

Osptek Display

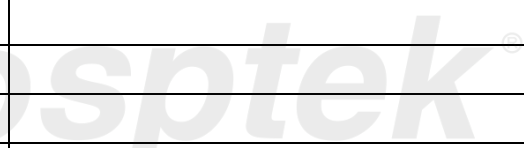
AMOLED SPECIFICATION

Model No:

AM178E585-B

osptek[®]

Version History

The logo for osptek, featuring the word "osptek" in a lowercase, italicized, sans-serif font, with a registered trademark symbol (®) to the upper right of the "k". The logo is positioned at the bottom of the page, centered horizontally.

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1 Scope

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

2 Features

2.1 Product Applications

Smart Watch

2.2 Product Features

- 1) Display color: 16.7M (RGB x 8bits)
- 2) Display format: 1.78"(368RGBx448)
- 3) Pixel arrangement: Real RGB arrangement
- 4) Interface: MIPI/SPI

3 Mechanical Specifications

Item	Specification	unit
LTPS Glass outline	30.6*37.99	mm
Encapsulation Glass outline	30.6*37.24	mm
Number of dots	368(W) x RGB x 448(H)	dots
Active area	28.7*34.94	mm
Diagonal size	1.78	inch
Pixel pitch	78*78 [®]	μm
Glass thickness (LTPS/Encap. glass)	0.2 / 0.3	mm
Weight	TBD	g

4 Maximum Rating

Parameter	Symbol	Spec			Unit	Note
		Min.	Typ.	Max.		
Analog/boost power voltage	VCI	-0.3	-	5.5	V	-
I/O voltage	VDDIO	-0.3	-	5.5	V	-
Operating temperature	Top	-20	-	70	°C	-
Storage temperature	Tstg	-40	-	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	3.0	4.6	5.0	V	-
AMOLED power Negative	ELVSS	-4.0	-2.0	-0	V	Ref
Digital Power supply	VDDIO	1.65	1.8	3.3	V	Ref
Analog Power supply	VCI	2.7	2.8	3.6	V	Ref

1) Normal Mode

Power Supply: IOVCC=1.8V VCI=2.8V

Frame Frequency: $F_{\text{frame}}=60\text{HZ}$ @ 25degC, Brightness 500 nits, Command Mode,

Display Condition	Symbol	Min.	Typ.	Max.	Unit	Remark
100% Pixel On 500nits	IELVDD /ELVSS	-	27.9	-	mA	Ref
	IVCI	-	6	7.2	mA	Ref
	IVDDIO	-	2	2.4	mA	Ref

2) Idle Mode

Power Supply: IOVCC=1.8V VCI=2.8V

Frame Frequency: $F_{\text{frame}}=15\text{HZ}$ @ 25degC, Brightness:50nits, OPR:10%,Command Mode

Display Condition	Symbol	Min.	Typ.	Max.	Unit	Remark
10% Pixel On 50 nits	IELVDD /ELVSS	-	2.8	-	mA	Supplied by Driver IC
	IVCI	-	3.5	4.5	mA	Ref
	IVDDIO	-	1.2	1.5	mA	Ref

3) Deep Standby Mode

Display Condition	Symbol	Min.	Typ.	Max.	Unit	Remark
Deep Standby	IVCI	-	-	15	uA	-
	IVDDIO	-	-	4	uA	-
	Power Consumpti on	-	-	<50	uW	Ref

5.1.2 Driver IC

SH8601A.

5.2 TP IC Recommended Operating Conditions

Touch IC: CHSC5816(refer to the datasheet)

Symbol	Description	Min	TYP	MAX	UNIT
VCCA	Analog power supply voltage	2.7	2.8	3.6	V
V _{IN} (I2C)	Input voltage range	0	-	3.6	V
V _{OUT} (I2C)	Output voltage range	0	-	3.6	V
V _{IN} (INT)	Input voltage range	0	-	3.6	V
V _{OUT} (INT)	Output voltage range	0	-	3.6	V
V _{OUT} (TX)	Output voltage range	0	-	VCCA	V
V _{OUT} (RX)	Input voltage range	0	-	VCCA	V



Item	Spec	Remark
Operating voltage	2.7-3.6V	
Operating current	2mA	
Linearity	Center part $\leq$ 1mm	Test tool: ϕ 7mm copper cylinder
	The peripheral position $\leq$ 2mm	
Sensitivity	No broken line	Lineation with 5mm/s&20mm/s respectively by Φ 7mm copper cylinder
Response time	$\leq$ 10ms	

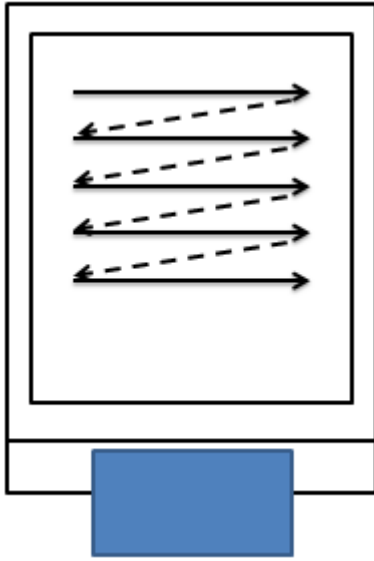
5.3 I/O Connection

5.3.1 COF Bonding FPC PAD Define

No.	Symbol	Function
1	NFC_ANT2	Near Field Communication Antenna 2
2	NFC_ANT1	Near Field Communication Antenna 1
3	GND	Ground
4	TP_INT(1.8V)	Touch IC's interrupt to Host
5	TP_SDA(1.8V)	Touch IC I2C data
6	TP_SCL(1.8V)	Touch IC I2C clock
7	TP_RESET(1.8V)	This signal will reset Touch IC.Signal is active low.
8	TP_VDD(3.3V)	Power supply for Touch IC
9	TP_VDD(3.3V)	Power supply for Touch IC
10	GND	Ground
11	CLKN	MIPI DSI clock lane-
12	CLKP	MIPI DSI clock lane+
13	GND	Ground
14	D0N	MIPI DSI data lane0-
15	D0P	MIPI DSI data lane0+

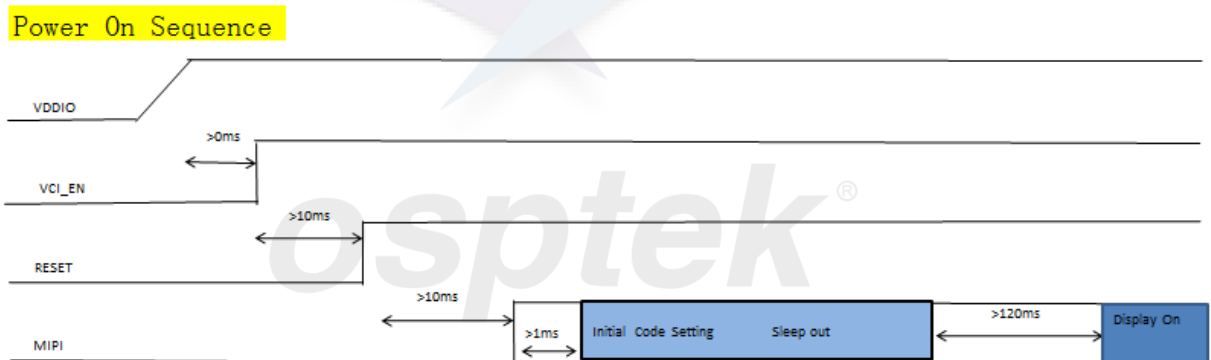
16	VDDIO(1.8V)	Power supply for I/O block provided from outside VDDI < 0.05V (When power is turned off)
17	VDDIO(1.8V)	Power supply for I/O block provided from outside VDDI < 0.05V (When power is turned off)
18	VCI_EN	Power Supply for Analog Circuits VCI < 0.05V (When power is turned off)
19	REST	Reset
20	TE	Tearing effect signal is used to synchronize MCU to frame memory
21	GND	Ground
22	QSPI_CLK	This pin is used to be serial interface clock
23	QSPI_SI03	Serial input signal in QSPI serial data interface
24	QSPI_SI02	Serial input signal in QSPI serial data interface
25	QSPI_SI01	Serial input signal in QSPI serial data interface
26	QSPI_SI00	Serial input signal in QSPI serial data interface
27	QSPI_CS	Chip selection pin ;Low enable ,high disable.
28	GND	Ground
29	IM1	
30	MTP_PWR	Power supply for OTP. Leave the pin to open when not in use.
31	VBAT(3.7V)	Power Supply for DC/DC Converter Circuit
32		This is the power supply pin for the internal buffer of the DC/DC voltage converter.It must be connected to external source when the converter is used.It should be connected to VDD when the converter is not used.
33		
34	GND	Ground
35	GND	Ground
36	GND	Ground

5.4 Graphic memory writing direction



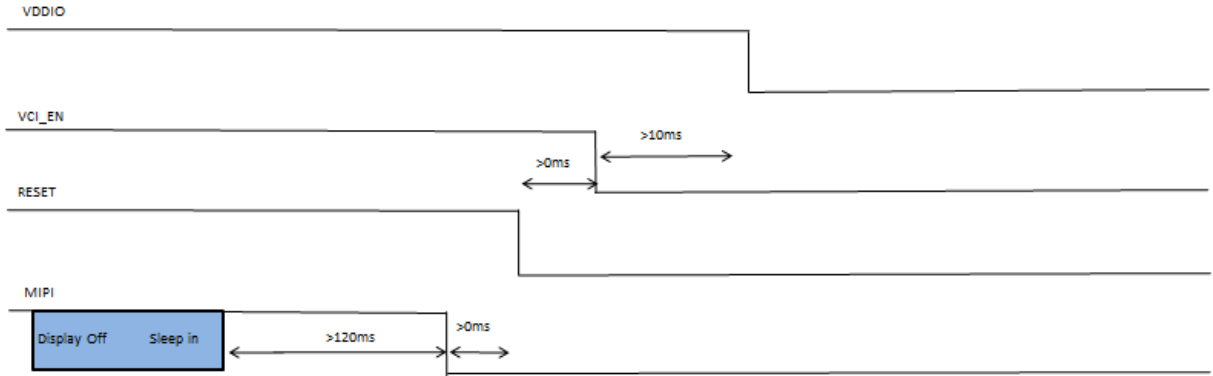
5.5 Recommended Operating Sequence

5.5.1 Power on sequence



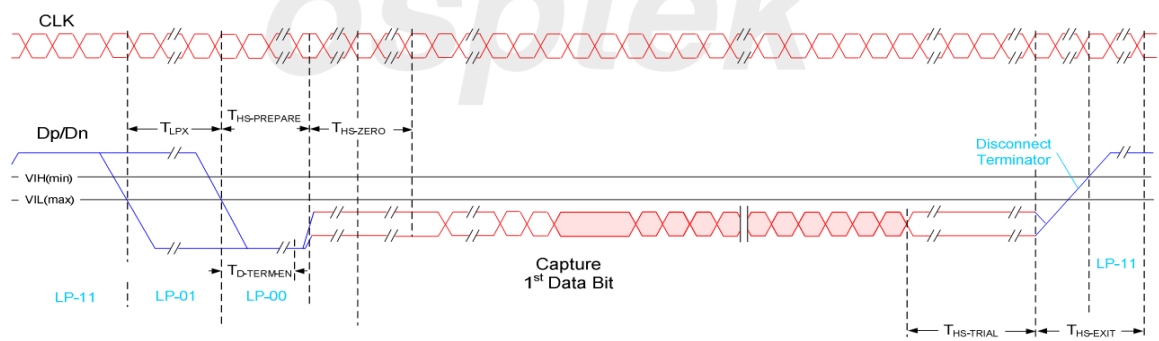
5.5.2 Power off sequence

Power Off Sequence



5.5.3 AC Characteristics (MIPI)

HS Data Transmission Burst



HS Clock Transmission

	associated Data Lane beginning the transition from LP to HS mode.				
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
THS-EXIT(1)	time to drive LP-11 after HS burst	100	-	-	ns
THS-PREPARE	Time to drive LP-00 to prepare for HS transmission	40ns + 4*UI	-	85ns+6*UI	ns
THS-PREPARE + THS-ZERO	THS-PREPARE + Time to drive HS-0 before the Sync sequence	145ns + 10*UI	-	-	ns
THS-SKIP	Time-out at RX to ignore transition period of EoT	40	-	55ns+4*UI	ns
THS-TRAIL	Time to drive flipped differential state after last payload data bit of a HS transmission burst	60 + 4*UI	-	-	ns
TLPX	Length of any Low-Power state period	50	-	-	ns

Ratio TLPX	Ratio of TLPX(MASTER)/TLPS(SLAVE) between Master and Slave side	2/3	-	3/2	ns
TTA-GET	Time to drive LP-00 by new TX	5*TLPX	5*TLPX	5*TLPX	ns
TTA-GO	Time to drive LP-00 after Turnaround Request	4*TLPX	4*TLPX	4*TLPX	ns
TTA-SURE	Time-out before new TX side starts driving	TLPX	-	2*TLPX	ns

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, TA=-20°C~+70°C)

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

Table: Reset timing



6 Electro-Optical Specification

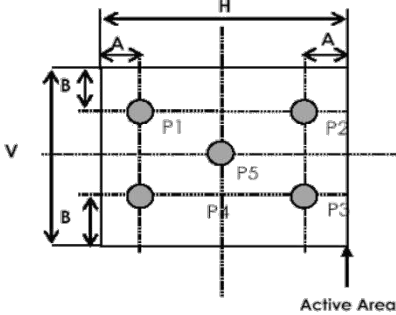
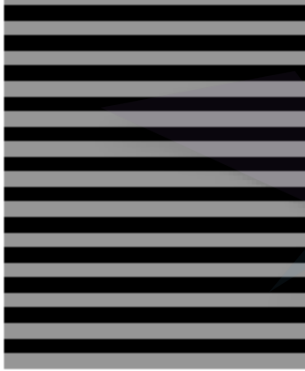
Test condition: 25°C±3°C, 65±20%RH, darkroom.

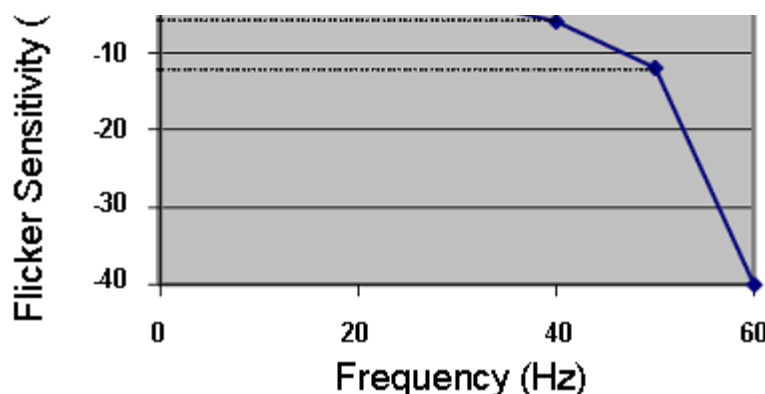
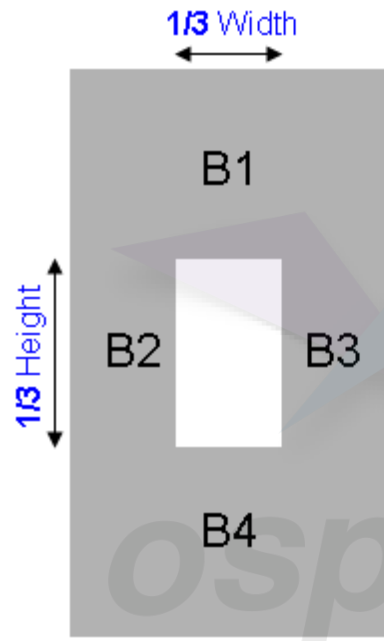
No	Item	Symbol	Condition	Value			Unit	Remark
				Min.	Typ.	Max.		
1	Brightness	L	Full white Without CG	450	500	550	cd/m ²	Note1.
2	Brightness Uniformity	UL	Full white	80	85	-	%	Note4
3	Contrast Ratio	CR	Normal θ=Φ=0°	10000	100000	-	-	Note3.

4	Response time		Ton+Toff	Normal Θ=Φ=0°	-	2	4	ms	Note2.
5	Color Coordinate of CIE1931	White	X	Normal Θ=Φ=0°	0.27	0.29	0.31	-	Note1.
			Y		0.29	0.31	0.33		
		Red	X		0.647	0.687	0.727		
			Y		0.272	0.312	0.352		
		Green	X		0.175	0.225	0.275		
			Y		0.679	0.729	0.779		
		Blue	X		0.102	0.143	0.183		
			Y		0.002	0.043	0.083		
6	Color Gamut		NTSC	CIE1931	90	105	-	%	
7	Viewing Angle			Top/Botton/Righ t/Left CR ratio ≥1000	80			°	Note3.
8	Gamma			Log(Lv- Lb)=log(V)+log(a) V(Gray)= 48,72,104,132, 164,192,224 Lum(gray255)=3 50nit	2.0	2.2	2.4	-	
9	Flicker			Normal Θ=Φ=0°	-	-35	-30	dB	Note6.
10	Crosstalk			-	-	-	4	%	Note7.
11	Color shift			θL=30°			6		
12	OLED Life Time			0.95*(TYP brightness) At 25℃,with white color pattern	150			hrs	Note8.
13	Image Retention			With 8*8 black-white chess board test image, lighting on with maximum luminance for 10min	8*8 black-white chess board 10min,to G128,20s disappear				

See the note in the table below:

No	Item	Details
Note1	Brightness	
Note 2	Response time	
Note 3	Viewing Angle	Contrast Ratio Dark Room C.R=LW/LB LW: full white brightness of display center P0; LB: full black brightness of display center P0.
Note 4	Brightness	

	Uniformity	 A: 1/4H B: 1/4V H.V: Active Area
Note 5	Luminance decrease ration	Definition of Luminance decrease ratio Test pattern : Full White The luminance decrease ratio is calculated by using following formula: $\text{Luminance decrease ration} = 1 - \frac{\text{Luminance test at left, right, top, bottom :}}{\text{Luminance test at left, right, top, bottom}}$
Note 6	Flicker	Suggested Instruments: Konica Minolta CA-310 or Klein Instruments K-8  Odd row : L0 Black Even row : L186 gray level Flicker Test Pattern The flicker level is defined by Fast Fourier Transformation (FFT) as follows: $\text{Flicker} = 20 \log_{10} \left(2 \frac{f_{FFT}(n)}{f_{FFT}(0)} \right) + FS(Hz) \quad (dB)$ Where fFFT(n) is the n-th FFT coefficient. fFFT(0) is the 0-th FFT coefficient which is DC component. FS(Hz) is the flicker sensitivity as a function of frequency. The peak flicker level shall be reported based on the calculation using above formula in which FS(Hz) is determined by the flicker weighing factor shown below.

		
Note 7	Crosstalk	Crosstalk shall be calculated by the luminance of B1~B4 and G1~G4 in the patterns shown below. Box Pattern: L128 gray level background with a L255 White window in the central area. Gray Pattern: L128 gray level background only.  Box Pattern  Gray Pattern <i>Crosstalk</i> $\equiv \text{Maximum} : \left\{ \frac{ B1 - G1 }{G1}, \frac{ B2 - G2 }{G2}, \frac{ B3 - G3 }{G3}, \frac{ B4 - G4 }{G4} \right\} \times 100\%$
Note 8	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

7 Reliability

7.1 Environmental Test

Item	Main spec	No. of failures / No. of examinations
High Temperature Operation	70℃ / 240hrs	0/10
Low Temperature Operation	-20℃ / 240hrs	0/10
High Temperature Storage	80℃ / 240hrs	0/10
Low Temperature Storage	-40℃ / 240hrs	0/10
High Temperature Humidity Operation	60℃/90%RH/ 240hrs	0/32
Thermal Shock	-40℃~85℃ dwell time=0.5hr, 100cycles.	0/10

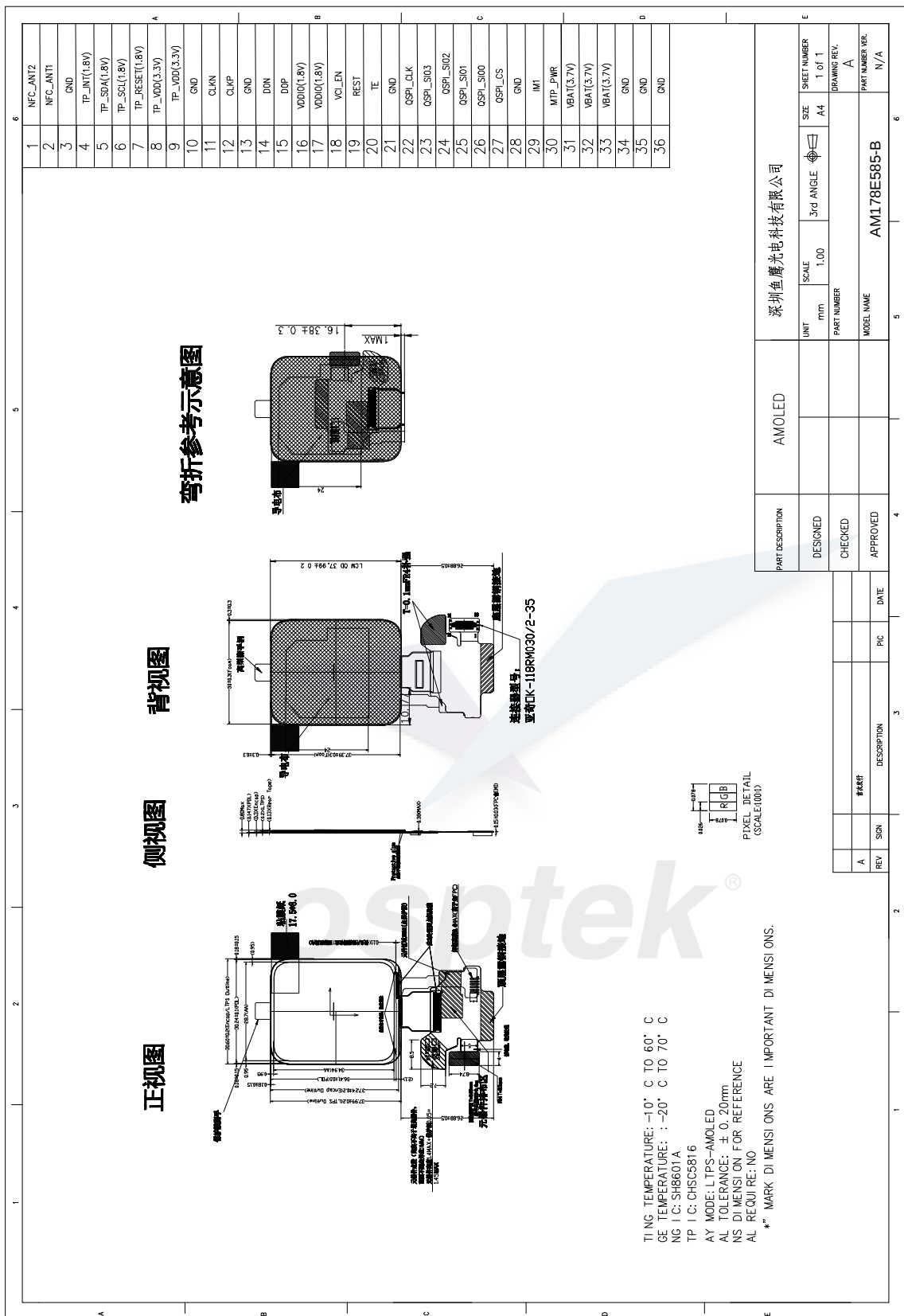
7.2 Electrical Test

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)	

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

8 Outline Dimension Drawing



9 Packing Specification

TBD

10 The Control of Hazardous Substances

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

