b < 0.4$	Ignore											
05	Glass Chipping Rear of Pad Area: (Minor defect)	<div></div> <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">$a < \text{Glass Thickness}$</td></tr></table>	Length and Width	Acc. Qty	$c > 3.0, b < 1.0$	1	$c < 3.0, b < 1.0$	2	$c < 3.0, b < 0.5$	4	$a < \text{Glass Thickness}$	
Length and Width	Acc. Qty											
$c > 3.0, b < 1.0$	1											
$c < 3.0, b < 1.0$	2											
$c < 3.0, b < 0.5$	4											
$a < \text{Glass Thickness}$												
06	Glass Chipping Except Pad Area: (Minor defect)	<div></div> <table><tr><th>Length and Width</th><th>Acc. Qty</th></tr><tr><td>$c \leq 0.6, b < 5.0$</td><td>Ignore</td></tr><tr><td colspan="2">$a < \text{Glass Thickness}$</td></tr></table>	Length and Width	Acc. Qty	$c \leq 0.6, b < 5.0$	Ignore	$a < \text{Glass Thickness}$					
Length and Width	Acc. Qty											
$c \leq 0.6, b < 5.0$	Ignore											
$a < \text{Glass Thickness}$												

No.	Item	Criteria (Unit: mm)								
07	Glass Corner Chipping: (Minor defect) 	<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">$a < \text{Glass Thickness}$</td></tr></table>	Length and Width	Acc. Qty	$c < 2.0, b < 1.5$	Ignore	$c < 1.5, b < 2$	Ignore	$a < \text{Glass Thickness}$	
Length and Width	Acc. Qty									
$c < 2.0, b < 1.5$	Ignore									
$c < 1.5, b < 2$	Ignore									
$a < \text{Glass Thickness}$										
08	Glass Burr: (Minor defect) 	Glass burr don't affect assemble and module dimension. <table><tr><th>Length</th><th>Acc. Qty</th></tr><tr><td>$F < 0.5$</td><td>Ignore</td></tr></table>	Length	Acc. Qty	$F < 0.5$	Ignore				
Length	Acc. Qty									
$F < 0.5$	Ignore									
09	FPC Defect: (Minor defect) 	9.1 Dent, pinhole width $a < w/3$. (w: circuitry width.) 9.2 Open circuit is unacceptable. 9.3 No oxidation, contamination and distortion.								
10	Bubble on Polarizer (Minor defect)	<table><tr><th>Diameter</th><th>Acc. Qty</th></tr><tr><td>$\varphi \leq 0.10$</td><td>Ignore</td></tr><tr><td>$0.1 < \varphi \leq 0.2$</td><td>1</td></tr><tr><td>$0.2 < \varphi$</td><td>None</td></tr></table>	Diameter	Acc. Qty	$\varphi \leq 0.10$	Ignore	$0.1 < \varphi \leq 0.2$	1	$0.2 < \varphi$	None
Diameter	Acc. Qty									
$\varphi \leq 0.10$	Ignore									
$0.1 < \varphi \leq 0.2$	1									
$0.2 < \varphi$	None									
11	Dent on Polarizer (Minor defect)	<table><tr><th>Diameter</th><th>Acc. Qty</th></tr><tr><td>$\varphi \leq 0.10$</td><td>Ignore</td></tr><tr><td>$0.1 < \varphi \leq 0.2$</td><td>1</td></tr><tr><td>$0.2 < \varphi$</td><td>None</td></tr></table>	Diameter	Acc. Qty	$\varphi \leq 0.10$	Ignore	$0.1 < \varphi \leq 0.2$	1	$0.2 < \varphi$	None
Diameter	Acc. Qty									
$\varphi \leq 0.10$	Ignore									
$0.1 < \varphi \leq 0.2$	1									
$0.2 < \varphi$	None									
12	Bezel	12.1 No rust, distortion on the Bezel. 12.2 No visible fingerprints, stains or other contamination.								

No.	Item	Criteria (Unit: mm)
13	Touch Panel	<p>D: Diameter W: width L: length</p> <p>13.1 Spot: $D \leq 0.20$ is acceptable $0.20 < D \leq 0.3$, acceptable QTY, 3 2 dots are acceptable and the distance between defects should more than 10 mm. $D > 0.3$ is unacceptable</p> <p>13.2 Dent: $D > 0.30$ is unacceptable</p> <p>13.3 Scratch: $W \leq 0.03$, $L \leq 10$ is acceptable, $0.03 < W \leq 0.10$, $L \leq 10$, acceptable QTY, 3 Distance between 2 defects should more than 10 mm. $W > 0.10$ is unacceptable.</p>
14	PCB	<p>14.1 No distortion or contamination on PCB terminals.</p> <p>14.2 All components on PCB must same as documented on the BOM/component layout.</p> <p>14.3 Follow IPC-A-600F</p>
15	Soldering	Follow IPC-A-610C standard
16	Electrical Defect (Major defect)	<p>The below defects must be rejected.</p> <p>16.1 Missing vertical / horizontal segment,</p> <p>16.2 Abnormal Display.</p> <p>16.3 No function or no display.</p> <p>16.4 Current exceeds product specifications.</p> <p>16.5 LCD viewing angle defect.</p> <p>16.6 No Backlight.</p> <p>16.7 Dark Backlight.</p> <p>16.8 Touch Panel no function.</p> <p>16.9 Dark Dot –one Allowed.</p> <p>16.10 Bright Dot – one Allowed.</p> <p>Remark:</p> <p>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.</p> <p>2. Bright dot caused by scratch and foreign object accords to item 1.</p>

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

12.5 Classification of Defects

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

12.6 Identification/marketing 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	$+40 \pm 3^{\circ}\text{C}$, $90 \pm 3\%\text{RH}$	120hrs	--	*1
High Temp. Operation Test	$+70 \pm 3^{\circ}\text{C}$	120hrs	--	
Low Temp. Operation Test	$-20 \pm 3^{\circ}\text{C}$	120hrs	--	
Thermal Shock Test	$-20 \pm 3^{\circ}\text{C}$ (30min) $+70 \pm 3^{\circ}\text{C}$ (30min)	10cycles	--	
ESD Test(end product)	150pF, 330Ω, $\pm 2\text{KV}$, Contact	10times	--	*2, *3
	150pF, 330Ω, $\pm 6\text{KV}$, 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 us and customer, We will replace or repair any of its LCD and LCM which we found to be defective electrically and visually when inspected in accordance with our Quality Standards, for a period of one year from date of shipment.

14.5.2 The warranty liability of us is limited to repair and/or replacement. We 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 Prior Consult Matter

1. For our standard products, we keep the right to change material, process for improving the product property without prior notice to our customer.
2. For OEM products, if any changes are needed which may affect the product property, we will consult with our customer in advance.
3. If you have special requirement about reliability condition, please let us know before you start the test on our samples.

Reference

Item	Description	Revision
RM6310	IC Data sheet	
BO095F120S	OLED assembly drawing	V1