Specification of Display

Module

Customer Project Name	
Module Name	YM14MMSA23
Version No.	V0
Release Date	2025-04-01

Customer Approval:

□ **Approve Specification Only**

□ **Approve Specification and Sample**

Approved By
Date

Designed By	Checked By	Approved By

Revision Record

Date	Rev.	Description	Chapter	Remarks
2025/04/01	V0	Initial Released		

Contents

1. Introduction

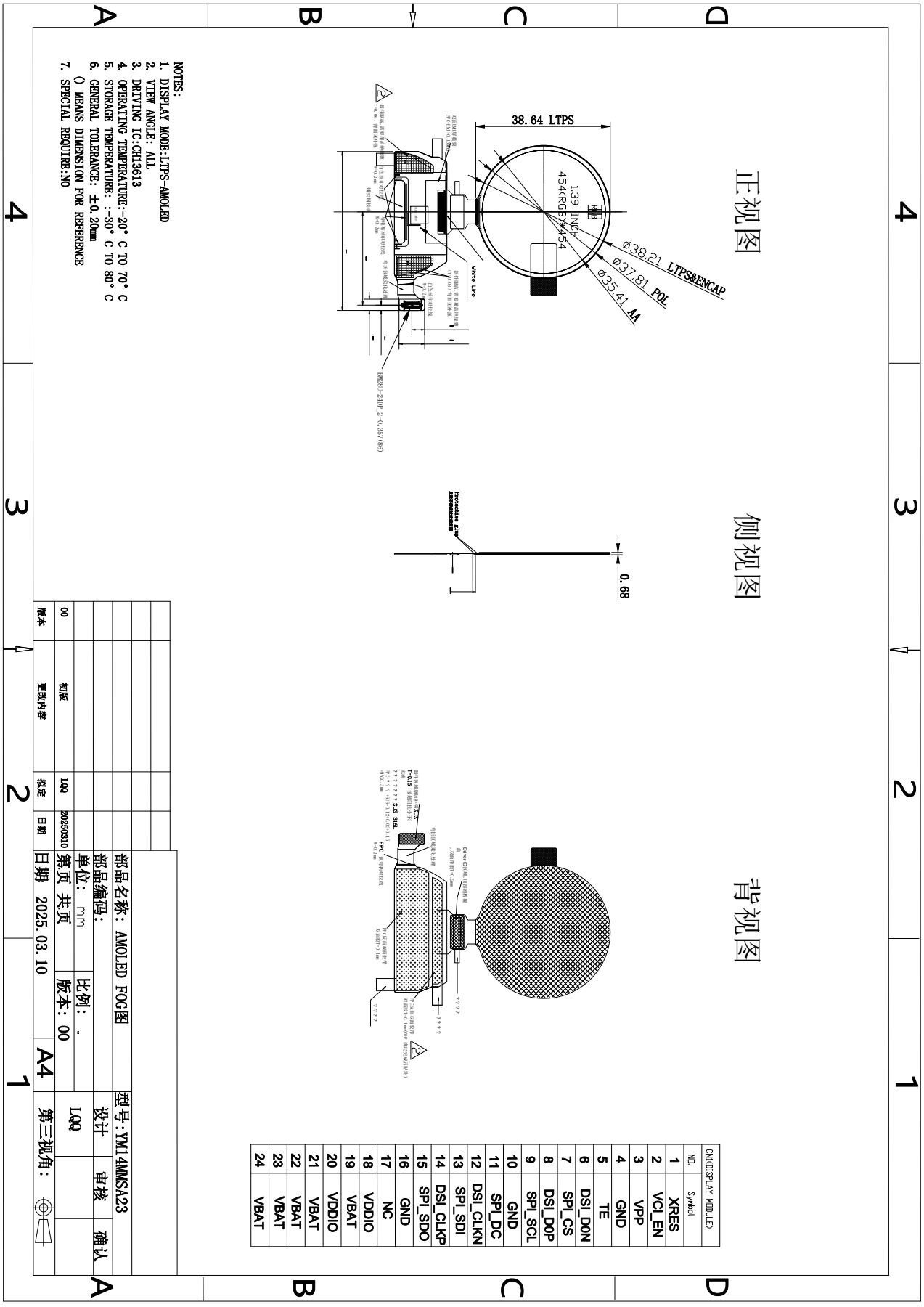
All materials and processes of this display module are Lead Free.
Display, display module, LCM or module in this specification has the same meaning.

2. General Specification

2.1 Display Module General Specification

Item	Content	Unit
Display Module Size (inch)	1.39	inch
Active Area (W×H)	35.412×35.412	mm
Module Size (W×H×T)	38.212×38.642	mm
Pixel Pitch (W*H)	0.078×0.078	mm
Display Type	AMOLED	/
Viewing Direction	ALL	/
Number of Dots	454×(RGB)×454	Dots
Pixel Per Inch (PPI)	461	/
Driver IC	CH13613	/
Interface Type	MIPI	/
Approx. Weight	TBD	g
Display Colors	16.7M(8bits)	/
NTSC	100%(Type)	/

3.Mechanical Drawing



4. Display Module Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Supply Voltage for Logic	VDDIO	-0.3	5.5	V
Supply Voltage for Analogic	VCI	2.8	3.3	V
Supply Voltage for Analogic	VGH/	-0.3	+15	V
Driver Supply Voltage	VGL	0.3	-15	V
Operating Temperature	Top	-20	+70	°C
Storage Temperature	Tst	-30	+80	°C

5. Electrical Characteristics

5.1 Display Module Electrical Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage for Logic	VDDIO	1.65	1.8	3.6	V
Supply Voltage for Analogic	VCI_EN	2.8	2.8	3.3	V
Supply Voltage for Analogic	VBAT	2.9	3.7	5.5	V
Input Voltage	V_{IL}	Vss	-	0.3VDDIO	V
	V_{IH}	0.7VDDIO	-	VDDIO	V

6. Display Module Optical Characteristics

Item		Symbol	Condition	Specifications			Unit	Remark
				Min.	Typ.	Max.		
Brightness		Lv	Viewing normal angle Θ= 0°	300	350	--	Cd/m2	Note 2
Contrast Ratio		CR		30000	--	--	/	Note 1
Response Time		Tr+Tf		--	--	--	ms	Note 4
Chromaticity CIE(x,y)	Red	x		0.660±0.03			/	Note 6
		y		0.340±0.03			/	
	Green	x		0.220±0.03			/	
		y		0.730±0.03			/	
	Blue	x		0.140±0.03			/	
		y		0.050±0.03			/	
	White	x		0.30±0.03			/	
		y		0.31±0.03			/	
Viewing Angle	Hor.	θ_{X+}	Center CR>=10	88	--	--	Deg.	Note 5
		θ_{X-}		88	--	--		
	Ver.	θ_{Y+}		88	--	--		
		θ_{Y-}		88	--	--		
Luminance Uniformity		White		80	--	--	%	Note 3

Note1. Contrast Ratio (CR) is defined mathematically by the following formula. For more information see FIG.1
Contrast= Average Surface Luminance with all white pixels (P1,P2,P3,P4,P5,P6,P7,P8,P9)
Ratio Average Surface Luminance with all black pixels (P1,P2,P3,P4,P5,P6,P7,P8,P9)

Note2. Surface luminance is defined mathematically by the following formula. For more information see FIG.1
Brightness = Average Surface Luminance with all white pixels (P1,P2,P3,P4,P5,P6,P7,P8,P9)

Note3. The luminance uniformity is defined mathematically by the following formula. For more information see FIG.1
Luminance = Minimum Surface Luminance with all white pixels (P1,P2,P3,P4,P5,P6,P7,P8,P9)
Uniformity Maximum Surface Luminance with all white pixels (P1,P2,P3,P4,P5,P6,P7,P8,P9)

Note4. Response time is the time required for the display to transition from White to black(Rise Time, Tr) and from black to white(Decay Time, Tf). For more information see FIG.2

Note5. Viewing angle means the best contrast ratio of display for user. For more information see FIG.3

Note6. Chromaticity CIE(x, y) is determined by the CIE(x, y) value of the point5. For more information see FIG.1

Note7: NTSC ratio is defined mathematically by the following formula. For more information see FIG.4
NTSC = Area of RGB triangle
Ratio Area of NTSC triangle

Note8. For viewing angle and response time testing, the testing data is base on instruments of Autronic-Melchers's ConoScope series. For contrast ratio, Surface Luminance, Luminance uniformity and CIE(x,y), the testing data is base on BM-7 photo detector.

FIG.1. Measuring method for Contrast ratio,surface luminance, Luminance uniformity,CIE(x,y) chromaticity
A: 6 mm
B: 6 mm
H,V: Active Area
Light spot size Φ=5mm, 500mm distance from the display surface.

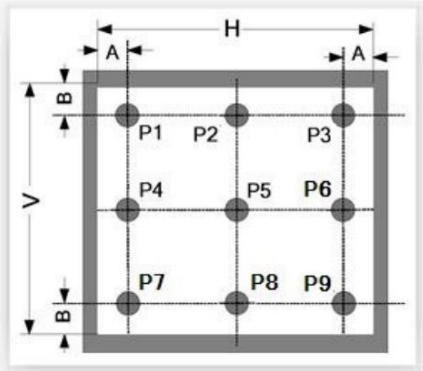


FIG.1. 9-point position on display 测量点位置示意

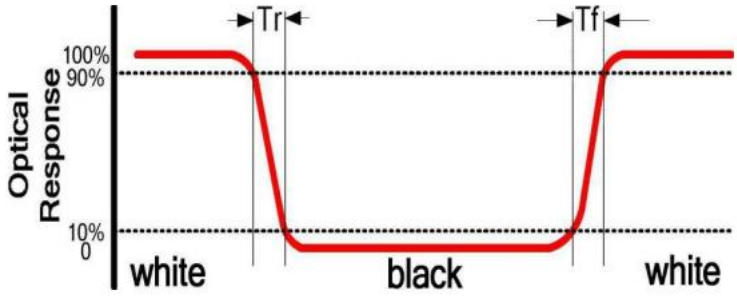


FIG.2. The definition of response time 响应时间定义

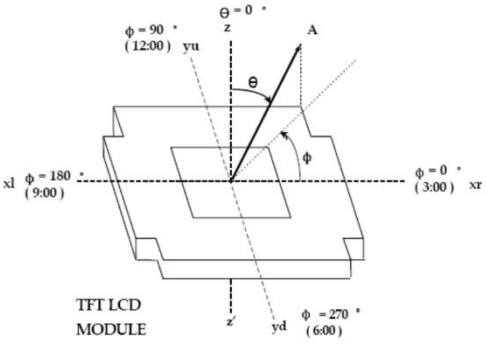


FIG.3. The definition of viewing angle 视角定义

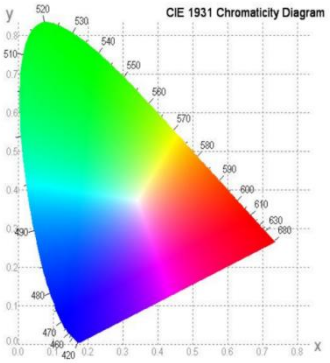
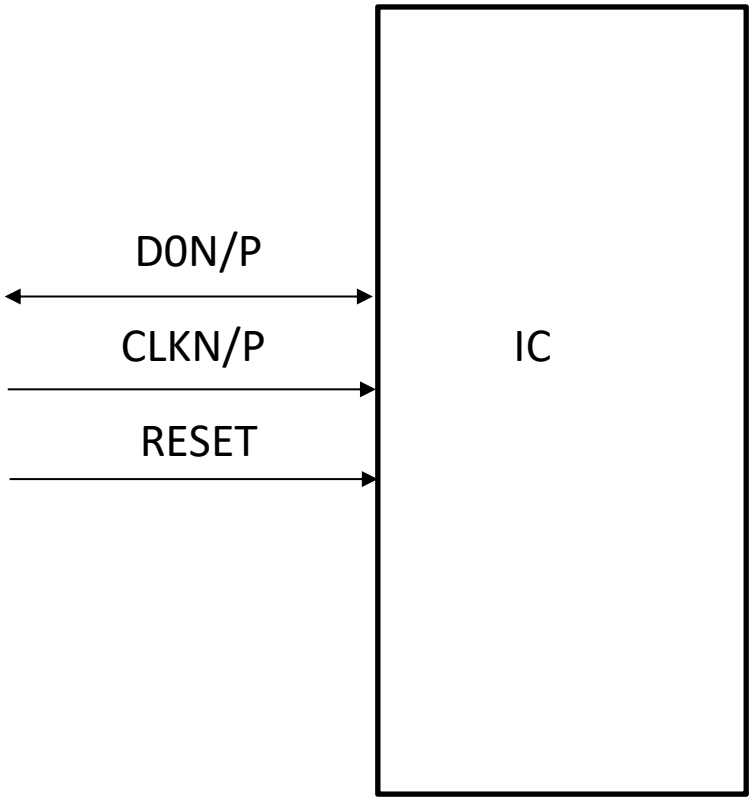


FIG.4. NTSC ratio 色域定义

7. Display Module Interface Description(Pin Definition)

No.	Symbol	Description	I/O
1	XRES	Reset signal	I
2	VCI_EN	Power supply 2.8V	P
3	VPP	-	-
4	GND	Ground	P
5	TE	Tearing effect signal is used to synchronize MCU to frame memory	O
6	DSI_D0N	MIPI-DSI Data differential signal input pins.(data lane 0)	I/O
7	SPI_CS	Chip select input pin	I
8	DSI_D0P	MIPI-DSI Data differential signal input pins.(data lane 0)	I/O
9	SPI_SCL	This pin is used to be serial interface clock	I
10	GND	Ground	P
11	SPI_DC	Display data/command selection in 8 bit SPI I/F	I
12	DSI_CLKN	MIPI-DSI CLOCK differential signal input pins	I
13	SPI_SDI	Serial input signal in SPI I/F	I/O
14	DSI_CLKP	MIPI-DSI CLOCK differential signal input pins	I
15	SPI_SDO	Serial outputs signal in SPI I/F	O
16	GND	Ground	P
17	NC	-	-
18	VDDIO	Power supply 1.8V	P
P	VBAT	Power supply 3.7V	P
20	VDDIO	Power supply 1.8V	P
21	VBAT	Power supply 3.7V	P
22	VBAT	Power supply 3.7V	P
23	VBAT	Power supply 3.7V	P
24	VBAT	Power supply 3.7V	P

8.Display Module Block Diagram



9. Caution

9.1 Handling of Display Module

Be sure to ground the body when handling the display module.
Do not give external shock.
Do not apply excessive force on the surface.
Material in display is hazardous substance,do not lick and swallow.
When the material is attach to your hand, skin, cloth etc., wash it out thoroughly and immediately.
Do not operate it above the absolute maximum rating.
Do not disassemble the display module.

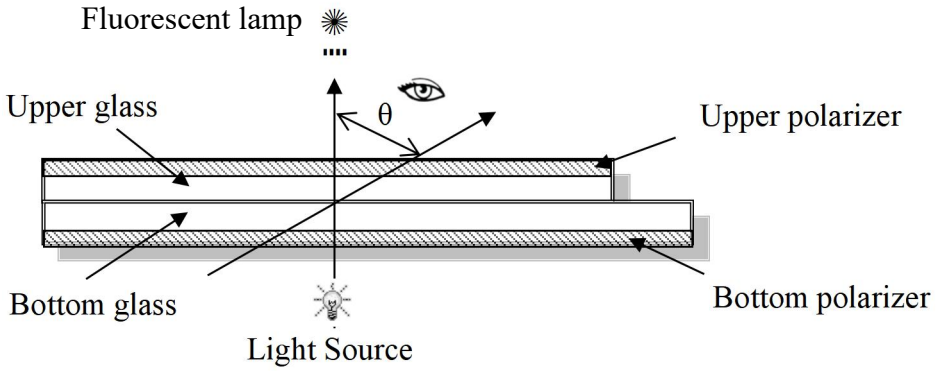
9.2 Storage

Store in an ambient temperature of 5℃ to 45℃,and in a relative humidity of 40% to 60%. Do not expose to sunlight or intensive ultraviolet rays.
Storage in a clean environment, free from dust, active gas, and solvent.
Store in anti-static electricity container.
Store without any physical load.

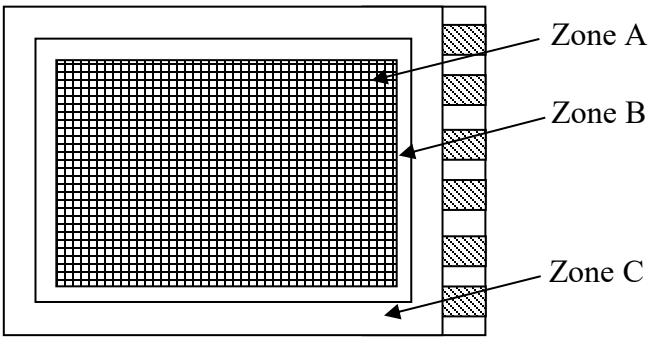
10. Display Module Quality Criteria

10.1 Inspection Conditions

Inspection performed under the following conditions:
Temperature: 25±5℃
Humidity: 65%±10%RH
Viewing angle θ: ≤ 30°
Illumination:under a fluorescent lamp at a distance of 50cm with 300~700Lux
Viewing distance: 30cm±5cm



10.2 Zone Definition



Zone A : Effective viewing area(AA)
Zone B : Viewing area except Zone A
Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer .)
Note: Visual defect in Zone C can be ignored, as it does not effect display function or appearance after being assembled by customer.

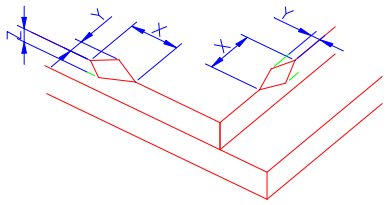
10.3 Inspection Specification

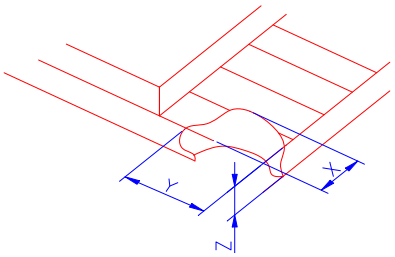
Sampling plan according to GB/T2828.1-2012/ISO 2859-1：1999 and ANSI/ASQC Z1.4-1993,normal level 2 and based on:
AQL:

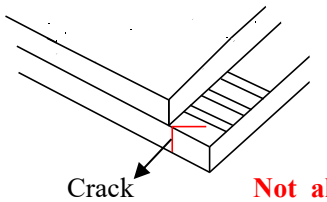
Major Defect	Minor Defect
0.4	1.0

No.	Items to be inspected	Criteria	Classification of Defect
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 dimensions are larger or shorten than the drawing.	
4	Color Tone	Color unevenness, refer to limited sample.	Minor
5	Soldering Appearance	Good soldering , Peeling off is not allowed.	
6	Display/Polarizer/TP	Black/White spot/line, scratch, crack, etc.	
7	Linearity	No more than 1.5%.	

10.4 Criteria (Visual)

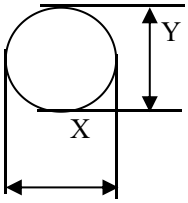
<table>
<tr><th>No.</th><th>Items</th><th>Criteria(mm)</th></tr>
<tr><td rowspan="3">1</td><td>Display Edge Broken</td><td> 

<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≤3.0mm</td><td><Inner border line of the seal</td><td>≤T</td></tr>
</table>
No effective function. Allowed</td></tr>
<tr><td>Display Corner Broken</td><td> 

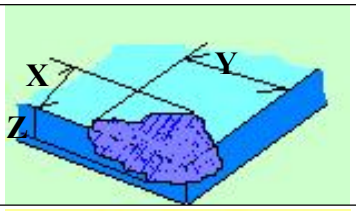
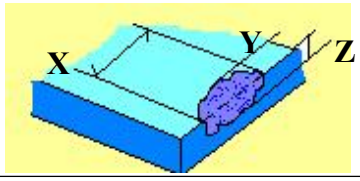
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≤3.0mm</td><td>≤L</td><td>≤T</td></tr>
</table>
No effective function. Allowed</td></tr>
<tr><td>Display Crack</td><td> 

Not allowed</td></tr>
</table>

Notes: X=Length of defect, Y=Width of defect, Z=Height of defect, L=Length of ITO, T=Height of display.

<table>
<tr>
<td rowspan="2">2</td>
<td>Clear Spot Defect
 

Φ=(X+Y)/2</td>
<td>1.Light dot(Display/TP/Polarizer black/white spot , light dot, pinhole, dent, stain)
<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≤0.1</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.1<Φ≤0.2</td><td colspan="2">2(distance≥5mm)</td></tr>
<tr><td>Φ>0.2</td><td colspan="2">0</td></tr>
</table>
2.Dim spot(Display/TP/Polarizer dim dot, light leakage、dark spot)
<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≤0.1</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≥5mm)</td></tr>
<tr><td>0.2<Φ≤0.25</td><td colspan="2">1</td></tr>
<tr><td>Φ＞0.25</td><td colspan="2">0</td></tr>
</table>
3.TP Dirt
<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≤0.1</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.1<Φ≤0.25</td><td colspan="2">2(distance≥5mm)</td></tr>
<tr><td>Φ>0.25</td><td colspan="2">0</td></tr>
</table></td>
</tr>
<tr>
<td>Line Defect</td>
<td>Black or white line, foreign material, scratch, stain on Display/TP/polarizer.
<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≤0.02</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.02<W≤0.03</td><td>L≤2.0</td><td colspan="2">N≤1</td></tr>
<tr><td>0.03<W≤0.05</td><td>L≤1.0</td><td colspan="2">N≤1</td></tr>
<tr><td>W>0.05</td><td colspan="4">Define as spot defect</td></tr>
</table></td>
</tr>
<tr>
<td>3</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≤0.1</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.1<Φ≤0.25</td><td colspan="2">2(distance≥5mm)</td></tr>
<tr><td>Φ>0.25</td><td colspan="2">0</td></tr>
</table>
</td>
</tr>
<tr>
<td>4</td>
<td>SMT</td>
<td>According to IPC-A-610C class II standard.Function defects and missing parts are major defects, others are minor defects.</td>
</tr>
<tr>
<td>5</td>
<td>MURA</td>
<td>Test with 5%ND filter covered on white picture, it can’t be seen as OK.</td>
</tr>
</table>

<table>
<tr><td rowspan="3">6</td><td>Newton Ring</td><td>Newton Ring area>1/6 TP area NG
Newton Ring area≤1/6 TP area OK</td><td>  </td></tr>
<tr><td></td><td>Rule-less Newton Ring area>1/4 TP area NG
Rule-less Newton Ring area≤1/4 TP area OK</td><td>  </td></tr>
<tr><td>TP Corner Broken</td><td><table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>X≤2.0mm</td><td>Y≤2.0mm</td><td>Z<Lens thickness</td></tr></table>* Circuitry broken is not allowed.</td><td>  </td></tr>
<tr><td>TP Edge Broken</td><td><table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>X≤2.0mm</td><td>Y≤0.15mm</td><td>Z<lens thickness</td></tr></table>* Circuitry broken is not allowed.</td><td>  </td></tr>
<tr><td>7</td><td>TP Dirt</td><td colspan="2"><table><tr><td>Zone
Size (mm)</td><td colspan="2">Acceptable Qty</td><td></td></tr><tr><td></td><td>A</td><td>B</td><td>C</td></tr><tr><td>Φ≤0.1</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr><tr><td>0.1<Φ≤0.2</td><td colspan="2">2(distance≥5mm)</td></tr><tr><td>Φ>0.2</td><td colspan="2">0</td></tr></table></td></tr>
<tr><td>8</td><td>Foreign Material on TP Film</td><td colspan="2">The line can be seen after mobile phone in the operating condition<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="2">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>W>0.05</td><td colspan="4">L>3 Define as spot defect</td></tr></table></td></tr>
<tr><td>9</td><td>Dim Line on TP Film</td><td colspan="2"><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>W>0.05</td><td colspan="3">Define as spot defect</td></tr></table></td></tr>
<tr><td>10</td><td>Pattern Font</td><td colspan="2">Pattern fonts are clear and symmetrical,slightly uneven are allowed.Font swing is no more than 1mm,font line should be smooth.</td></tr>
</table>

11. Reliability Test

No.	Item	Condition	Standard
1	High Temp. Storage	80℃, 48 hours	1. Functional test is OK. Missing segment, short, unclear segment, display abnormally and liquid crystal leak are not allowed. 2. No low temperature bubbles, end seal loose and fall, frame rainbow.
2	Low Temp. Storage	-30℃, 48 hours	
3	High Temp. Operation	70℃, 48 hours	
4	Low Temp. Operation	-20℃, 48 hours	
5	High Temp. and High Humidity Storage	60℃,90%RH ,48 hours	
6	Thermal and Cold Shock	Static state, -30℃(30 Min)~80℃(30 Min)~ -30℃(30Min),packaging,10 cycles	
7	Vibration Test	Packaging，Frequency: 10-55Hz Amplitude: 1.0mm Each direction on X,Y,Z for 2 hours	1. Function test is OK. 2. No glass crack, chipped glass, end seal loose and fall, epoxy frame crack and so on. 3. No structure loose and fall.
8	Dropping Test	Pack products into a carton box,and drop it to ground from 80cm height,once each side of the carton.	

Notes:

11.1 The reliability items will be fully carried out in new project sample-test.
11.2 The reliability items will be tested as a continuous monitoring during mass production by plan.
11.3 All samples are inspected after being kept in the room with normal temperature and humidity for 2 hours or above after reliability test.
11.4 Vibration test: It is not necessary without assembly frame of backlight, or PCB/FPC etc..
11.5 Dropping test: It is not necessary until confirm new package.
11.6 For the high temperature and high humidity test, pure water of over 10 MΩ.cm should be used.
11.7 Each test item applies only once for every test display.Tested display cannot be used again in any other test item.
11.8 The quantity of display for each reliability item is 5pcs to 10pcs.

12 Precautions for Using Display Modules

12.1 Safety Instructions

12.1.1 If the display panel breaks, be careful not to get any liquid crystal substance or other materials in your mouth.
12.1.2 If the liquid crystal substance touches your skin or clothes, please wash it off immediately by using soap and water.

12.2 Handling Precautions

12.2.1 Avoid static electricity damaging the display.
12.2.2 Do not remove the panel or frame from the module .
12.2.3 The polarizer of the display is very fragile, so please handle it very carefully.
12.2.4 Do not wipe the polarizer with a dry cloth, as it may easily scratch the surface of it.
12.2.5 The color tone of Display has the possibility of being changed in the large storage temperature range.
12.2.6 Pay attention to the working environment, as the components may be destroyed by static electricity.
--Be sure to ground human body and electric appliance during working.
--Avoid working in a dry environment to minimize the generation of static electricity.
--Static electricity may be generated when the protective film is quickly peeled off.
12.2.7 When soldering the terminal of display, make sure the power source of soldering iron does not leak.
12.2.8 If the display surface contaminated, clean it gently with a clean cloth. If it is heavily contaminated, moisten the clean cloth with the following solvent (ex:ethyl alcohol). Solvents without mentioned may damage the polarizer.

12.3 Operation Instructions

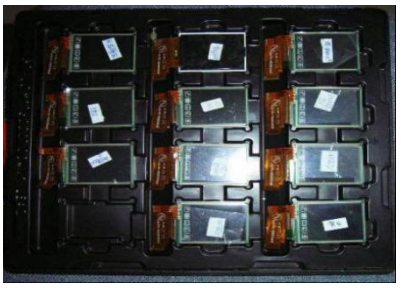
12.3.1 It is recommended to drive the display within the specified voltage limits, try to adjust the operating voltage for the optimal contrast, the color and contrast of display panel will varies at different temperature.
12.3.2 Response time is greatly delayed at low operating temperature range. However, it does not mean the display is damaged, it will recover in the specified temperature range.
12.3.3 If the display area is pushed hard during operation, the display will become abnormal.
12.3.4 Do not operate the display at the environments over the specified conditions, this may cause damage on the display and shorten the lifetime.

12.4 Storage Instructions:

12.4.1 Store display in a sealed polyethylene bag.
12.4.2 Store display in a dark place, Do not expose to sunlight or fluorescent light. Keep the temperature between 0℃and 35℃.
12.4.3 Avoid the polarizer being touched by any objects.(Recommend to store in the container while shipped)

12.5 Limited Warranty

12.5.1 Will replace or repair any of its display module, after customers inspected defects according to quality standard (in this specification), with a period of 12 months from ink-print date on product.
12.5.2 Any defect product must be returned to within 60 days since shipped out. Confirmation of such date shall be based on freight documents. The warranty liability of limited to repair and/or replacement on defects above (10.4)
12.5.3 No warranty can be granted if the precautions stated above have been disregarded. The typical samples are as below:
--Display glass cracked or broke.
--Display modified by grinding or engraving or painting varnished etc..
--PCB/FPC components damaged or modified.
--PCB/FPC cracked or damaged.
--Protect film of polarlizer removed.
12.5.4 Modules must be returned with sufficient descriptions of defects. Any connectors or cable installed by the customer must be removed completely without damaging the display. Modules must be packed with the container in which they were shipped.The figures below illustrate the correct and incorrect packaging.



13. Packing Specification

-TBD-