

Osptek Display

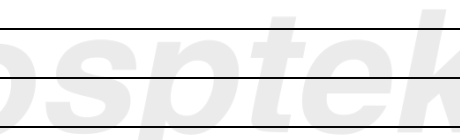
AMOLED SPECIFICATION

Model No:

E1604AC63.A

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Version History

The logo for osptek, featuring the word "osptek" in a bold, 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 slide, 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 Osptek. In the case of any unspecified item, it may require both Osptek 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: 1.6"(320RGBx360)
- 3) Pixel arrangement: Real RGB arrangement
- 4) Interface: QSPI
- 5) Driver IC:RM69092 (COF)
- 6) TP IC: TMA520
- 7) Pixel format: support 16bit GBRG 3553

3 Mechanical Specifications

Item	Specification	unit
LTPS Glass outline	28.92 × 33.35	mm
Number of dots	320(W) x RGB x 360(H)	dots
Active area	27.02×30.40	mm
Diagonal size	1.60	inch
Pixel pitch	84.45x84.45	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

Power Characteristic:

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
AMOLED Power Positive	ELVDD	3.25	3.3	3.35	V	-
AMOLED power Negative	ELVSS	-3.35	-3.3	-3.25	V	Ref
Digital Power supply	VDDIO	1.65	1.8	1.95	V	Ref
Analog Power supply	VCI	3.25	3.3	3.35	V	Ref

1) Normal Mode

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

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

Display Condition	Symbol	Min.	Typ.	Max.	Unit	Remark
100% Pixel On 450nits	IELVDD /ELVSS	-	21.6	26.10	mA	Ref
	IVCI	-	5.8	6.5	mA	Ref
	IVDDIO	-	5.5	5.8	mA	Ref

2) Idle Mode

Power Supply: VDDIO=1.8V VCI=3.3V

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

Display Condition	Symbol	Min.	Typ.	Max.	Unit	Remark
10% Pixel On 50 nits	IELVDD /ELVSS	-	-	-	mA	Supplied by Driver IC
	IVCI	-	3.4	4.0	mA	Ref
	IVDDIO	-	0.8	1	mA	Ref

3) Deep Standby Mode

Display Condition	Symbol	Min.	Typ.	Max.	Unit	Remark
Deep Standby	IVCI	-	-	3	uA	-
	IVDDIO	-	-	3	uA	-

4) HBM Mode

Power Supply: VDDIO =1.8V VCI=3.3V ELVSS=-3.7V ELVDD=3.3V

Frame Frequency: F_{frame} =60HZ @ 25degC, Brightness 1000 nits, Command Mode,

Display Condition	Symbol	Min.	Typ.	Max.	Unit	Remark
100% Pixel On 1000nits	IELVDD /ELVSS	-	43.2	52.3	mA	-
	IVCI	-	5.9	6.6	mA	
	IVDDIO	-	5.6	5.9	mA	

5.2 Driver IC

RM69092(refer to the datasheet)

5.3 TP IC

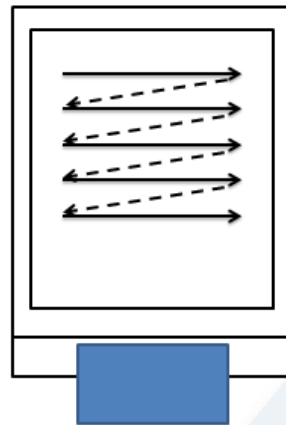
Parade/TMA520 (refer to the datasheet)

5.4 I/O Connection

Pin No.	Symbol	I/O	Function Description
1	TP_OPT_I2C_SDA	I/O	TP & OPT I2C DATA
2	TP_OPT_I2C_SCL	I	TP & OPT I2C CLK
3	OPTIC_INT	I/O	ALS INT
4	NC	NC	NC
5	LCD_MSPIO_3	I	OLED QSPI interface
6	LCD_MSPIO_CE0	I	OLED QSPI interface
7	LCD_MSPIO_1	I	OLED QSPI interface
8	GND	Power	Ground
9	AVDD_3V3	Power	3.3V power for OLED DDIC
10	OVDD_3V3	Power	OLED Power Supply
11	OVDD_3V3	Power	OLED Power Supply
12	GND	Power	Ground
13	OVSS_3V3	Power	OLED Power Supply
14	OVSS_3V3	Power	OLED Power Supply
15	GND	Power	Ground
16	SWDIO(NC)	I	Floating
17	TP_INT	I/O	TP INT
18	LCM_DC3V3	Power	3.3V power for TP
19	TP_RST	I/O	TP Reset
20	LCM_TP_DC1V8	Power	1.8V power for TP&OPTIC
21	LCM_DC1V8	Power	1.8V power for OLED DDIC
22	LCD_ID	O	Customer ID
23	SWIRE	O	Swire control interface.
24	LCD_TE	O	Synchronous signal output from panel to avoid tearing effect
25	LCD_RST_N	I	OLED Device reset signal(0:enable;1:Disable)
26	GND	Power	Ground
27	LCD_MSPIO_0	I/O	OLED QSPI interface
28	LCD_MSPIO_SCK	I	OLED QSPI interface

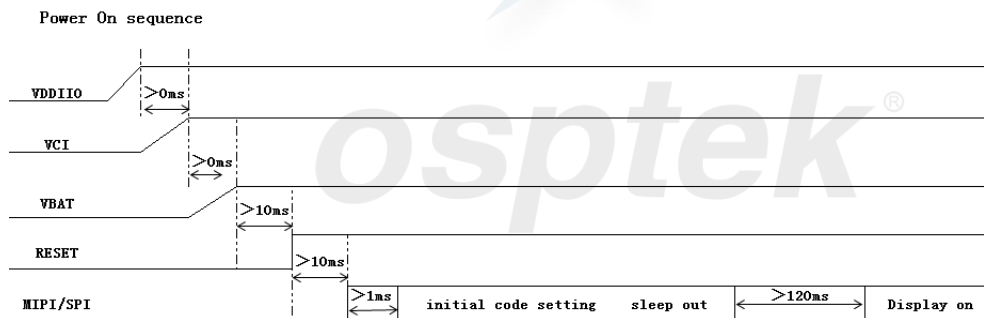
29	LCD_MSPIO_2	I	OLED QSPI interface
30	GND	Power	Ground
31	VPP(NC)	-	Floating
32	GND	Power	Ground
33	NFC_P	I/O	NFC TX1
34	NFC_N	I/O	NFC TX2

5.5 Graphic memory writing direction

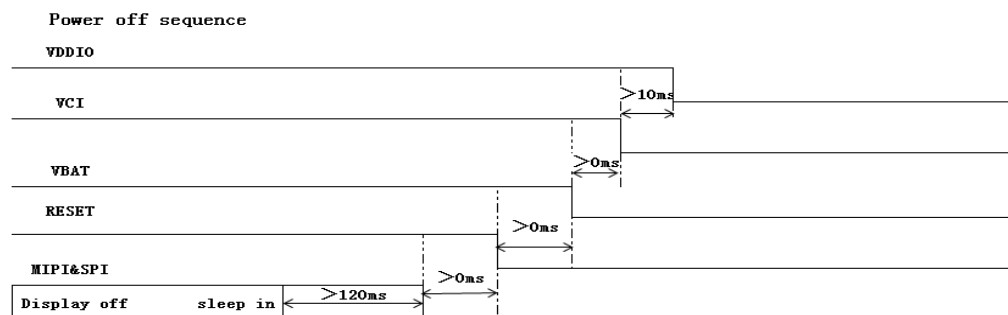


5.6 Recommended Operating Sequence

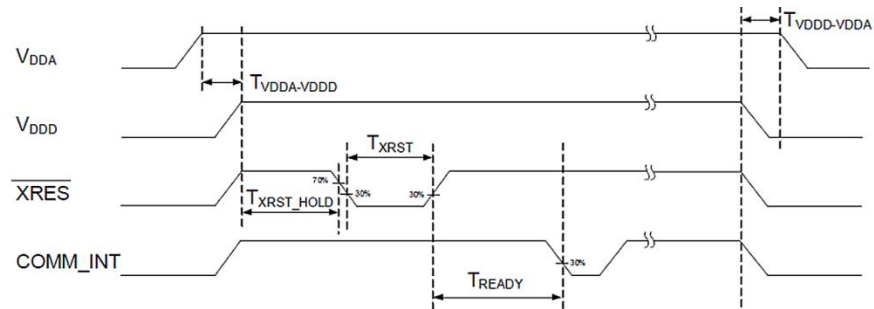
5.6.1 Power on sequence



5.6.2 Power off sequence



5.6.3 Power on/off sequence(Touch panel)



Symbol	Description	Conditions	Min	Typ	Max	Units
$T_{VDDA-VDDD}$	Time of V_{DDA} Ready Time before V_{DDD} Ready Time	—	0	—	—	ms
T_{XRST_HOLD}	Hold time before External Reset ($XRES$) Asserted	—	2	—	—	ms
T_{XRST}	External Reset ($XRES$) Pulse Width	After V_{DDD} is valid.	0.01	—	20	ms
$T_{VDDD-VDDA}$	Time of V_{DDD} Discharge before V_{DDA} Discharge Time	—	0	—	—	ms
T_{READY}	Time from Deassertion of $XRES$ to $COMM_INT$	—	—	—	16	ms

5.6.4 Timing requirements for RESETB(For RM69092)

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: $V_{DDIO}=1.65V\sim 3.6V$, $V_{SS}=0V$, $T_A=-20^{\circ}C\sim +70^{\circ}C$)

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

Table: Reset timing



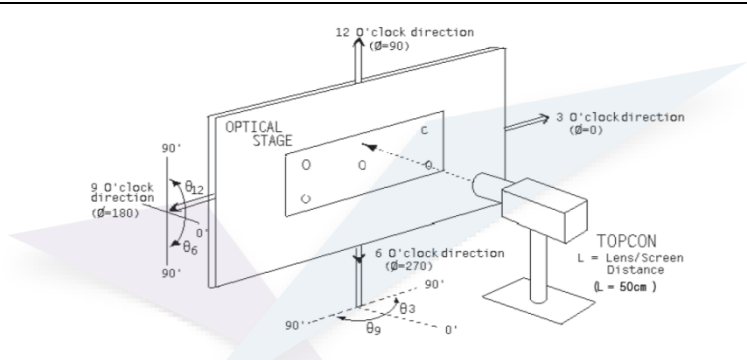
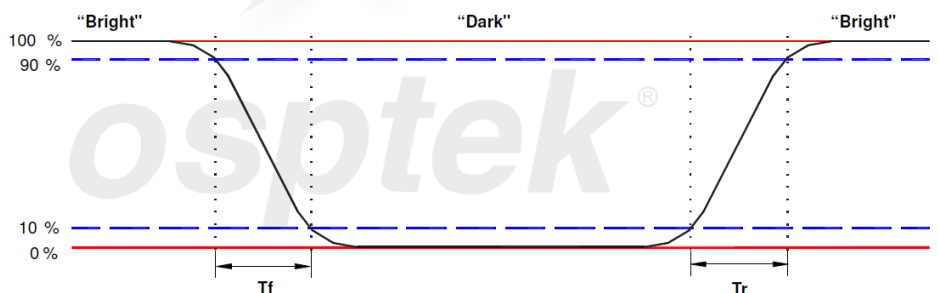
6 Electro-Optical Specification

Test condition: 25°C±3°C, 65±20%RH, darkroom, use the Auto-gamma system from EDO.

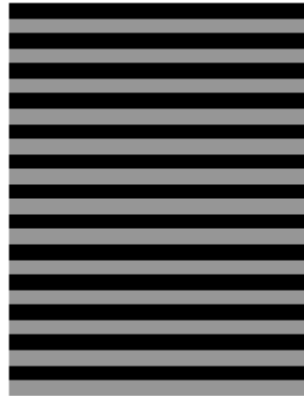
No	Item		Symbol	Condition	Value			Unit	Remark
					Min.	Typ.	Max.		
1	Brightness(Normal)			Full white Without CG	400	450	500	cd/m ²	Note1
2	Brightness(HBM)			Full white Without CG	900	1000	1100		
3	Brightness Uniformity		UL	Full white	85			%	Note4
4	Contrast Ratio		CR	Normal Θ=Φ=0°	10000			-	Note3
5	Response time		Ton+Toff	Normal Θ=Φ=0°		2	4	ms	Note2
6	Color Coordinate of CIE1931	White	X	Normal Θ=Φ=0°	0.270	0.300	0.335	-	Note1
			Y		0.280	0.310	0.345		
		Red	X		0.656	0.686	0.716		
			Y		0.280	0.310	0.340		
		Green	X		0.185	0.235	0.285		
			Y		0.670	0.720	0.770		
		Blue	X		0.108	0.143	0.178		
			Y		0.009	0.044	0.079		
7	Color Gamut		NTSC	CIE1931	97	108		%	
8	Viewing Angle			Top/Bottom/Right/Left CR ratio ≥10	80			°	Note3
9	Gamma			Log(Lv-Lb)=log(V)+log(a) V(Gray)=48,72,104,132, 164,192,224 Lum(gray255)=450nit	2.0	2.2	2.4	-	
10	Flicker			Normal Θ=Φ=0°			-30	dB	Note6
11	Crosstalk						2	%	Note7
12	Color shift			θL=30°			5.5	JNCD	
13	OLED Life Time			0.95*(TYP brightness) At 25℃,with		200		hrs	Note8

		white color pattern					
14	Image Retention	With 8*8 black-white chess board test image, lighting on with maximum luminance for 60min	8*8 black-white chess board 60min , to G128, 3 min disappear by ND06				

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: $\text{Luminance decrease ration} = 1 - \frac{\text{Luminance test at left, right, top, bottom} = 30^\circ}{\text{Luminance test at left, right, top, bottom} = 0^\circ}$
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:

$$Flicker = 20 \log_{10} \left(2 \frac{f_{FFT}(n)}{f_{FFT}(0)} \right) + FS(Hz) \quad (dB)$$

Where

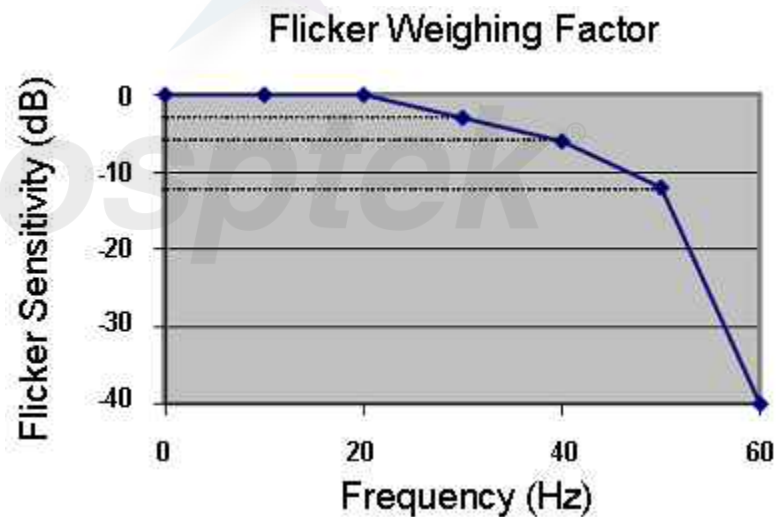
fFFT(n) is the n-th FFT coefficient.

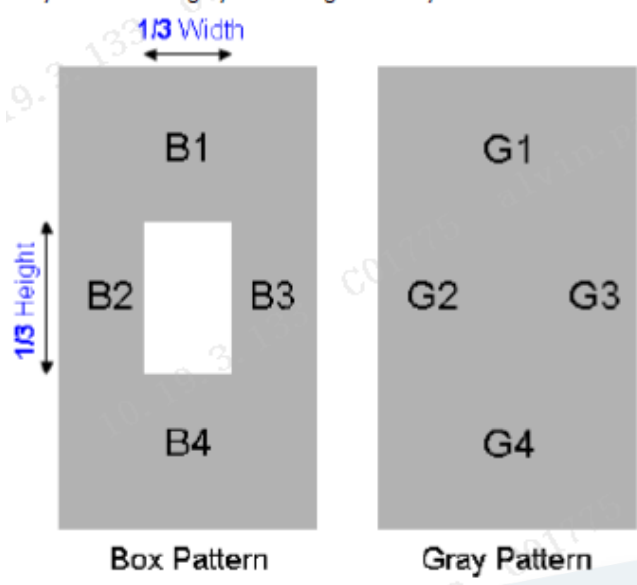
fFFT(0) is the 0-th FFT coefficient which is DC component.

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	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

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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
POL 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

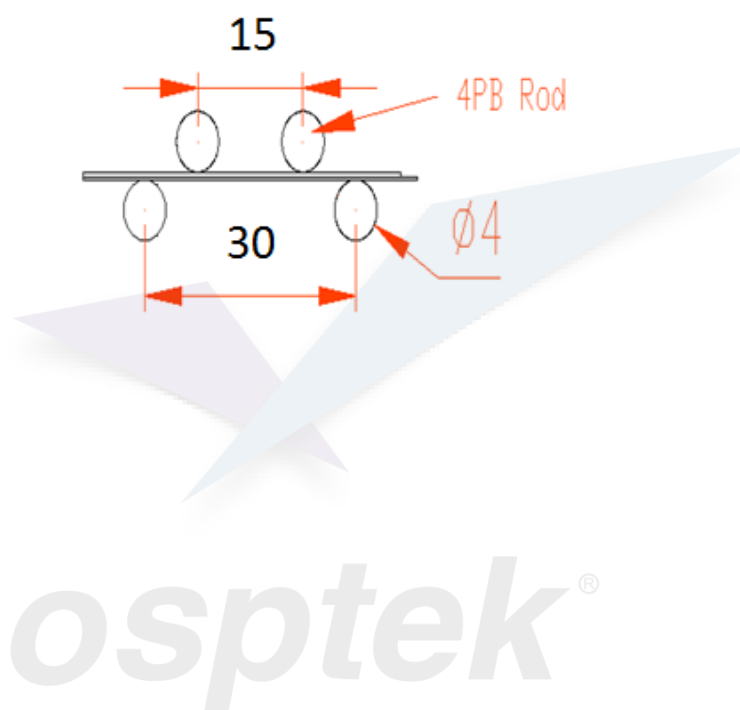
Item	Main spec	Note
Air Discharge	±2 kV , 150pF/330Ω (Module level; without CG)	5Points, Each 10times. After one time discharge, panel and gun touch the ground, through the whole test, turn on ion fan. No degradation of OLED performance after this test.
Contact Discharge	±2kV, 150pF/330Ω (Module level;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

7.3 Mechanical Test

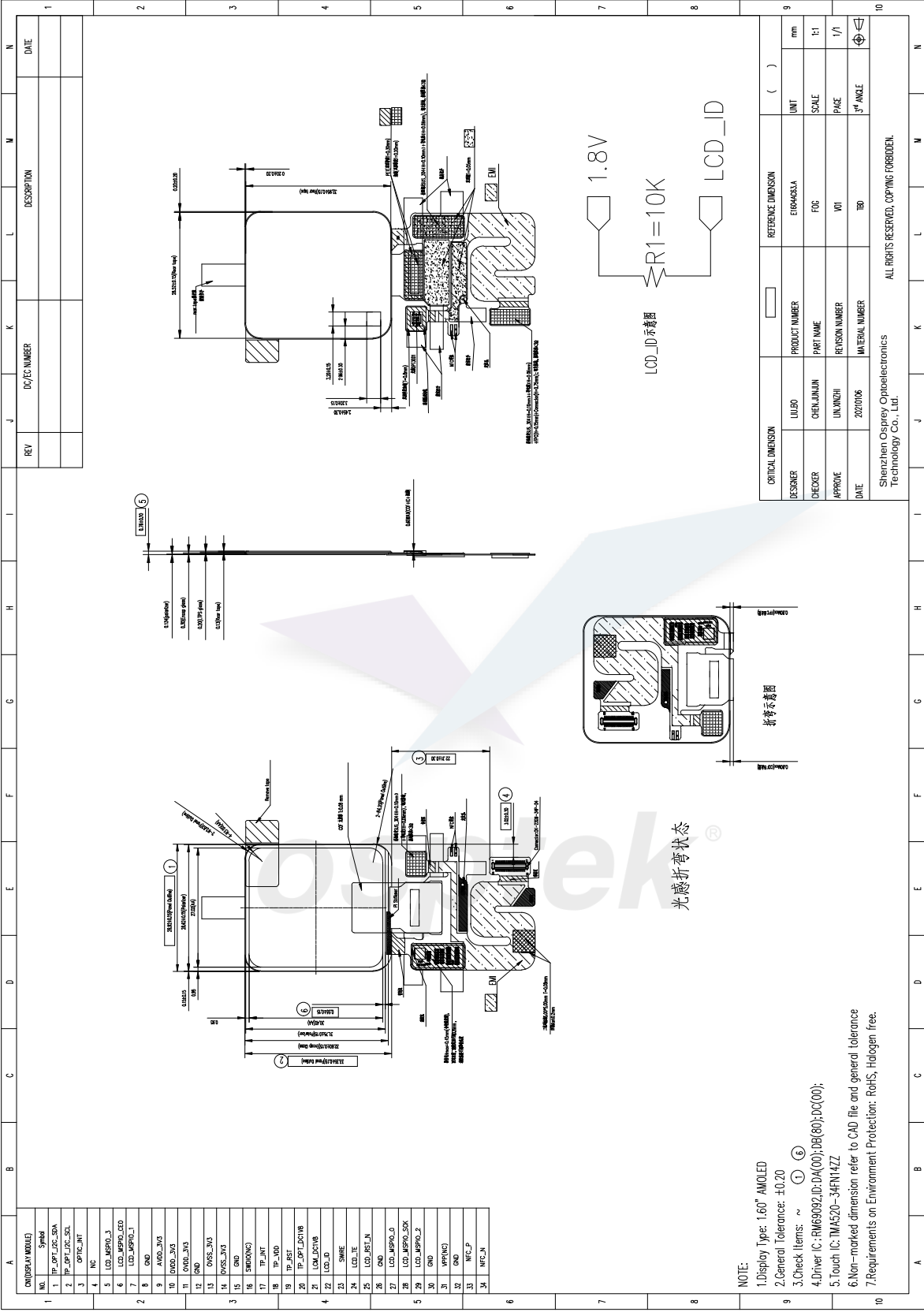
Test item	Test condition	Note
Glass Strength Test- 4PB	B10 ≥ 100MPa Y-deriction	Note 9
Packing Vibration Test	30mins for three surfaces each , Frequency rate: 5~95Hz, Frequency Velocity: 0.1	1 box

	octave/min, Displacement: 0.75mm									
Packing drop test	1 Angle, 3 edges,6 surfaces, one time each, the height is as follows: <table><tr><th>重量M (kg) ; 跌落高度 (mm)</th></tr><tr><td>M<10 ; 1000</td></tr><tr><td>10≤M<15 ; 1000</td></tr><tr><td>15≤M<20 ; 800</td></tr><tr><td>20≤M<30 ; 600</td></tr><tr><td>30≤M<40 ; 500</td></tr><tr><td>40≤M<50 ; 400</td></tr><tr><td>50≤M<100 ; 300</td></tr></table>	重量M (kg) ; 跌落高度 (mm)	M<10 ; 1000	10≤M<15 ; 1000	15≤M<20 ; 800	20≤M<30 ; 600	30≤M<40 ; 500	40≤M<50 ; 400	50≤M<100 ; 300	1 box
重量M (kg) ; 跌落高度 (mm)										
M<10 ; 1000										
10≤M<15 ; 1000										
15≤M<20 ; 800										
20≤M<30 ; 600										
30≤M<40 ; 500										
40≤M<50 ; 400										
50≤M<100 ; 300										

Note 9 Glass Strength Test- 4PB



8 Outline Dimension Drawing



9 Packing Specification

TBD

10 Handling Precautions

- a) Before FOG Bonding , please clean panel pad & COF input/output lead.
- b) When cleaning ITO pad, avoid using hard and abrasive material or corrosive solution
- c) Keep module away from direct sunlight or fluorescent light, and keep it at room temperature and humidity
- d) Strong impact & pressure on module and packing is prohibited
- e) Following normal power on/off sequence is necessary for preventing abnormal display or permanent damage to display
- f) Optimal contrast ratio under ideal voltage is AMOLED module's characteristic, hence it is recommended a voltage control function available
- g) Image sticking may occur if an image displays for an extended period of time
- h) When interfered by system's overall mechanical design, an abnormal display may occur
- i) After considering emitting energy, you should plan your design to satisfy EMI standards.
- j) Host side should place a surge-prevent circuit at power trace (ie: VCI, Vddi) to protect AMOLED module.
- k) Avoid strong light exposure back of panel, especially UV light.

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