

SPECIFICATION

Revision: 0.3

TR178A368448MS

This module uses ROHS material



If there is no special request from customer, TRULY (HUI ZHOU) SMART DISPLAY LTD. will not reserve the tooling of the product under the following conditions:

1. There is no response from customer in two years after TRULY (HUI ZHOU) SMART DISPLAY LTD. submit the samples;
2. There is no order in two years after the latest mass production.

And correlated data (include quality record) will be reserved one year more after tooling was discarded.

TRULY (HUIZHOU) SMART DISPLAYLTD:

CUSTOMER:

Quality Assurance Department: _____

Approved by:

Technical Department: _____

Approved by:

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■ SCOPE

This AMOLED module Specification defines general provisions and inspection standard, AMOLED modules Involved are supplied by TRULY (HUIZHOU) SMART DISPLAY LIMITED. In the process of using, if unforeseen problem or unspecified items may occur, we have to negotiate to resolve the issue with the customer certainly.

■ FEATURES

- 1) Display color: 16.7M colors(24bits)
- 2) Display format: 1.78 Inch 368×448
- 3) Interface: MIPI 1lane /SPI
- 4) Driver IC: RM69090
- 5) Polarizer: Hard Coating Polarizer
- 6) ID: DA=0XAB,DB=0X90,DC=0X11

■ APPLICATION

Smart Watch

■ GENERAL INFORMATION

Item	Contents	Unit
Display Mode	AMOLED	/
LTPS Glass Outline (W×H)	30.6 ×37.99	mm
Encapsulation Glass Outline (W×H)	30.6 ×37.19	mm
Active area	28.704 ×34.944	mm
Number of Dots	368 ×3(RGB) ×448	/
Diagonal Inch	1.78	inch
Pixel pitch (W×H)	78 ×78	um
Glass Thickness	0.2 (LTPS) 0.305(Encap)	mm
Module Thickness	0.769	mm

■ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit
Supply voltage (Display)	VCC	-0.3	5.5	V
	IOVCC	-0.3	5.5	V
	ELVDD	0.0	6.0	V
	ELVSS	-6.5	0.0	V
Supply voltage (TP)	TSP_VCC	-0.5	6	V
	TSP_IOVCC	-0.5	6	V
Operating temperature	T _{OP}	-20	70	°C
Storage temperature	T _{ST}	-30	80	°C
Humidity	RH	-	90	%RH

Note: Absolute maximum ratings means the product can withstand short-term, NOT more than 120 hours. If the product is a long time to withstand these conditions, the life time would be shorter.

■ ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Condition	Min	Typ	Max	Unit	
Supply voltage (Display)	VCC		2.7	3.3	3.6	V	
	IOVCC		1.65	1.8	3.3	V	
	ELVDD	-	4.55	4.6	4.65	V	
	ELVSS	-	-2.25	-2.2	-2.15	V	
Supply voltage (TP)	TSP_VCC		2.65	2.8	4.7	V	
	TSP_IOVCC		1.71	1.8	1.95	V	
Input voltage	'L' level	IOVCC=1.65 V~3.3V	GND	-	0.2*IOVCC	V	
	'H' level		0.8*IOVCC	-	IOVCC	V	
Output voltage	'L' level	I(OH)=-1mA I(OL)=+1mA	GND	-	0.2*IOVCC	V	
	'H' level		0.8*IOVCC	-	IOVCC	V	
Current (Display)	Sleep out mode	I _{VCC}	Full white display	-	3	6	mA
		I _{IOVCC}		-	2	4	mA
		I _{ELVDD/ELVSS}		-	20	30	mA
	Sleep in mode	I _{VCC}	-	20	40	uA	
		I _{IOVCC}	-	50	100	uA	
	Deep Standby Mode	I _{VCC}	-	1	3	uA	
I _{IOVCC}		-	1	3	uA		
Frame Frequency	f _{FRM}		-	60	-	Hz	

■ OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Type	Max	Unit	Note
Surface Luminance	Lv	$\theta=0^\circ$	300	350	400	cd/m ²	Note1
Luminance uniformity	δ WHITE	$\varnothing=0^\circ$ Ta=25°C	85	-	-	%	Note2
Contrast Ratio	Cr		60000	-	-	-	Note3
Viewing Angle	θ	Up/Down/Right/Left Cr \geq 10	88	-	-	deg	Note4
Color Coordinate of CIE1931	Red x	$\theta=0^\circ$ $\varnothing=0^\circ$ Ta=25°C	0.630	0.660	0.690	-	Note 5
	Red y		0.310	0.340	0.370	-	
	Green x		0.180	0.220	0.260	-	
	Green y		0.690	0.730	0.770	-	
	Blue x		0.110	0.140	0.170	-	
	Blue y		0.020	0.050	0.080	-	
	White x		0.280	0.300	0.320	-	
	White y		0.290	0.310	0.330	-	
NTSC ratio	-	-	90	100	-	%	CIE1931
Gamma	-	$\theta=0^\circ$ $\varnothing=0^\circ$ Ta=25°C V(Gray)=44,6 8,100,132,164, 196,228,252,255	2.0	2.2	2.4	-	-
Lifetime	T95	25°C	240			h	-

Note1. Surface Luminance

- Measurement equipment: CS2000 or similar equipment.
- Measuring surroundings: Dark room.
- Measuring temperature: Ta=25°C.
- The data are measured after OLEDs are lighted on for more than 5 minutes and all pixels are fully white.
- The Surface Luminance is the average value of 5 measured spots (Fig-1):

L_v = Average Luminance with all white pixels (P₁, P₂, P₃, P₄, P₅)

- There are Two GAMMA Settings in IC, the default setting is HBM mode. Normal mode and brightness are set by the customer through registers.

Note2. Luminance Uniformity

- Measurement equipment: CS2000 or similar equipment.
- Measuring surroundings: Dark room.
- Measuring temperature: Ta=25°C.
- The data are measured after OLEDs are lighted on for more than 5 minutes and all pixels are fully white.
- The Luminance Uniformity is calculated by using following formula:

$$\delta \text{ WHITE} = L_p (\text{Min.}) / L_p (\text{Max.}) \times 100 (\%)$$

Lp (Min.) = Minimum Luminance with all white pixels (P₁, P₂, P₃, P₄, P₅)

Lp (Max.) = Maximum Luminance with all white pixels (P₁, P₂, P₃, P₄, P₅)

Note3. Contrast Ratio

- Measurement equipment: CS2000 or similar equipment.
- Measuring surroundings: Dark room.
- Measuring temperature: Ta=25°C.
- The data are measured after OLEDs are lighted on for more than 5 minutes.
- The Contrast Ratio is calculated by using following formula:

Contrast Ratio(Cr) = L_w / L_b

Lw = Average Luminance with all **white** pixels (P₁, P₂, P₃, P₄, P₅)

Lb = Average Luminance with all **black** pixels (P₁, P₂, P₃, P₄, P₅)

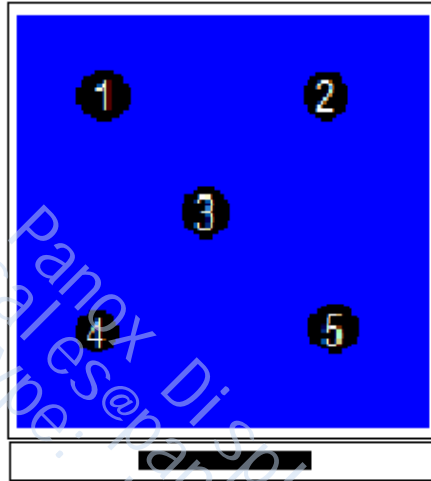


Fig-1

Note4. Viewing Angle

- Measurement equipment: DMS803 or similar equipment.
- Measuring surroundings: Dark room.
- Measuring temperature: Ta=25°C.
- The Viewing Angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the display surface.

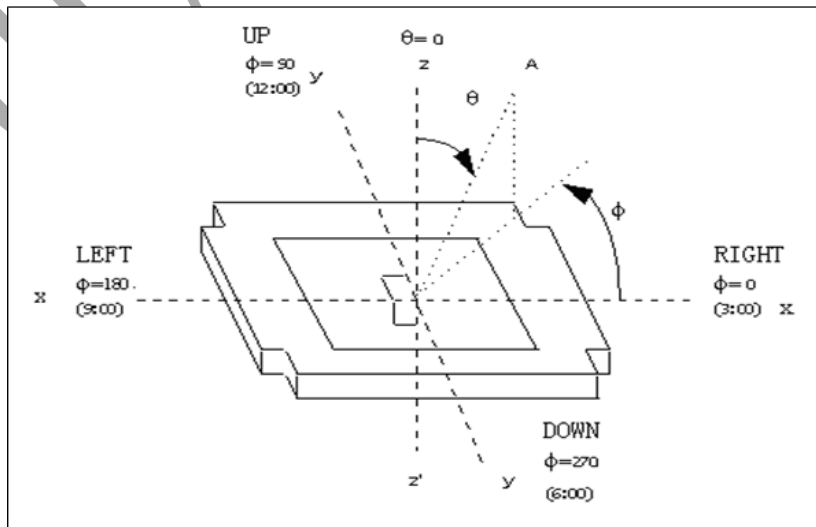


Fig-3

Note5. Color Coordinate of CIE1931

- Measurement equipment: CS2000 or similar equipment.
- Measuring surroundings: Dark room.
- Measuring temperature: $T_a=25^{\circ}\text{C}$.
- The x, y value of Color Coordinate is determined by measuring at center position of the display panel.

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■ INTERFACE DESCRIPTION

Interface NO.	Symbol	I/O or Connected to	Description	When not in use
1	MTP_PWR	Power	MTP programming power supply pin. (7.5V typical)	Left open or connected to GND
2	GND	Connected to GND	Ground.	/
3	D0P	I/O	MIPI interface.	Connected to GND
4	D0N			
5	GND	Connected to GND	Ground.	/
6	CLKP	I	MIPI interface.	Connected to GND
7	CLKN			
8	GND	Connected to GND	Ground.	/
9	D1P	I	MIPI interface.	Connected to GND
10	D1N			
11	GND	Connected to GND	Ground.	/
12	IM0	I	Interface type selection pin.	/
13	IM1			
14	GND	Connected to GND	Ground.	/
15	TSP_SDA	I/O	Touch I2C data	/
16	TSP_SCL	I	Touch I2C clock	/
17	TSP_RST	I	TSP Reset signal. Active low.	/
18	TSP_INT	O	Touch State change interrupt	/
19	TSP_VCC	Power	TP Power Supply	/
20	TSP_IOVCC	Power	TP Power Supply	/
21	D[1]	I/O	8-bit bi-directional data bus for 80-series MPU I/F .	Open
22	D[0]			
23	GND	Connected to GND	Ground.	/
24	CSX	I	Chip select input pin ("Low" enable) in SPI I/F.	Connected to IOVCC
25	WRX_SCL	I	SCL: A synchronous clock signal in SPI I/F.	Connected to GND
26	DCX	I	Display data / command selection in 4-wire SPI I/F. DCX = "0" : Command DCX = "1" : Display data or Parameter	Connected to GND
27	SDI_RDX	I/O	SDI: Serial inputs signal in SPI I/F. The data is input on the rising edge of the SCL signal.	Open
28	SDO	O	Serial outputs signal in SPI I/F. The data is output on the rising/falling edge of the SCL signal. If the host places the SDI line into high-impedance state during the read interval, the SDI and SDO can be tied together.	Open
29	RESET	I	This signal will reset the device and must be applied to properly initialize the chip. Signal is active low.	/
30	TE	O	Tearing effect output pin to synchronize MCU to frame writing, activated by S/W command.	Open
31	OLED_EN	O	Power IC enable control pin (Note: "H" = IOVCC level, "L" = GND level.)	/

32	SWIRE	O	Swire protocol setting pin (Note: "H" = IOVCC level, "L" = GND level.)	/
33	GND	Connected to GND	Ground.	/
34	VCC	Power	Input Voltage for analog power supply	/
35	IOVCC	Power	Input voltage for logic/interface power supply	/
36	GND	Connected to GND	Ground.	/
37	ELVDD	Power	Power supply for pixel circuit.	/
38	ELVDD			
39	ELVDD			
40	GND	Connected to GND	Ground.	/
41	ELVSS	Power	Power supply for pixel circuit.	/
42	ELVSS			
43	ELVSS			
44	GND	Connected to GND	Ground.	/
45	GND			

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