Product Specification

Part Name: 5.48 inch AMOLED Module
Customer Part ID:
Topovision Part ID: TVA0548FH107GG
Ver: A

Customer:
Approved by

From: Topovision Technology Co.,Ltd.
Approved by

Notes:

1. Please contact Topovision Technology Co., Ltd. before assigning your product based on this module specification
2. The information contained herein is presented merely to indicate the characteristics and performance of our products. No responsibility is assumed by Topovision Technology Co., Ltd. for any intellectual property claims or other problems that may result from application based on the module described herein.

Contents

Revision History

Rev.	Date	Contents	Written	Approved
A	2017/09/12	Preliminary Specification	ZHENG	YUAN

Special Notes

Note1.	

1 General Specifications

Feature		Spec	Remark
Display Spec	Screen Size (inch)	5.48	
	Display Mode	AMOLED	
	Resolution(dot)	1080(W)×1920(H)	
	Active Area(mm)	68.256(W)×121.344 (H)	
	Pixel Pitch (um)	94.8 (W)×63.2(H)	
	Technology Type	LTPS	
	Color Depth	16.7M	
	Interface	MIPI 4LANE	
	Surface Treatment	Hard Coating	
Mechanical Characteristics	With TP/Without TP	WithTP(on Cell)	
	Module Outline Dimension(W x H x D) (mm)	70.356(W)x127.344(H)x0.643(D)	
	Weight (g)	TBD	
Electronic	Driver IC(Type)	RM67198	
	Touch IC(Type)	GT1151	

Note 1: Requirements on Environmental Protection: RoHS.

2 Input/output Terminals

2.1 Main FPC Pin Assignment

FPC connector: FP270H-039G1AM ZIF Connector.

No	Symbol	I/O	Description
1	GND	GND	Ground
2	GND	GND	Ground
3	GND	GND	Ground
4	VBAT	P	Power Supply for Power IC
5	VBAT	P	Power Supply for Power IC
6	VBAT	P	Power Supply for Power IC
7	VBAT	P	Power Supply for Power IC
8	VBAT	P	Power Supply for Power IC
9	GND	GND	Ground
10	VPP	P	Power supply for MTP Programming or Erase. If it is not used please open it.
11	NC		NC
12	GND	GND	Ground
13	D3P	I/O	MIPI data lane
14	D3N	I/O	MIPI data lane
15	GND	GND	Ground
16	D0P	I/O	MIPI data lane
17	D0N	I/O	MIPI data lane
18	GND	GND	Ground
19	CLKP	I	MIPI clock lane
20	CLKN	I	MIPI clock lane
21	GND	GND	Ground
22	D1P	I/O	MIPI data lane
23	D1N	I/O	MIPI data lane
24	GND	GND	Ground
25	D2P	I/O	MIPI data lane
26	D2N	I/O	MIPI data lane
27	GND	GND	Ground
28	RESET	I	Display reset. Active low.
29	VDDIO	P	Power supply for display logic circuits
30	VCI_3.3V	P	Power supply for display analog circuits
31	NC		NC
32	GND	GND	Ground
33	TSP_2.8V	P	Analog Power for TP
34	TSP_1P8V	P	Power supply for display logic circuits

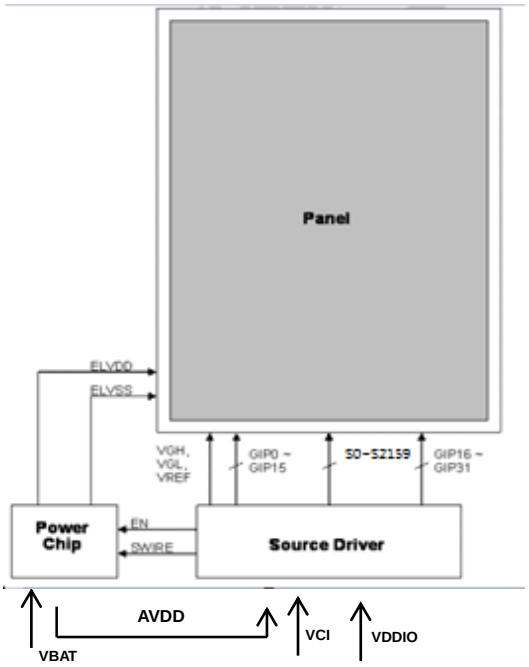
35	TSP_SDA	I/O	SDA pin for TP
36	TSP_SCL	I	SCL pin for TP
37	TSP_RESET	I	Reset Pin for TP, Active low.
38	TSP_ATTN	I	ATTN pin for TP
39	GND	GND	Ground

Note: I=Input; O=Output; P=Power; I/O=Input / Output

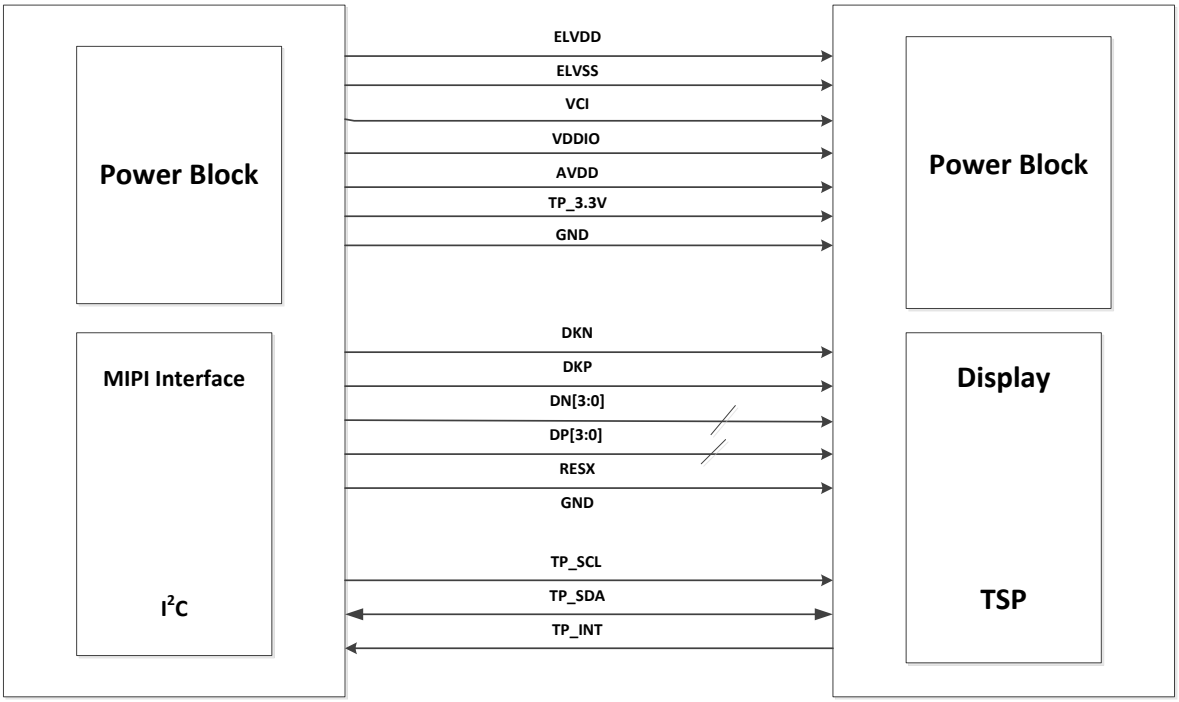
2.2 TP FPC Pin Assignment-On-cell TP Input / Output Signal Interface

No	Symbol	I/O	Description
1	GND	GND	Ground
2	TSP_INT	I/O	INT pin for TP
3	TSP_RESET	I	Reset Pin for TP, Active low
4	TSP_SCL	I/O	SCL pin for TP
5	TSP_SDA	I/O	SDA pin for TP
6	GND	GND	Ground
7	NC	/	/
8	TSP_AVDD_3.3V	Power	Analog Power for TP

2.3 Circuit block diagram (Display)



2.4 MCU and Display Module Interface Conflagration



3 Absolute Maximum Ratings

3.1 Driving AMOLED Panel

Maximum Ratings (Voltage Referenced to VSS) Vss=0V, Ta=25℃

Item	Symbol	MIN	MAX	Unit
Analog Power supply	VCI	-0.3	+5.0	V
Logic Power supply	VDDIO	-0.3	+4.0	V
Power IC Power Supply	VBAT	-	+4.5	V

Note: Functional operation should satisfy the limits in the Electrical Characteristics tables or Pin Description section. If the module exceeds the absolute maximum ratings, permanent damage may occur. Besides, if the module is operated with the absolute maximum ratings for a long time, the reliability may also drop.

4 Electrical Characteristics

4.1 Driving AMOLED Panel

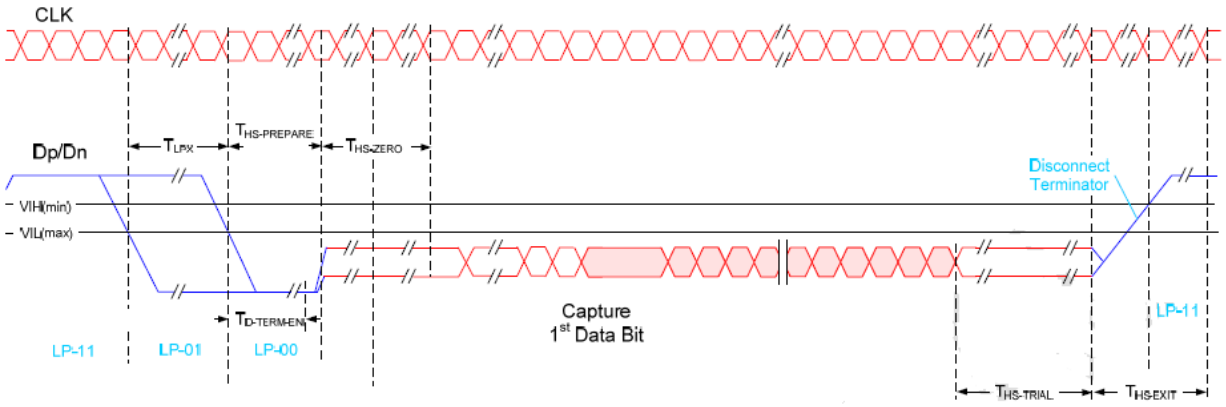
Ta=25℃

Item		Symbol	MIN	TYP	MAX	Unit
Logic Power supply		VDDIO	1.65	1.8	3.30	V
Analog Power supply		VCI	2.65	2.8	3.60	V
Power IC Power Supply		VBAT	2.90	3.7	4.50	V
Input Signal Voltage	High Level	VIH	0.80*VDDIO	-	VDDIO	V
	Low Level	VIL	0.00	-	0.20*VDDIO	V
Output Signal Voltage	High Level	VOH	0.80*VDDIO	-	VDDIO	V
	Low Level	VOL	0.00	-	0.20*VDDIO	V
Normal		I_{VBAT}		TBD		mA
		I_{VCI}	-	2.6	3.5	mA
		I_{VDDIO}	-	28	60	mA
Stand-by		I_{VCI}	-	38	100	uA
		I_{VDDIO}	-	259	800	uA

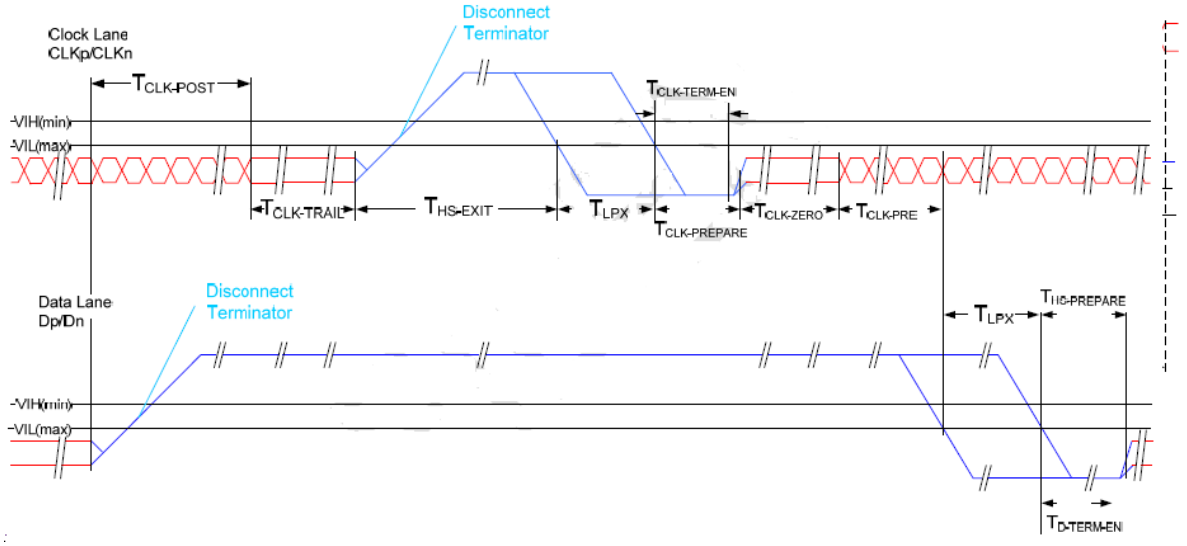
5 AC Characteristics

5.1 MIPI Interface Characteristics

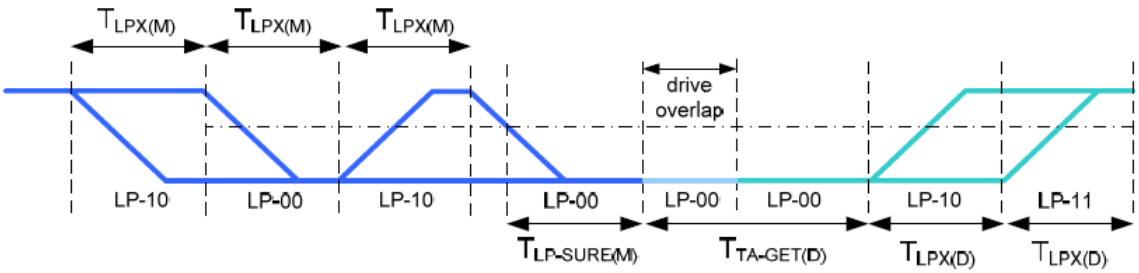
HS Data Transmission Burst



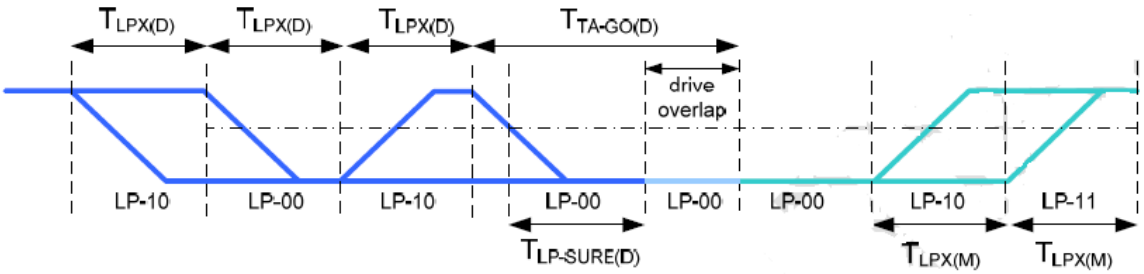
HS clock transmission



Turnaround Procedure



Bus turnaround (BAT) from MPU to display module timing



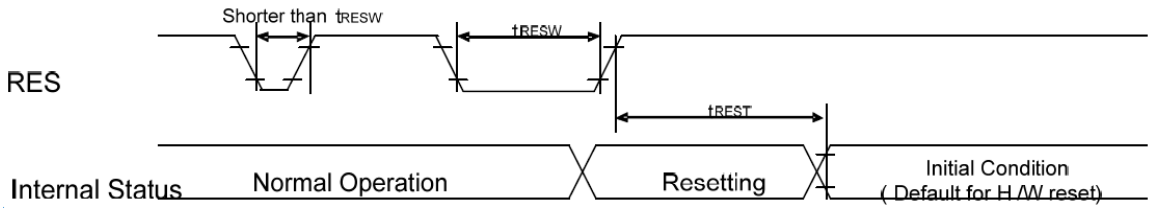
Timing Parameters

Parameter	Description	Min	Typ	Max	Unit
$T_{CLK-POST}$	Time that the transmitter continues to send HS clock after the last associated Data Lane has transitioned to LP Mode. Interval is defined as the period from the end of $T_{HS-TRAIL}$ to the beginning of $T_{CLK-TRAIL}$.	60ns + 52*UI			ns
$T_{CLK-TRAIL}$	Time that the transmitter drives the HS-0 state after the last payload clock bit of a HS transmission burst.	60			ns
$T_{HS-EXIT}$	Time that the transmitter drives LP-11 following a HS burst.	**300**			ns
$T_{CLK-TERM-EN}$	Time for the Clock Lane receiver to enable the HS line termination, starting from the time point when Dn crosses $V_{IL,MAX}$.	Time for Dn to reach $V_{TERM-EN}$		38	ns
$T_{CLK-PREPARE}$	Time that the transmitter drives the Clock Lane LP-00 Line state immediately before the HS-0 Line state starting the HS transmission.	38		95	ns
$T_{CLK-PRE}$	Time that the HS clock shall be driven by the transmitter prior to any associated Data Lane beginning the transition from LP to HS mode.	8			UI
$T_{CLK-PREPARE}$ + $T_{CLK-ZERO}$	$T_{CLK-PREPARE}$ + time that the transmitter drives the HS-0 state prior to starting the Clock.	300			ns
$T_{D-TERM-EN}$	Time for the Data Lane receiver to enable the HS line termination, starting from the time point when Dn crosses $V_{IL,MAX}$.	Time for Dn to reach $V_{TERM-EN}$		35 ns +4*UI	
$T_{HS-PREPARE}$	Time that the transmitter drives the Data Lane LP-00 Line state immediately before the HS-0 Line state starting the HS transmission	40ns + 4*UI		85 ns + 6*UI	ns
$T_{HS-PREPARE}$ + $T_{HS-ZERO}$	**$T_{HS-PREPARE}$ + time that the transmitter drives the HS-0 state prior to transmitting the Sync sequence.**	**145ns + 10*UI**			**ns**
$T_{HS-TRAIL}$	Time that the transmitter drives the flipped differential state after last payload data bit of a HS transmission burst	60ns + 4*UI			ns

Parameter	Description	Min	Typ	Max	Unit	Notes
$T_{LPX(M)}$	Transmitted length of any Low-Power state period of MCU to display module	50		**150**	ns	1,2
$T_{TA-SURE(M)}$	Time that the display module waits after the LP-10 state before transmitting the Bridge state (LP-00) during a Link Turnaround.	$T_{LPX(M)}$		2*$T_{LPX(M)}$	ns	2
$T_{LPX(D)}$	Transmitted length of any Low-Power state period of display module to MCU	50		**150**	ns	1,2
$T_{TA-GET(D)}$	Time that the display module drives the Bridge state (LP-00) after accepting control during a Link Turnaround.		5*$T_{LPX(D)}$		ns	2
$T_{TA-GO(D)}$	Time that the display module drives the Bridge state (LP-00) before releasing control during a Link Turnaround.		4*$T_{LPX(D)}$		ns	2
$T_{TA-SURE(D)}$	Time that the MPU waits after the LP-10 state before transmitting the Bridge state (LP-00) during a Link Turnaround.	$T_{LPX(D)}$		2*$T_{LPX(D)}$	ns	2

5.2 Display RESET Timing Characteristics

Reset input timing:



VDDIO=1.65 to 3.3V, VDD=2.7 to 3.6V, AGND=DGND=0V, Ta=-40 to 85℃

Timing Parameters

Symbol	Parameter	Related Pins	MIN	TYP	MAX	Note	Unit
t_{RESW}	*1) Reset low pulse width	RESX	10	-	-	-	μs
t_{REST}	*2) Reset complete time	-	-	-	5	When reset applied during Sleep in mode	ms
		-		-	120	When reset applied during Sleep out mode	ms

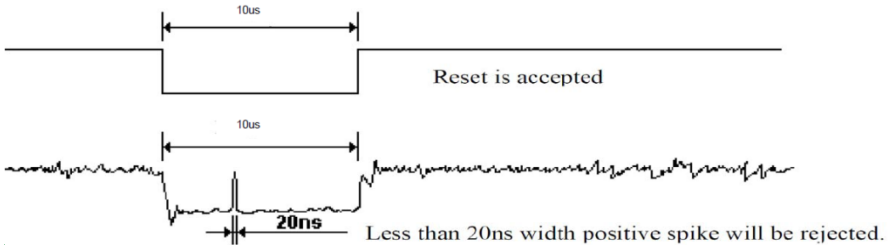
Note1.Spike caused by an electrostatic discharge on RESX line does not cause irregular system reset according to the table below.

RESX Pulse	Action
Shorter than 5μs	Reset Rejected
Longer than 10μs	Reset
Between 5μs and 10μs	Reset starts (It depends on voltage and temperature condition.)

Note 2. During the resetting period, the display will be blank (The display is entering blanking sequence, whose maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains blank in Sleep In –mode) and then return to Default condition for H/W reset.

Note 3. During Reset Complete Time, data in OTP will be latched to internal register during this period. This loading is done every time when there is H/W reset complete time (tREST) within 5ms after a rising edge of RESX.

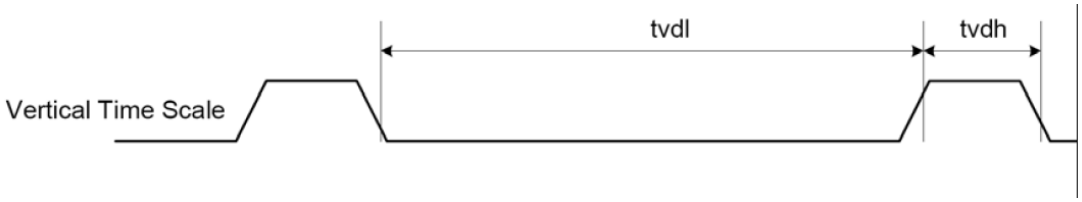
Note 4. Spike Rejection also applies during a valid reset pulse as shown below:



Note 5. It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

5.3 TE Timing Characteristics

Mode1, The Tearing Effect Output line consists of V-Blanking information only.

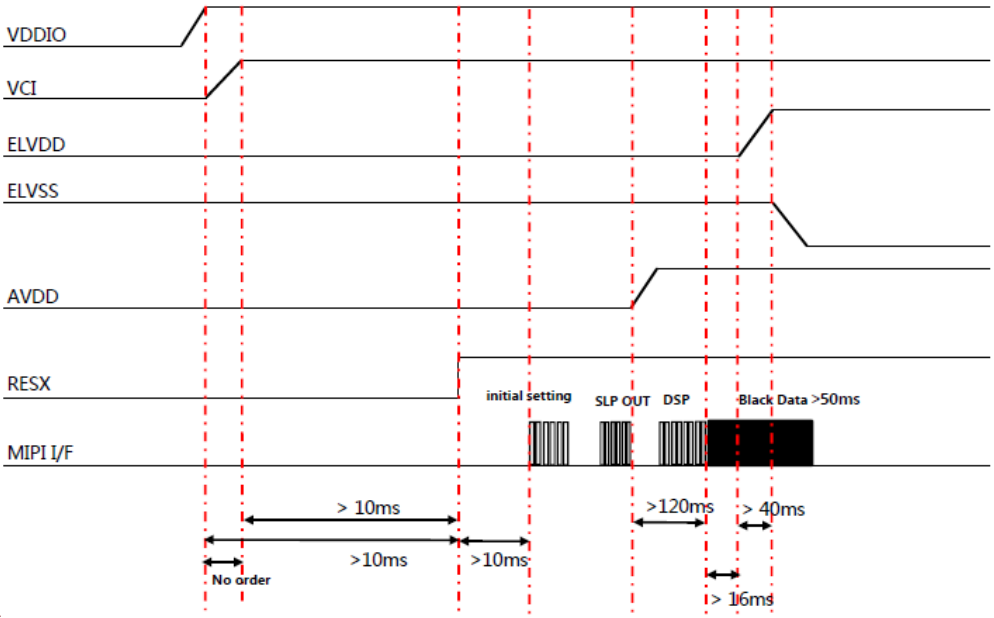


Tvdh = The LCD display is not updated from the frame memory.
Tvdl = The LCD display is updated from the frame memory.

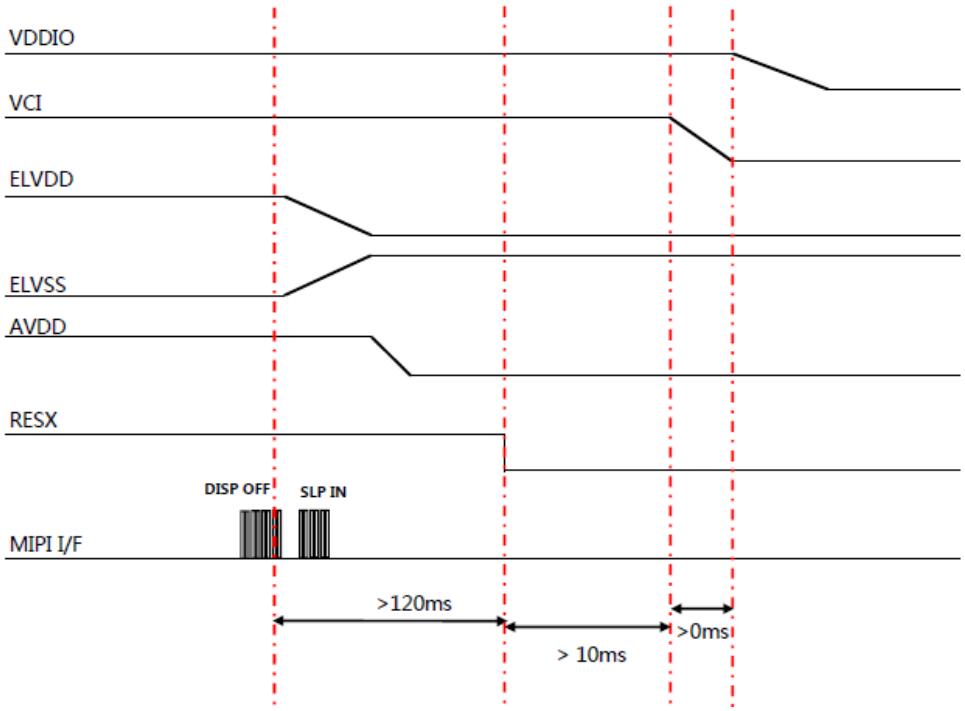
6 Recommended Operating Sequence

6.1 Display Power on / off Sequence

6.1.1 Power On Sequence



6.1.2 Power Off Sequence

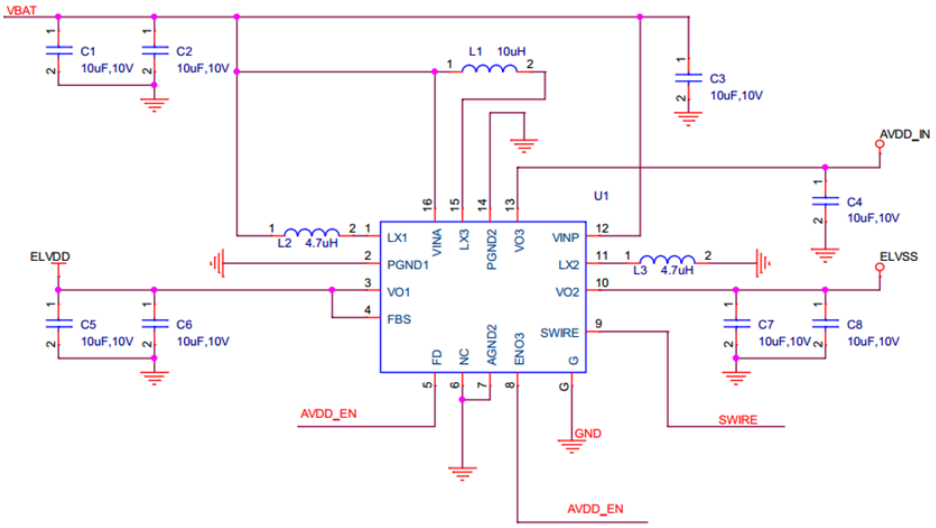


6.2 Brightness control

Inst/Para	R/W	Address		Date Type	Description
		MIPI	Other		
BRTCTRL	W	51h	5100h	Hex	Value form 0~255(FF)

7 Application Circuit

Concerning ELVDD&ELVSS & AVDD power supply schematic, the Triple DC/DC converter TPS65651A/ RT4722 is recommended. The application schematics and external components are as below.



Description	Part Reference	Manufacturer	Manufacturer PN
10uF, 10V, ±20%, X5R, 0402	C1 C2 C3 C4 C5 C6 C7 C8	Murata	GRM155R61A106ME44D
		Samsung	CL05A106MP5NUNC
Power Inductor, 10uH, 20%, LS2520	L1	成育科技	ACDNR252010UP-100MT
		科明电子	KMPHS252010-100M
Power Inductor, 4.7uH, 20%, LS2520	L2 L3	成育科技	ACDMR252010T-4R7MT
		科明电子	KMPHS252010-4R7M
QFN16 (3.0x3.0)	U1	TI	TPS65651 A
		RICHTEK	RT4722

8 Optical Characteristics Optical Specification

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angle		θT	CR≥10	80			Degree	Note 2 Test Equipment：CS2000A
		θB		80				
		θL		80				
		θR		80				
Contrast Ratio		CR	θ=0°	10000				Note1 Note3 Test Equipment：CS2000A
Response Time		T_{ON}	25℃			1	ms	Note1 Note4 Test Equipment：Admesy MSE
		T_{OFF}						
Chromaticity	White	x		(0.280)	(0.300)	(0.320)		Test Equipment：CS2000A Note: Chromaticity can be modified according to customer demand
		y		(0.300)	(0.320)	(0.340)		
	Red	x		(0.625)	(0.655)	(0.685)		
		y		(0.315)	(0.345)	(0.375)		
	Green	x		(0.210)	(0.250)	(0.290)		
		y		(0.670)	(0.710)	(0.750)		
	Blue	x		(0.105)	(0.135)	(0.165)		
		y		(0.030)	(0.060)	(0.090)		
Uniformity		U		75			%	Note1 Note6 luminance of center point is 350±35nits Test Equipment：CS2000A
NTSC				90	100		%	Note5
Luminance		L		280	350	420	Cd/m^2	Note1 Note7 Test Equipment：CS2000A

Cross-talk					3	%	Note8 L≤350nits Test Equipment： CS2000A
Gamma			2.0	2.2	2.4		Gamma=2.2±0.2 （L≤350nits）; Gamma Self-adjustment (L＞ 350nits) Test Equipment： CS2000A

Test Conditions:

the ambient temperature is 25℃.

1. The test systems refer to Note1 and Note2.

Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. The optical properties are measured at the center point of the AMOLED screen. All input terminals AMOLED panel must be ground when measuring the center area of the panel.

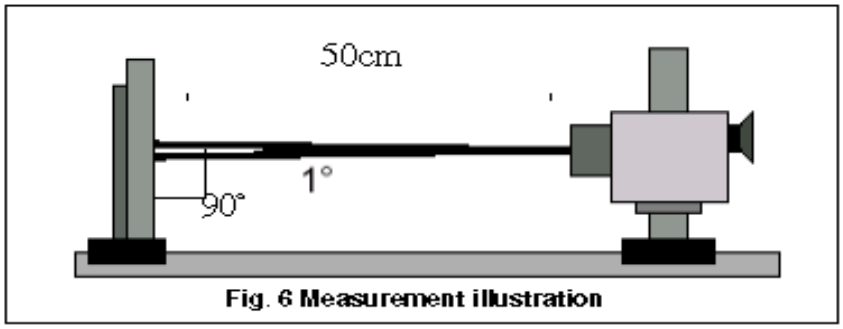


Fig. 6 Measurement illustration

Note 2: Definition of viewing angle range and measurement system.

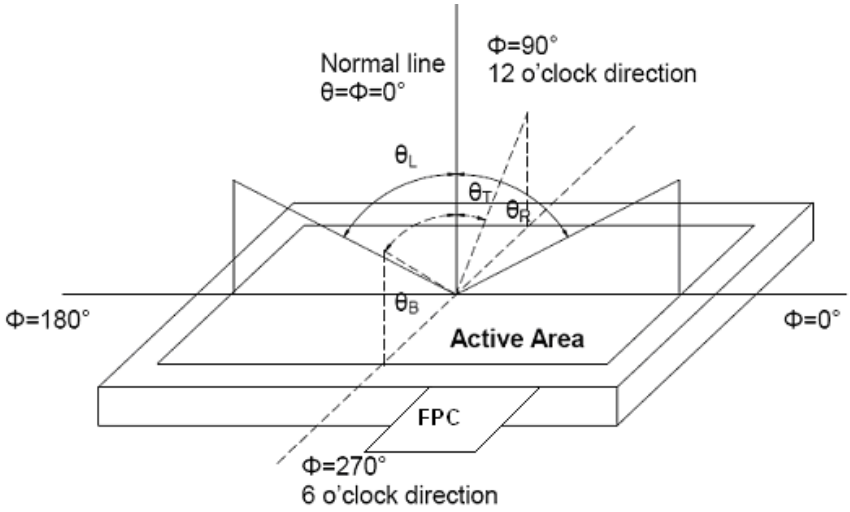


Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

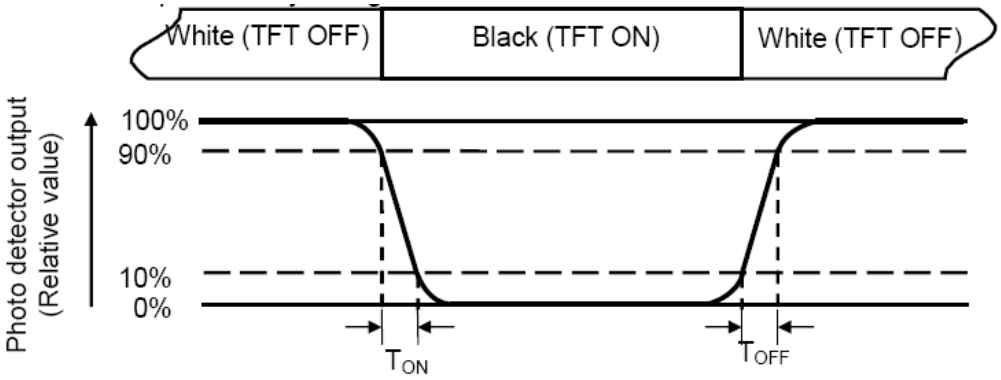
$$\text{Contrast ratio(CR)} = \frac{\text{Luminance measured when LCD is on the "white" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

“White state “: A state where the AMOLED should be driven by Vwhite.

“Black state”: A state where the AMOLED should be driven by Vblack.

Note 4: Definition of response time

The response time is defined as the AMOLED optical switching time interval between “White” state and “Black” state. Rise time (T_{ON}) is the time between photo detector output intensity changing from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changing from 10% to 90%.



Note 5: Definition of color chromaticity (CIE1931)

Color coordinates are measured at the center point of AMOLED.

Note 6: Definition of luminance uniformity

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

Luminance Uniformity(U) = Lmin/ Lmax

L-------Active area length W----- Active area width

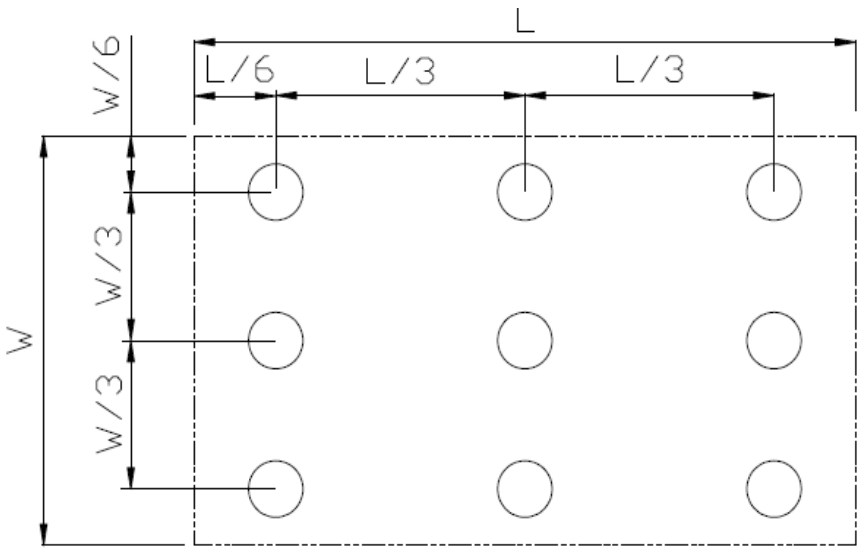


Fig. 2 Definition of uniformity

Lmax: The measured maximum luminance of all measurement position.

Lmin: The measured minimum luminance of all measurement position.

Note 7: Definition of luminance:

Measure the luminance of white state at the center point.

Note 8: Cross Talk

A. Measure luminance at the position, P0.

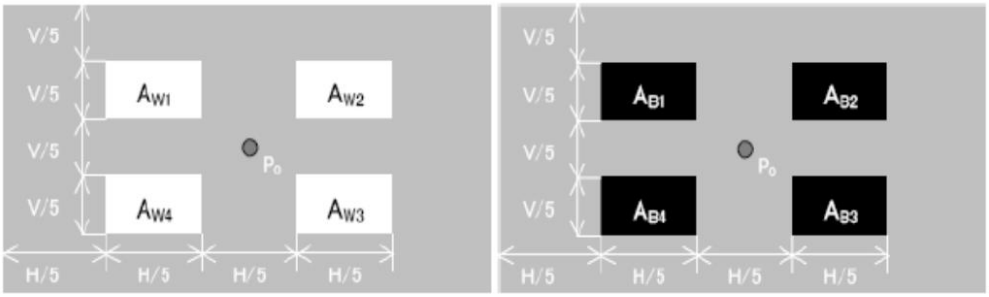
B. Calculate cross talk as below equation.

$$L_{W\_OFF} = \frac{L_{W1} + L_{W2} + L_{W3} + L_{W4}}{4}$$

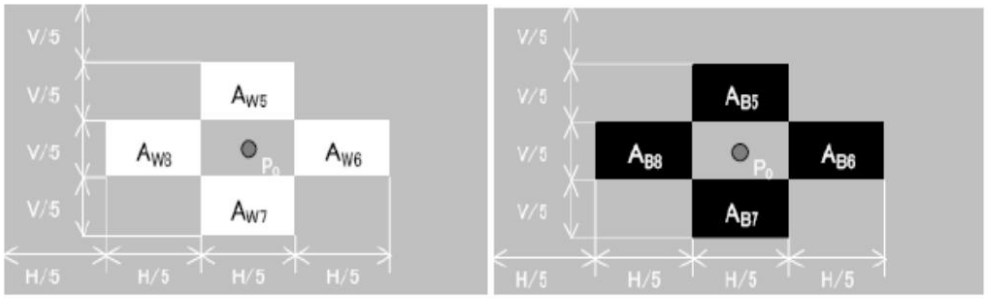
$$L_{B\_OFF} = \frac{L_{B1} + L_{B2} + L_{B3} + L_{B4}}{4}$$

$$\text{crosstalk} = \frac{|L_{Wi\_ON} - L_{W\_OFF}|}{L_{W\_OFF}} \times 100\% \qquad (i = 5 \text{ to } 8)$$

$$\text{crosstalk} = \frac{|L_{Bi\_ON} - L_{B\_OFF}|}{L_{B\_OFF}} \times 100\% \qquad (i = 5 \text{ to } 8)$$

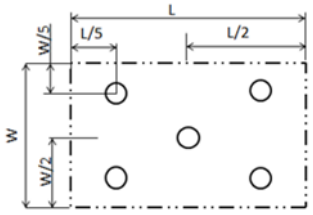


(a) L_{W_OFF}, L_{B_OFF} measuring pattern



(b) L_{W_ON}, L_{B_ON} measuring pattern

9 Environmental / Reliability Test

No	Test Item	Condition	Remark
1	High Temperature Operation	+60℃, 120hrs	IEC60068-2-2,GB2423.2
2	Low Temperature Operation	-20℃, 120hrs	IEC60068-2-1 GB2423.1
3	High Temperature Storage	+70℃, 120hrs	IEC60068-2-2 GB2423.2
4	Low Temperature Storage	-30℃, 120hrs	IEC60068-2-1 GB2423.1
5	High Temperature & High Humidity Operation	60℃, 90% RH,120hrs	IEC60068-2-78 GB/T2423.3
6	Thermal Shock (Non-operation)	-40(℃)/30(min) ~+80 (℃)/30(min), Change time:10min, 30Cycles	Start with cold temperature, End with high temperature, IEC60068-2-14,GB2423.22
7	Electro Static Discharge (Operation)	C=150pF, R=330Ω，5points/panel Air:±8KV, 5times; Contact:±4KV, 5 times; (Environment: 15℃~35℃, 30%~60%, 86Kpa~106Kpa). 	IEC61000-4-2 GB/T17626.2

10 Quality Level

10.1 AMOLED Module of Characteristic Inspection

The environmental condition and visual inspection shall be conducted as below:

(1) Ambient temperature: 20~26℃

(2) Humidity: 55 ± 10%RH

(3) Ambient light intensity of visual inspection: 800 ~ 1200 lux

(4) Ambient light intensity of function inspection: ≤200 lux

(5) Viewing Distance: 30 ± 5cm

(6) Viewing angle (tolerance): ±30°

(7) Inspection time: 10 ±2 sec

10.2 Sampling Procedures for each item acceptance table

Defect type	Sampling Procedures	AQL
Major defect	GB/T2828.1-2012 Inspection level Ⅱ normal inspection single sample inspection	0.65
Minor defect	GB/T2828.1-2012 Inspection level Ⅱ normal inspection single sample inspection	1.0

Major defect:

Any defect may result in functional failure, or reduce the usability of product for its purpose, such as electrical failure, deformation and so on.

Minor defect

A defect does not reduce the usability of product for its intended purpose, such as dot defect and so on.

The criteria on major and/or minor judgment will be according with the classification of defects.

10.3 Inspection Item

No.	Item	Area	Criterion of Defect			Defect type
1	Dot Defect	AA	Type	DS	Acceptable number	
			Bright Dot	≥10mm	0	Minor
			Dark Dot	≥10mm	4	
			Dark Dot（≥two connections）	≥10mm	0	
2	No Display	AA	/		Not allowed	Major
3	Abnormal Display	AA	/		Not allowed	Major
4	Normally white	AA	/		Not allowed	Major
5	Line Defect	AA	single line	Bright line	Not allowed	Major
				Dark line	Not allowed	
			Multiple lines	Bright line	Not allowed	
				Dark line	Not allowed	
			Half-Line	Bright line	Not allowed	
				Dark line	Not allowed	
6	ELA Mura	AA	See limit sample(under 64 gray-scale white screen)			Major
7	Color Mura	AA	See limit sample(under full white screen)			Major
8	Edge Mura	AA	See limit sample(under full white screen)			Major
9	Water Ripple	AA	See limit sample			Major
10	View Angle	AA	See limit sample(under full white screen)			Major
11	Low Gray White Mura	AA	See limit sample(under 128 gray-scale white screen)			Major
12	S Line Mura	AA	Not allowed under 128 gray-scale white screen			Major
13	White Mura	AA	Not allowed under 128 gray-scale white screen			Major
14	Dot Black Mura	AA	See limit sample(under 96 gray-scale white screen)			Major
15	Massive Black Mura	AA	See limit sample(under 128 gray-scale white screen)			Major
16	Ribbon Mura	AA	See limit sample(under 64 gray-scale white screen)			Major
17	Switching-Screen Black Mura	AA	Black dot is allowed under 32 gray-scale, white dot is not allowed under 255 gray-scale.			Major
18	TP	AA	TP function NG		Not allowed	Major

<table>
<tr><td rowspan="3">19</td><td rowspan="3">Edge/Side breakage</td><td rowspan="3">OA</td><td rowspan="2">Orther Area not including two edges in LTPS Glass or four edges in Encap Glass</td><td>Z(mm)</td><td>Y(mm)</td><td>X(mm)</td><td>Acceptable number</td><td rowspan="2">Minor</td></tr>
<tr><td>≤ T</td><td>Not extended to circuit Area or Frit</td><td>≤2.0</td><td>＜5</td></tr>
<tr><td>Two edges in LTPS Glass & four edges in Encap Glass</td><td colspan="3">See attachment</td><td>＜5</td><td>Minor</td></tr>
<tr><td>20</td><td>Glass crack</td><td>Whole area</td><td colspan="4">/</td><td>Not allowed</td><td>Major</td></tr>
<tr><td rowspan="6">21</td><td rowspan="6">Panel Scratch</td><td rowspan="6">AA</td><td colspan="2">W（mm）</td><td>L（mm）</td><td>DS（mm）</td><td>Acceptable number</td><td rowspan="6">Minor</td></tr>
<tr><td colspan="2">W≤0.03</td><td>L＜5.0</td><td>≥10</td><td>Ignore</td></tr>
<tr><td colspan="2" rowspan="2">0.03＜W≤0.05</td><td>L≤2.0</td><td>≥10</td><td>Ignore</td></tr>
<tr><td>2.0＜L≤5.0</td><td>≥10</td><td>2</td></tr>
<tr><td colspan="2">0.05＜W</td><td>-</td><td>0</td><td>0</td></tr>
<tr><td colspan="2"></td><td>L>5.0</td><td>0</td><td>0</td></tr>
<tr><td>22</td><td>Frit Encapsulation</td><td>FA</td><td colspan="5">Frit width uniformity. It should not have bubble or breakage.</td><td>Minor</td></tr>
<tr><td>23</td><td>Protective film Scratch</td><td>Whole area</td><td colspan="5">No control unless Injury to the body</td><td>Minor</td></tr>
<tr><td>24</td><td>Protective film starved /overflow glue/ galling</td><td>Whole area</td><td colspan="5">No control</td><td>Minor</td></tr>
<tr><td>25</td><td>Bubble in Protective film</td><td>Whole area</td><td colspan="5">Cover film protective film bubble is not controlled, polarizer protective film bubble: phone does not allow, watch no control</td><td>Minor</td></tr>
<tr><td>26</td><td>Protective film dirt</td><td>Whole area</td><td colspan="5">Not allowed dirts that not to be wiped</td><td>Minor</td></tr>
<tr><td>27</td><td>Polarizer crease / indentation</td><td>AA</td><td colspan="5">See limit sample</td><td>Minor</td></tr>
<tr><td>28</td><td>Polarizer edge overflow</td><td>OA</td><td colspan="5">No control W≤0.2mm</td><td>Minor</td></tr>
<tr><td rowspan="2">29</td><td rowspan="2">Easy to tear</td><td rowspan="2">Cover front</td><td colspan="5">Function is invalid, damaged, leaked not allowed</td><td rowspan="2">Minor</td></tr>
<tr><td colspan="5">Wrinkles, bumps, dirt, punching bad, burr, overflow glue is not controlled</td></tr>
<tr><td>30</td><td>Composite tape</td><td>LTPS</td><td colspan="5">Don't go beyond the edge of panel.</td><td>Minor</td></tr>
</table>

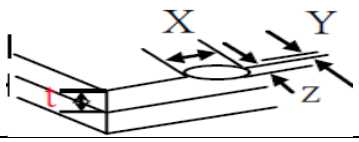
			Don’t have wrinkle, light leak, affect assembling and thickness.				
			Don’t have breakage.				
			No control unless concave and salient dots affect assembling.				
			No control when the dimensions conform to the drawing requirements.				
			Not allowed dirts and particles that not to be wiped, particles see the dot and line sample.				
			No control unless galling over glass.				
			Don’t have bubble.				
			No control pattern and overflow.				
31	Polarizer concave convex point	Whole area	Convex point: D≤0.25mm / concave point :D≤1mm			Acceptable number:3	Major
32	Concave dot、Black and white dot、Polarizer Dent/Bubble	AA	Front（Encap surface）	D（mm）	DS（mm）	Acceptable number	Minor
				D≤0.1	≥10	Ignore	
				0.1＜D≤0.2	≥10	3	
				0.2＜D	≥10	0	
			Metal material foreign material	/	/	Ignore	
33	Polarizer bubble line	Out of AA，≤0.25 mm	Encap surface	/	/	Not allowed	Major
34	Polarizer Scratch/ Fiber(Linear)	AA	W（mm）	L（mm）	DS	Acceptable number	Minor
			W≤0.03	L<5.0	≥10	Ignore	
			0.03＜W≤0.05	L≤2.0	≥10	Ignore	
				2.0＜L≤5.0	≥10	3	
			0.05＜W	-	≥10	0	
				L>5.0	≥10	0	
35	UV	Not IC side	Over coating			Not allowed	Minor
		IC side	The coating of IC side is not higher than POL.				
36	Tuffy glue	IC and FPC bonding area	The coating should not have breakage or Bubble.				Minor
			The coating is not higher than POL.				Minor
		Other	Tuffy glue is not allowed to interrupt and the diameter of				

		area	Bubble is not more than 0.5mm.	
			The coating is not higher than POL.	
		IC	Not allowed	
		FPC	Ribbon glue: the width is not more than 1mm. Dot glue: the diameter is not more than 2mm.	
37	Rear reinforcement glue of FPC	FPC	The width is not more than 1mm . The height is lower than LTPS.	Minor
38	Insulation tape	Bonding area	Bonding area is not allowed breakage or bubble.	Minor
		Device area	No control scratching and pattern.	
			Not allowed dirts that not to be wiped.	
			Don't go beyond the edge of panel.	
			No control galling and overflow.	
			Not allowed breakage, mutilation and missing.	
39	ACF	Bonding Area	The length of attachment is more than both ends of FPC, which should be range from 0.2 to 1mm. Don’t go beyond the edge of panel. Effective lap width of wiring ACF is more than 2/3, which is compared with the width of the gold finger of FPC. Don’t have bubble or wrinkle.	Major
40	FPCA	FPC	The component can not reverse polarity	Minor
			No wrong insertion	
			No control without affecting assembling.	
			FPC should not have serious crease which destroy the line, prick and spots damage. Scratch is not allowed if Cu layer is exposed.	
			The gold fingers should not be oxidized, scraped, folded, impressed, broken, spotted or dissymmetry.	
			Make sure FPC is not scalded, with its location holes not having deficiency or obviously shift.	
			The component of FPC should be the same as BOM list.	
			No remaining soldering Sn	
			No dirt.	
			No visual particle on the pad line	
			No control galling.	
			Not allowed content mistake.	
			FPC breakage can’t go beyond 1/2 between edge and AA , or <2.5mm.	
			Not allowed location hole missing, over or offset.	
			Indention in circuit area can’t cause end face of cover film turn white; Indention out circuit area can’t cause FPC breakage.	
			Bubble area<10%	
			FPC cover film can’t cause bubble or metallic conductor	

			exposed.	
			Not allowed enen tin, pseudo soldering, tin leaking and crack.	
			Gold fingers can't have solder splash, tin sweat in without tin area.	
			Breakage（W≤0.3mm，L≤1mm）	
			Not allowed reinforcement plate missing.	
			Salient dot: D≤0.25mm	
		FPC gold fingers	Not allowed unsmooth.	
			Cracking in top ≤0.3mm, not allowed in other area.	
			Not allowed breakage and salient dot.	
			Offset of gold fingers and mark W≤0.1mm	
			Leaking copper: W≤1/3, L≤1/3, not allowed 3 or over 3 gold fingers leak copper.	
			Nick ≤1/3	
			Not allowed apparently bruised.	
			Not allowed acute Angle to fold	
			Not allowed dirt.	
41	FPCA bubble	Bonding area	Not allowed visual bubble.	Major
42	FPCA End Overhang	Bonding area	The size above 1/2 of soldering electrode of the parts overhang to the LAND is prohibited, The height between FPC and overhang ≤0.5mm	Major
43	FPCA Tilt Defect	Bonding area	Not allowed	Major
44	Connector	Connector body	The connector and fillet should not have sticky tin phenomenon.	Major
45	Package	other	Products should put into the anti-static trays, with non-overlapping, and the trays should be staggered placed.	Minor
			Different products cannot be mixed into the same inner package.	
			The package should not have obvious deformation or breakage .The printing labels type and quantity are correct.	
			The package should have QC signature. ROHS label is needed if the product is under ROHS control.	

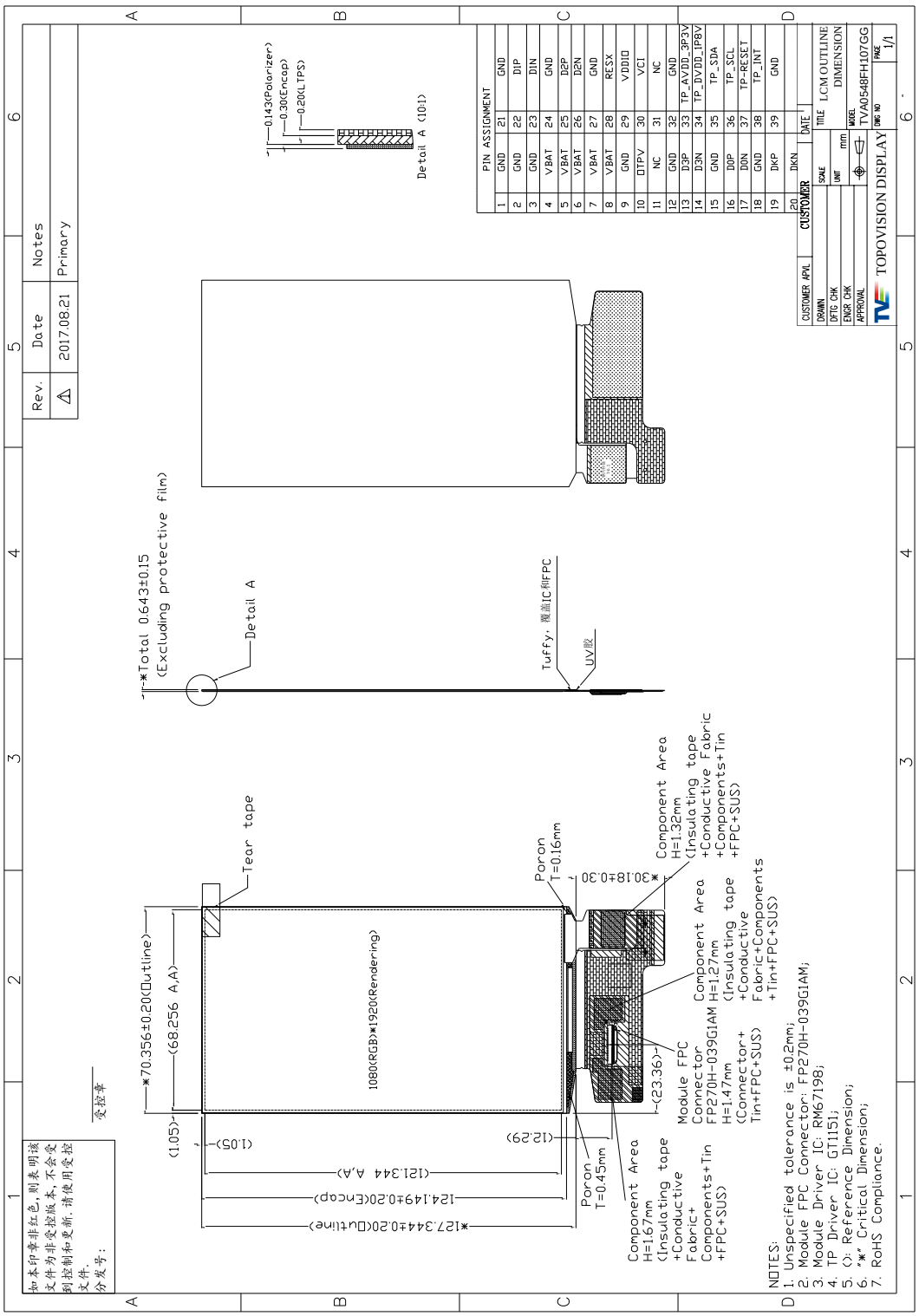
10.4 Inspection standard for cover

46	Dark and white defects、	Whole region	D（mm）	DS（mm）	N	AA	OA	Minor
			D≤0.1mm	DS≥3mm	-	Ignore		Minor

<table>
<tr><td rowspan="5"></td><td rowspan="5">dotted foreign matters</td><td rowspan="5"></td><td>D≤0.1mm</td><td>DS≤3mm</td><td>Dot cluster</td><td colspan="2">Not allowed</td><td rowspan="5"></td></tr>
<tr><td>0.1mm＜ D≤0.2mm</td><td>DS≥10mm</td><td>-</td><td>1</td><td>1</td></tr>
<tr><td>D＞0.2mm</td><td>/</td><td>/</td><td colspan="2">Not allowed</td></tr>
<tr><td colspan="5">Black spots aren’t allowed on the front of cover，the total number of defects: N≤3</td></tr>
<tr><td rowspan="6">47</td><td rowspan="6">Cover Scratch/ Fiber(Linear)</td><td rowspan="6">AA</td><td>W(mm)</td><td>L(mm)</td><td>DS(mm)</td><td colspan="2">Acceptable number</td><td rowspan="5">Minor</td></tr>
<tr><td>W≤0.03mm</td><td>L≤5.0mm</td><td>DS≥10mm</td><td colspan="2">Ignore</td></tr>
<tr><td rowspan="2">0.03mm＜ W≤0.05mm</td><td>L≤2mm</td><td>DS≥10mm</td><td colspan="2">Ignore</td></tr>
<tr><td>2mm＜ L≤5mm</td><td>DS≥10mm</td><td colspan="2">2</td></tr>
<tr><td>W＞0.05mm</td><td>-</td><td>0</td><td colspan="2">0</td></tr>
<tr><td>-</td><td>L＞5mm</td><td>0</td><td colspan="2">0</td><td></td></tr>
<tr><td>48</td><td>Cover concave convex point</td><td>Whole area</td><td colspan="5">front：height & depth≤0.15mm，size≤0.4mm. if necessary reference limit sample
back：Don’t affect the fit process is not controlled</td><td>Minor</td></tr>
<tr><td>49</td><td>cover chipping / edge chipping</td><td>OA</td><td>Chipping is observed in front</td><td colspan="4">Not allowed，if necessary reference limit sample</td><td>Minor</td></tr>
<tr><td></td><td></td><td>other invisible parts in the front</td><td colspan="4">X≤0.3mm，Y≤0.3mm，Z≤1/2T，Only one is allowed on each side，if necessary reference limit sample</td><td></td></tr>
<tr><td rowspan="3">50</td><td rowspan="3">chipping / edge chipping</td><td rowspan="3">OA</td><td></td><td>X</td><td>Y</td><td>Z</td><td>N</td><td rowspan="3">Minor</td></tr>
<tr><td>Other areas except the two horns in LTPS -glass and four horns in encap glass</td><td>X≤2mm</td><td>Not extended to Leading area and Frit</td><td>Z≤t</td><td>Total number ≤5</td></tr>
<tr><td>two horns in LTPS -glass and four horns in encap glass</td><td colspan="4"> 
</td></tr>
<tr><td>51</td><td>Blunt</td><td>Whole area</td><td colspan="5">Not allowed</td><td>Major</td></tr>
<tr><td>52</td><td>Cover sawtooth</td><td>OA</td><td colspan="5">CG Sawtooth of cutting on edge of CG/sawtooth of ink when silk screening： if necessary reference limit sample</td><td>Minor</td></tr>
</table>

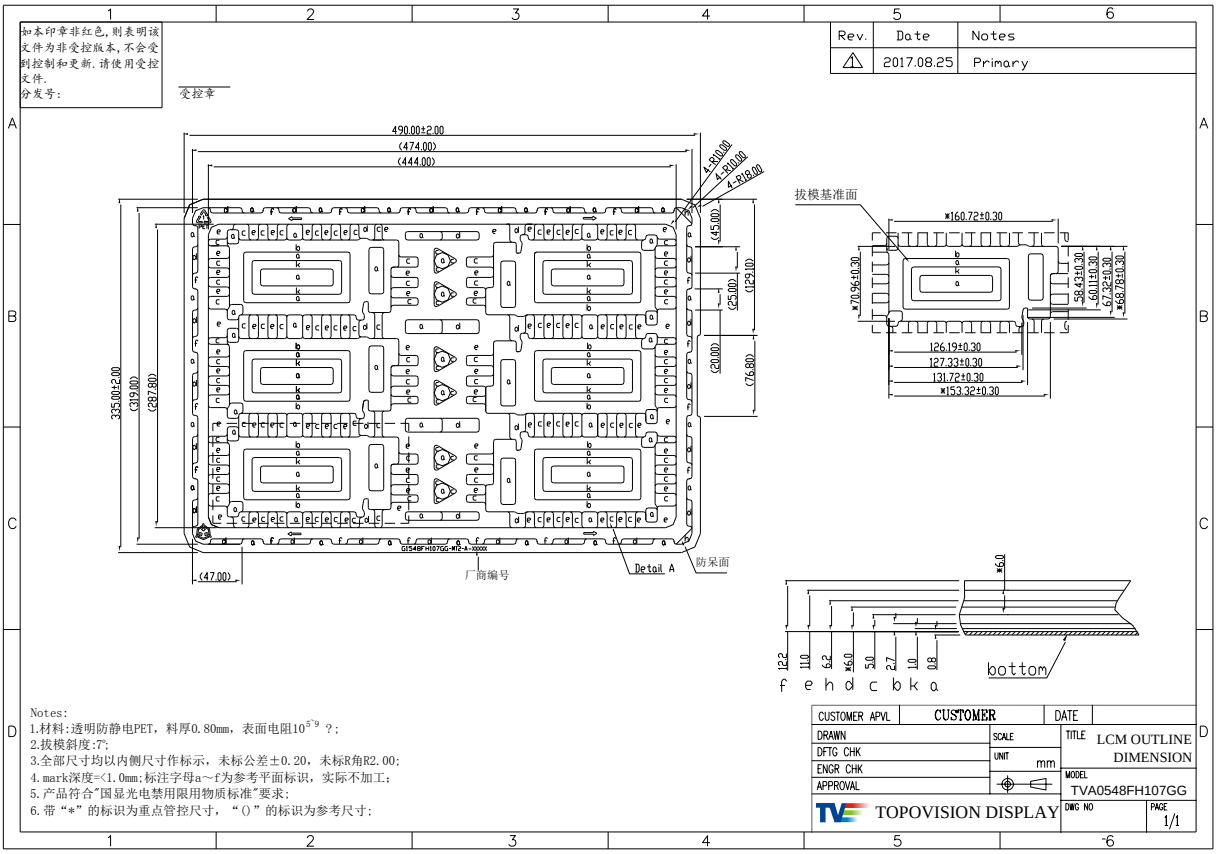
			BM or sawtooth of ink when silk screening				
			spot	D(mm)	DS(mm)	Acceptable number	
				D≤0.2	DS≥10	2	
			Line	W≤0.15； and overall is flat or smooth			
53	Pinhole transparency	OA	The black background is not visible；If visible，depending on the size of the dots.				Minor
54	Cover dirty	Whole area	Can’t wipe off： Not allowed				Minor
55	Fit bubble	AA	Refer to dot specifications				Minor
56	Vision area edge defect	OA	D≤0.2mm，DS＞10,N≤2（hole saw tusk less than 2），if necessary reference limit sample.				Minor
57	Ink salient points	AA	Refer to the size of dot specification				Minor
58	Light leakage due to uneven ink	OA	Edge light leakage: Refer to the sawtooth specification Pinhole light-leaking: not allowed in Black window region, the others refer to D≤0.25mm，N≤1 inspection standard：Black window + Positive light source detection				Minor
59	Cover heterochrosis	OA	Heterochrosis side execute according to point defect size, bulk/stick refer to Limited sample				Minor
60	Cover breakage or crack	Whole area	Not allowed				Minor
61	IR hole	OA	Color shading: not visible in black background, pass Transmittance determination IR hole area/line defect : not visible in black background, pass Transmittance determination				Minor
62	Camera Hole	OA	Camera hole smudge: not allowed Dot Defect: D≤0.1mm，and N≤1,not allowed in center area; no color stain Line defect；not allowed				Minor
63	ICON and LOGO	OA	character size：±20% Printing Derect：Not allowed chromatic aberration、double image、dot defect 、line defect：not allowed（or refer to limited sample）				Minor
64	Button hole/phone	OA	left-right asymmetry，Hole Rather large/small or off normal(Out of specification)No chamfer, Uneven				Minor

11 Mechanical Drawing



Packing Drawing

Packing Condition	Contents
Packing Type	TRAY + Carton packing type
TRAY material model	tray (10^5~$10^9\Omega$)
Tray packing type	See the picture 1
Number of panels per tray	6 pieces
Number of Tray per carton	13units ((12 units + 1 empty)PET tray)
Number of panels per carton	72 pieces



Picture 1

12 Precautions for Use of AMOLED Modules

12.1 Handling Precautions:

12.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from height.

12.1.2 Do not press down the screen or the adjoining areas too hard because the color tone may be shifted.

12.1.3 The polarizer covering the display surface of the AMOLED module is soft and easily scratched. Handle this polarizer carefully.

12.1.4 If the display surface is contaminated, blow on the surface and gently wipe it with a soft dry cloth. If it is still not completely clear, moisten the cloth with ethyl alcohol.

12.1.5 Solvents may damage the polarizer. Do not use water, ketone or aromatic solvents except ethyl alcohol.
Do not attempt to disassemble the AMOLED Module.

12.1.6 If the logic circuit power is off, do not apply the input signals.

12.1.7 To prevent destruction from static electricity, be careful to maintain an optimum working environment.

12.1.8 Be sure to make yourself in contact with the ground when handling with the AMOLED Modules.

12.1.9 Tools required for assembly, such as soldering irons, must be properly ground.

12.1.10 To reduce the generation of static electricity, do not conduct assembly or other work under dry conditions.

12.1.11 To protect the display surface, the AMOLED Module is coated with a film. Be careful when peeling off this protective film, because static electricity may generate.

12.2 Storage Precautions:

12.2.1 When storing the AMOLED modules, be sure that they are not directly exposed to the sunlight or the light of fluorescent lamps.

12.2.2 The AMOLED modules should be stored under the storage temperature range. If the AMOLED modules will be stored for a long time, the recommended condition is:
Temperature: 0℃~40℃ Relatively humidity: ≤80%

12.2.3 The AMOLED modules should be stored in the room without acid, alkali or harmful gas.

12.3 Transportation Precautions:

12.3.1 The AMOLED modules should not be suffered from falling and violent shocking during transportation. Besides, excessive press, water, damp and sunshine, should be avoided.