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AMOLED

Product Specification

Model Name: E1473AC63.B

Description: 1.47"

Doc. Version: 01

Customer: XM

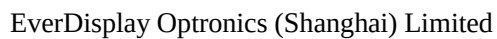
☒ Approved for Preliminary Specification

☐ Approved for Final Specification

☐ Approved for Final Specification & Sample

Prepared	Checked	Approved
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Customer's Approval



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1 Scope

This Specification defines AMOLED manufactured by EverDisplay Optronics(Shanghai) Limited, from here on refer as EDO. In the case of any unspecified item, it may require both EDO and the party designs this module into its product to work out a solution.

2 Features

2.1 Product Applications

Display/Touch terminals for Smart Watch

2.2 Product Features

- 1) Display color: 16.7M (RGB x 24bits)
- 2) Display format: 1.47"(194 RGB*368)
- 3) Pixel arrangement: Real RGB arrangement
- 4) Interface: Quad SPI
- 5) Driver IC: SH8501B (COF)
- 6) On cell touch sensor
- 7) Pixel format: **only** support 16bit GBRG 3553

3 Mechanical Specifications

Item	Specification	unit
LTPS Glass outline	19.36(V) x 36.17(W)	mm
Encapsulation Glass outline	19.36(V) x 35.42(W)	mm
Number of dots	194(W) x RGB x 368(H)	dots
Active area	17.46*33.12	mm
Diagonal size	1.47	inch
Pixel pitch	90*90	μm
Glass thickness (LTPS/Encap. Glass/POL)	0.2/0.3/0.147	mm
Weight	TBD	g

4 Maximum Rating

Parameter	Symbol	Spec			Unit	Note
		Min.	Typ.	Max.		
Analog/boost power voltage	VCI	3.2	3.3	3.4	V	-
I/O voltage	VDDIO	1.7	1.8	1.9	V	-

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Operating temperature	Top	-20	-	70	°C	-
Storage temperature	Tstg	-30	-	80	°C	-

5 Electrical Specifications

5.1 Electrical Characteristics

5.1.1 Power Characteristic:

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
AMOLED Power positive	ELVDD	3.2	3.3	3.4	V	-
AMOLED power Negative	ELVSS	-3.4	-3.3	-3.2	V	Ref
Digital Power supply	VDDIO	1.7	1.8	1.9	V	Ref
Analog Power supply	VCI	3.2	3.3	3.4	V	Ref

1) Normal Mode

Power Supply: VDDIO=1.8V VCI=3.3V ELVDD=3.3V,ELVSS=-3.3V

Frame Frequency: F_{frame}=60HZ @ 25degC, Brightness 450 nits,

Display Condition	Symbol	Min.	Typ.	Max.	Unit	Remark
100% Pixel On,450nits	Normal mode	-	110	130	mW	Ref

2) Idle Mode

Power Supply: VDDIO=1.8V VCI=3.3

Frame Frequency: F_{frame}=15HZ @ 25degC, Brightness 50 nits,

Display Condition	Symbol	Min.	Typ.	Max.	Unit	Remark
10% Pixel On,50nits	Idle mode	-	6.5	8.2	mW	Ref

3) Deep Standby Mode

Display Condition	Symbol	Min.	Typ.	Max.	Unit	Remark
All Pixel Off,0nits/ Vci off/Vddio on	Standby mode	-	-	50	μW	-

5.2 Driver IC

SH8501B (refer to the datasheet)

5.3 TP IC

ZTW622

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5.3.1 Basic Specifications

No.	Item	Specification	Description	Remark
1	Project ID	10 Bytes		1.The ninth byte increased by 1 if sensor or circuit changed and cannot use one TP FW compatible for them. 2.No need to read it by FW
2	Communication Protocol to Host	I2C		
3	I2C Address	TBD		
4	Touch Origination Dot	Left-up		Refer AMOLED
5	Finger	2		
6	Respond Time(60HZ~120HZ)	Active: 18 ms(Avg)/ 30ms(Max)		Active mode
	Response Time(60HZ~120HZ)	TBD		Doze mode
7	Point Sensitivity	≤Φ5mm	Report Percentage=100% (Both center area and edge area)	Arm of robot with 5mm diameter copper
8	Accuracy(Φ7mm)	Edge area<2.0mm Center area<1.5mm		
9	Precision(Φ7mm)	Edge area <0.5mm Center area <0.4mm		
10	Jitter (Φ7mm)	Edge area <0.5mm Center area <0.4mm		
11	Move Sensitivity	≤Φ 5mm		
12	Linearity (Φ7mm)	Edge area <2.0mm Center area <1.5mm		
13	Adjacent Finger	Finger Distance <15mm	Center to Center	

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14	Palm & Face	Ø14mm		
15	Water Proof	Refer to Note 1	1.No ghost finger, 2.No fault ID 3.No sensitivity reduce when water wiped off	Note 1
16	Move with low speed (2mm/s)-Handwork	NO fault ID, especial missing point near edge area		
17	Fast drawing(1 fingers)-Handwork	NO fault ID report to host interface	Touch Panel must detect touch ID fast and exactly	
18	Fast Tap (2 fingers)-Handwork	NO fault ID report to host interface		
19	Common-mode interference	$\geq 2.5V_{pp}$	1.Input wave: Sine Wave Frequency: <500KHz 2. support standard Charger	
20	Ripple interference	100mv	Based on Power typ. Value mentioned in item7.2	

5.3.2 Waterproof touch Requirement

No	Item	Water proof	Remark
1	Water Spray Test	1.No ghost finger, 2.No fault ID 3.No sensitivity reduce when water wiped off	
2	Drop Test	1.No ghost finger reported to host 2.Wipe off water the water area 3.No sensitivity reduce when water wiped off	
3	Bathroom Test	1.No ghost finger, 2.No fault ID 3.No sensitivity reduce when water wiped off	

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3	Wash with running water	1.No ghost finger reported to host 2.Wipe off water the water area	
4	Operate with Wet finger	1.No ghost finger, 2.No fault ID 3.No sensitivity reduce when water wiped off	
5	Operate with Sweat	1.No ghost finger, 2.No fault ID 3.No sensitivity reduce when water wiped off	

5.3.3 Touch IC Specifications

NO.	Item	Specification	Description	Remark
1	Communication Host I2C to Host		Speed: $\geq 400\text{KHZ}$	
2	SPI Communication to Host	NO		
3	Main Oscillator Frequency Shift	$\leq 3\%$	1, (Max – Min)/Max 2, between $-20^{\circ}\text{C} \sim 60^{\circ}\text{C}$	
4	Auxiliary Oscillator Frequency Shift	$\leq 15\%$	1, (Max – Min)/Max 2, between $-20^{\circ}\text{C} \sim 60^{\circ}\text{C}$	
5	Power on latency	$\leq 100\text{ ms}$	from power up to the 1st Frame	
6	Maximum Sensing Frequency	$\geq 500\text{ KHz}$	Tx Sensing Frequency	
7	Minimum Sensing Frequency	$\leq 50\text{ KHz}$	Tx Sensing Frequency	
8	Sensing Frequency resolution	$\leq 5\text{ KHz}$		
9	Software Update	Must support	1, If FW update fails for some reason, IC must have secured bootloader section which can inform host the project code etc. and start re-flash operation per host command 2, Can not affect the other information	
11	Calibration time	If the IC need do Calibration	1,must calibrate and save in factory 2, driver can calibrate the IC automatically	no manual calibration

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12		<200 ms	Calibration must be done in 200ms	
13	Timing request	Mode Switching Latency from idle mode to active mode less than_ <u>16</u> ms		

Reference :

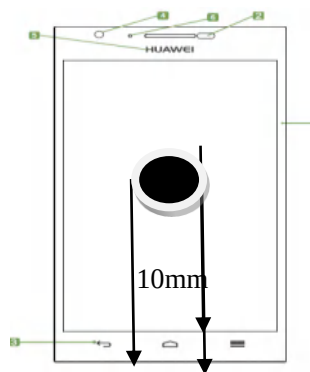
Note 1 : TP Water Proof

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 particular requirement in the document.

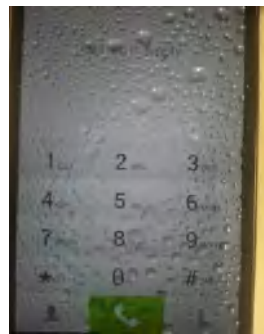
Test procedure:

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

Spray size: 3ml once



Water Drop



Water Spray Test

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

Test 2-Spray test:

Step 1: Spray the water on the surface of touch for 3ml.

Step 2: Keep the water on the surface of touch for 60 seconds.

Step 3: Wipe off the water then test the function

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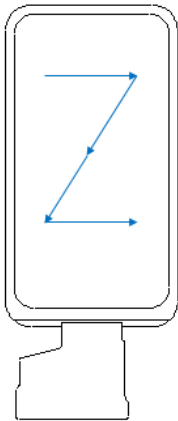
5.4 I/O Connection

5.4.1 Main FPC Bonding PAD Define

Pin No.	Symbol	I/O	Function Description
1	TP_OPT_VDDIO	I/O	1.8V power for TP&OPTIC
2	GND	Power	Ground
3	OPTIC_INT	I/O	ALS INT
4	TP_OPT_I2C_SDA	I/O	TP & OPT I2C DATA
5	TP_OPT_I2C_SCL	I/O	TP & OPT I2C CLK
6	TP_VDD	Power	2.8V power for TP
7	GND	Power	Ground
8	AM_SPI_CSX	I	OLED QSPI interface
9	AM_SPI_SCL	I	OLED QSPI interface
10	REST	I	OLED Device reset signal(0:enable;1:Disable)
11	GND	Power	Ground
12	TE	O	Synchronous signal output from panel to avoid tearing effect
13	VDDIO	Power	OLED Power supply for interface system
14	GND	Power	Ground
15	ELVDD	Power	OLED Power Supply
16	ELVDD	Power	OLED Power Supply
17	GND	Power	Ground
18	GND	Power	Ground
19	ELVSS	Power	OLED Power Supply
20	ELVSS	Power	OLED Power Supply
21	SWDIO(NC)	-	Floating
22	VCI	Power	AMOLED power
23	GND	Power	Ground
24	Swire	I	Swire control interface.
25	AM_SPI_SD0	I/O	OLED QSPI interface
26	AM_SPI_SD1	I/O	OLED QSPI interface
27	AM_SPI_SD2	I/O	OLED QSPI interface
28	AM_SPI_SD3	I/O	OLED QSPI interface
29	NC (MTP)	--	Floating
30	TP_RST	I/O	TP Reset
31	TP_INT	I/O	TP INT
32	GND	Power	Ground
33	NFC_P	I/O	NFC TX1
34	NFC_N	I/O	NFC TX2

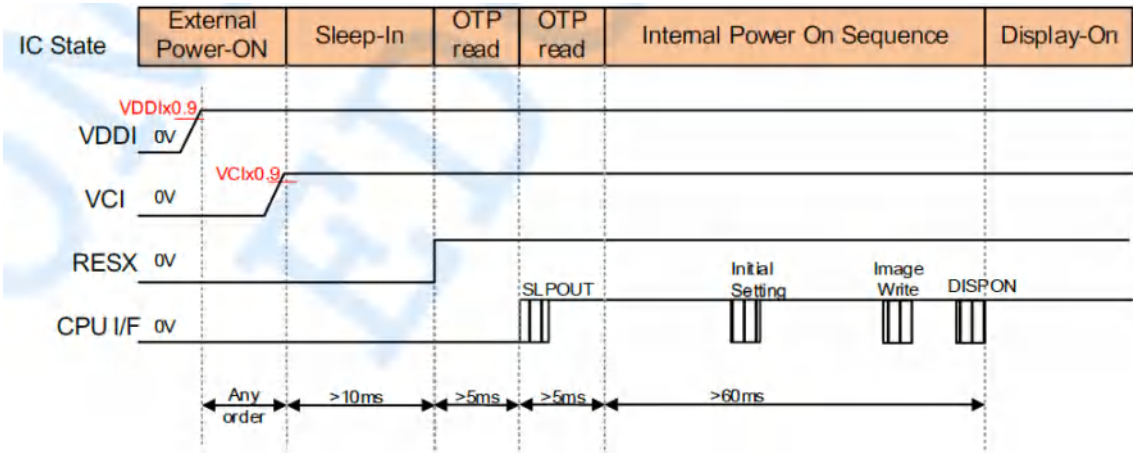
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5.5 Graphic memory writing direction

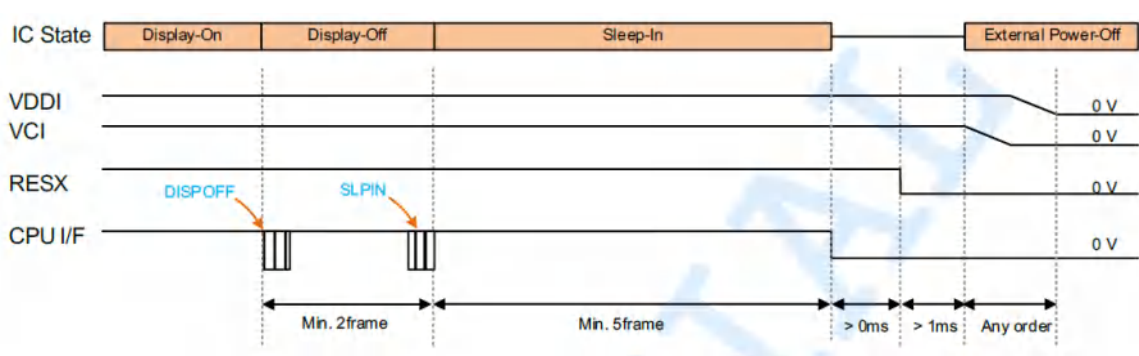


5.6 Recommended Operating Sequence

5.6.1 Power on sequence



5.6.2 Power off sequence



5.6.3 Quad SPI Interface Characteristics



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5.6.4 Display Reset Timing

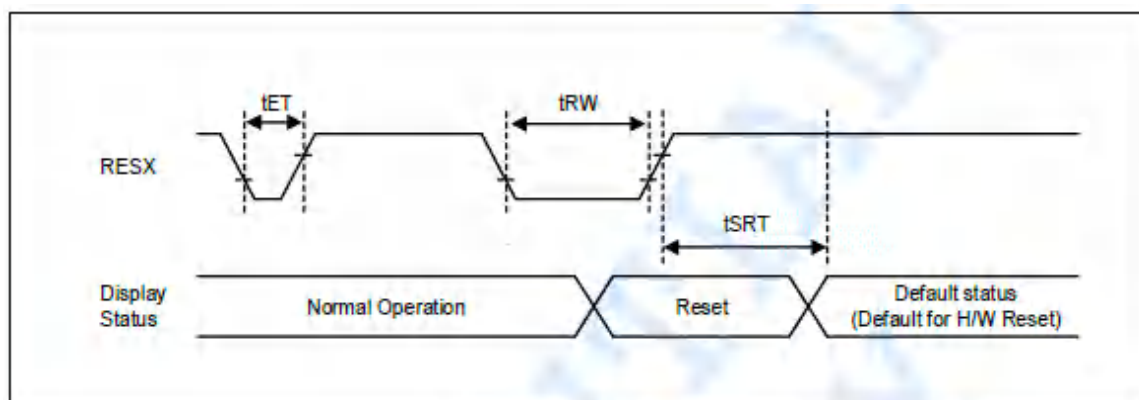


Figure 1 Reset Input Timing



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Table 11 Reset Input Timing

Parameter	Symbol	Pad	Min.	Typ.	Max.	Unit	Note
Reset low pulse width	tRW	RESX	10	—	—	μs	—
Secure reset completion time	tSRT	RESX	—	—	5	ms	Reset during Sleep In mode
		RESX	—	—	150		Reset during Sleep Out mode
Reset un-reacted pulse width	tET	RESX	—	—	5	μs	—

NOTE:

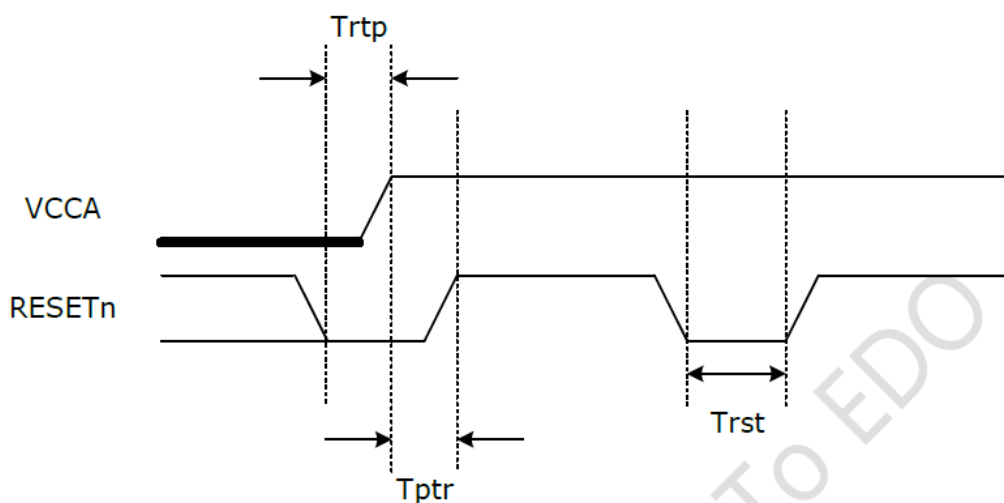
1. Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below.

Table 12 RESX Pulse

RESX Pulse	Action
Shorter than 5 μs	Reset rejected
Longer than 10 μs	Reset
Between 5 μs and 10 μs	Reset start

2. During the reset period, the display will be blanked (The display is entering blanking sequence, for which the maximum time is 60ms, when Reset starts in Sleep Out-mode. The display remains in the blank state in Sleep In-mode) and then return to Default condition for H/W reset.
3. During Reset Completion Time, 10 bytes (or similar) value in OTP will be latched to the internal register during this period. This loading is done every time when there is H/W reset complete time (tSRT) within 5ms after a rising edge of RESX.

5.6.5 TP Reset Timing



SYMBOL	PARAMETER	MIN	MAX	UNIT
T _{trp}	Reset to low time before power-on	0	—	us
T _{ptr}	Reset time after power-on	1	—	ms
T _{rst}	Reset time	1	—	ms

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6 Electro-Optical Specification

Test condition: IOVCC=1.8V , VCI=3.3V ,Ta=25℃

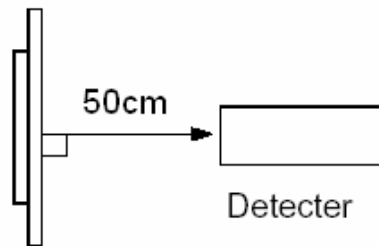
Item		Symbol	Condition	Value			Unit	Note
				Min	Typ	Max		
Luminance			θ=0°	400	450	500	cd/m2	Note 1
Uniformity				85		-	%	Note 2
Viewing Angle	Left	θ _L	Cr≥200	80	85	-	Deg.	Note 3
	Right	θ _R		80	85	-		
	Top	ψ _T		80	85	-		
	Bottom	ψ _B		80	85	-		
Contrast Ratio		CR	θ=0°	50000	100000	-	-	Note 4
Response Time		Tr+Tf		-	2	3	ms	Note 5
Color Coordinate of CIE1931	Red	X	θ=0°	0.656	0.686	0.716	-	-
		Y		0.283	0.313	0.343		
	Green	X		0.195	0.235	0.275		
		Y		0.685	0.725	0.765		
	Blue	X		0.113	0.143	0.173		
		Y		0.014	0.044	0.074		
	White	X		0.28	0.30	0.32		
		Y		0.29	0.31	0.33		
NTSC Ratio		NTSC	CIE1931		100	-	%	-
Flicker		-	-	-	-	-30	dB	-
Gamma		-	-	1.9	2.2	2.5		Note 6
Crosstalk		ΔCT	-	-	-	1.1		Note 7
Color shift		θL=30°				6	JNCD	
OLED Life Time		0.95*(TYP brightness) At 25℃,with white color pattern		200			hrs	Note8

Note 1: Luminance measurement

The test condition is measured on the surface of AMOLED module at 25℃.

- Measurement equipment CS2000 or similar equipment (Field of view:1deg,Distance:50cm)
- Measuring surroundings: Dark room.
- Measuring temperature: Ta=25℃.
- Adjust operating voltage to get optimum contrast at the center of the display.

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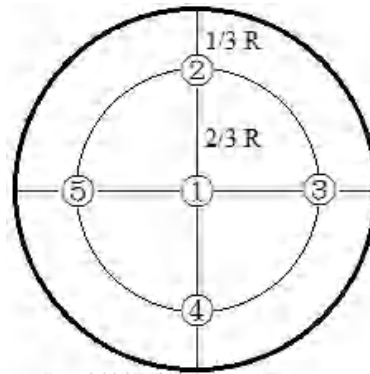
Note 2: Uniformity

The luminance uniformity is calculated by using following formula:

$$\Delta Bp = Bp (\text{Min.}) / Bp (\text{Max.}) \times 100 (\%)$$

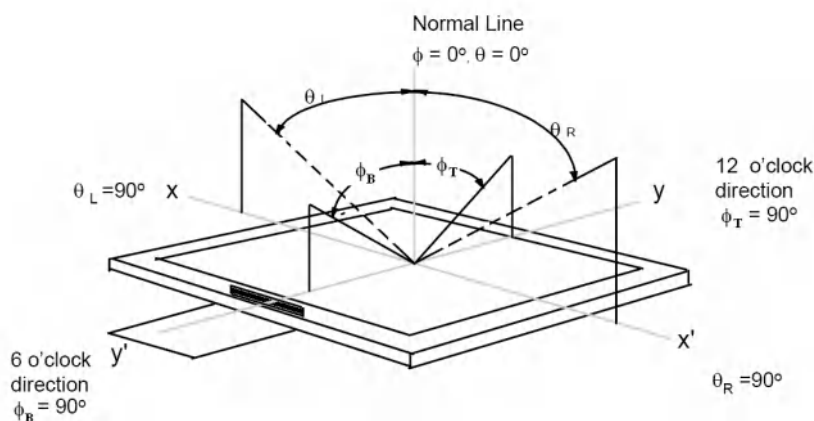
Bp (Max.) = Maximum brightness in 5 measured spots

Bp (Min.) = Minimum brightness in 5 measured spots.



Note 3: The definition of Viewing Angle

Refer to the graph below marked by ϑ and ϕ



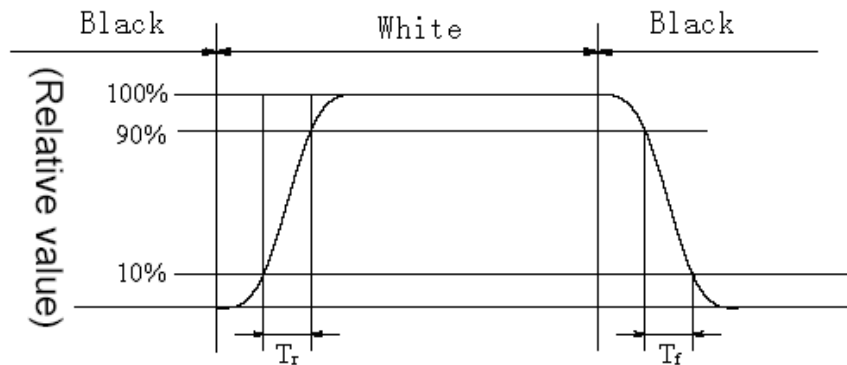
Note 4: The definition of Contrast Ratio:

$$\text{Contrast Ratio (CR)} = \frac{\text{Luminance When AMOLED is at "White" state}}{\text{Luminance When AMOLED is at "Black" state}}$$

Note 5: Definition of Response time.

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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 90% of amplitudes. Refer to figure as below.



Note 6: Gamma curve

The whole curve's tolerance must control within +/-0.3, test the gray scale below:
8, 16, 25, 33, 41, 49, 58, 66, 74, 82, 90, 99, 107, 115, 123, 132, 140, 148, 156, 165, 173, 181, 189, 197, 206, 214, 222, 230, 239, 255

Note 7: Crosstalk

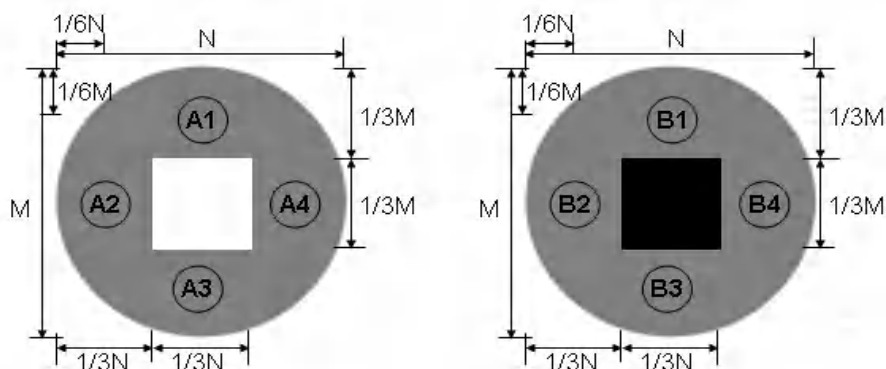
There should be no visible cross-talk in normal direction of the display when the two “Cross-talk Test Patterns” below are loaded.

ΔBp (Max.) = Maximum value in $\Delta Bp1 \sim \Delta Bp4$.

ΔBp (Min.) = Minimum value in $\Delta Bp1 \sim \Delta Bp4$.

$\Delta CT = \Delta Bp$ (Max.) / ΔBp (Min.).

ΔCT must be less than 1.10



Cross-talk Test Pattern

Note 7: Life Time

OLED life time is defined by the Minimum Duration Time that the luminance is decayed to a specific ratio (ex. 92%) of initial state.

Test Pattern under duration period: L255 White

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7 Reliability

7.1 Environmental Test

Item	Main spec	No. of failures / No. of examinations
High Temperature Operation	70℃ / 240hrs	0/5
Low Temperature Operation	-20℃ / 240hrs	0/5
High Temperature Storage	80℃ / 240hrs	0/5
Low Temperature Storage	-30℃ / 240hrs	0/5
High Temperature Humidity Operation	60℃/90%RH/ 240hrs	0/16
Thermal Shock	-40℃~80℃ dwell time=0.5hr, 100cycles.	0/16
TP Sensor-Film 表面能测试	达因笔画线 5 秒后成 A 状	0/10
TP FPC 拉拔力测试	>5N/CM	0/5
TP FPC 抗弯折测试	20 次, 同位置反向弯折 20 次	0/5
撕膜 ESD 测试	静电峰值电压<500V	0/10

7.2 Electrical Test

Item	Main spec	Note
Air Discharge	±4 kV , 150pF/330Ω (Module level; without CG)	5Points, Each 10times. After one time discharge, panel and gun touch the ground, through the whole test, turn on ion fan. No degradation of OLED performance after this test.
Contact Discharge	±2kV, 150pF/330Ω (Module level; without CG)	

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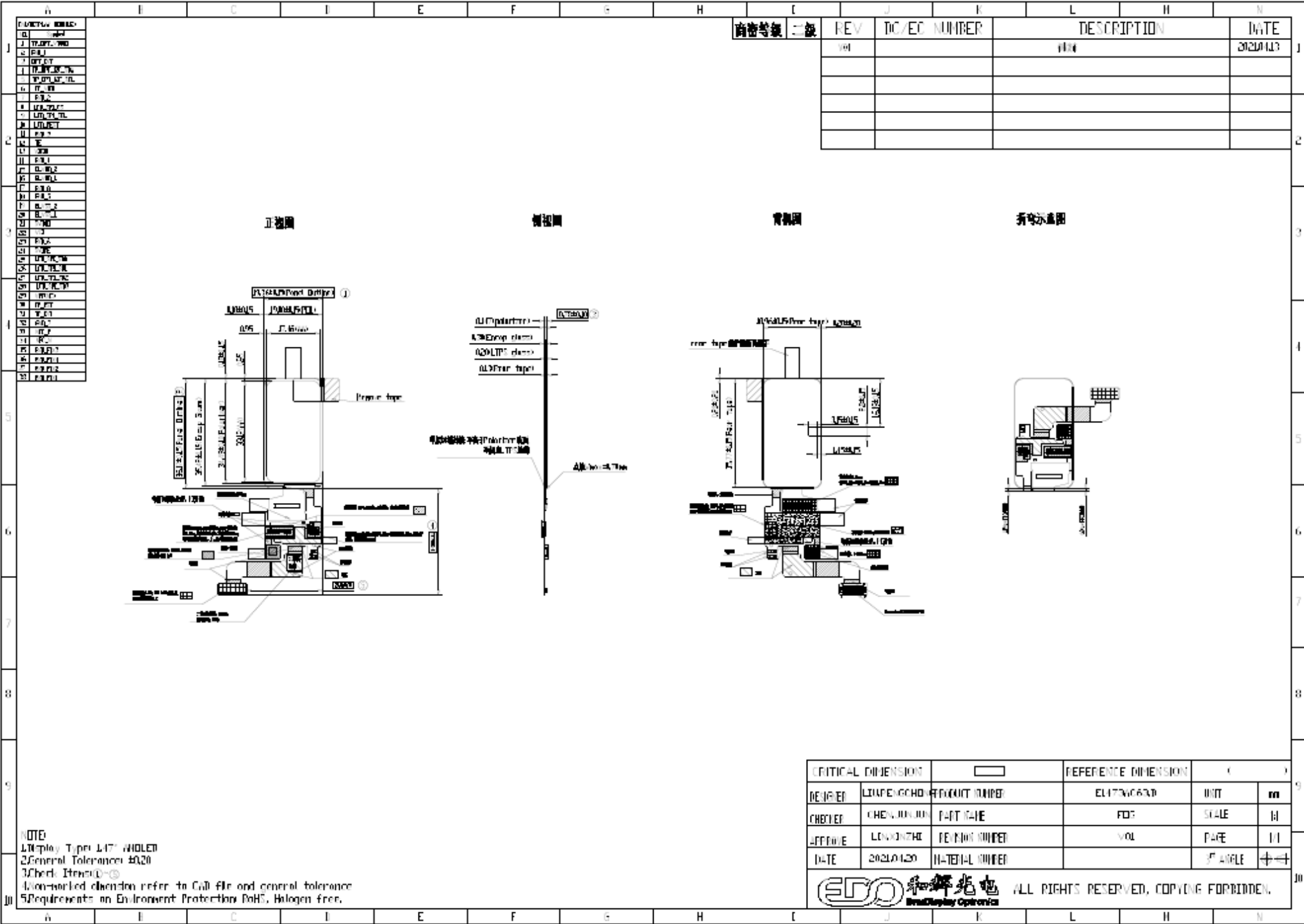
7.3 Mechanical Test

Test item	Test condition	Note
Packing vibration-proof test	2g, f=10->55->10Hz apply in each of X, Y, and Z direction for 30 min	Package
Packing Drop test	Drop the packing from 60cm height, 6-faces, 3-edges and 1-corner(one time for each)	Package



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8 Outline Dimension Drawing



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9 Packing Specification

TBD

10 The Control of Hazardous Substances

The control of Hazardous substances refer to EDO document 《有害物质管控标准书》 (Standard document for the Control of Hazardous substances) EDO –IS- 110, the latest version.