

3.19"火山

Product Specification

Rev. P1

Customer Name : _____

Product Name : 3.189" 火山

Model Name : AM319M262928HFL

Description : 3.189"(262*928)AMOLED Translating pens

Proposed by			Customer's Approval
Designed	Checked	Approved	

Revision History

Rev.	ECN No.	Description of Change	Date	Prepared
P0	-	-	2022.02.07	
P1	-	更新取消 SCF	2022.03.03	

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1. General Description

1-1. Introduction

BOE 3.19inch 262x928 is a color active matrix AMOLED module using Low Temperature Poly-silicon TFT's (Thin Film Transistors) as active switching devices. This module has a 3.19inch diagonally measured active area with 262x928 resolutions (262 horizontal by 928 vertical pixel arrays). Each pixel is divided into RED, GREEN, BLUE dots and this module can display 16.7M colors.

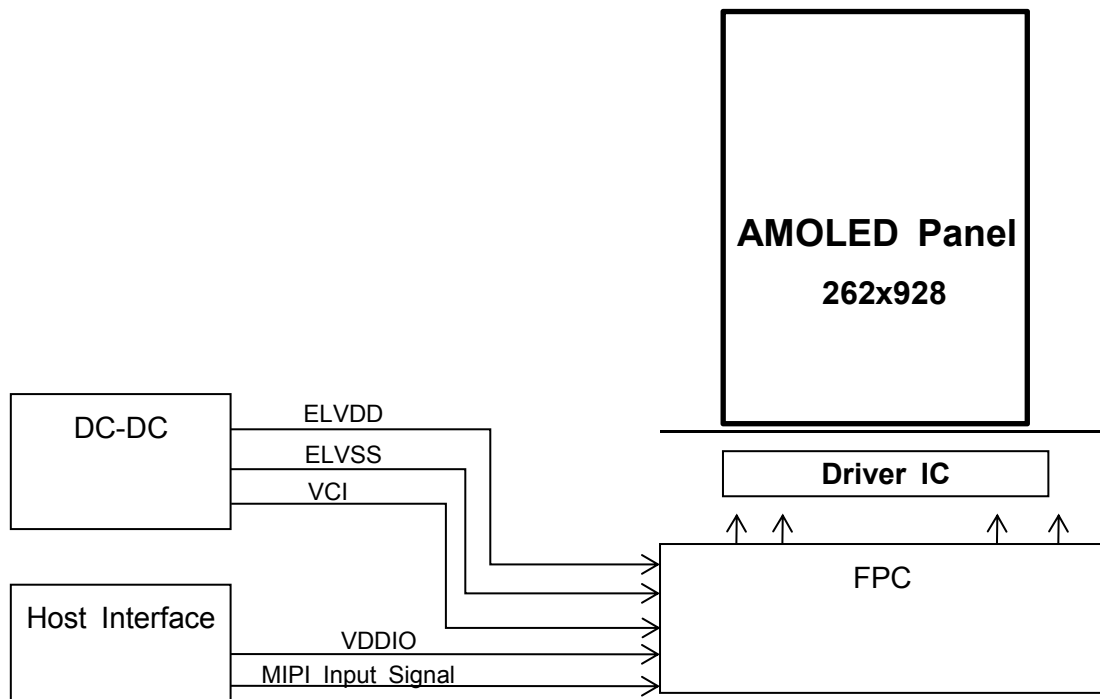


Figure 1

1-2. Features

- 1) Display Colors : 16.7M
- 2) Display Format : 3.19" OLED 262 × 928
- 3) MUX: source 1:6
- 4) Interface : MIPI1-lane
- 5) Driver IC : Raydium RM690C0
- 6) Touch IC: ZT2628

1-3. Application

Education application

2. Mechanical Specification

Table 1

Item	Specifications	Unit	Remark
Panel outline	23.808(H)*81.052(V)	mm	Round
Number of dots	262 (H)RGB*928 (V)	Dots	Real RGB
Active area	22.008*77.952	mm	Radius
Diagonal Inch	3.189	Inch	Radius
Pixel pitch	84(H)*84(V)	μm	
Pixel Arrangement	Real RGB	-	S-RGB
MDL outline	<=108.15mm*57.65mm	-	Include COF bending dimension
Total Thickness	0.63	mm	POL~panel
View area	/	mm	No CG
Weight	3.06	g	

3. Absolute Maximum Ratings

Table 2

Item	Symbol	Min.	Max.	Unit	Note
Module I/O Voltage	VDDIO	-0.3	5.5	V	
Module Operation Voltage	VCI	-0.3	5.5	V	
EL Driving Voltage	ELVDD	-0.3	5.5	V	
Driver IC Operating temperature	ELVSS	-5.5	-0.3	V	
	Topr	-40	+85	°C	
Driver IC Storage temperature	Tstg	-55	+125	°C	
Touch power supply voltage	TP_1.8V	-	4.0	V	
Touch Input voltage for I/O bus	-	-	4.0	V	
Touch IC Storage temperature	Tstg	-40	+125	°C	

4. Electrical Characteristics

4-1 Power Consumption of Display Panel

Test Condition: Temp=25±2℃

Table 3

Item		Symbol		Condition	Symbol	Min.	Typ.	Max.	Uni
ELVDD		ELVDD		Normal	-	3.25	3.3	3.35	V
				Idle	-	3.25	3.3	3.35	V
ELVSS		ELVSS		Normal	-	-3.25	-3.3	-3.35	V
				Idle	-	-3.25	-3.3	-3.35	V
VBAT		VBAT		-	-	2.9	3.7	5.0	V
VDDIO		Vddio		-	-	1.65	1.8	3.3	V
Power Consumption	Display on mode	IC	Vddio	100% Pixel On,500nits,60 Hz	Ivddio	-	5.1	-	mA
			Pvddio		-	9.18	-	mW	
		VBAT	10% Pixel On,50nits, 15Hz		Ivbat	-	99.54	-	mA
		Pvbat			-	368.28	-	mW	
	Idle mode	IC	Vddio	10% Pixel On,50nits, 15Hz	Ivddio	-	1.02	-	mA
			Pvddio		-	1.836	-	mW	
		VBAT	10% Pixel On,50nits, 15Hz		Ivbat	-	10.27	-	mA
		Pvbat			-	37.99	-	mW	
Frame Rate		F _{frm}		-40℃~85℃	F _{frm}	55.2	60	64.8	Hz
				25℃		58.2	60	61.8	Hz

BOE	PRODUCT GROUP		REV.	ISSUE DATA
	AMOLED - PRODUCT		P1	20220303

5. Electro-optical Characteristics

Table 4

Item	Symbol	Temp	Condition	Min.	Typ.	Max.	Unit	Note
Normal Mode Brightness		25°C	Normal (White pattern)	450	500	550	cd/m ²	Center brightness
High Brightness Mode Brightness		25°C	Normal (White pattern)	-	-	-	cd/m ²	
Idle Mode Brightness		25°C	Normal (White pattern)	-	50	60	cd/m ²	
Uniformity		25°C	Normal (White pattern)	80	85	-	%	(1)
Contrast ratio	K	25°C	$\Phi=0^\circ, \theta=0^\circ$	100000	-	-		(2)
Color of CIE coordinate	White	x	$\Phi=0^\circ, \theta=0^\circ$ CIE1931	0.285	0.30	0.315	-	(3)
		y		0.295	0.31	0.325	-	
	Red	x		0.65	0.68	0.71	-	
		y		0.29	0.32	0.35	-	
	Green	x		0.205	0.245	0.285	-	
		y		0.675	0.715	0.755	-	
	Blue	x		0.121	0.141	0.161	-	
		y		0.023	0.043	0.063	-	
Color Gamut		25°C	NTSC, CIE1931	95	100	-	%	(3)
Viewing Angle		25°C	Up/Down/Right/Left CR ratio ≥ 10	80	85	-	°	(3)
Color temp		25°C	-	7000	7500	8000	K	
Crosstalk		25°C	Background: gray127	-	-	3	%	(4)
Color Shift(White)		25°C	30°	-	-	5	JNCD	(5)
Response time		25°C	-		2	3	ms	(6)
Lifetime		25°C	350nit T95	300	-	-		
Gamma		25°C		2.0	2.2	2.4		
Image Sticking		25°C	5x5 Chess box, 12h → G127	-	-	3	min	3min 后消失到L0.5水平, 基本不可见
			2x2 Chess box, 10s → G127	-	-	15	s	
Flicker		25°C	JEITA Method at 60Hz			-30	dB	@L255 灰阶

(1) Uniformity Measuring Point

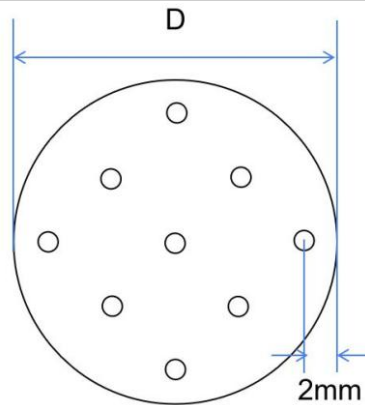


Figure 2

$$\text{Uniformity} = L_{\min} / L_{\max} * 100\%$$

(2) Definition of contrast ratio(K)

$$CR = \frac{\text{Luminance When Display panel is at "White" state}}{\text{Luminance When Display panel is at "Black" state}}$$

(3) Optical & viewing angle measuring system

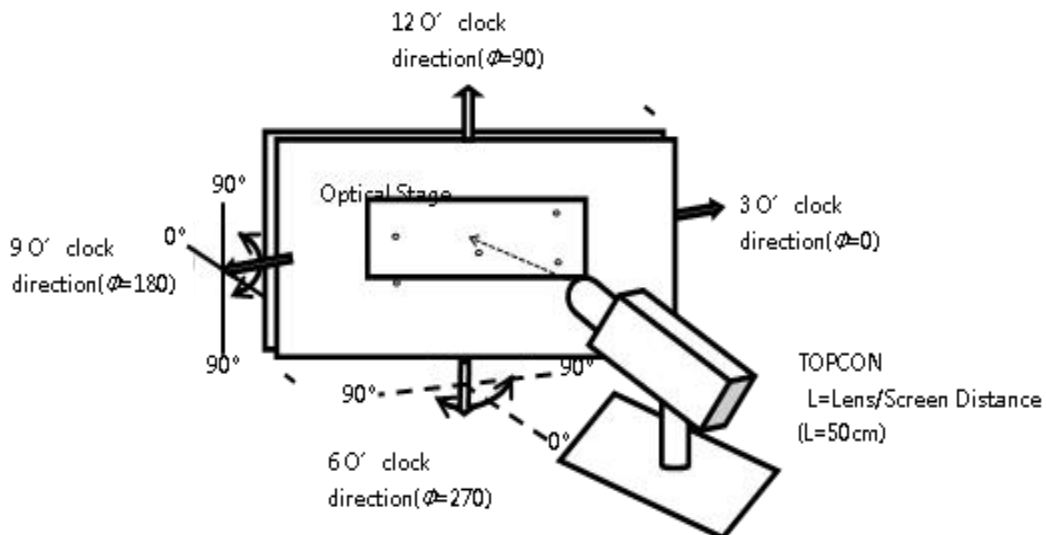


Figure 3. Viewing Angle measuring system

Definition of Color of CIE Coordinate and NTSC Ratio:

$$S = \frac{\text{Area of RGB triangle}}{\text{Area of NTSC triangle}} * 100\%$$

(4) Test crosstalk in dark room, use the pattern as figure 4. the center point of pattern, and the background gray level is 127.

$$LW_{OFF} = \frac{L1 + L2 + L3 + L4}{4}$$

$$CT1 = \left| \frac{LW1 - LW_{OFF}}{LW_{OFF}} \right| \times 100\%$$

$$CT2 = \left| \frac{LW2 - LW_{OFF}}{LW_{OFF}} \right| \times 100\%$$

$$CT3 = \left| \frac{LW3 - LW_{OFF}}{LW_{OFF}} \right| \times 100\%$$

$$CT4 = \left| \frac{LW4 - LW_{OFF}}{LW_{OFF}} \right| \times 100\%$$

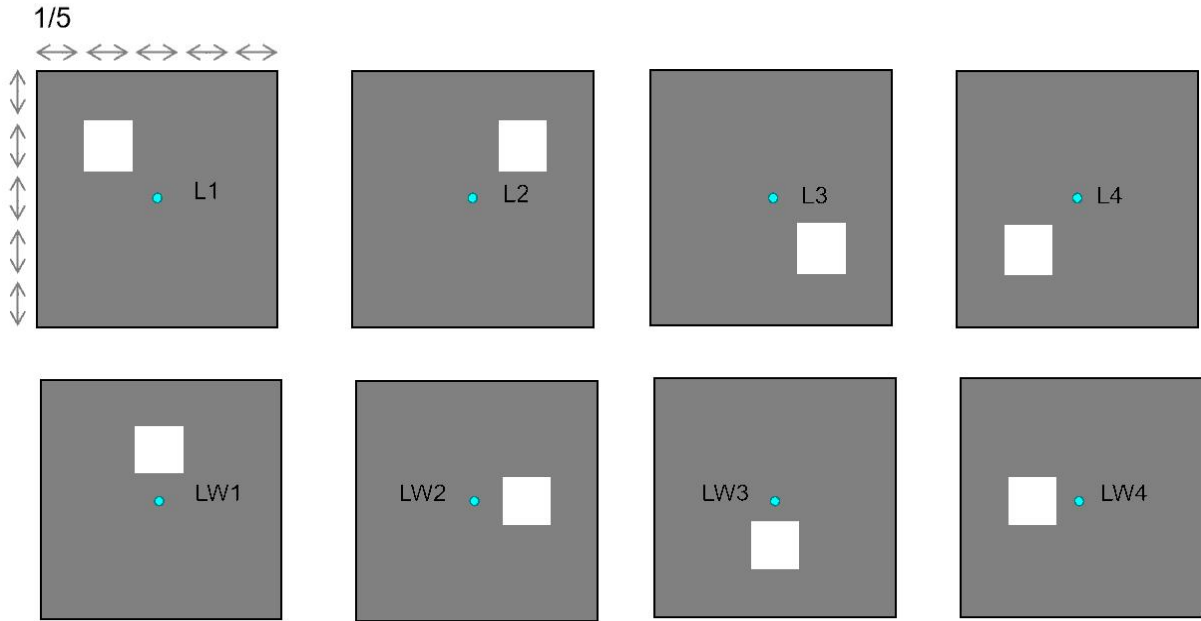


Figure 4. crosstalk measuring pattern

(5) Color Shift JNCD

For JNCD measure:

Fix on one pattern like white pattern,

On the condition $\theta=0$ $\phi=0^\circ$, we can get the color coordinate (u_1', v_1') and on 30° we can get another color coordinate (u_2', v_2')

$$\Delta = \text{Square Root}((u_2' - u_1')^2 + (v_2' - v_1')^2)$$

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 pattern

(6) The output signals of photo detector are measured when the input signals are changed from "black" to "white"(Voltage falling time) and from "white" to "black"(Voltage rising time), respectively. The response time is defined as the time interval between the 10% and 80% of amplitudes. Refer to figure as below:

	L0	L36	L73	L109	L146	L182	L219	L255
L0	Black	White	White	White	White	White	White	White
L36	White	Black	White	White	White	White	White	White
L73	White	White	Black	White	White	White	White	White
L109	White	White	White	Black	White	White	White	White
L146	White	White	White	White	Black	White	White	White
L182	White	White	White	White	White	Black	White	White
L219	White	White	White	White	White	White	Black	White
L255	White	White	White	White	White	White	White	Black

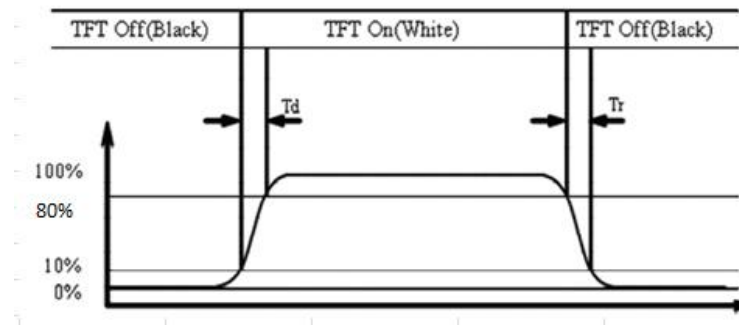


Figure 5

6. FPC Pin Assignment

Main FPC assignment- AMOLED Panel Input/output Signal Interface.

Connector: Kyocera OK-23GM030-04

Table 5

PinNo.	Pin Name	Type	Descriptions
1	GND	P	Ground
2	GND	P	Ground
3	LCM_CLKN	I/O	MIPI strobe negative signal
4	VCI_EN	I	Active high enable input pin for VCI
5	LCM_CLKP	I/O	MIPI strobe positive signal
6	GND	P	Ground
7	GND	P	Ground
8	LCD_IO(1.8V)	P	DIC Logic 1.8V
9	LCM_D1N	/	NC
10	GND	P	Ground
11	LCM_D1P	/	NC
12	LCD_RST	I	OLED Device reset signal (0 : enable ; 1 : Disable)
13	GND	P	Ground
14	LCM_ID	/	ID
15	LCM_D0N	I/O	MIPI data 1 negative signal
16	GND	P	Ground
17	LCM_D0P	I/O	MIPI data 1 positive signal
18	VCC_CTP	P	TP Power 2.8V
19	GND	P	Ground
20	GND	P	Ground
21	LCM_TE	O	Synchronous signal output from panel to avoid tearing effect
22	CTP_RST	I	TP reset signal
23	VPP	P	MTP OLED

24	CTP_INT	I	TP INT signal
25	GND	P	Ground
26	TP_TWI2_SDA	I/O	TP I ² C data.
27	VBAT	P	PMIC input power
28	TP_TWI2_SCK	I	TP I ² C clock.
29	VBAT	P	PMIC input power
30	GND	P	Ground

<Pin layout of B-to-B contact pads>

7. AC Characteristics (For reference only)

7-1-1. DC Characteristics for MIPI DSI

Table 6

Signal	Symbol	Parameter	Min.	Typ.	Max.	Unit	Note
HS_RX	V _{IDTH}	Differential input high threshold			70	mV	-
	V _{IDTL}	Differential input low threshold	-70				-
	V _{IHHS}	Single-ended input high voltage			460		1
	V _{ILHS}	Single-ended input low voltage	-40				1
	V _{CMRX(DC)}	Common-mode voltage HS receive mode	70		330		1-2
	Z _{ID}	Differential input impedance	80	100	125	Ω	-
LP_RX	V _{IL}	Logic0 voltage not in ULP State	0		550	mV	
	V _{IH}	Logic1 input voltage	880		1350	mV	
	V _{LEAK}	I/O leakage current					
LP_TX	V _{OL}	The venin output low level	-50		50	mV	
	V _{OH}	The venin output high level	1.1	1.2	1.3	V	
	Z _{OLP}	Output impedance of LP transmitter					

Notes:

- 1、 Excluding possible additional RF interference of 100mV peak sine wave beyond 450MHz.
- 2、 This table value includes a ground difference of 50mV between the transmitter and the receiver, the static common-mode level tolerance and variations below 450MHz.

7-1-2. MIPI DSI High-Speed RX Clock and Data-Clock Timing

Table 7

Symbol	Parameter	Min.	Typ.	Max.	Unit	Notes
$T_{\text{SKEW[TX]}}$	Data to Clock Skew	-0.15		0.15	UI _{INST}	1
T_{SETUP}	Data to Clock Setup time	0.15			UI _{INST}	2
T_{HOLD}	Data to Clock Hold time	0.15			UI _{INST}	2
UI _{INST}	UI instantaneous	1.818		12.5	ns	3-4

Notes:

- 1、 Total silicon and package delay budget of $0.3 \cdot \text{UI}_{\text{INST}}$.
- 2、 Total setup and hold window for receiver of $0.3 \cdot \text{UI}_{\text{INST}}$.
- 3、 This value corresponds to a minimum 80 Mbps data rate.
- 4、 The minimum UI shall not be violated for any single bit period, i.e., any DDR half cycle within a data burst.

7-1-3. Timing Parameters:

Table 8

Parameter	Description	Spec.			Unit
		Min.	Typ.	Max.	
$T_{\text{CLK-POST}}$	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 $T_{\text{HS-TRAIL}}$ to beginning of $T_{\text{CLK-TRAIL}}$	$60\text{ns} + 52 \cdot \text{UI}$			
$T_{\text{CLK-PRE}}$	Time that the HS clock shall be driver by the transmitter prior to any associated Data Lane beginning the transition from LP to HS mode.	8			UI
$T_{\text{CLK-PREPARE}}$	Time that the transmitter drives the Clock Lane LP-00 Line state immediately before the HS-00 Line state starting the HS transmission.	38		95	ns
$T_{\text{CLK-TERM-EN}}$	Time for the Clock Lane receiver to enable the HS line termination, starting from the time point when Dn crosses V_{ILMAX} .			38	ns
$T_{\text{CLK-TRAL}}$	Time that the transmitter drives the HS-00 state after the last payload clock bit of a HS HS transmission burst.	60			ns
$T_{\text{CLK-PREPARE}} + T_{\text{CLK-ZERO}}$	$T_{\text{CLK-PREPARE}}$ + Time to that the transmitter drives the HS-00 state prior to starting the clock.	300			ns
$T_{\text{HS-EXIT}}$	Time that the transmitter drives LP-11 following HS burst.	300			ns
$T_{\text{HS-TRAIL}}$	Time that the transmitter drives the flipped differential state after last payload data bit of a HS transmission burst	$60\text{ns} + 4 \cdot \text{UI}$			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
$T_{HS-PREPARE}$	Time that the transmitter drives the Data Lane LP-00 Line state immediately before the HS-0 Line state starting the HS transmission	$40ns+4*UI$		$85ns+6*UI$	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 $V_{TERM-EN}$		$35ns+4*UI$	ns

7-3-1. Touch Panel I2C Timing Characteristics

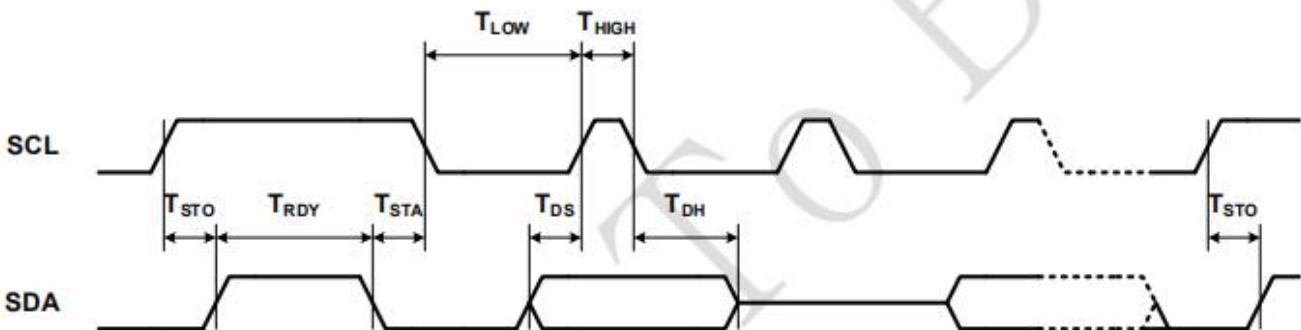


Figure 6

Table 9

SYMBOL	PARAMETER	FAST-MODE		HS-MODE		UNIT
		MIN	MAX	MIN	MAX	
F_{SCL}	SCL clock frequency	0	400	0	1000	KHz
T_{LOW}	LOW period of SCL	1300	-	500	-	ns
T_{HIGH}	HIGH period of SCL	600	-	260	-	ns
T_{STA}	Hold time for START condition	600	-	260	-	ns
T_{STO}	Setup time for STOP condition	600	-	260	-	ns
T_{DH}	Data hold time	0	900	0	900	ns
T_{DS}	Data set-up time	100	-	50	-	ns
T_{rC}	Rise time of SCL	20	300	20	120	ns
T_{fC}	Fall time of SCL	20	300	20	120	ns
T_{rD}	Rise Time of SDA	20	300	20	120	ns
T_{fD}	Fall time of SDA	20	300	20	120	ns
T_{RDY}	Ready time between STOP and START condition	20	-	20	-	us

7-3-2. Touch Specification

Table 10

No.	ITEM	SPEC	REMARK
1	Touch IC	ZT2628	Zinitix
2	Communication Protocol to Host	I2C	≤400KHz
3	Multi-Finger	Yes	/
4	I2C Address	/	
5	Touch Origination Dot	COF 对侧左上角	
6	Performance	Accuracy(Φ7mm)	Edge area<1.5mm Center area<1.0mm
		Linearity(Φ7mm)	Edge area<1.5mm Center area<1.0mm
		Jitter (Φ7mm)	<1.5mm
		Move Sensitivity	Φ4,5,6,7mm, 20mm/s
7	Structure	On-Cell MLOC	
8	Sensor Pitch	4.4336×4.3396	Unit: mm
9	Connector type /No.	/	NO connector
10	Low Temperature	-20℃	Operating test
11	Obvious ITO etching pattern	NO	

Note (1): Accuracy is determined by a comparison of the actual copper position and the reported position when the copper touch on the surface of touch.

1. Test Condition : Handset is on the insulated table.

2. Measurement equipment: Arm of robot with 7mm diameter copper.

3. Test procedure: Test touch panel with 7*9 points , each point 10 time.

4. The Accuracy is calculated by using following formula:

Calculate every distance from reported position to actual position (Each point contains 10 reported position dates)

Accuracy Error = square root $[(x_i - x_0)^2 + (y_i - y_0)^2]$ (i=1,2...10)

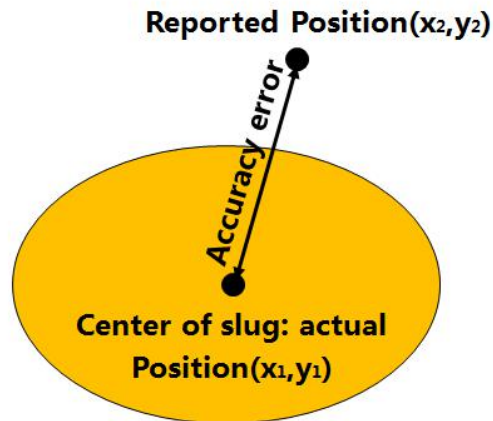


Figure 7

Note (2): Linearity is defined as the difference between reported finger positions versus the least square fitted line as the finger moves linearly across a specified trajectory of the Display panel area.

1. Test Condition : Handset is on the insulated table.
2. Measurement equipment: Arm of robot
3. Test procedure: Draw 8 line with 30mm/s by 7mm copper.
4. The Precision is calculated by using following formula:

Calculate the max ΔE for each line

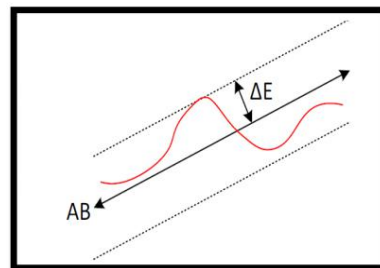
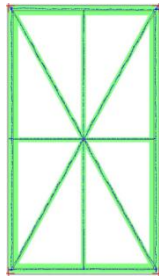


Figure 8

Note (3): Point sensitivity is determined by the minimum size finger that touch panel can detect. When the minimum size finger touch on the surface of touch, the touch can report to host exactly.

1. Test Condition : Handset is on the insulated table.
2. Measurement equipment: Arm of robot with 6mm diameter copper.
3. Test procedure: Test touch panel with 7*9 points , each point 10 times
4. The point sensitivity is calculated by using following formula:

Report Rate = Reported points/280*100%

Note (4): Move sensitivity is determined by the minimum size finger that touch panel can detect. When the minimum size finger draw on the surface of touch, the touch can report to host exactly.

1. Test Condition : Handset is on the insulated table.

2. Measurement equipment: Arm of robot

3. Test procedure: Draw 8 line with 30mm/s by 6mm copper

Standard: No missing point.

Note (5): Jitter is defined as the deltas of reported positions when a conductive copper is in stationary contact with the sensor cover lens. A total of hundred sequential samples are collected with each stationary contact of the Copper with the sensor cover lens.

1. Test Condition : Handset is on the insulated table.

2. Measurement equipment: Arm of robot with 6mm diameter copper.

3. Test procedure: Test 8 points in the touch for 1s

4. The Precision is calculated by using following formula:

Then we will get the result like below (Take point 1 as the example)

(1). calculate distance from each reported position to the rest of points

$$\text{Distance Error} = \text{square root} [(x_i - X_j)^2 + (y_i - y_j)^2] \quad (i=1,2,\dots,120, j=1,2,\dots,120)$$

(2). Select the maximum distance error from one to each one

$$\text{jitter 1} = \max(\text{error 1}, \text{error 2}, \dots, \text{error 120})$$

(3). Repeat 1 to 2 for the other 7 point as the jitter value

(4). Select the maximum value as our test result

$$\text{jitter} = \max(\text{jitter1}, \text{jitter 2}, \dots, \text{jitter 8})$$

Note (6): Anti-water:

The presence of moisture on the surface of touch can affect touch performance. Performance will vary based on the amount of moisture and its properties. In the test we will define the basic requirement in the document.

Method:

Drop: Size : \varnothing 10 mm diameter drop, 4 drops

Spray size: 3ml once

Procedure:

Test 1-drop test:

Step 1: Make 4 drops water on the surface of touch, each drop with 10mm diameter.

Step 2: Test the area (without water area) handwork, and test it again after wiped off water

Step 3: Observe whether the water area report ghost finger

8. Recommended Operating Sequence

8-1. Display Power on/off Sequence

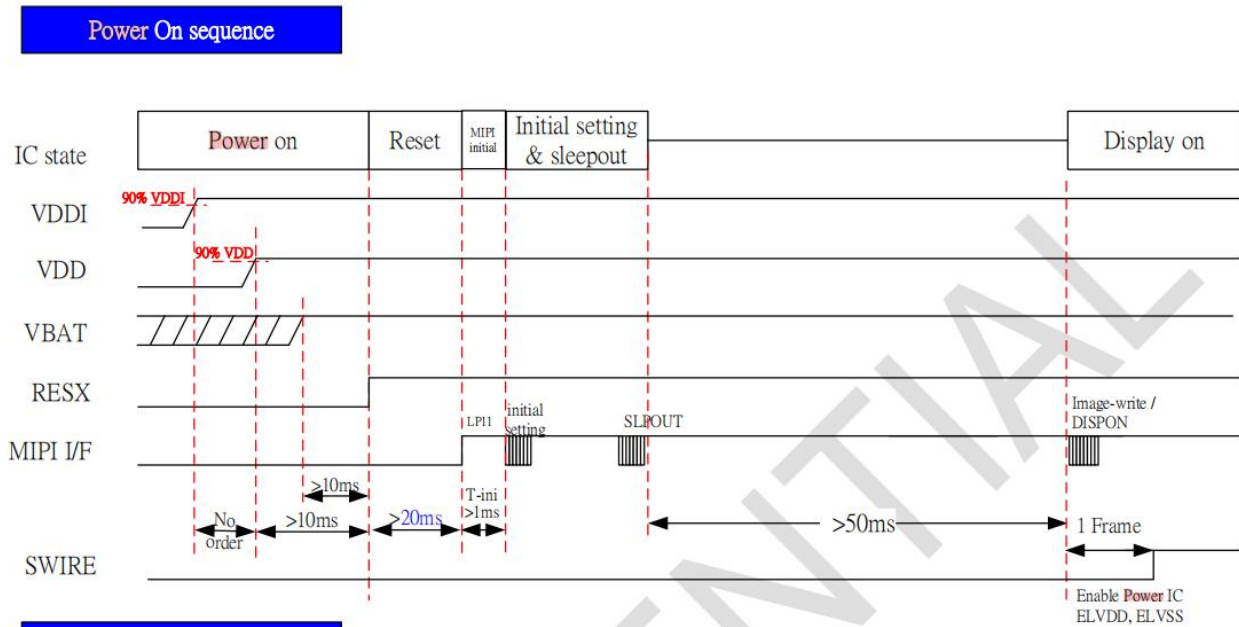


Figure 9 Power On Sequence

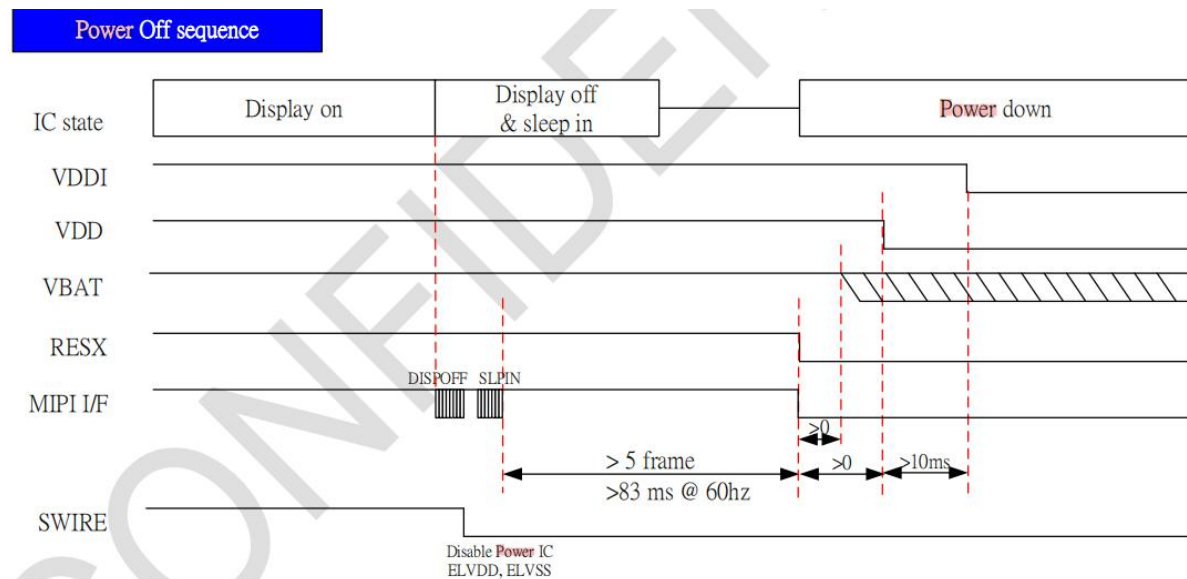
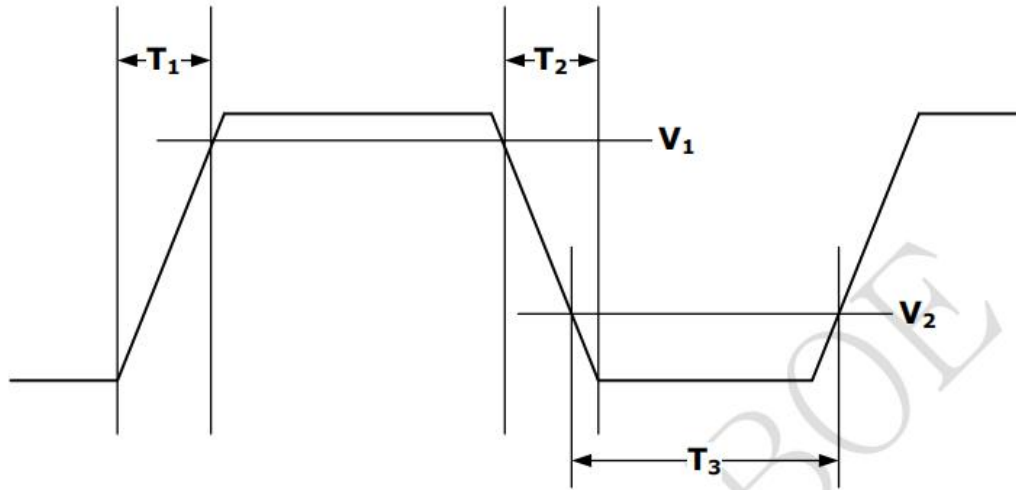


Figure 10 Power Off Sequence

8-2. Touch Panel Power on Sequence



SYMBOL	PARAMETER	MIN	MAX	UNIT
T_1	Power-on time	-	10ms@ $V_1=2.5V$	ms
T_2	Power-off time	-	10ms@ $V_2=0.3V$	ms
T_3	From power-off to power-on time	20	-	ms

Figure 11

9. Outline Information

9-1. Total Outline

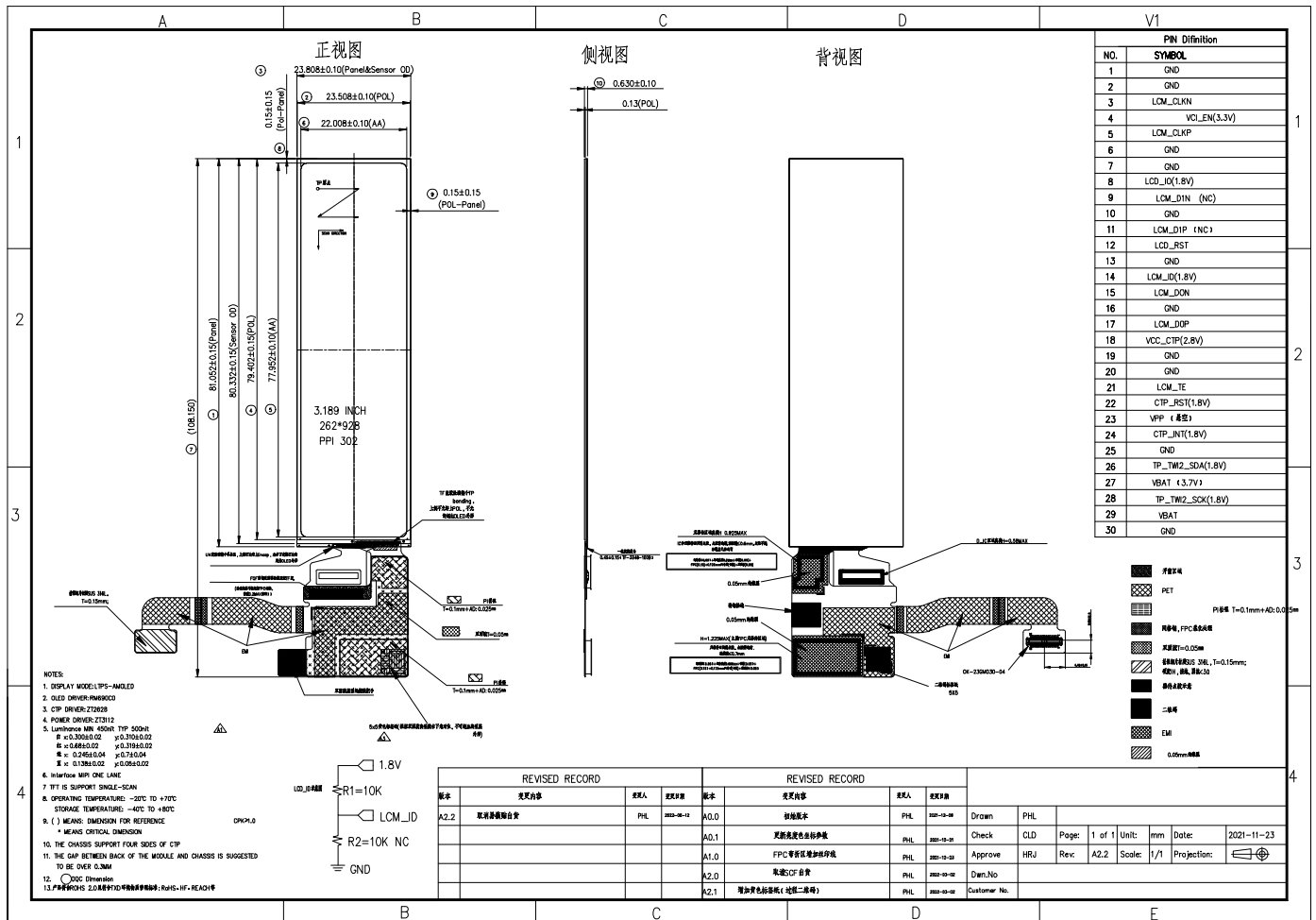


Figure 12

9-2. Main FPCB & TSP FPCB Drawing

9-2-1. Main FPC & TSP FPC Schematic Diagram

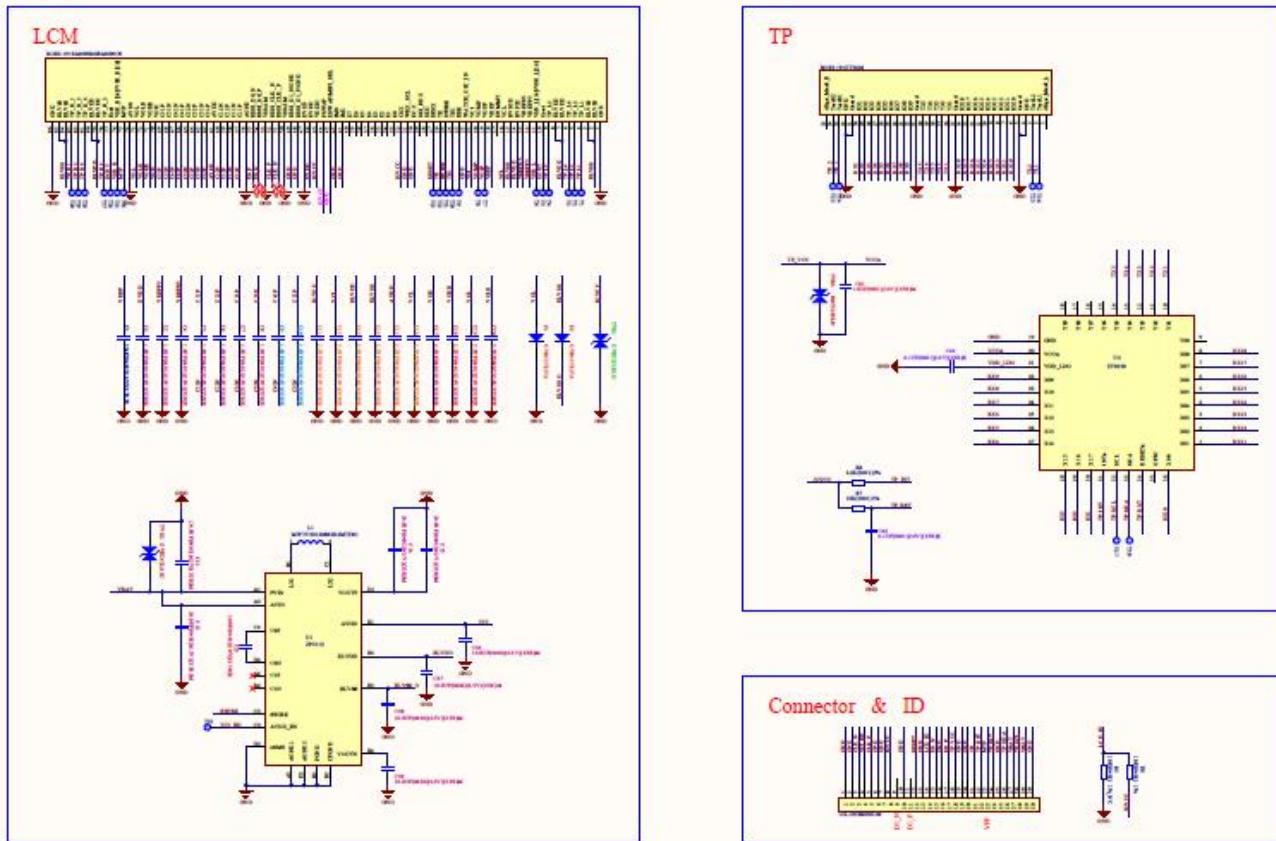


Figure 13

9-2-2.Main FPC & TSP FPC Electronic Part List

Table 11

CATEGORY	REFERENCE	SPECIFICATION/PN	Qty	Maker
CAPACITOR	C1	22nF/16V/0402/X7R	1	Murata
	C42,C43	0.1uF/10V/0201/X5R	2	
	C41	1.0uF/10V/0201/X5R	1	
	C2-C8,C33	1.0uF/10V/0402/X5R	8	
	C9, C10	1.0uF/16V/0402/X5R	2	
	C11-C16	2.2uF/10V/0402/X5R	6	
	C17-C20	2.2uF/16V/0402/X5R	4	
CONNECTOR	J30	OK-23GM030-04	1	亚奇
DIODE	D1, D2	OVB32TL37A	2	欧跃
INDUCTANCE	L1	HTTH2012FE-2R2MSR	1	乾坤
Resistor	R8	2.2K (0201) ±1%	1	厚生
	R7	10K (0201) ±1%		厚生
	R6	10K (0402) ±1%		厚生

BOE	PRODUCT GROUP			REV.	ISSUE DATA
	AMOLED - PRODUCT			P1	20220303

PMIC	U1	ZP3112	1	ZINITIX
TP IC	U2	ZT2628	1	ZINITIX
TVS	TVS1	OVE3232R1G	1	欧跃
	TVS2	OVE2432A1G	1	欧跃
	TVS3	RST5265LN	1	欧跃

10. Code Information

10-1. Power on Initial Code

```
VDDI/VCI power on; //No order
wait 10ms;
Reset pull high;
wait 10ms;
mipi LP11;
wait 1ms;
mipi 0x15 0xFE 0x00;
mipi 0x15 0x35 0x00;
mipi 0x39 0x2A 0x00 0x00 0x01 0x05;
mipi 0x39 0x2B 0x00 0x00 0x03 0x9F;
mipi 0x39 0x31 0x00 0x01 0x01 0x04;
mipi 0x39 0x30 0x00 0x01 0x03 0x9E;
mipi 0x15 0x51 0xFF;
mipi 0x05 0x11;
wait 120ms;
mipi 0x05 0x29
```

10-2. Power off Code

```
mipi 0x05 0x28;
mipi 0x05 0x10
wait 5 Frames;// 83ms@60Hz
mipi low;
reset pull low;
VCI power off;
wait 10ms;
VDDI power off;
```

10-3. Enter Idle Mode Code

```
Black pattern;
mipi 0x15 0xFE 0x00;
```

mipi 0x05 0x39;
 wait 50ms;//AOD mode patterns can be sent to module in this period.
 mipi 0x15 0x51 0x5A;
 mipi 0x15 0xFE 0x00;

10-4. Exit Idle Mode Code

mipi 0x15 0xFE 0x00;
 mipi 0x15 0x51 0xFF;
 Black pattern;
 wait 50ms;// Normal mode patterns can not be sent to module in t

11. Reliability TEST

Table 12

ITEM		Condition
Environment Reliability	Thermal Humidity Operating test (THO)	+60°C,90%RH, 240h
	Low Temperature Operating test (LTO)	-20°C, 240h
	High Temperature Operating test (HTO)	+70°C,240h
	High Temperature Storage test(HTS)	80°C, 240h
	Low Temperature Storage test (LTS)	-40°C,240h
	Thermal Cycle Storage test (TST)	-40°C~+80°C,storage,1h/cycle,100cycle
	Salt fog test	35°C ± 2°C,PH: 6.5-7.2,NaCl: 5% ± 1%,24h
Electrical reliability	Power Off (100pF + 1500 ohm)	(Contact) ±2KV/100pF+1500 ohm
	Power On (150pF+330ohm)	(Contact) ±4kv/150pF + 330 ohm (Air) ±6kv/150pF + 330 ohm

Judgment criteria: no functional failures

12. Handling Precautions

12-1. Mounting Method

The AMOLED panel module can easily get damaged. Since the module is constructed as to be fixed by utilizing fitting holes in the printed circuit board. Extreme care should be used when handling the AMOLED modules.

12-2. Caution of AMOLED Handling and Cleaning

When cleaning the display surface, use soft cloth solvent as recommended below and wipe gently.

- Ethyl alcohol

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface. Do not use the following solvent.

- Water
- Ketone
- Aromatics

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns. Do not use the following solvent on the pad and prevent it from being contaminated.

- Soldering flux
- Chlorine(Cl), Sulfur(S)
- Spittle, Fingerprint

If the product is not wrapped with a desiccant added pad, ITO pattern can be damaged by corrosion. BOE suggests wrapping a product with a desiccant unless customers particularly indicate that they do not want it. In case ITO pattern corrodes due to the usage of chlorine, sulfur or customer's mishandling of the product, the responsibility lies with the customer.

12-3. Caution against Static Charge

For AMOLED module, use C-MOS LSI drivers, therefore we recommend that you ; Connect any unused input terminal to Panel, do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity. It could occur static electricity when taping off the film which protects AMOLED. Against static charge, you should make sure that the product is safe or not by experiment in advance.

12-4. Packing

- The packing principle is that AMOLED module should keep its packing condition at the time of delivery.
- For safety & avoiding the module damage, Carton box must stack the below boxes. When storing the AMOLED after unpacking, note the followings.
- AMOLED module is consisted of flexible materials. It should avoid pressure, especially the back and edge of the product. It should avoid strong impact, and being dropped from a height.
- To prevent modules from degradation, do not operate or store them in a place where they are directly exposed to sunlight or high temperature/humidity.

12-5. Caution for Operation

- If you do not follow normal POWER ON, OFF sequence or abnormal operating, then AMOLED module can be damaged electro-optically and does not recover. Do not change software without BOE confirmation.
- Response time may extremely delay at a temperature lower than operating range; AMOLED does not normally operate at a high temperature. But this may recover at a proper temperature.
- When you set optimal operating voltage to AMOLED module, you can see the optimal contrast of AMOLED. So, add voltage controllable function at SET Module.
- AMOLED module may not display normally when abnormal power or pressing power is added. Therefore you should secure AMOLED module maximum power at set not to have any pressure affect AMOLED module.
- Electro-chemical reaction may occur when there is humidity on pad; therefore, you should use AMOLED Module below maximum operating humidity.
- AMOLED Module Power Vdd should be designed to protect surge current at SET Module.
- You should not damage connector and cable for AMOLED module assembly by force folding or by applying extreme power.
- AMOLED may not display normally when it is interfered by surrounding elements, therefore you should consider setting design not to damage AMOLED module by surrounding elements.
- To satisfy EMI standards, you should plan your design after considering emitting energy.
- We cannot guarantee display characteristics outside viewing area, therefore your set window should be fixed into viewing area.
- Image-sticking may occur if AMOLED displays same image for a long time, so you need to make a change for AMOLED.
- When remove the window protective film, necessarily need to apply as a way to prevent Cushion and conductive tape Delamination.
 - As an upper Figure, the handler takes off the direction of the arrow to remove the protective film.

12-6. Storage

- Place in a dark place where neither exposure to direct sunlight nor any fluorescent light is permitted and keep at room temperature & room humidity.
- Store with no contact with product surface.

[It is recommended to store them as they have been contained in the inner container when we delivered them.]

12-7. Safety Precautions

- Disassembly or modification may cause electric shock, damages to sensitive part inside of the AMOLED module, dust adhesion, or scratches on the display part.
- In the event that the contents of AMOLED module are on skin, wipe them with a paper towel or gauge and wash the part well, and receive medical attention if necessary.
- Do not use the AMOLED module for the special purpose besides display units.
- Be careful of the glass chips that may cause injury to fingers of skin, when the display part is broken.
- For keeping safe quality from outer exposure or contamination, modules should be consumed within 2

months after unpacking.

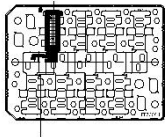
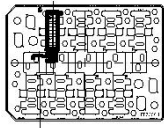
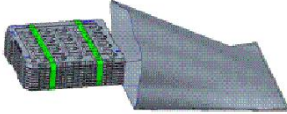
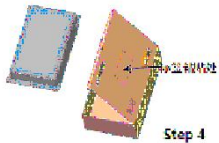


12-8. Precautions before use

You should discuss the following case with BOE.

- In case of any questions about contents of this Specification.
- In case of occurring new problems not mentioned at this Specification.
- In case of your request about income inspection specification change.
- In case of occurring new problem at your driving test.
- ◆ If BOE has to change the conditions specified in the specification, previously the negotiation shall be held and decided.


13. Packing Specification

13-1. Box Pack

<p>1.托堆物料箱内依次放入8 pcs 产品显示面朝上，上下各放一张珍珠棉</p> 	<p>2.堆叠方式为8 EA满托堆+1 EA空托堆（顶部）</p> 	<p>3.托堆堆叠后采用2条美纹胶捆绑后，再用1个真空袋包装，抽真空的压力为4.0 KPa</p> 	<p>4.1个 inner box装 1个真空袋包装，并贴1张 inner box标签，然后密封</p>  <p style="text-align: right;">Step 4</p>
<p>5.1个 outer box 装 6个 inner box</p>  <p style="text-align: right;">Step 5</p>	<p>6.outer box按照2×2×4堆叠(栈板尺寸：1200*800*150mm)，8边放置纸护角，缠绕拉伸膜，缠绕层数3层（四周及顶面），最后纵向4根打包带，横向2根打包带，并粘贴 1张标签</p>  <p style="text-align: right;">Step 6</p>		

NOTE:

1. 符合TXD环境物质管理标准：RoHS、HF、REACH标准

REVISED RECORD		BOE							
A		Drawn	PHL	Page:	2 of 6	Unit:	mm	Date:	2017-10-16
B		Check	CLD	Rev:	Λ0	Scale:	1/1	Projection:	
C		Approve	HRJ	TDM320ECGP-IV2 包装示意图					
D		Down.No							
E									