Product Specification

Part Name: 5.49 inch AMOLED MODULE
Customer Part ID:
Topovision Part ID: TVA0549A1
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.

Revision History

Rev.	Date	Contents	Written	Approved
A	2013/8/7	Preliminary Specification	Royal	Kevin

Special Notes

Note1.	

Contents

1 Scope

This Specification defines AMOLED manufactured by TopoVision Display Co., Ltd, from here on refer as TV . In the case of any unspecified item, it may require both TV and the party designs this module into its product to work out a solution.

2 Features

2.1 Product Applications

mobile phone, portable GPS, handheld game console…

2.2 Product Features

2.2.1 Display color：16.7M (RGB x 8bits)
2.2.2 Display format：5.49”FHD(1080RGBx1920)
2.2.3 Pixel arrangement：Rendering
2.2.4 Interface：MIPI 4 lanes
2.2.5 Driver IC: RM67191 (Raydium)
2.2.6 Touch IC: GT1151 (Goodix) or Focal
2.2.7 Touch screen：On-Cell
2.2.8 Power IC on FPC
2.2.9 Module Type : FOG

3 Mechanical Specifications

Item	Specification	unit
Dimension outline	70.66 *128.36*0.82	mm
Encapsulation outline	70.66 *125.11	mm
Resolution	1080 RGB x 1920 (Rendering)	dots
Active area	68.299 x 121.421	mm
Diagonal size	5.49	inch
Pixel pitch	31.62*63.24	μm
Glass thickness (LTPS/encapsulation glass)	0.20 / 0.30	mm
Weight	(TBD)	g

4 Maximum Rating

Parameter	Symbol	Spec			Unit	Note
		Min.	Typ.	Max.		
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	-0.3	-	6.5	V	-
VPP(OTP power)	VPP	-	-	8.64	V	-
TP Power voltage	TP_AVDD	-0.3		4.2	V	-
TP I/O Digital Voltage	TP_VDDIO	-0.3		4.2	V	-
Operating temperature	Top	-20		60	℃	
Storage temperature	Tstg	-30		70	℃	

5 Electrical Specifications

5.1 Electrical Characteristics

5.1.1 Current Characteristic

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
AMOLED Power positive	ELVDD	-	4.6	-	V	Ref
AMOLED power Negative	ELVSS	-	-2.5	-	V	Ref
Gamma Voltage	VSP	6.1	6.4	6.5	V	Ref
Digital Power supply	VDDIO	1.65	1.8	3.6	V	Ref
Analog Power supply	VCI	2.5	3.3	4.8	V	Ref
TP Supply voltage	TP_AVDD	2.6	2.8	3.6	V	-
TP Digital Power supply	TP_VDDIO	1.8	-	TP_AVDD	V	-
TP Logic Input Voltage	VIH	0.75*TP_VDDIO	-	TP_VDDIO+0.3	V	-
	VIL	-0.3	-	0.25*TP_VDDIO	V	-
TP Logic Input Voltage	VOH	0.85*TP_VDDIO	-	-	V	-
	VOL	-	-	0.15*TP_VDDIO	V	-

Mode	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Normal	IVBAT	VELVDD=4.6V VELVSS=-2.5V VCI=3.3V VDDIO=1.8V VSP=6.4V VBAT=4V @Full White 350 nits	400	466	558	mA	Ref
	IVCI		1	2	3	mA	Ref
	IVDDIO		45	51	60	mA	Ref
Sleep in (LP mode)	IVCI		0.01	0.036	0.05	mA	Ref
	IVDDIO		0.1	0.145	0.2	mA	Ref
Deep Standby (DSTB=1)	IVCI		0	0.002	0.01	mA	Ref
	IVDDIO		0	0.003	0.01	mA	Ref
Normal Operation	Iopr	TP_AVDD=2.8V ,TP_VDDIO=1.8 V 或 TP_VDDIO=TP_ AVDD	29	34	38	mA	-
Green	Imon		7	11	14	mA	-
Sleep	Islp		100	140	180	uA	-

	Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Active	AMOLED Power positive	ELVDD	-	4.6	-	V	Ref
	AMOLED power Negative	ELVSS	-	-2.5	-	V	Ref
	Gamma Voltage	VSP	6.1	6.4	6.5	V	Ref
	Digital Power supply	VDDIO	1.65	1.8	3.6	V	Ref
	Analog Power supply	VCI	2.5	3.3	4.8	V	Ref

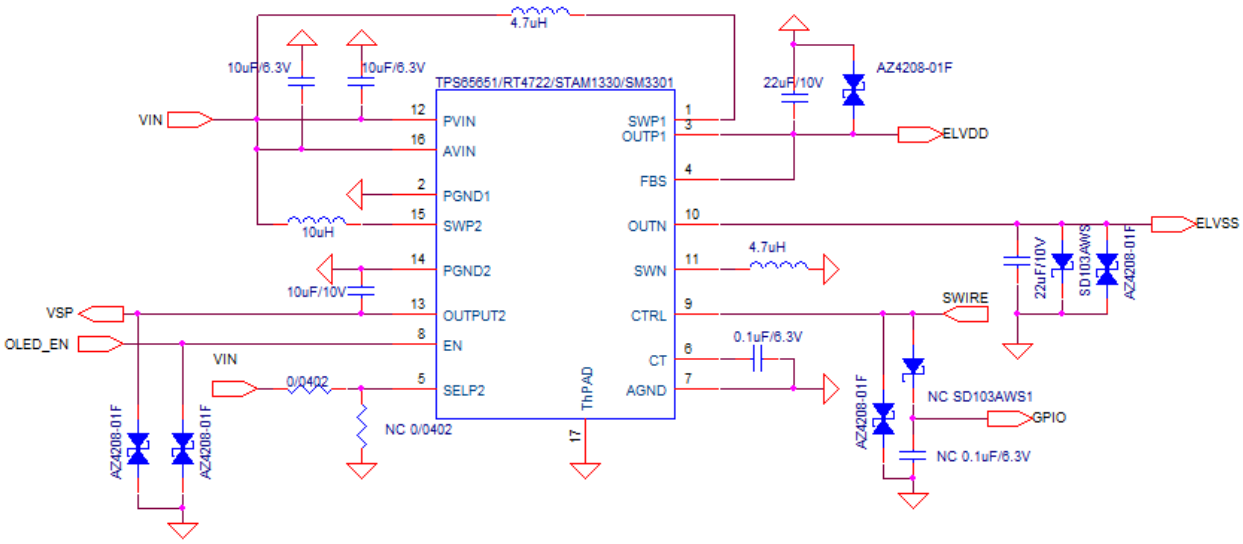
	Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Sleep in	AMOLED Power positive	ELVDD	-	0	-	V	Ref
	AMOLED power Negative	ELVSS	-	0	-	V	Ref
	Gamma Voltage	VSP	-	0	-	V	Ref
	Digital Power supply	VDDIO	1.65	1.8	3.6	V	Ref
	Analog Power	VCI	2.5	3.3	4.8	V	Ref

	supply						

	Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Deep stanby (DPTB=1)	AMOLED Power positive	ELVDD	-	0	-	V	Ref
	AMOLED power Negative	ELVSS	-	0	-	V	Ref
	Gamma Voltage	VSP	-	0	-	V	Ref
	Digital Power supply	VDDIO	1.65	1.8	3.6	V	Ref
	Analog Power supply	VCI	2.5	3.3	4.8	V	Ref

5.1.2 Application circuit

Power IC recommend :TPS65651、ST:STAM1330、Silicon Mitus:SM3301, Richtek:RT4722



5.2 I/O Connection and Block Diagrams

5.2.1 I/O Connection

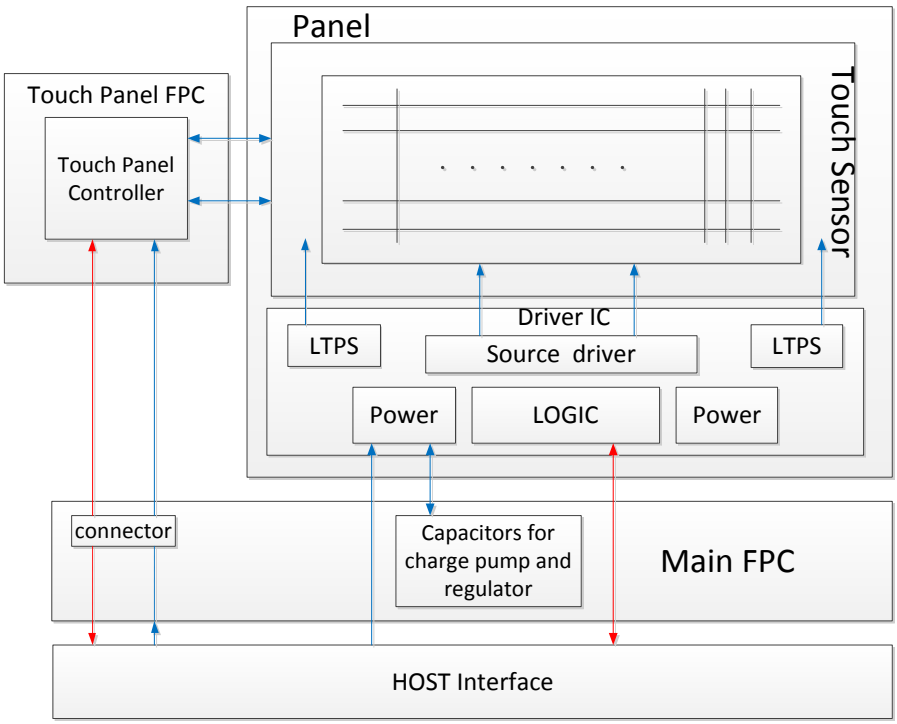
#	Pin_name	I/O	Description
1	GND	Power	The power ground
2	GND	Power	The power ground
3	GND	Power	The power ground
4	VBAT	Power	power IC input Voltage
5	VBAT	Power	power IC input Voltage

6	VBAT	Power	power IC input Voltage
7	VBAT	Power	power IC input Voltage
8	VBAT	Power	power IC input Voltage
9	LPTE	O	Tear effect output
10	VPP	Power	Power supply for OTP. Leave the pin to open when not in use.
11	NC	-	No connection
12	GND	Power	The power ground
13	D3P	I	MIPI DSI data3+
14	D3N	I	MIPI DSI data3-
15	GND	Power	The power ground
16	D0P	I/O	MIPI DSI data0+
17	D0N	I/O	MIPI DSI data0-
18	GND	Power	The power ground
19	DKP	I	MIPI DSI clock+
20	DKN	I	MIPI DSI clock-
21	GND	Power	The power ground
22	D1P	I	MIPI DSI data1+
23	D1N	I	MIPI DSI data1-
24	GND	Power	The power ground
25	D2P	I	MIPI DSI data2+
26	D2N	I	MIPI DSI data2-
27	GND	Power	The power ground
28	RESX	I	This signal will reset the device and must be applied to properly initialize the chip. Active low.
29	VDDIO	Power	Driver IC digital I/O supply
30	VCI	Power	Driver IC analog supply
31	NC	-	No connection
32	GND	Power	The power ground
33	TP_AVDD	Power	I/O Power Supply
34	TP_VDDIO	Power	Digital power supply
35	TP_SDA	I/O	I2C Data Input & Output
36	TP_SCL	I/O	I2C Clock Input
37	TP_RESET	I	External Reset,Low is Active
38	TP_INT	I	Interrupt request to the host, or Wakeup request from the host.
39	GND	Power	The power ground

5.3 I/O Connection and Block Diagrams

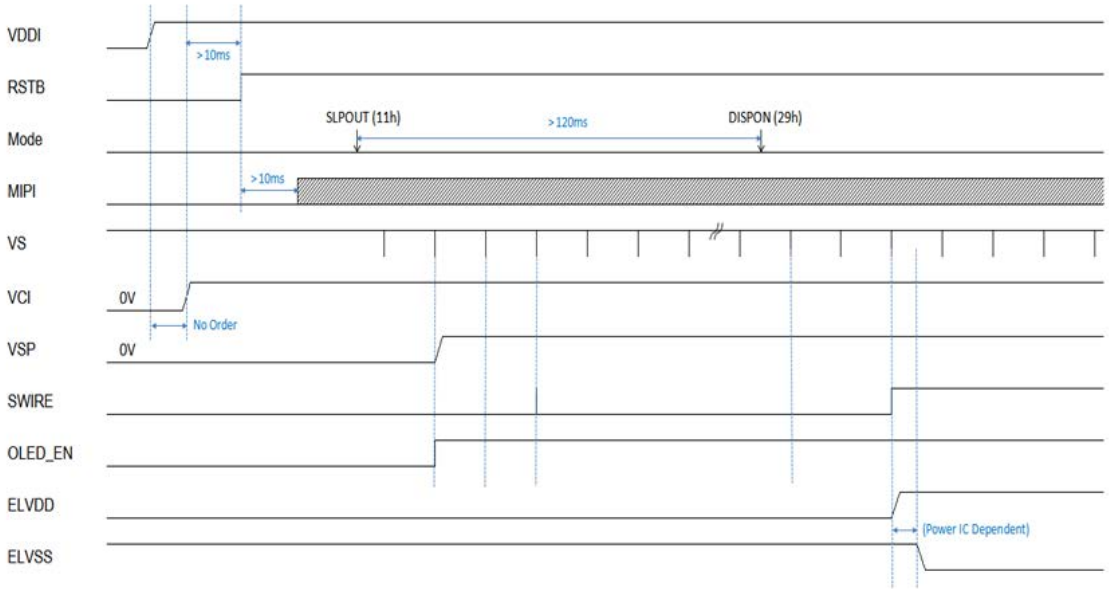
5.3.1 I/O Connection

5.2.2 Display Module Block Diagram

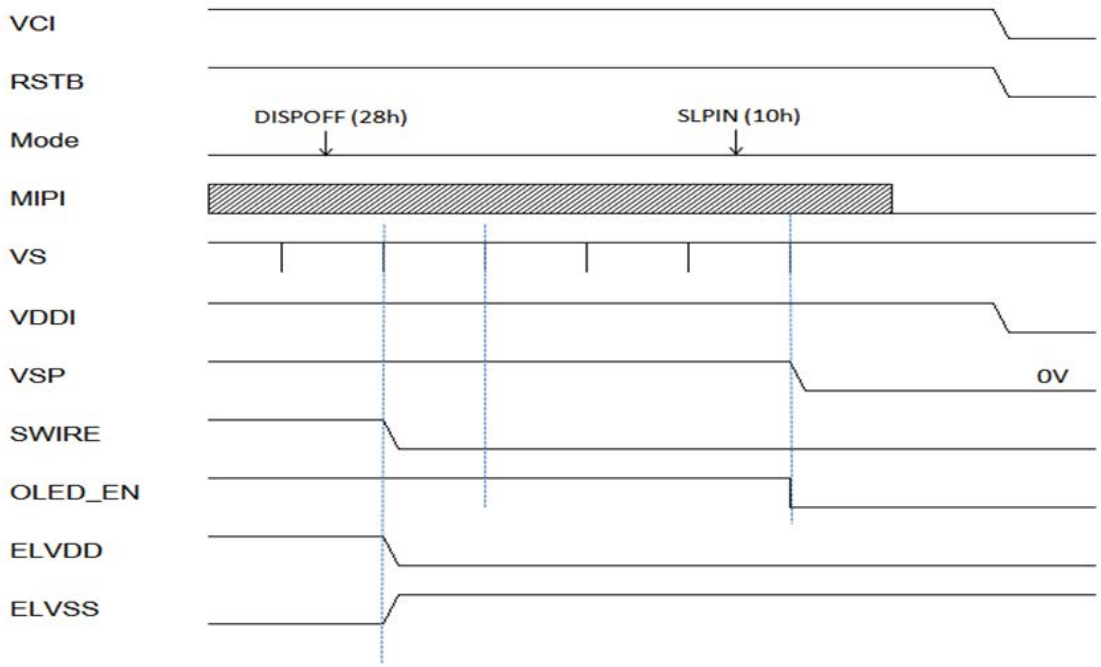


5.4 Recommended Operating Sequence

5.3.1 Power on sequence

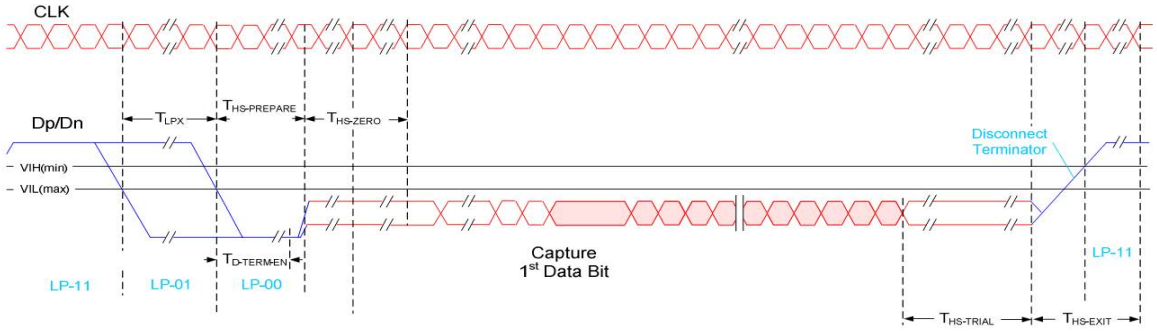


5.3.2 Power off sequence

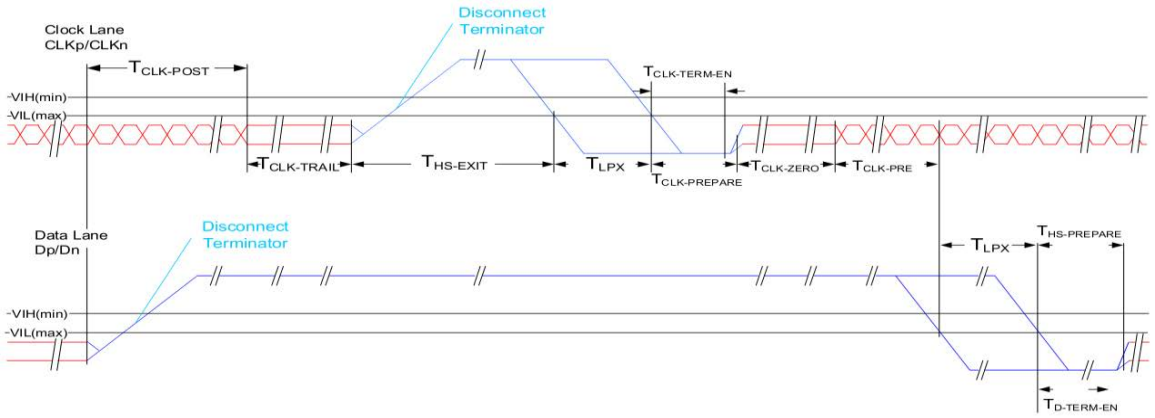


5.5 AC Characteristics (MIPI)

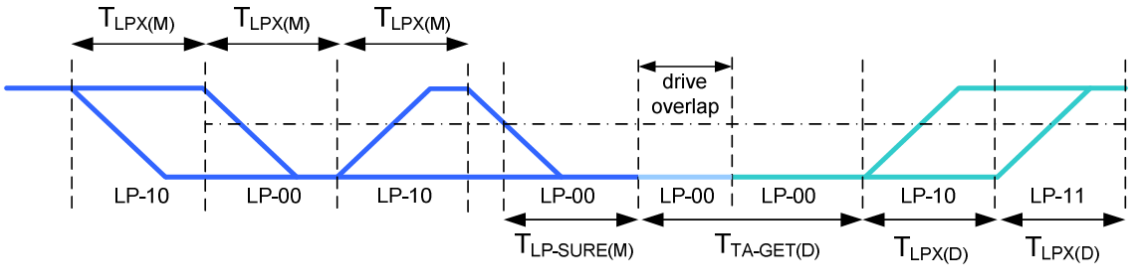
5.4.1 HS Data Transmission Burst



5.4.2 HS Clock Transmission



5.4.3 Turnaround Procedure



5.4.4 Timing Parameters

Symbol	Description	Min	Typ	Max	Unit
TREOT	30%-85% rise time and fall time	-	-	35	ns
TCLK-MISS	Timeout for receiver to detect absence of Clock transitions and disable the Clock Lane HS-RX.	-	-	60	ns
TCLK-POST*1	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 THS-TRAIL to the beginning of TCLK-TRAIL.	60ns + 52*UI (For DCS)	-	-	ns
TCLK-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	-	-	ns
TCLK-SETTLE	Time interval during which the HS receiver shall ignore any Clock Lane HS transitions, starting from the beginning of TCLK-PRE.	95	-	300	ns
TCLK-TERM-EN	Time for the Clock Lane receiver to enable the HS line termination,starting from the time point when Dn crosses VIL,MAX.	Time for Dn to reach VTERM-EN		38	ns
THS-SETTLE	Time interval during which the HS receiver shall ignore any Data Lane HS transitions, starting from the beginning of THSPREPARE.	85 ns + 6*UI		145 ns + 10*UI	ns
TEOT	Time from start of THS-TRAIL or TCLK-TRAIL period to start of LP-11 state	-	-	105ns+48*UI	ns

$T_{HS-EXIT}$(1)	time to drive LP-11 after HS burst	100	-	-	ns
$T_{HS-PREPARE}$	Time to drive LP-00 to prepare for HS transmission	40ns + 4*UI	-	85ns+6*UI	ns
$T_{HS-PREPARE}$ + $T_{HS-ZERO}$	THS-PREPARE + Time to drive HS-0 before the Sync sequence	145ns + 10*UI	-	-	ns
$T_{HS-SKIP}$	Time-out at RX to ignore transition period of EoT	40	-	55ns+4*UI	ns
$T_{HS-TRAIL}$	Time to drive flipped differential state after last payload data bit of a HS transmission burst	60 + 4*UI	-	-	ns
T_{LPX}	Length of any Low-Power state period	50	-	-	ns
Ratio T_{LPX}	Ratio of $T_{LPX(MASTER)}$/$T_{LPS(SLAVE)}$ between Master and Slave side	2/3	-	3/2	ns
T_{TA-GET}	Time to drive LP-00 by new TX	5*TLPX	5*TLPX	5*TLPX	ns
T_{TA-GO}	Time to drive LP-00 after Turnaround Request	4*TLPX	4*TLPX	4*TLPX	ns
$T_{TA-SURE}$	Time-out before new TX side starts driving	TLPX	-	2*TLPX	ns

5.4.5 Timing requirements for RESETB

When RESETB of the reset pin equals to Low, it will be in the condition of reset.

When it is in the condition of reset, it will make the device recover the initial set.

However, in order to avoid the reset noise cause reset, there is a mechanism to judge about whether the reset is needed or not.

The closed interval of Low can be shown as the following.

(Test condition: VDDIO=1.65V~3.6V, VSS=0V, -20℃~+85℃)

Parameter	Symbol	Conditions	Spec			Unit
			Min.	Typ.	Max.	
Reset low pulse width	Trst	-	20	-	-	ns

Table: Reset timing

Figure: Reset timing

6 Electro-Optical Specification

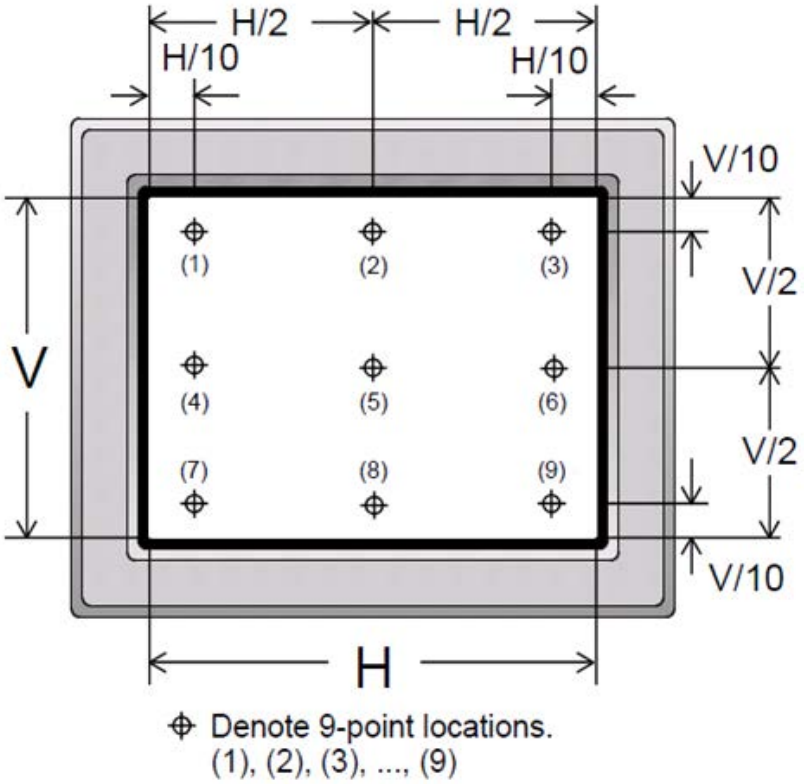
Item		Symbol	Conditions	Min.	Typ.	Max.	Unit	Remark
Brightness			Full White	300	350	-	cd/m^2	Note2
Brightness Uniformity			Full White	75		-	%	
Contrast Ratio		CR	Normal to surface	8,000	10,000	-	-	
CIE Chromaticity	White	x	Normal to surface	0.27	0.30	0.33	-	
		y		0.29	0.32	0.35	-	
	Red	x		0.62	0.66	0.7	-	Ref.
		y		0.3	0.34	0.38	-	Ref.
	Green	x		0.16	0.21	0.26	-	Ref.
		y		0.67	0.72	0.77	-	Ref.
	Blue	x		0.09	0.13	0.17	-	Ref.
		y		0.02	0.06	0.10	-	Ref.
Color Gamut			vs. NTSC	80	100	-	%	
Viewing angle			U/D/L/R CR≥1000	80		-	°	
Cross-talk			4% black or white window, 117 gray scale	-	-	5	%	Note3
Gamma			V(Gray)=48,72,104,132, 164,192,224,255	1.9	2.2	2.5	-	
Color shift			@ 30 degree	-	4	5	JNCD	Note4
Response time				-	-	2	ms	Note 5

Note1: Temp.25℃，（Angle、distance）
Environmental conditions：Temp.25℃±3℃，65±20%RH，Dark Room。
Distance of OLED display center to measuring machine is 50cm。

Note2: Brightness Uniformity definition

Measure 9 points of Display Brightness,

Brightness Uniformity=L_{min}/L_{Max}×100%



Contrast Ratio：

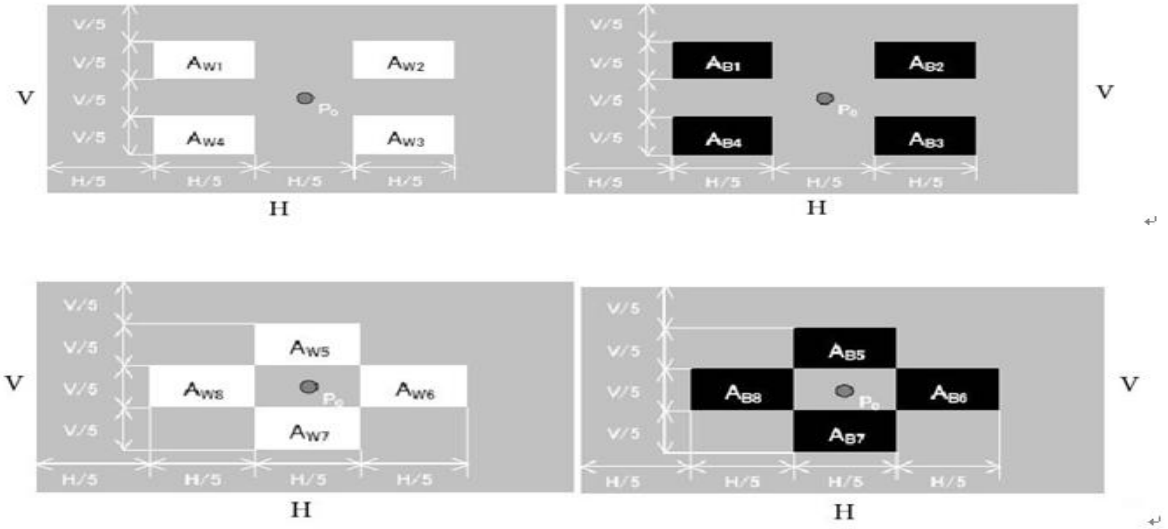
Dark Room C.R=LW/LB

LW: full white brightness of display center P0;

LB : full black brightness of display center P0.

Note3: Cross-talk

4% black or white window ， 117 gray background.



$$L_{W\_OFF} = \frac{L_{w1} + L_{w2} + L_{w3} + L_{w4}}{4}$$

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

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

For white windows A_{Wi} (i = 5 to 8), and

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

For black windows A_{Bi} (i = 5 to 8).

The maximum cross-talk value shall be noted in the measurement report.

Note4: Color Shift JNCD

For JNCD measure:

Fix on one pattern like white pattern,

On the condition θ=0 F=0°, we can get the color coordinate (u1', v1') and on θ F=30° we can get another color coordinate (u2', v2')

Delta = Square Root((u2'-u1')^2 + (v2'-v1')^2)

JNCD stands for "Just Noticeable Color Difference"

For the (u', v') color space JNCD=0.0040.

2JNCD means Delta u'v'<0.0080

For color shift we need to measure white/red/green/blue pattern.

This Requirement is from our customer and we have test some of our phone display and the result is OK.

Note5: Response Time

Response time=Pixel turn on and turn off time (White<=>Black).

It is measuring transition time from 10% to 90% of luminance.

7 Reliability

7.1 Environmental Test

No	Item	Conditions	Note
1	High Temperature Operation	70℃/ 128hours	After testing - No clearly visible defects or remarkable deterioration of display quality. However, any polarizer's deteriorations by the high temperature/ High humidity test are permitted. - No function-related abnormalities.
2	Low Temperature Operation	-20℃/ 128hours	
3	High Temperature Storage	85℃ 128hrs	
4	Low Temperature Storage	-40℃ 128hrs	
5	High Temperature Humidity Operation	60℃/93% RH 240hrs	
6	High Temperature Humidity Storage	60℃/93% RH 240hrs	
7	Thermal Shock	-20℃ ~ 70℃ 30min,change time ＜ 5min, 10 cycles	

7.2 Electrical Test

No	Item	Conditions
1	Air discharge	±8KV,150PF/330Ω (MDL level)
2	Contact discharge	±4KV, 150PF/330Ω (MDL level)

7.3 Mechanical Test

No	Item	Conditions	Note
1	Glass Strength Test	4PB， B10 >100MPa	
2	Drop Test	GB/T4857.18-19 Test Description For Packages(1 corner, 3 edges, 6 surfaces)	Package

3	Sinusoidal Vibration Test	Frequency range:10~55Hz,Stroke:1.5mm,Sweep:10Hz~55Hz~10Hz 2hours for each direction of X.Y.Z.(6 hours for total, Package condition)	Package

8 Handling Precautions

8.1 When cleaning ITO pad, avoid using hard and abrasive material or corrosive solution

8.2 Keep module away from direct sunlight or fluorescent light, and keep it at room temperature and humidity

8.3 Strong impact & pressure on module and packing is prohibited

8.4 Following normal power on/off sequence is necessary for preventing abnormal display or permanent damage to display

8.5 Optimal contrast ratio under ideal voltage is AMOLED module's characteristic, hence it is recommended a voltage control function available

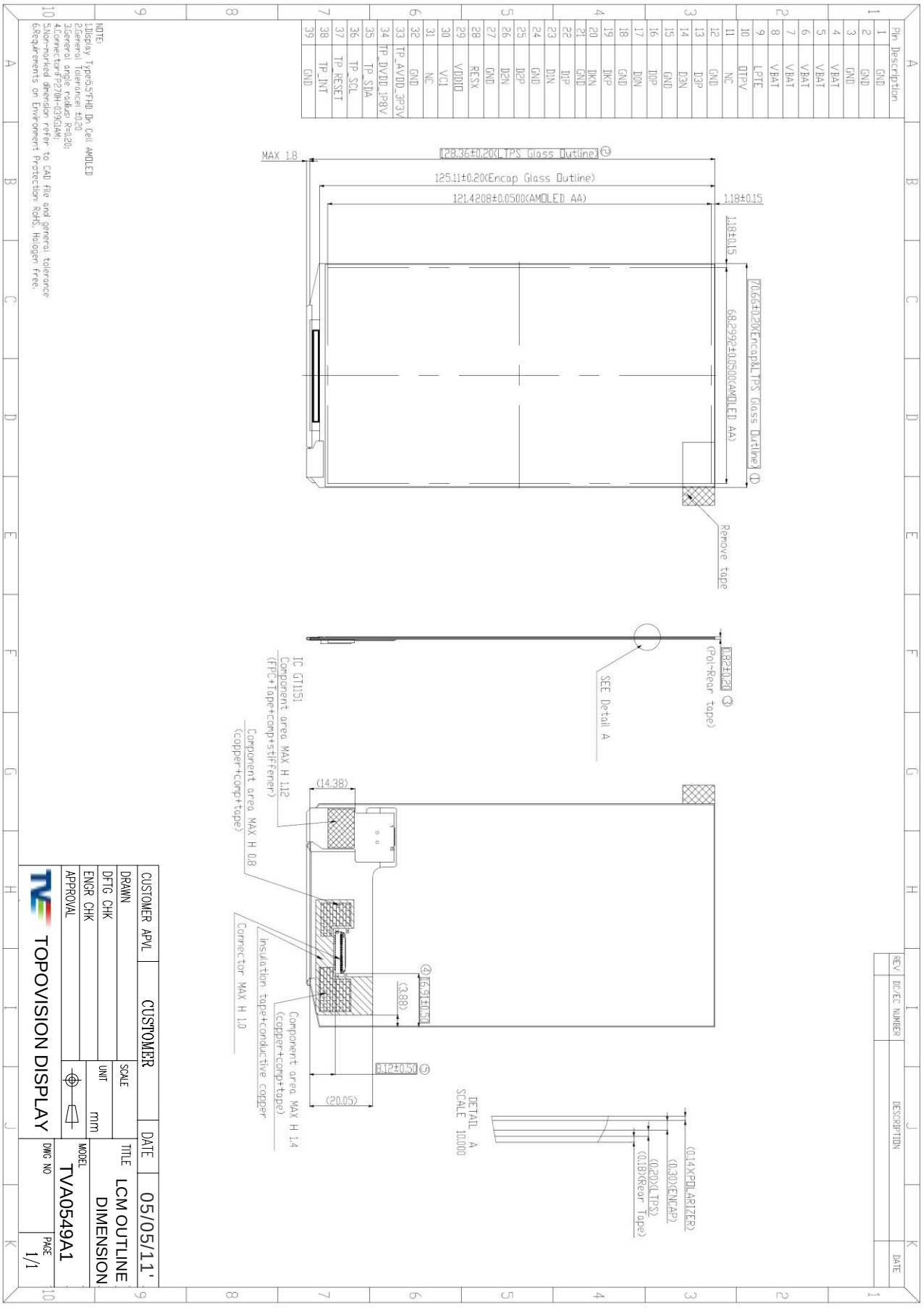
8.6 Image sticking may occur if an image displays for an extended period of time

8.7 When interfered by system's overall mechanical design, an abnormal display may occur

8.8 After considering emitting energy, you should plan your design to satisfy EMI standards.

8.9 Host side should place a surge-prevent circuit at power trace (ie: VCI, Vddi) to protect AMOLED module.

9 Outline Dimension Drawing



10 Packing Specification

1. Packaging Material: (Per carton)

No.	Item	Model(Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity	Remark
1	Module	TVA0549A1	70.66*128.36*0.82	TBD	108	
2	Tray	PET (White)	455.00*290.00*14.00	TBD	20	
3	Vacuum bag	PE	630.00*550.00*0.14	TBD	2	
4	Desiccant	Desiccant	55.00*75.00	TBD	4	
5	Carton	Corrugated Paper	516.00*338.00*248.00	TBD	1	
6	Box	Corrugated Paper	459.00*294.00*115.00	TBD	2	
7	EPE 1	EPE	222.30*377.70*1.00	TBD	36	
8	EPE 2	EPE	457.00*292.00*10.00	TBD	4	
9	EPE 3	EPE	120.00*244.00*100.00	TBD	4	
10	PP Board	PP	457.00*292.00*5.00	TBD	2	
11	Total weight	TBD Kg±5%				
12	Pallet	Wood	TBD	TBD	1/30	

2. Packaging specifications and quantity:

(1) Module quantity per tray: quantity per row	2 X quantity per column	2X3 = 6
(2) Module quantity in box: quantity per tray	6 X quantity of trays	9 = 54
(3) Module quantity in carton: quantity per box	54 X quantity of boxes	2 = 108
(4) Total LCM quantity in pallet: quantity per carton	108 X quantity of cartons	30 = 3240