

Specification for Colour AMOLED Display module

1.3" Circular AMOLED Display module

Manufacturer	Truly Semiconductors LTD
Part n°	AM013RN90020V0
Ordering n°	AM013RN90020V0
Customer Part n°	n/a
Revision n°	0.6
Issue Date	2017/06/26

Customer's Approval

Company name	
Printed name	
Job title	
Signature	
Approval Stage:	<p>This product is approved for the following production stage: -</p> <ul style="list-style-type: none"> <input type="checkbox"/> Sample / Prototype <input type="checkbox"/> Pre-Production <input type="checkbox"/> Mass Production
Approval Date	

Supplied by Anders Electronics plc
 Manufactured by Truly Semiconductors LTD

PRODUCT : AMOLED MODULE

MODEL NO. : AM013RN90020V0

SUPPLIER : TRULY (HUI ZHOU)
SMART DISPLAY LTD.

DATE : May. 26,2017

SPECIFICATION

Revision: 0.6

AM013RN90020V0

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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WRITTEN BY	CHECKED BY	APPROVED BY
MA XINLAN	YW WANG	

■ 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: 1.3 Inch Circle 360×360
- 3) Interface: MIPI 1lane/2lane
- 4) Driver IC: RM67162
- 5) Polarizer: Hard Coating Polarizer

■ APPLICATION

Smart Watch

■ GENERAL INFORMATION

Item	Contents	Unit
Display Mode	AMOLED	/
LTPS Glass Outline (W×H)	35.34 × 36.84	mm
Encapsulation Glass Outline (W×H)	35.34 × 35.34	mm
Active area	φ 32.94	mm
Number of Dots	360×3(RGB)×360	/
Diagonal Inch	1.3	inch
Pixel pitch (W×H)	91.5 × 91.5	um
Glass Thickness	0.2 (LTPS) 0.205 (Encap) 0.678(Total)	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
Operating temperature	T _{OP}	-20	60	°C
Storage temperature	T _{ST}	-30	70	°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	2.8	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
Input voltage	'L' level	V _{IL}	IOVCC=1.65V ~3.3V	0.0	-	0.2*IOVCC	V
	'H' level	V _{IH}		0.8*IOVCC	-	IOVCC	V
Output voltage	'L' level	V _{OL}	I(OH)=-1mA I(OL)=+1mA	0.0	-	0.2*IOVCC	V
	'H' level	V _{OH}		0.8*IOVCC	-	IOVCC	V
Current (Display)	Sleep out mode	I _{VCI}	Full white display	-	5	7.5	mA
		I _{IOVCC}		-	1	2	mA
		I _{ELVDD/ELVSS}		-	15	22.5	mA
	Deep Standby Mode	I _{VCI}		-	1	3	uA
		I _{IOVCC}		-	1	3	uA
		I _{ELVDD/ELVSS}		-	-	-	mA
Frame Frequency	f _{FRM}		-	60	-	Hz	

■ OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Type	Max	Unit	Note
Surface Luminance	L _v	θ=0° ∅=0° T _a =25°C	300	350	-	cd/m ²	Note1
Luminance uniformity	δ WHITE		80	-	-	%	Note2
Contrast Ratio	Cr		10000	-	-	-	Note3
Viewing Angle	θ	Up/Down/Right/Left Cr≥10	88	-	-	deg	Note4
Color Coordinate of CIE1931	Red x	θ=0° ∅=0° T _a =25°C	0.635	0.665	0.695	-	Note 5
	Red y		0.309	0.339	0.369	-	
	Green x		0.169	0.219	0.269	-	
	Green y		0.673	0.723	0.773	-	
	Blue x		0.100	0.140	0.180	-	
	Blue y		0.008	0.048	0.088	-	
	White x		0.275	0.295	0.315	-	
White y	0.295	0.315	0.335	-			
NTSC ratio	-	-	85	100	-	%	CIE1931

Note1. Surface Luminance

- Measurement equipment: CS2000 or similar equipment.
- Measuring surroundings: Dark room.
- Measuring temperature: T_a=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):

$$L_v = \text{Average Luminance with all white pixels (P}_1, P_2, P_3, P_4, P_5)$$

Note2. Luminance Uniformity

- Measurement equipment: CS2000 or similar equipment.
- Measuring surroundings: Dark room.
- Measuring temperature: T_a=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:

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

$$L_p (\text{Min.}) = \text{Minimum Luminance with all white pixels (P}_1, P_2, P_3, P_4, P_5)$$

$$L_p (\text{Max.}) = \text{Maximum Luminance with all white pixels (P}_1, P_2, P_3, P_4, P_5)$$

Note3. Contrast Ratio

- Measurement equipment: CS2000 or similar equipment.
- Measuring surroundings: Dark room.
- Measuring temperature: T_a=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:

$$\text{Contrast Ratio(Cr)} = L_w / L_b$$

$$L_w = \text{Average Luminance with all white pixels (P}_1, P_2, P_3, P_4, P_5)$$

$$L_b = \text{Average Luminance with all black pixels (P}_1, P_2, P_3, P_4, P_5)$$

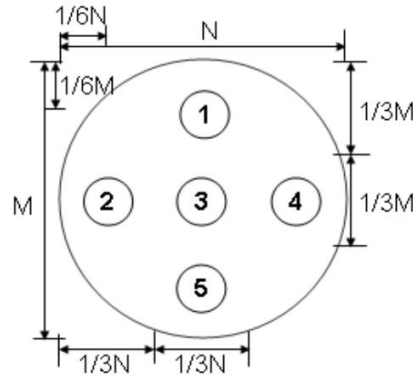


Fig-1

Note4. Viewing Angle

- Measurement equipment: DMS803 or similar equipment.
- Measuring surroundings: Dark room.
- Measuring temperature: $T_a=25^{\circ}\text{C}$.
- 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.

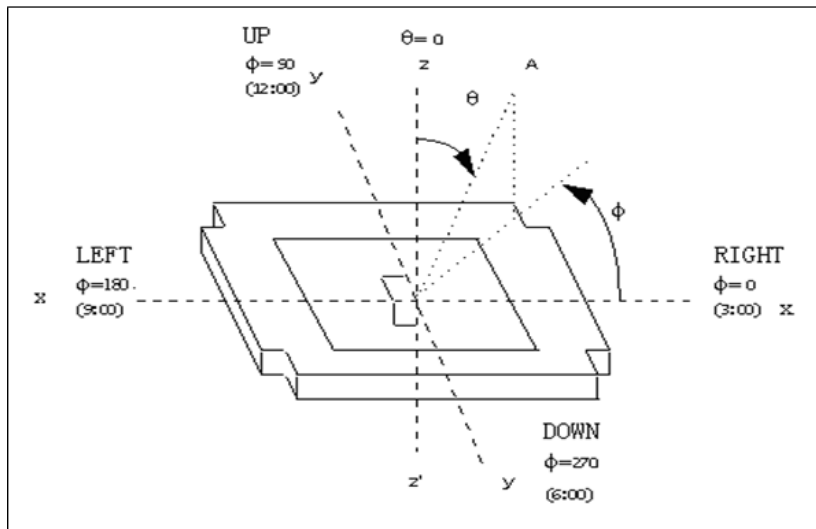


Fig-3

Note5. Color Coordinate of CIE1931

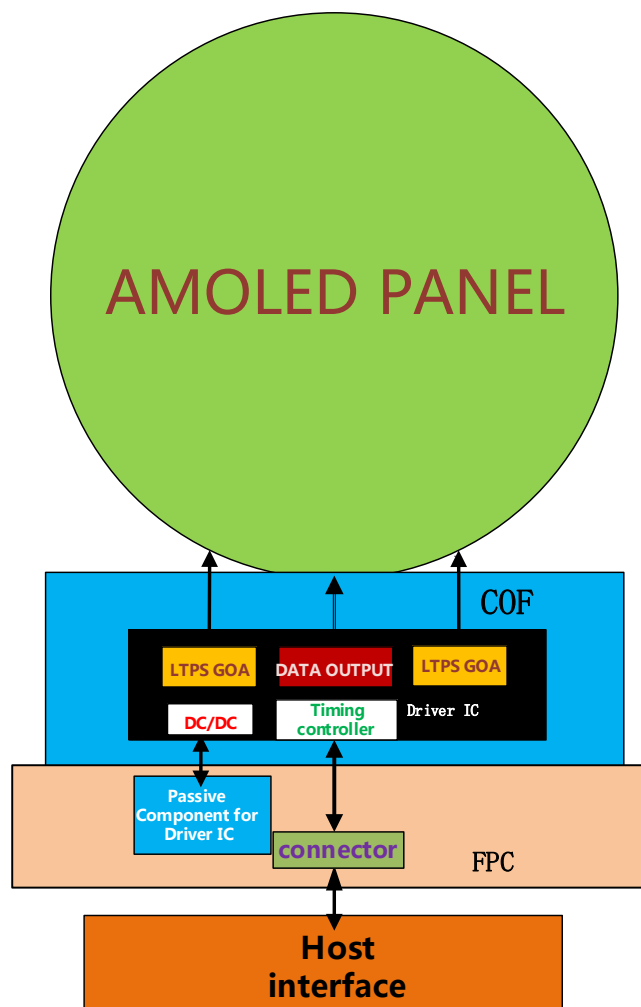
- Measurement equipment: CS2000 or similar equipment.
- Measuring surroundings: Dark room.
- Measuring temperature: $T_a=25^{\circ}\text{C}$.
- The x, y value of Color Coordinate is determined by measuring at center position of the display panel.

■ INTERFACE DESCRIPTION

Interface NO.	Symbol	I/O or Connected to	Description	When not in use
1	TSP_VCC	Power	TP Power Supply	/
2	TSP_IOVCC	Power	TP Power Supply	
3	TP_GND	Power	TP Ground.	/
4	TSP_SCL	I	Touch I2C clock	
5	TSP_SDA	I/O	Touch I2C data	/
6	TSP_HSYNC	I/O	Multi-chip synchronization signal	
7	TSP_INT	I	Touch State change interrupt	
8	TSP_RESET	I	TSP Reset signal. Active low.	/
9	GND	Power	Ground.	/
10	MTP_PWR	I	MTP programming power supply pin. (8V typical) Must be left open or connected to DVSS in normal condition.	
11	TE	O	Tearing effect output pin to synchronize MCU to frame writing, activated by S/W command. When this pin is not activated, this pin is output low. If not used, please open this pin.	/
12	GND	Power	Ground.	
13	D3P/NC	NC	No connection	
14	D3N/NC	NC	No connection	
15	GND	Power	Ground.	
16	DOP	I/O	- These pins are DSI -D0+/- differential data signals if MIPI interface is used	
17	DON	I/O	These pins are DSI -D0+/- differential data signals if MIPI interface is used	/
18	GND	Power	Ground.	/
19	CLKP	I	- These pins are DSI -CLK+/- differential data signals if MIPI interface is used	
20	CLKN	I	These pins are DSI -CLK+/- differential data signals if MIPI interface is used	
21	GND	Power	Ground.	/
22	D1P	I	These pins are DSI -D1+/- differential data signals if MIPI interface is used	
23	D1N	I	These pins are DSI -D1+/- differential data signals if MIPI interface is used	
24	GND	Power	Ground.	
25	D2P/NC	NC	No connection	
26	D2N/NC	NC	No connection	/
27	GND	Power	Ground.	
28	RESET	I	This signal will reset the device and must be applied to properly initialize the chip. Signal is active low.	
29	OLED_EN	O	Power IC enable control pin (Note: "H" = VDDI level, "L" = VSSI level.)	
30	SWIRE	O	Swire protocol setting pin (Note: "H" = VDDI level, "L" = VSSI level.)	
31	PCD	O	PCD (Panel Crack Detection) output pin.	
32	VCC	Power	Input Voltage for analog power supply	/
33	IOVCC	Power	Input voltage for logic/interface power supply	/
34	GND	Power	Ground	/
35	AVDD	NC	No connection	/
36	GND	Power	Ground	

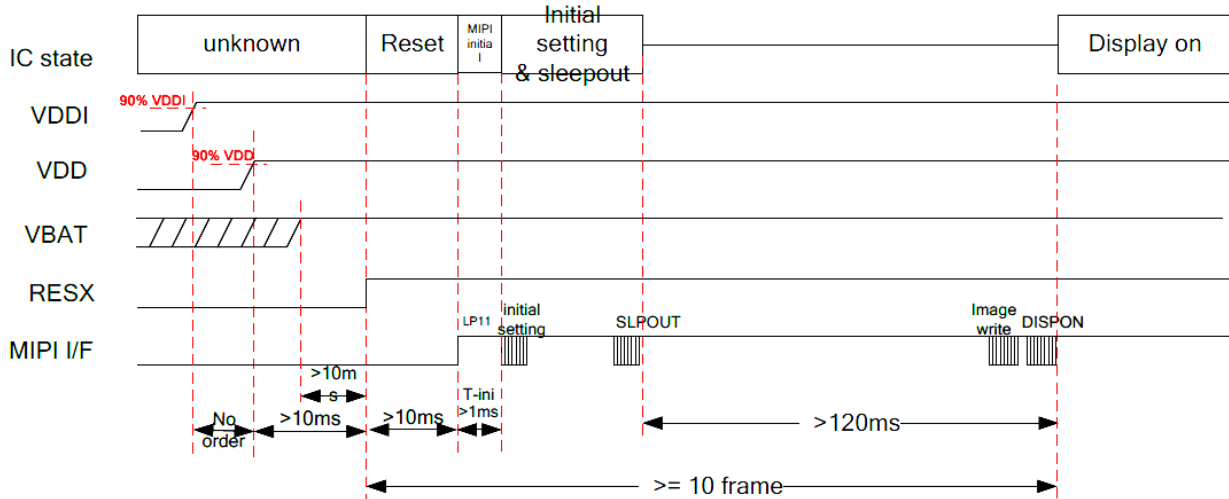
37	ELVDD	Power	Power supply for pixel circuit.	
38	ELVDD			
39	ELVDD			/
40	GND	Power	Ground	/
41	ELVSS	Power	Power supply for pixel circuit.	/
42	ELVSS			/
43	ELVSS			/
44	GND	Power	Ground	/
45	GND			/

Module Block Diagram

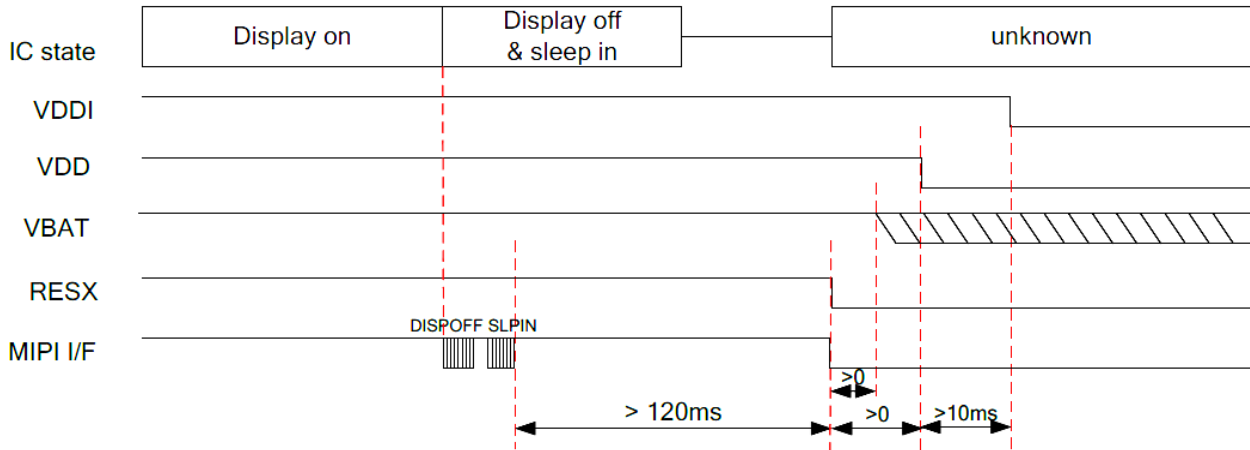


Recommended Operating Sequence

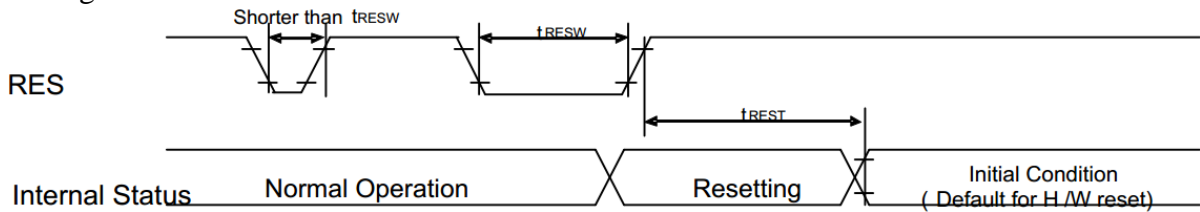
Power on sequence



Power off sequence



Reset Timing



Reset input timing:

IOVCC=1.65 to 3.3V, VCC=2.7 to 3.6V, AGND=DGND=0V, Ta=-40 to 85°C

Symbol	Parameter	Related Pins	MIN	TYP	MAX	Note	Unit
tRESW	Reset low pulse width	RESX	10	-	-	-	Us
tREST	Reset complete time	-	-	-	5	When reset applied during Sleep in mode	ms
		-	-	-	120	When reset applied during Sleep out mode	ms

EXTERNAL DIMENSIONS

