US Micro Products
ENGINEERED DISPLAY SOLUTIONS

AMOLED SPECIFICATION

Part Number	USMP-A055-108192CDX-A0
Size	5.5"
Resolution	1080 x 1920
Brightness	350 cd/m²
Contrast	10000:1
Viewing Angle	85/85/85/85
Operating Temp.	-20 ~ 60℃

FOR ADDITIONAL INFORMATION
PLEASE CONTACT:
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Issue Date	Approved by (customer use)	Checked by	Prepared by

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RECORDS OF REVISION

DATE	REF.PAGE PARAGRAPH DRAWING No.	REVISED No.	SUMMARY	REMARK
2017/5/17	ALL	0.0	FIRST ISSUE	
2018/1/18	12	0.1	Modify Pin Function Description	
2018/6/13	8	0.2	Add the current	
2018/6/15	8-9	0.3	Add power operating sequence	

Contents

1. Introduction

1.1 Scope of application

This specification applies to the AMOLED module that is supplied by USMP. This AMOLED module should be designed for mobile phone use.

AMOLED specification: Duty 1/1920, Dots 1080xRGBx1920
As to basic specification of the driver IC, refer to the IC (Raydium:RM67191) specification and datasheet.
All material & processing of the AMOLED module should be USMP Free.

1.2 TFT features:

Structure: AMOLED PANNEL+IC+FPC+TP FPC
MIPI interface

1.3 Applications:

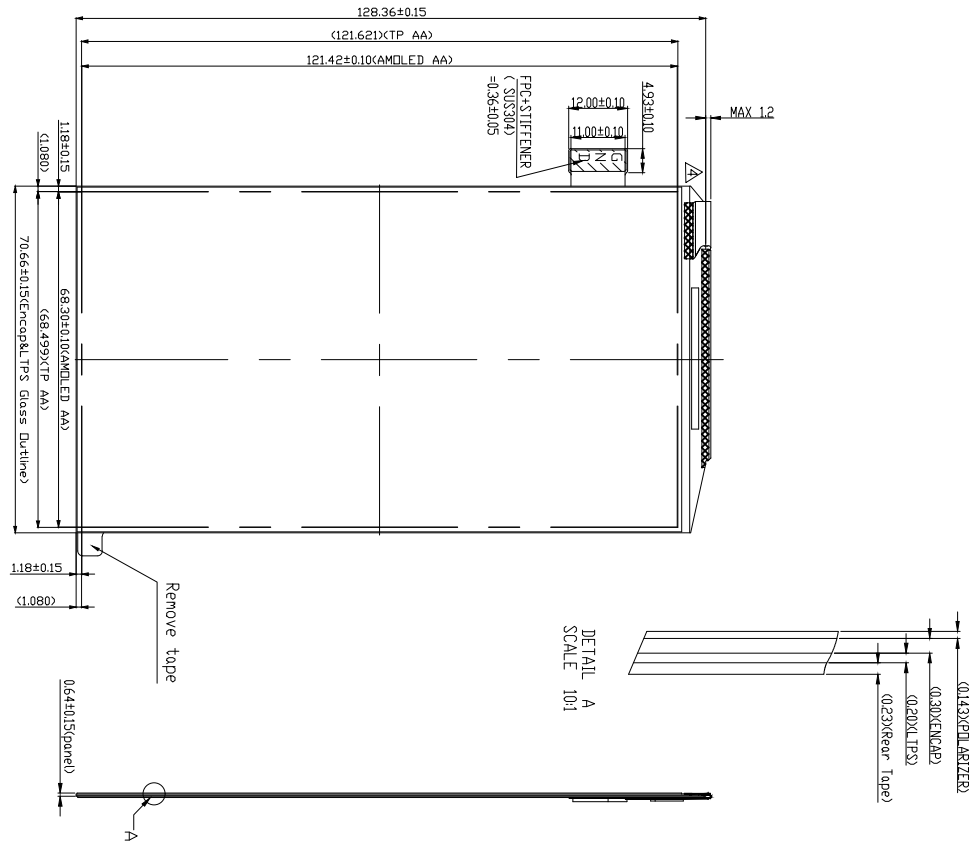
Mobile phone

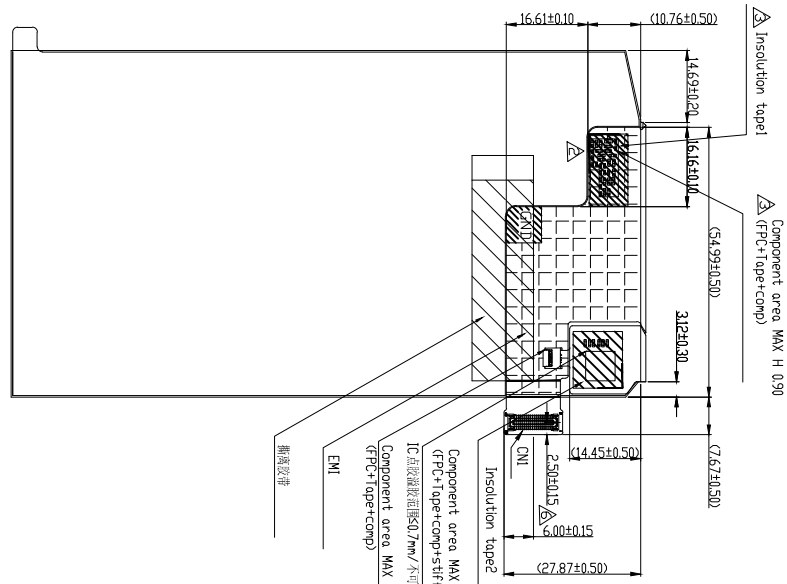
2. AMOLED General specification

ITEM	AMOLED	UNIT
Number of Dots	1080*(RGB)*1920	Dots
Pixel Size (H*V)	31.62*63.24	μm
Active Area	68.299*121.421	mm
Glass Area (W*H)	70.66*128.36	mm
Driver IC	RM67191	--
Touch IC	S3508	
Weight	TBD	

Pin	Description	Pin	Description
1	ELVDD1	2	ELVSS1
3	ELVDD2	4	ELVSS2
5	ELVDD3	6	ELVSS3
7	VPP	8	GND8
9	ID	10	D2P
11	TSP_2.8V	12	D2N
13	TSP_SDA	14	GND7
15	TSP_SCL	16	D1P
17	TE	18	D1N
19	TSP_ATTN	20	GND6
21	TSP_RESET	22	CLKP
23	VDDP_EN	24	CLKN
25	ELDN2	26	GND5
27	GND1	28	D0P
29	VDD_1.8V	30	D0N
31	VLIN 6.1V	32	GND4
33	VCL_3.3V	34	D3P
35	RESET	36	D3N
37	GND2	38	GND3
39	ERR_FG	40	NC

NOTE:
1.Display Type:5.5"FHD On Cell AMOLED
2.General Tolerance: ±0.20
3.General angle radius: R=0.20
4.Connector:BM10NB-40DS
5.OLED IC:RM67191
6.Non-marked dimension refer to CAD file and general tolerance
7.Requirements on Environment Protection: RoHS, Halogen free.





REV	DC/EC NUMBER	DESCRIPTION	DATE
1		first edition	20160523
2		Component area MAX H 0.9 (FPC+Tape+comp)	20160602
3		Component area MAX H 0.9 (FPC+Tape+comp) Insolution tape1 Insolution tape2	20160606
4	5.5FHD-20160729-01	ITP:150ppi	20160729
5	5.5FHD-20160729-01		20160801
6	5.5FHD-20160729-01		20160802

CRITICAL DIMENSION			
REFERENCE DIMENSION	( )		
DESIGNER Yingbo.Zhao 2016.8.02	PRODUCT NUMBER	2D Rev.	V06
REVIEWER JunJun.Chen 2016.8.02	PART NAME 5.5FHD	3D Rev.	V06
CHECKER	DRAWING NUMBER FDG	UNIT	mm
APPROVER	MATERIAL NUMBER	SCALE	1/1
		PAGE	1/1
		3rd ANGLE	

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4. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit
Analog/boost power voltage	VCI	-0.3	5.28	V
VCI I/O voltage	VCI_IF	-0.3	5.28	V
I/O voltage	VDDIO	-0.3	3.96	V
VSP voltage	VSP	-	6.5	V
VPP(OTP power)	VPP	-	8.64	V
TP Power voltage	VDD3	-0.3	3.6	V
TP I/O Digital Voltage	IOVCC	1.8	3.6	V
Operating temperature	Top	-20	60	°C
Storage temperature	Tstg	-30	70	°C

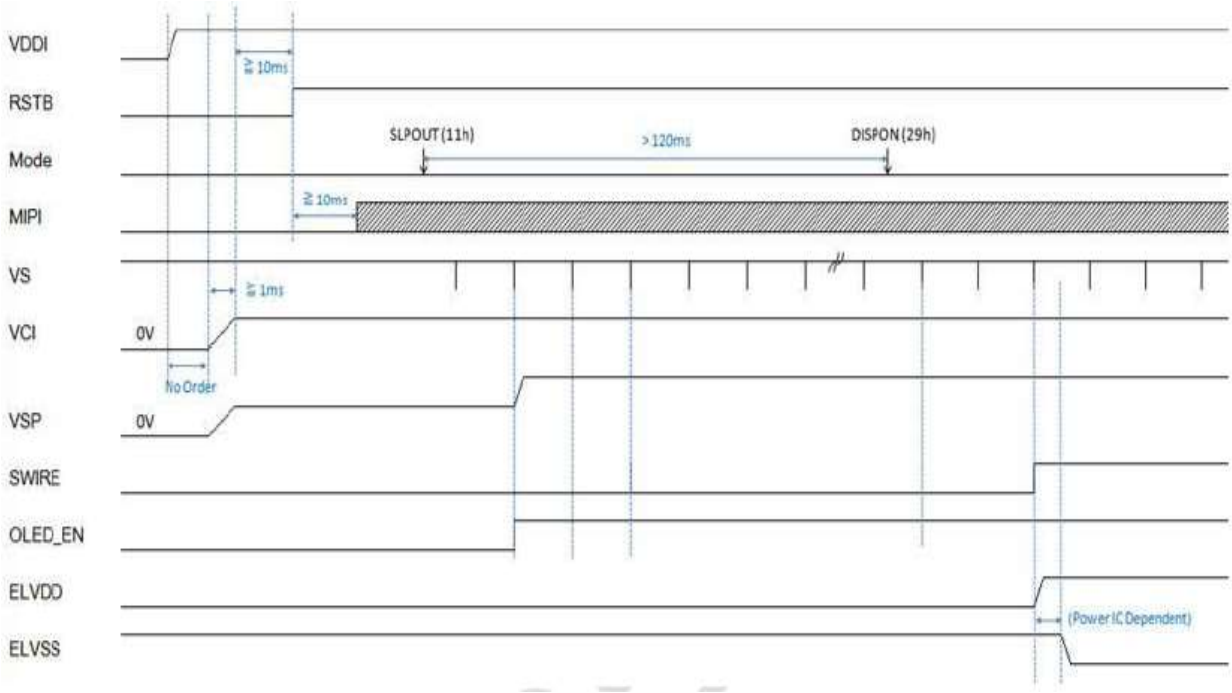
5. ELECTRICAL CHARACTERISTICS

Item	Symbol	Min	Typ	Max	Unit
AMOLED Power positive	ELVDD	-	4.6	-	V
AMOLED power Negative	ELVSS	-	-2.5	-	V
Gamma Voltage	VSP	6.1	6.4	6.5	V
Analog Power supply	VDDIO	1.65	1.8	3.6	V
	VCI	2.5	3.3	4.8	V
TP Supply voltage	VDD3	2.8	-	3.6	V
TP Logic Input Voltage	VIH	0.7*IOVCC	-	IOVCC	V
	VIL	-0.3	-	0.3*IOVCC	V
TP Logic Input Voltage	VOH	0.7*IOVCC	-	-	V
	VOL	-	-	0.3*IOVCC	V

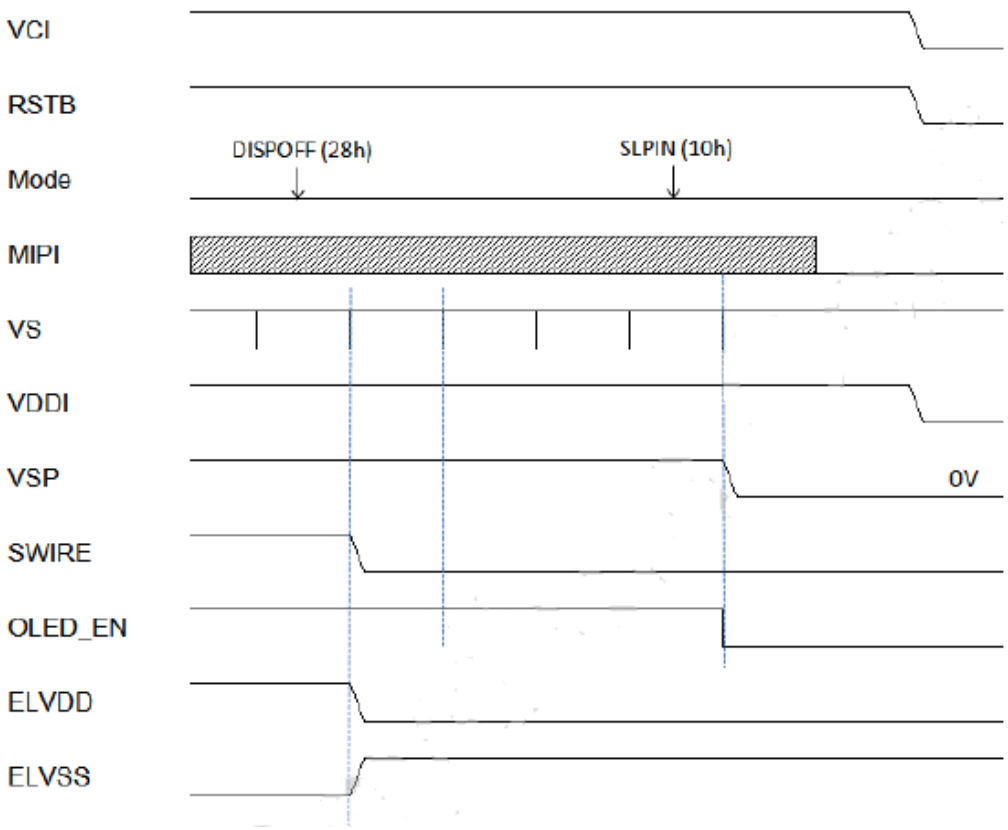
Mode	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Full White @350 Nits	$I_{ELVDD/ELVSS}$	VELVDD=4.6V VELVSS=-2.5V VCI=3.3V VDDIO=1.8V VSP=6.4V @ Full white 350 nits	-	210	275	mA	-
	I_{VCI}		-	2	3	mA	-
	I_{VDDIO}		-	50	65	mA	-
	I_{VSP}		-	17	150	mA	-
TP Normal Operation	Iopr	AVDD=3.3V		16		mA	-
TP Monitor	Imon			0.6		mA	-
TP Sleep	Islp			40		uA	-

5.2 Recommended Operating Sequence

5.2.1 Power on sequence



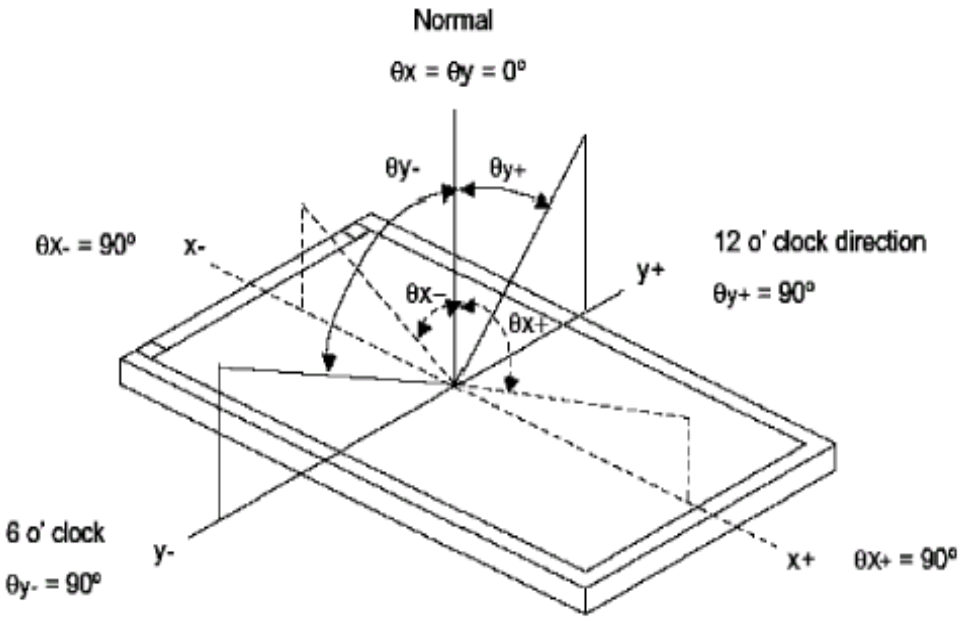
5.1.2 Power off sequence



6. AMOLED Optical Characteristics

ITEM		SYMBOL	CONDITIONS	SPECIFICATIONS			UNIT	NOTE
				MIN.	TYP.	MAX		
Brightness		B	Viewing normal angle	300	350	-	cd/m^2	All left side data are based on USMP's product reference only
Contrast Ratio		CR		8,000	10,000	-	--	
Response Time		Tr+Tf		-	-	2	ms	
CIE Color coordinate	Red	X_R			/			
		Y_R			/			
	Green	X_G			/			
		Y_G			/			
	Blue	X_B			/			
		Y_B			/			
	White	X_W		0.27	0.30	0.33		
		Y_W		0.29	0.32	0.35		
Viewing Angle	Hor.	θ_{X+}	Center CR>=1000	/	85	-	Deg.	
		θ_{X-}		/	85	-		
	Ver.	θ_{Y+}		/	85	-		
		θ_{Y-}		/	85	-		
Color Gamut			NTSC	80	100	-	%	
Uniformity	Un			70	-	-	%	

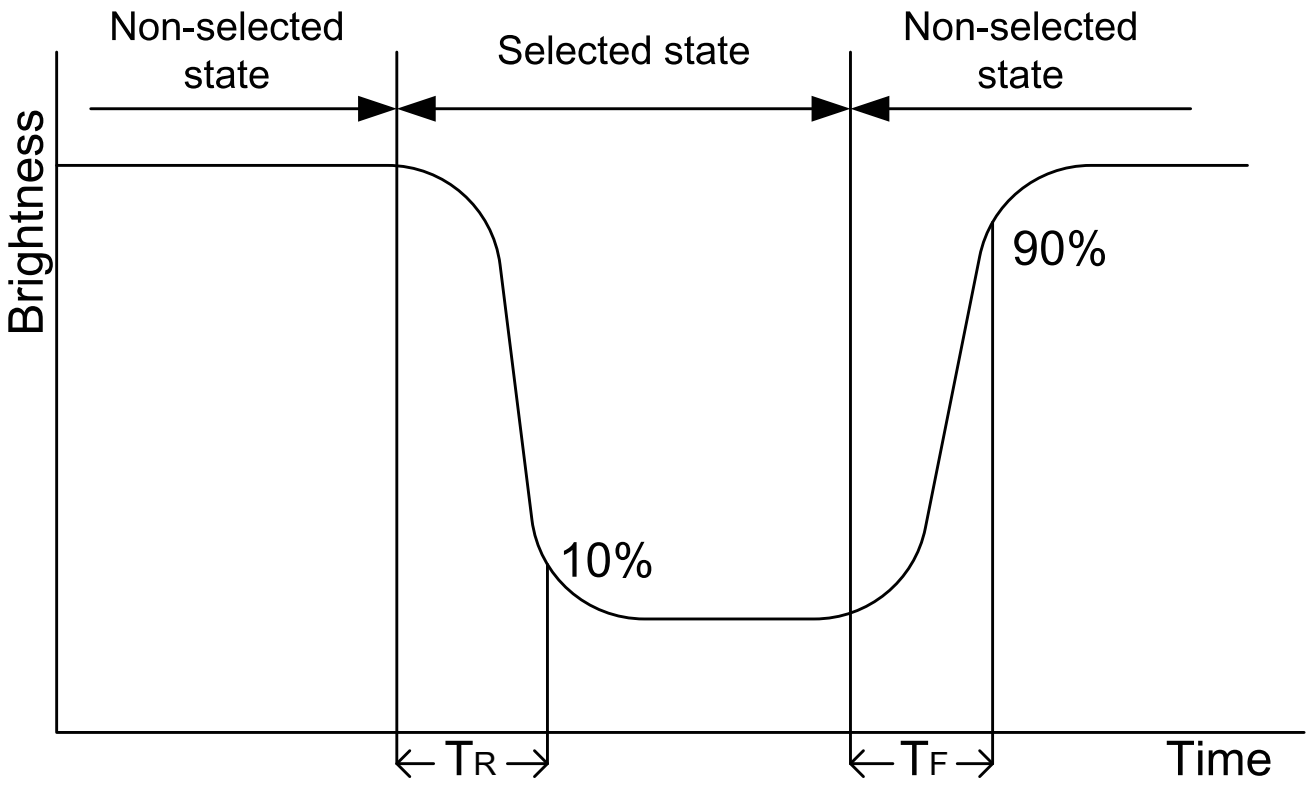
Note 1 : Definition of Viewing Angle θ_x and θ_y :



Note 2: Definition of contrast ratio CR:

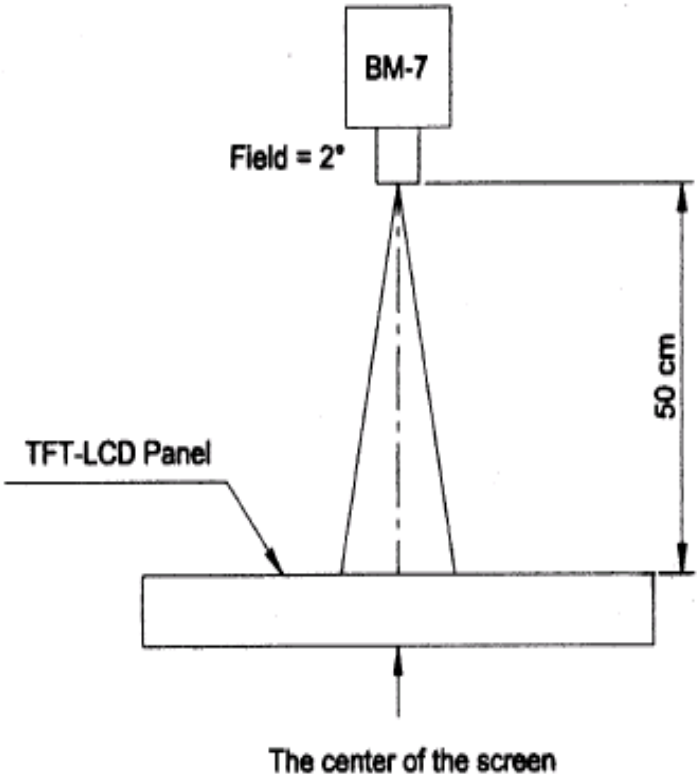
$$CR = \frac{\text{Brightness of non-selected dots (white)}}{\text{Brightness of selected dots (black)}}$$

Note 3: Definition of response time (T_R, T_F)

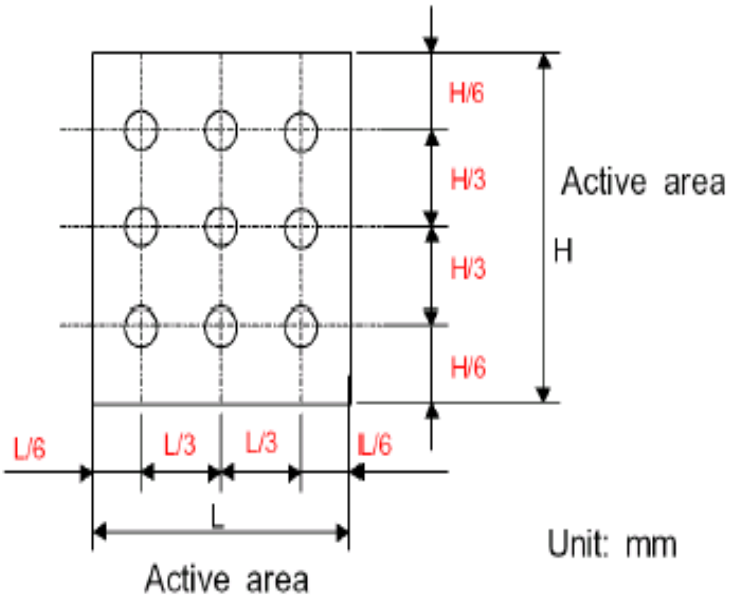

Non-selected state
Selected state
Non-selected state
Brightness
90%
10%
TR
TF
Time

: The brightness test equipment setup

20mA Field=2° (As measuring "black" image, field=2° is the best testing condition)



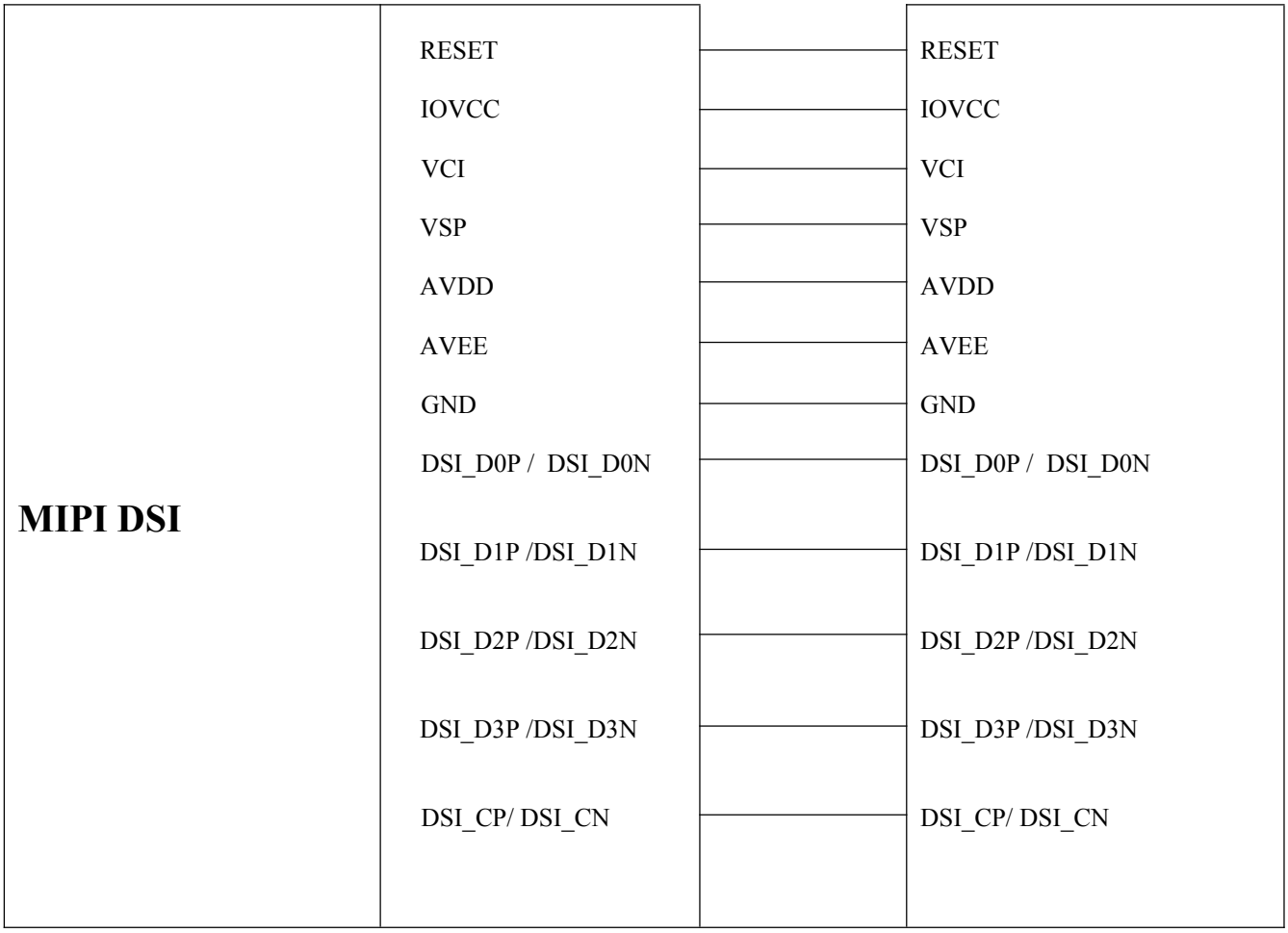
Note 4 :



7. LCM MCU Interface Pin Function

#	Pin_name	I/O	Description
1	ELVDD	Power	AMOLED power Positive
2	ELVSS	Power	AMOLED power Negative
3	ELVDD	Power	AMOLED power Positive
4	ELVSS	Power	AMOLED power Negative
5	ELVDD	Power	AMOLED power Positive
6	ELVSS	Power	AMOLED power Negative
7	VPP	Power	Power supply for OTP. Leave the pin to open when not in use.
8	GND	Power	The power ground
9	ID	O	Connect to Mainboard ID, default High
10	D2P	I	MIPI DSI data2+
11	TSP_AVDD	I	Analog Power for TSP
12	D2N	I	MIPI DSI data2-
13	TSP_SDA	I/O	Serial interface Data for TSP
14	GND	Power	The power ground
15	TSP_SCL	I/O	Serial interface Clock for TSP
16	D1P	I	MIPI DSI data1+
17	TE	O	Tear effect output
18	D1N	I	MIPI DSI data1-
19	TSP_ATTN	I	State change interrupt for TSP
20	GND	Power	The power ground
21	TSP_RESET	I	Active low， Reset the Touch IC
22	CLKP	I	MIPI DSI clock+
23	OLED_EN	O	Enable VSP(VLIN) for DC/DC IC
24	CLKN	I	MIPI DSI clock -
25	SWIRE	O	Enable ELVDD and ELVSS of DC/DC IC
26	GND	Power	The power ground
27	GND	Power	The power ground
28	D0P	I	MIPI DSI data0+
29	VDDI	I	Driver IC digital I/O supply
30	D0N	I	MIPI DSI data0-
31	VSP	I	Charge pumping Power for Driver IC
32	GND	Power	The power ground
33	VCI	I	Driver IC analog supply
34	D3P	I	MIPI DSI data3+
35	RSTB	I	This signal will reset the device and must be applied to properly initialize the chip. Active low.
36	D3N	I	MIPI DSI data3-
37	GND	Power	The power ground
38	GND	Power	The power ground
39	ERR_FG	O	MIPI error flag monitor， open it if not use
40	NC	-	No connection

8.LCM Block Diagram



9. Caution

9.1 Handling of AMOLED

. Be sure to ground the body when handling the AMOLED.
. Don’t give external shock
. Don’t apply excessive force on the surface.
. Liquid in AMOLED is hazardous substance. Must not lick and swallow.
When the liquid is attach to your hand, skin, cloth etc. Wash it out thoroughly and immediately.
. Don’t operate it above the absolute maximum rating.
. Don’t disassemble the AMOLED

9.2 Storage

.Store in an ambient temperature of 5℃ to 45℃,and in a relative humidity of 40% to 60%. Don’t 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.AMOLED Quality Criteria

1.Description/描述

These inspection standars shall be applied to OLED Module supplied by USMP.
此份检验标准适用于USMP提供之成品的出货检验。

2. The environmental condition of inspection/环境检测

The environmental condition and visual inspection shall be conducted as below.
环境及外观检查如下

(1) Ambient temperature/环境温度 ：25℃±3℃

(2) Humidity/湿度: 25~75 %RH

(3) The visual inspection distance: The visual inspection distance of panel between OLED module and the inspector's sight should be at 30±5cm distance.
外观检查距离：眼镜距离产品 30±5cm

(4) The viewing angle: 检测角度

a) 30 degree to the front surface of display panel in vertical direction. 玻璃表面垂直方向 30 度

b) 30 degree to the front surface of display panel in horizontal direction. 玻璃表面水平方向 30 度

(5) Ambient Illumination/环境亮度:

a) External appearance inspection/外观检测: 800 ~ 1200 Lux

b) Light on inspection/显示检测: 100 ~ 150 Lux

(6) ND filter shall be conducted at the distance 2cm to front surface of display panel.
ND Filter 需离屏幕表面 2cm,

(7) 画面检查依据 EDO 提供的检测治具进行判定

3. Classification of defects/缺陷分类

The defects are classified as major, minor and critical defects. The definitions of defects are described as below.
缺陷共分为重缺陷、轻缺陷和致命缺陷。定义如下：

(1) Major defect 重缺陷

The defect may cause the functional failure, or reduce the usability of the product for its purpose. For example: electrical failure, deformation etc.
能引起失效或显著降低产品预期性能，如电性失效、结构不完整

(2) Minor defect 轻缺陷

The defect doesn't reduce the usability of product for its purpose.
For example: spot defect, mura etc.
不会显著降低产品的预期性能的缺陷，如：点缺陷、显示不均等

The judgment of the major and minor defects shall be according to Item 4.
(Classification table of defects)
缺陷的判定可依照项目 4

(3) Critical defect 致命缺陷

The defect may do harm to personal safety or threaten the customer's property.
产品对人身安全造成伤害或存在安全隐患，对客户财产构成威胁的缺陷。

4. 检验画面

全红/全蓝/全绿/全黑/全白/64 灰阶

5. Inspection Criteria/检测标准

(1) Display Defect/显示缺陷

a) **Sampling Procedures for each item's acceptance table**

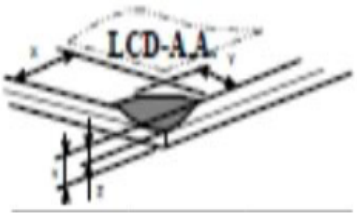
Defect type	Sampling Procedures	AQL
Major defect	ANSI/ASQ Z1.4 Level Ⅱ GB/T2828.1-2012 Level Ⅱ	0.65
Minor defect	ANSI/ASQ Z1.4 Level Ⅱ GB/T2828.1-2012 Level Ⅱ	1.50

① Major defect/主缺陷:
The major defect refers to defect which may substantially degrade usability for product applications.
会很大程度上降低产品可用性的缺陷
② Minor defect/轻缺陷:
The minor defect refers to defect which is not considered to substantially degrade product application, or a defect which deviates from existing standards almost unrelated to the effective use of the product or its operation.
不会很大程度上影响产品的应用或者不会影响产品使用或操作的缺陷
③ View Area(VA)为 AA 区单边+0.1mm，VA 区外的 Spot/划伤/线状异物/ Panel Stain/ Bubble 等缺陷不计。

b) 适用的产品形态：Panel & FOG & Full module

<table>
<tr><th>No</th><th>Item</th><th>Conditions</th><th>Type</th></tr>
<tr><td>1</td><td>No Display/无显示</td><td>Not allowance/不允许</td><td>Major</td></tr>
<tr><td>2</td><td>Irregular Operating/
不正常显示</td><td>Not allowance/不允许</td><td>Major</td></tr>
<tr><td>3</td><td>Dot Defect/点缺陷</td><td>
<table>
<tr><th>Defect</th><th>Acceptable number</th></tr>
<tr><td>Bright Dot</td><td>2</td></tr>
<tr><td>Dark Dot</td><td>1. 单画面≤5 颗
2. 2 连点：N≤4，D≥10mm
3. 3 连点不允许</td></tr>
</table>
1. 亮点：模组厂二次 aging 后才可计入；ND10%遮盖后可见判定为亮点；不允许连点，距离大于 10mm
2. 等间距暗点不管控
</td><td>Minor</td></tr>
</table>

<table>
<tr><td>4</td><td>Spot Defect/点缺陷/气泡/异物点
 
D=(a+b)/2</td><td><table><tr><th>Size D(mm)</th><th>Acceptable number</th></tr><tr><td>D≦0.15</td><td>Ignore</td></tr><tr><td>0.15＜D≦0.25</td><td>N≦2</td></tr><tr><td>D＞0.25</td><td>不允许</td></tr></table></td><td>Minor</td></tr>
<tr><td>5</td><td>Scratches、materials(Line shape)/划伤、线状异物（正面）</td><td><table><tr><th>Size(mm)</th><th>Acceptable number</th></tr><tr><td>W≦0.03，L 不计</td><td>Ignore</td></tr><tr><td>0.03＜W≦0.05,L≦5.0</td><td>N≦2</td></tr><tr><td>0.05＜W, L>5.0</td><td>不允许</td></tr></table></td><td>Minor</td></tr>
<tr><td>6</td><td>反面划伤</td><td>1. 正面不可见/点亮后不可见
2. 不可刮手</td><td>Minor</td></tr>
<tr><td>7</td><td>FPC</td><td>FPC 外观不良，若未导致功能性不良且无 RA 问题，忽略不计</td><td>Minor</td></tr>
<tr><td>8</td><td>CG 针孔</td><td>1. ф≤0.15，N≤1
2. ф＞0.15，不允许</td><td>Minor</td></tr>
<tr><td>9</td><td>CG Logo 外观</td><td>异物点 /气泡等：
1. D≦0.15，忽略不计
2. 0.15＜D≦0.25，N≦2
3. D＞0.25，N=0</td><td>Minor</td></tr>
<tr><td>10</td><td>CG 异色</td><td>必要时可与客户签订限度样品</td><td>Minor</td></tr>
<tr><td>11</td><td>CG 油墨</td><td>正面视窗区丝印油墨边缘：
1. W≤0.2mm，允许
2. W＞0.2mm，不允许</td><td>Minor</td></tr>
<tr><td>12</td><td>CG</td><td>非 CG 正面，不影响外观和功能的，忽略不计</td><td>Minor</td></tr>
<tr><td>13</td><td>Panel Stain/脏污</td><td>Not allowance/不允许（不可擦拭）</td><td>Minor</td></tr>
<tr><td>14</td><td>Mura/显示不均（Including discoloration/包括混色）</td><td>一、Mura definition:
1、Only in 64 gray pattern/仅在 64 灰阶画面下：ND filter 2%遮盖后不可见；
2、白画面 mura 不计；
二、discoloration ：
白、红、绿、蓝画面下：
1、ND filter 2%不可见；
If its limit sample is needed, it can be fixed mutually with a customer./必要时可与客户签订限度样品</td><td>Minor</td></tr>
</table>

15	玻璃台阶面（含线路区）	FOG区域崩边： Z≤T X≤3.0mm Y≤0.25mm 非FOG区域及背面： Z≤T X≤3.0mm Y≤1.0mm 	Minor
16	非玻璃台阶面区域及背面&CG	边缘： Z≤T X≤5.0mm Y≤0.5mm 四角： Z≤T X（Y）≤1.5mm Y（X）≤1.0mm 	Minor
17	凸缘	≤0.2mm	Minor
18	牛顿环	If its limit sample is needed, it can be fixed mutually with a customer./必要时可与客户签订限度样品	Minor

11. RELIABILITY TEST

NO	ITEM	CONDTTION	STANDARD
1	High Temp. Storage	80℃, 24 hours	1. Functional test is OK. Missing Segment, short, unclear segment, non-display, display abnormally and liquid crystal leak are un-allowed. 2. No low temperature bubbles, end seal loose and fall, frame rainbow.
2	Low Temp. Storage	-30℃, 24 hours	
3	High Temp. Operation	60℃, 16 hours	
4	Low Temp. Operation	-20℃, 16 hours	
5	High temperature and high Humidity storage	55℃,90~95%RH ,48 hours	
6	Thermal and cold shock	Static state， -30℃（1 hour）~80℃（1 hour）~ -30℃（1 hour），packaging，10 cycles	
7	Vibration test	Packaging，Frequency : 10-55Hz Amplitude : 1.0mm， Each direction on X,Y axe 0.5 hour，circle 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 the carton box. Drop it from 80cm height to ground. Once for each side of the carton	

NOTE：

11.1.1 The reliability items will be fully performed in new sample qualification,

11.1.2 The reliability status will be tested as monitor during mass production. Individual reliability test shall be performed by lot , Moreover, the individual reliability item shall be decided according to reliability plan.

11.1.3 All samples are inspected after keeping in the room with normal temperature and humidity for 2 hours or above.

11.1.4 Vibration test: It is not necessary to test for those products without assembly frame , back light ,PCB and so on.

11.1.5 Dropping test : It is necessary for affirming new package.

11.1.6 For the high temperature and high humidity test, pure water of over 10 MΩ.cm should be used.

11.1.7 Each test item applies for test LCM only once .Then tested LCM cannot be used again in any other test item.

11.1.8 The quantity of LCM examination for each test item is 5pcs to 10pcs.

12. PRECAUTIONS FOR USING LCM MODULES

12.1 Safetv instructions

12.1.1 If the LCD panel breaks, be careful not to get any liquid crystal substance 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 LSI.

12.2.2 Do not remove the panel or frame from the module .

12.2.3 The polarizing plate of the display is very fragile . So, please handle it very carefully.

12.2.4 Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of the plate.

12.2.5 The color tone of display and background of LCM has the possibility to be changed in the storage temperature range.

12.2.6 Pay attention to the working environment, as the element may be destroyed by static electricity.

--Be sure to ground human body and electric appliance during work.

--Avoid working in a dry environment to minimize the generations of static electricity.

--Static electricity may be generated when the protective film is fast peeled off.

12.2.7 When soldering the terminal of LCM, make certain the AC power source of soldering iron does not leak.

12.2.8 If the display surface becomes contaminated ,breathe on the surface and gently wipe it with a soft-dry- clean cloth .If it is heavily contaminated ,moisten cloth with the following solvent(ex:Ethyl alcohol).Solvents other than those above-mentioned may damage the polarizer(Especially ,do not use them .ex: Warter / Ketone)

12.3 Operation instructions

12.3.1 It is recommended to drive the LCD within the specified voltage limits, try to adjust the operating voltage for the optimal contrast, the color and contrast of LCD panel will varies at different temperature.

12.3.2 Response time is greatly delayed at low operating temperature range. However, this does not mean the LCD will be out of the order, It will recover when it returns to 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 LCD at the environments over the specified conditions, this may cause damage on the LCD and shorten the lifetime.

12.4 Storage instructions:

12.4.1 Store LCDs in a sealed polyethylene bag.

12.4.2 Store LCDs 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 touch any other object, (It is recommended to store them in the container in which they were shipped.)

12.5 Limited Warranty

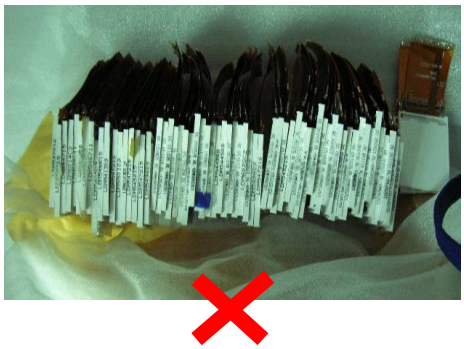
12.5.1 USMP will replace or repair any of its LCD modules, which are found to be defective, when inspected in accordance with USMP LCM acceptance standards (copies available upon request) for a period of 12 months from ink- print date on product

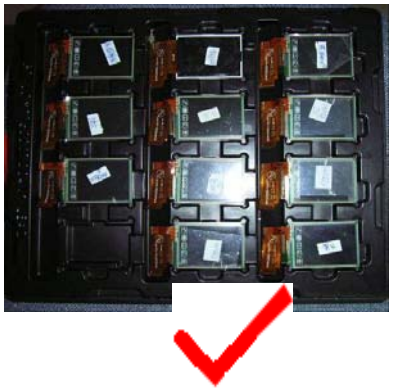
12.5.2 Any defects must be returned to USMP within 60 days since ship-out. Confirmation of such date shall be based on freight documents. The warranty liability of USMP limited to repair and/or replacement on defects above (7.1,7.2)

12.5.3 No warranty can be granted if the precautions stated above have been disregarded. The typical samples are as below:

-- LCD glass crack/break
--PCB outlet is damaged or modified.
--PCB conductors damaged.
--Circuit modified with by grinding, engraving or painting varnish.
--FPC crack

12.5.4 Modules must be returned with sufficient description of the failures of defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB outlet, conductors and terminals. Modules must be packed with the container in which they were shipped.





13. Packing method------TBD