Product Specification

Product Name: R154101

Product Code: R154101

Rev: V0

Customer			
Approved by Customer		Approved Date	

Designed By	Check By	Approved By	
		R&D	QA

Records of Revision

Date	Rev.	Description	Page	Remarks
2018/08/21	V0	Initial Released		

Table of Contents
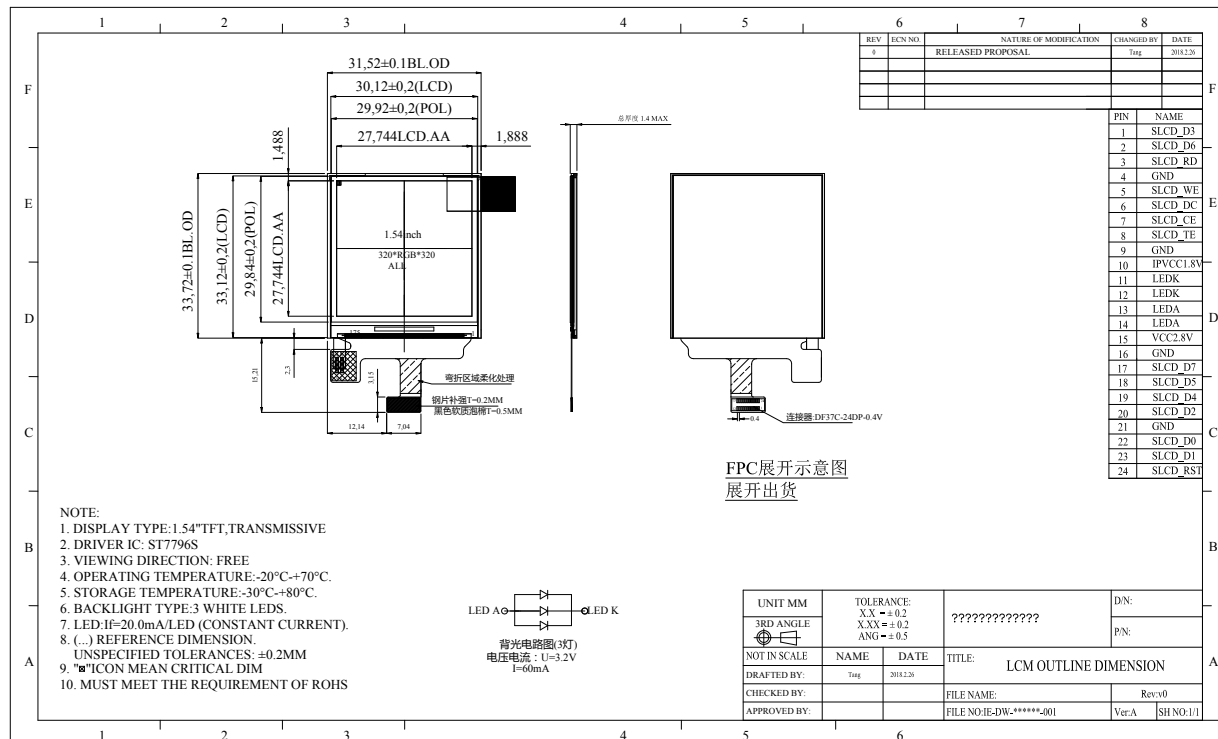
1   General Description

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 1.54" contains 320(RGB)X320 dots and can display up to 262k colors.

2   Module Parameter

Features	Details	Unit
Display Size(Diagonal)	1.54	inch
LCD type	α-Si TFT	-
Display Mode	Transmissive / Normally Black	-
Resolution	320(RGB)X320	-
View Direction	ALL	Best image
Module Outline	31.52(H) ×33.72(V)×1.4(T) (Note 1)	mm
Active Area	27.744 (H)×27.744(V)	mm
Viewing Area	N/A	mm
Display Colors	262K	-
Interface	8 bit Parallel	-
Driver IC	ST7796S	-
Operating Temperature	-20～70	℃
Storage Temperature	-30～80	℃
Weight	TBD	g

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

3 Mechanical Drawings

							REV	ECN NO.	NATURE OF MODIFICATION	CHANGED BY	DATE
							0		RELEASED PROPOSAL	Tang	2018.2.26

PIN	NAME
1	SLCD_D3
2	SLCD_D6
3	SLCD_RD
4	GND
5	SLCD_WE
6	SLCD_DC
7	SLCD_CE
8	SLCD_TE
9	GND
10	IPVCC1.8V
11	LEDK
12	LEDK
13	LEDA
14	LEDA
15	VCC2.8V
16	GND
17	SLCD_D7
18	SLCD_D5
19	SLCD_D4
20	SLCD_D2
21	GND
22	SLCD_D0
23	SLCD_D1
24	SLCD_RST

31,52±0.1BL.OD
30,12±0,2(LCD)
29,92±0,2(POL)
27,744LCD.AA
1,888
1,488
33,72±0.1BL.OD
33,12±0,2(LCD)
29,84±0,2(POL)
27,744LCD.AA
1.54 inch
320*RGB*320
ALL
厚厚度 1.4 MAX

弯折区域柔化处理
钢片补强T=0.2MM
黑色软质泡棉T=0.5MM
连接器:DF37C-24DP-0.4V
0.4
15.2
2.3
3.15
12,14
7.04

FPC展开示意图
展开出货

NOTE:
1. DISPLAY TYPE:1.54"TFT,TRANSMISSIVE
2. DRIVER IC: ST7796S
3. VIEWING DIRECTION: FREE
4. OPERATING TEMPERATURE:-20℃-+70℃.
5. STORAGE TEMPERATURE:-30℃-+80℃.
6. BACKLIGHT TYPE:3 WHITE LEDS.
7. LED:If=20.0mA/LED (CONSTANT CURRENT).
8. (...) REFERENCE DIMENSION.
   UNSPECIFIED TOLERANCES: ±0.2MM
9. "▪"ICON MEAN CRITICAL DIM
10. MUST MEET THE REQUIREMENT OF ROHS

LED A ◦ ◦ LED K
背光电路图(3灯)
电压电流：U=3.2V
I=60mA

UNIT MM	TOLERANCE: X.X = ± 0.2 X.XX = ± 0.2 ANG = ± 0.5	?????????????	D/N:
3RD ANGLE			P/N:
NOT IN SCALE	NAME	DATE	TITLE: LCM OUTLINE DIMENSION
DRAFTED BY:	Tang	2018.2.26	
CHECKED BY:			FILE NAME: Rev:v0
APPROVED BY:			FILE NO:IE-DW-******-001 Ver:A SH NO:1/1

4 Module Interface

NO	SYMBOL	FUNCTION
1	DB3	MCU parallel interface data
2	DB6	MCU parallel interface data
3	RD	Read MCU parallel interface
4	GND	Power Ground
5	WR	Write MCU parallel interface
6	RS	Display data/command selection pin.

7	CS	Chip selection pin; Low enable, High disable.	
8	TE	Data enable signal for RGB interface operation.	
9	GND	Power Ground	
10	IOVCC	Power Supply for I/O system. IOVCC=1.65V~3.3V	
11	LEDK	LED Cathode	
12	LEDK	LED Cathode	
13	LEDA	LED Anode	
14	LEDA	LED Anode	
15	VCC	Power Supply for Analog, VCC=2.4V~3.3V.	
16	GND	Power Ground	
17	DB7	MCU parallel interface data	
18	DB5	MCU parallel interface data	
19	DB4	MCU parallel interface data	
20	DB2	MCU parallel interface data	
21	GND	Power Ground	
22	DB0	MCU parallel interface data	
23	DB1	MCU parallel interface data	
24	RESET	This signal will reset the device and it must be applied to properly initialize the chip. Signal is active low.	

5 Application Circuit

Backlight recommended circuit

Motherboard driver backlight is need constant current circuit:
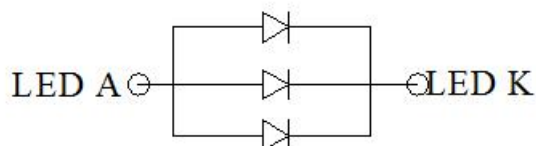
背光电路图(3灯)
电压电流：U=3.2V
I=60mA

Note: constant current circuit for every LED,and though LED lamp current is less than 20mA.Recommand between 15mA and 20 mA for every LED.

6   Absolute Maximum Ratings

VSS=0V, Ta=25ºC

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}	-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.

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
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	-	60	-	mA
	Standby mode	Ivdd	-	20	-	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=25ºC, VDD=2.8V, TN LC+ Polarizer

	Item	Symbol	Condition	Specification			Unit
				Min.	Typ.	Max.	

	Luminance on surface(I_f =20mA)	Lv	Normally viewing angle $\theta_X = \theta_Y$ =0º	TBD	200	-	cd/m²
	Contrast ratio	CR		-	600	-	-
	Response time	T_R		-	10	20	ms
		T_F	-	-	20	30	
Chromaticity Transmissive	Red	X_R	-	0.614	0.644	0.674	-
		Y_R		0.290	0.320	0.350	-
	Green	X_G		0.270	0.300	0.330	-
		Y_G		0.540	0.570	0.600	-
	Blue	X_B		0.104	0.134	0.164	-
		Y_B		0.097	0.127	0.157	-
	White	X_W		0.267	0.297	0.327	-
		Y_W		0.302	0.332	0.362	-
Viewing Angle	Horizontal	θ_{X+}	Center CR≥10	-	80	-	Deg.
		θ_{X-}		-	80	-	
	Vertical	θ_{Y+}		-	80	-	
		θ_{Y-}		-	80	-	
	NTSC Ratio(Gamut)	-	-	-	60	-	%

11.2 Definition of Response Time

11.2.1 Normally Black Type (Negative)
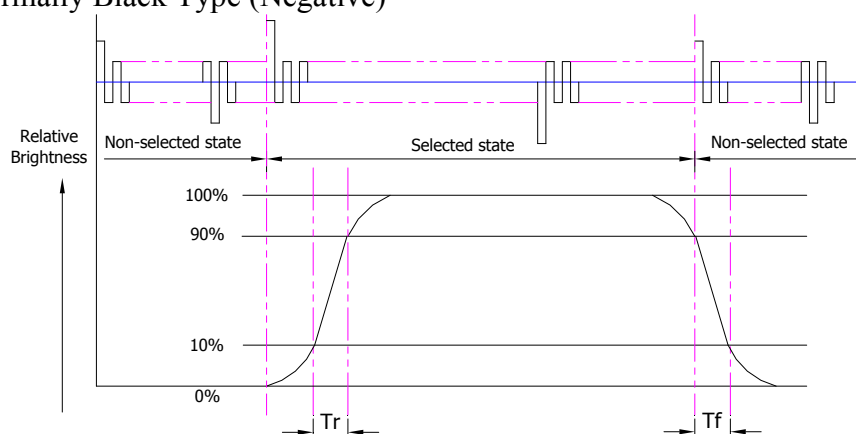
Tr is the time it takes to change form non-selected state with relative luminance 10% to selected state with relative luminance 90%;

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

11.2.2 Normally White Type (Positive)
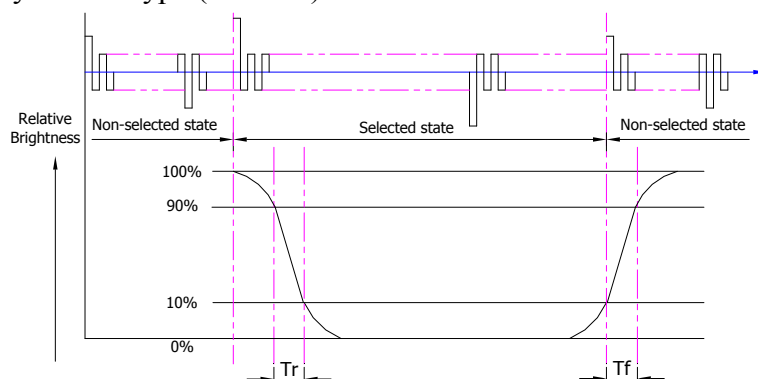
Tr is the time it takes to change form non-selected state with relative luminance 90% to selected state with relative luminance 10%;

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

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
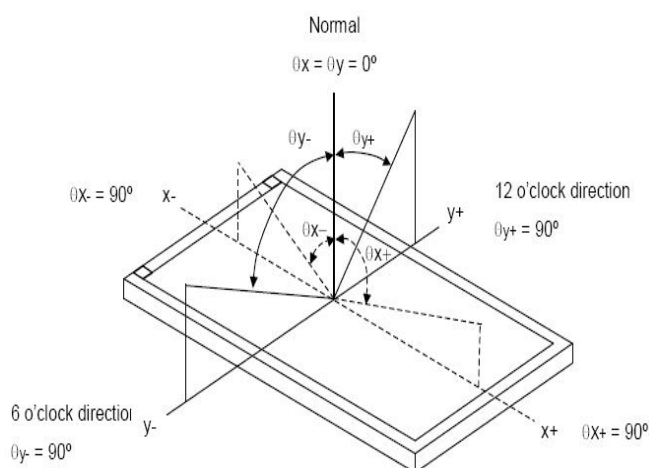
Measuring machine: LCD-5100 or EQUI

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)
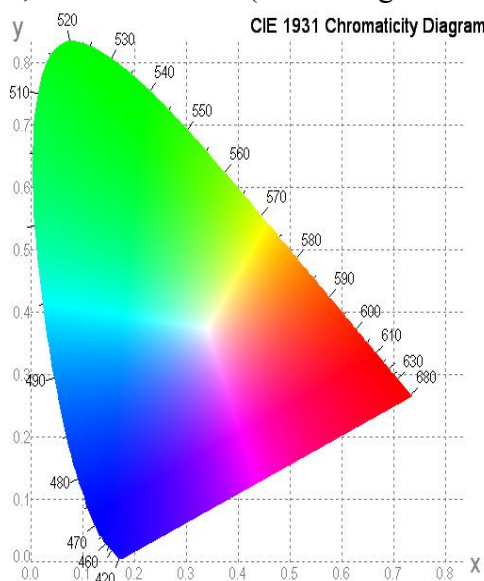
11.6 Definition of Surface Luminance, Uniformity and Transmittance

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

11.6.1 Surface Luminance: LV = average (LP1:LP9)

11.6.2 Uniformity = Minimal (LP1:LP9) / Maximal (LP1:LP9) * 100%

11.6.3 Transmittance = LV on LCD / LV on Backlight * 100%

Note :Measuring machine:BM-7
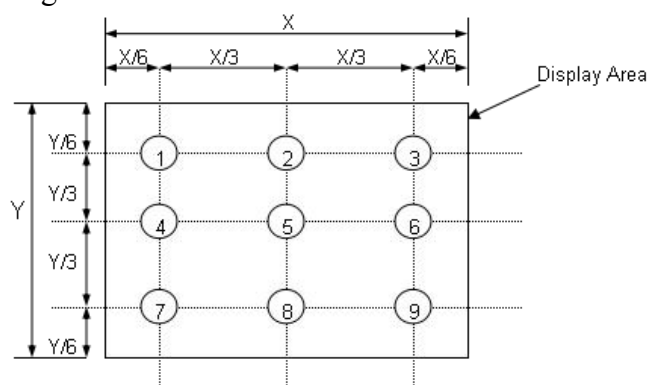
12 Quality Assurance

12.1 Purpose

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

12.2 Agreement Items

RRJ and customer shall negotiate if the following situation occurs:

12.2.1 Discrepancies between RRJ '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.
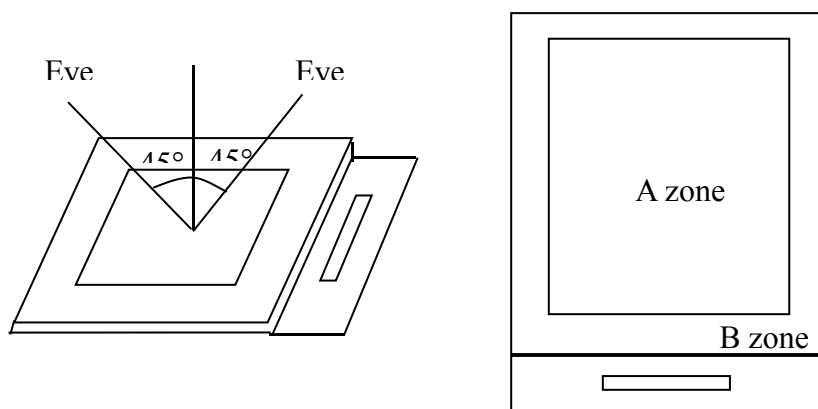
12.3.2 Basic principle:A set of sample to indicate the limit of acceptable quality level must be discussed by both RRJ and customer when there is any dispute happened.

12.4　Inspection Specification
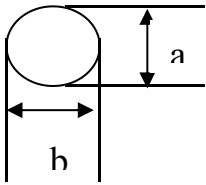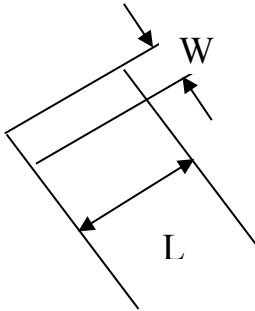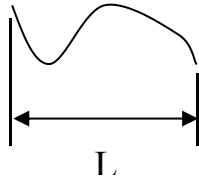
Sampling plan according to GB/T2828.1-2012/ISO 2859-1：1999 and ANSI/ASQC Z1.4-1993,normal level 2 and based on:
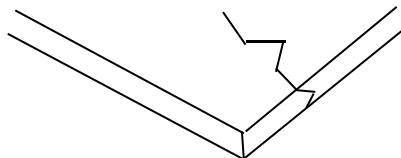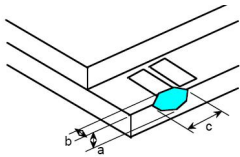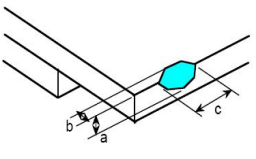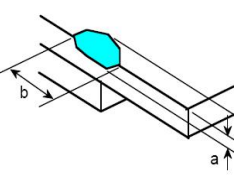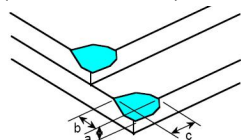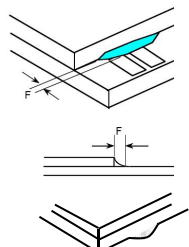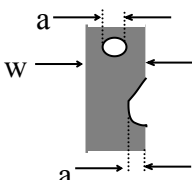
Major defect: AQL 0.65

Minor defect: AQL 1.5

No.	Item	Criteria (Unit: mm)

No.	Item	Criteria (Unit: mm)
01	Black / White spot Foreign material (Round type) Pinholes Stain Particles inside cell. (Minor defect)	 $\varphi = (a+b)/2$ 	Size / Area	Acc. Qty
---	---
$\varphi \le 0.10$	Ignore
$0.10 < \varphi \le 0.15$	2
$0.15 < \varphi \le 0.20$	1
$0.20 < \varphi$	0
Total	2 no include $\varphi \le 0.10$	 Distance between 2 defects should more than 5mm apart.
02	Black and White line Scratch Foreign material (Line type) (Minor defect)	 | Length	Width	Acc. Qty
/	$W \leqq 0.03$	Ignore
$L \leqq 2$	$0.03 < W \leqq 0.05$	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)	 LCD with extensible crack line is unacceptable(When press the cracked LCD area, the line will expand, we define it is extensible crack line)
04	Glass Chipping Pad Area: (Minor defect) 	<table><tr><td>Length and Width</td><td>Acc. Qty</td></tr><tr><td>c < 5.0, b< 0.4</td><td>Ignore</td></tr></table>
05	Glass Chipping Rear of Pad Area: (Minor defect) 	<table><tr><td>Length and Width</td><td>Acc. Qty</td></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>
06	Glass Chipping Except Pad Area: (Minor defect) 	<table><tr><td>Length and Width</td><td>Acc. Qty</td></tr><tr><td>c ≤0.6, b< 5.0</td><td>Ignore</td></tr><tr><td colspan="2">a<Glass Thickness</td></tr></table>

No.	Item	Criteria (Unit: mm)
07	Glass Corner Chipping: (Minor defect)	<table><tr><td colspan="2">Length and Width</td><td>Acc. Qty</td></tr><tr><td colspan="2">c < 2.0, b< 1.5</td><td>Ignore</td></tr><tr><td colspan="2">c < 1.5, b< 2</td><td>Ignore</td></tr><tr><td colspan="3">a<Glass Thickness</td></tr></table>
08	Glass Burr: (Minor defect)	Glass burr don't affect assemble and module dimension. <table><tr><td>Length</td><td>Acc. Qty</td></tr><tr><td>F < 0.5</td><td>Ignore</td></tr></table>
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><td>Diameter</td><td>Acc. Qty</td></tr><tr><td>φ≤0.10</td><td>Ignore</td></tr><tr><td>0.1 <φ≤0.15</td><td>2</td></tr><tr><td>0.15 <φ≤0.2</td><td>1</td></tr><tr><td>0.2 < φ</td><td>None</td></tr></table>
11	Dent on Polarizer (Minor defect)	<table><tr><td>Diameter</td><td>Acc. Qty</td></tr><tr><td>φ≤0.10</td><td>Ignore</td></tr><tr><td>0.1 <φ≤0.15</td><td>2</td></tr><tr><td>0.15 <φ≤0.2</td><td>1</td></tr><tr><td>0.2 < φ</td><td>None</td></tr></table>
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	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 item1.

No.	Item	Criteria (Unit: mm)
17	Screen deformation	Test for insertion of plug gauge at highest warping point： (0.9-4 .5 inches does not contain 4.5) H≦0.2MM (4.5-5.5 inches) H≦0.3MM Decision OK

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/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	120hrs	--	*1
High Temp. Operation Test	+70 ± 3ºC	120hrs	--	
Low Temp. Operation Test	-20 ± 3ºC	120hrs	--	
Thermal Shock Test	-20 ± 3ºC (30min) +70 ± 3ºC (30min)	10cycles	--	
ESD Test(end product)	150pF, 330Ω, ±2KV, Contact 150pF, 330Ω, ±6KV, Air	10times	--	*2, *3
Vibration Test (for packaging)	Frequency: 10Hz to 55Hz to10Hz,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 RRJ-DISPLAY and customer, RRJ-DISPLAY will replace or repair any of its LCD and LCM which RRJ-DISPLAY found to be defective electrically and visually when inspected in accordance with RRJ-DISPLAY Quality Standards, for a period of one year from date of shipment.

14.5.2 The warranty liability of RRJ-DISPLAY is limited to repair and/or replacement. RRJ-DISPLAY 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 RRJ-DISPLAY 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
ST7796S	IC Data sheet	ST7796S_SPEC_V0.1
R154101	LCM assembly drawing	V0