Revision Record			
Version	Modify the content	Revision date	Reviser
A0	Release	-	shenlijun

Document Distribution Chapter		Approval By		Checked By		Designed By	

CONTENTS

1. GENERAL DESCRIPTION 4
2. FEATURES 4
2.1 Display Color 4
2.2 Display Format 4
2.3 Interface 4
3. SPECIFICATIONS SUMMARY 4
4. MECHANICAL SPECIFICATION 4
5. ABSOLUTE MAXIMUM RATINGS 4
6. ELECTRICAL CHARACTERISTICS 5
7. ELECTRO-OPTICAL CHARACTERISTICS 5
8. INPUT/OUTPUT PIN ASSIGNMENT 7
8.1 I/O Signal Interface 7
8.2 Functional Block Diagram 9
8.3 RGB Interface 9
8.4 Recommended Signal Processing 9
8.5 I2C Interface Timing 10
8.5.1 Write data to one address at a time 10
8.5.2 Write data to multiple different registers 10
8.5.3 Read a specific address 11
8.5.4 I2C timing 12
8.6 Power On/Off Sequence 13
8.6.1 Power On Sequence 13
8.6.2 Power Off Sequence 13
9. DESCRIPTION OF FUNCTION 14
9.1 I2C address description 14
9.2 Display Mode 14
9.3 BIST Mode 14
9.4 Contrast Adjustment 15
9.5 Display Position Adjustment 15
9.6 Color Convert 15
9.7 Brightness Control 15
9.8 Display Direction Control 16
9.9 Gamma Function 16
10. RELIABILITY TEST PLAN 21
10.1 Test item list 21

10.2 Details For RA test items..... 21
10.2.1 High Temperature High Humidity Operation..... 21
10.2.2 High Temperature Operation..... 22
10.2.3 Low Temperature Operation..... 22
10.2.4 High Temperature Storage..... 22
10.2.5 Low Temperature Storage..... 23
10.2.6 Thermal shock test..... 23
10.2.7 Pencil hardness test..... 23
10.2.8 Transmittance test..... 24
10.2.9 Package drop test..... 24
11. DRAWING..... 25
11.1 Product Drawing..... 25
11.2 PCBA Drawing..... 25
11.3 Schematic Diagram..... 26
12. GENERAL PRECAUTIONS..... 27

1. General Description

PMOF039XGAM 1024x768 microdisplay is a high-resolution, light-emitting OLED microdisplay based on a CMOS backplane that also has a standard video interface. The S009F has high contrast, high consistency and highlight performance.

2. Features

2.1 Display Color : 16M_Color（RGB）

2.2 Display Format : 0.39” 1024（RGB）x768

2.3 Interface : RGB-24bits, I2C

3. Specifications Summary

No.	Item	Unit	Specification	Note
1	Screen size	inch	0.39	
2	Resolution	dot	1024（RGB）x768	
3	Display mode	--	Micro OLED	
4	Aspect ratio	--	4:3	
5	Active area	mm	7.83(W) x 5.91(H)	
6	Outline dimension	mm	10.55(W) x 7.96(H)	

4. Mechanical Specification

Item	Specifications	Unit
MOD dimensional outline	16.6(W) x 14.2(H)	mm
Panel thickness	1.2±0.05	mm
Number of dots	1044(W)（RGB）x788(H)	Dots
Pixel pitch	7.5 x 7.5	um

5. Absolute Maximum Ratings

Item	Symbol	Value		Unit	Remark
		Min.	Max.		
Digital power supply	DVDD	-0.3	2.0	V	
Analog power supply	AVDD	-0.3	2.0	V	
Data processing circuit power supply	AVDD5V	-0.3	5.5	V	
OLED Positive supply	AVDDP	-0.3	5.5	V	
OLED Negative supply	COM	-5.0	0.5	V	
Operating temperature(Ambient)	Top	-40	70	℃	
Storage temperature(Ambient)	Tstg	-40	85	℃	
Humidity	Hstg	10	95	%RH	

Note: If the module exceeds the absolute maximum ratings, it may be damaged permanently.

6. Electrical Characteristics

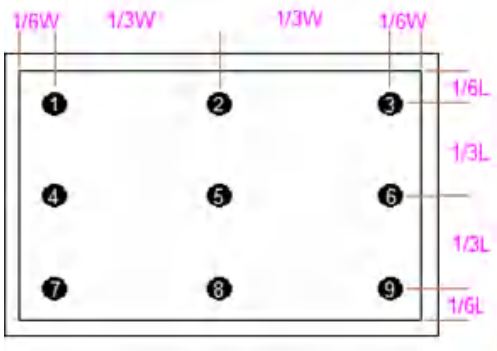
Display DC Characteristics &Current Consumption

Item		Symbol	Condition	Min	Typ.	Max.	Unit	Note
Supply voltage	Logic voltage	DVDD	-	1.62	1.8	1.98	V	
	Analog voltage	AVDD	-	1.62	1.8	1.98	V	
	OLED Positive supply	AVDDP	-	2.5	5.0	6.0	V	
	OLED Negative supply	COM	-	-4.0	-1.5	-1.0	V	
Input voltage	"H" level	VIH	-	1.3	-	-	V	
	"L" level	VIL	-	-	-	0.5	V	
Output voltage	"H" level	VOH	-	DVDD-0.2	-	-	V	
	"L" level	VOL	-	-	-	0.36	V	
Current consumption	Sleep out mode Display mode	IAVDD5	Frame frequency =60Hz white pattern	-	-	18.0	mA	2000 cd/m2
		IAVDD		-	-	20.0	mA	
		IAVDDP		-	-	43.7	mA	
		ICOM		-	-	20.5	mA	
	Sleep in mode	IVCI	sleep mode	-	-	-	mA	
		IVDDIO		-	-	-	mA	

7. Electro-optical characteristics

Item	Symbol	Temp	Condition	Min.	Typ.	Max.	Unit	Note
Brightness		25℃	Normal (White Mode)	200	1000	-	cd/m2	
Brightness uniformity		25℃	Normal (White Mode)	80	-	-	%	(1)
Contrast ratio	K	25℃	Φ=0°, θ=0°	2000	-	-	-	(1), (2)
Color gamut		25℃	vs. NTSC	-	100	-	%	(3)
Viewing angle		25℃	Up/Down/Right /Left CR ratio ≥10	60	-	-	-	(1), (4)
Crosstalk		25℃	window: black/white background: gray127	-	-	5	%	(1), (5)
Gamma		25℃	Gray= 16, 32, 48, 64, 80, 96, 112, 128, 144, 160,196,212, 228,244	2.0	2.2	2.4	-	

Note 1) Uniformity Measuring Point



$$\text{Uniformity} = \frac{\text{Minimum Surface Luminance with all white pixels } (P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8, P_9)}{\text{Maximum Surface Luminance with all white pixels } (P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8, P_9)} \times 100\%$$

Note 2) Definition of contrast ratio (K)

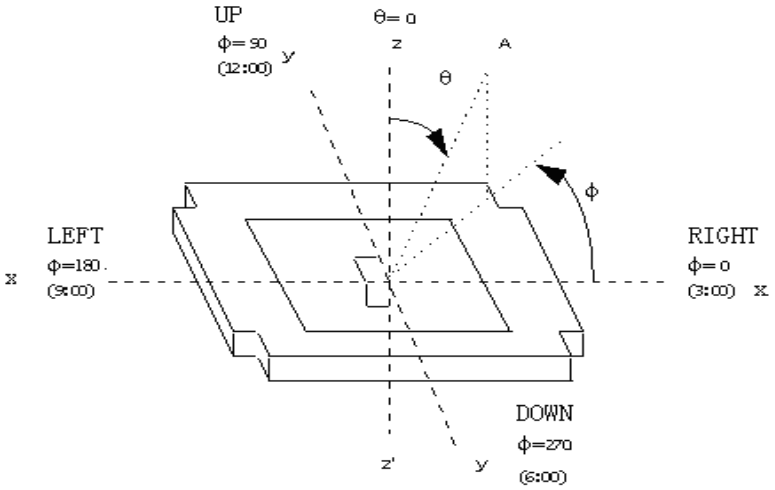
$$\text{Contrast Ratio} = \frac{\text{Average Surface Luminance with all white pixels } (P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8, P_9)}{\text{Average Surface Luminance with all black pixels } (P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8, P_9)}$$

Note 3) Definition of Color Gamut

Color Gamut = (0.5*((Rx*Gy + Gx*By + Bx*Ry) - (Ry*Gx + Gy*Bx + By*Rx)) / 0.1582) ×100%

Note 4) Calculation method of CrossTalk

The MICRO OLED module screen is placed horizontally on the test bench, and the screen contrast is tested in the up, down, left, and right directions, in the field where the contrast ratio ≥ 10 is satisfied, and there is no gray scale inversion. as the picture shows.

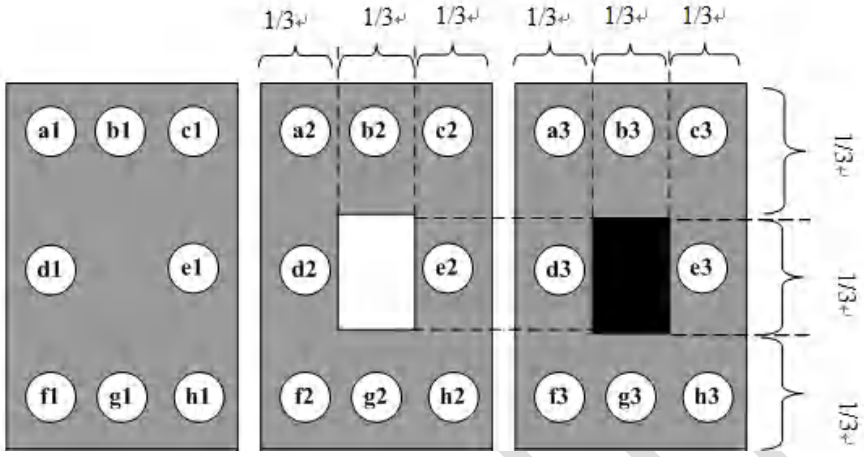


Note 5) Calculation method of CrossTalk

1. The test screen uses a half gray scale plus a square screen;
2. The length and width of the middle square each occupy 1/3 of the horizontal and vertical screen;

3. Test the brightness of the half gray scale and the square picture a/b/c/d/e/f/g/h, as shown in the figure;

4. Calculate Crosstalk according to the following formula.



$$CrossTalk\_White = \begin{cases} \left|1-\left(\frac{b2}{a2}\div\frac{b1}{a1}\right)\times 100\%\right|, \left|1-\left(\frac{b2}{c2}\div\frac{b1}{c1}\right)\times 100\%\right| \\ \left|1-\left(\frac{d2}{a2}\div\frac{d1}{a1}\right)\times 100\%\right|, \left|1-\left(\frac{d2}{f2}\div\frac{d1}{f1}\right)\times 100\%\right| \\ \left|1-\left(\frac{e2}{c2}\div\frac{e1}{c1}\right)\times 100\%\right|, \left|1-\left(\frac{e2}{h2}\div\frac{e1}{h1}\right)\times 100\%\right| \\ \left|1-\left(\frac{g2}{f2}\div\frac{g1}{f1}\right)\times 100\%\right|, \left|1-\left(\frac{g2}{h2}\div\frac{g1}{h1}\right)\times 100\%\right| \end{cases}$$

$$CrossTalk\_Black = \begin{cases} \left|1-\left(\frac{b3}{a3}\div\frac{b1}{a1}\right)\times 100\%\right|, \left|1-\left(\frac{b3}{c3}\div\frac{b1}{c1}\right)\times 100\%\right| \\ \left|1-\left(\frac{d3}{e3}\div\frac{d1}{e1}\right)\times 100\%\right|, \left|1-\left(\frac{d3}{f3}\div\frac{d1}{f1}\right)\times 100\%\right| \\ \left|1-\left(\frac{e3}{c3}\div\frac{e1}{c1}\right)\times 100\%\right|, \left|1-\left(\frac{e2}{h3}\div\frac{e1}{h1}\right)\times 100\%\right| \\ \left|1-\left(\frac{g3}{f3}\div\frac{g1}{f1}\right)\times 100\%\right|, \left|1-\left(\frac{g3}{h3}\div\frac{g1}{h1}\right)\times 100\%\right| \end{cases}$$

$$CrossTalk = MAX\{CrossTalk\_White\ ,\ CrossTalk\_Black\}$$

8. Input/Output Pin Assignment

8.1 I/O Signal Interface

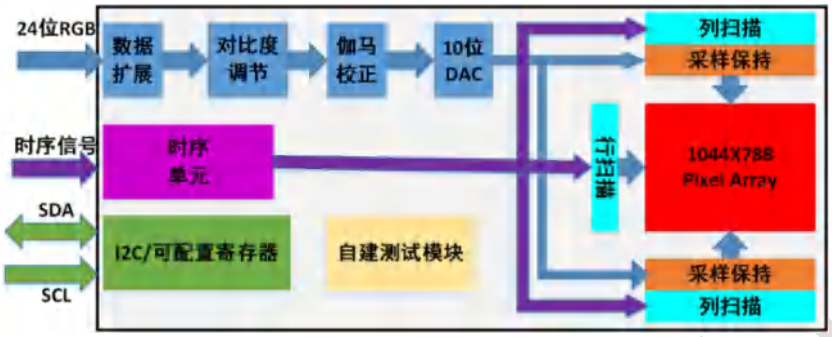
Connector Type: 5035664502

Pin	Symbol	I/O	Description	Notes
1	CMD_CE	I	I2C address selection	
2	CMD_SO	I/O	I2C SDA	
3	CMD_CK	I	I2C SCL	
4	CMD_SI	I	Not used, Connected ground	
5	COM	P	OLED device negative voltage	
6	CMD_SEL	I	Connected ground	
7	GND	P	Ground	
8	GND	P	Ground	

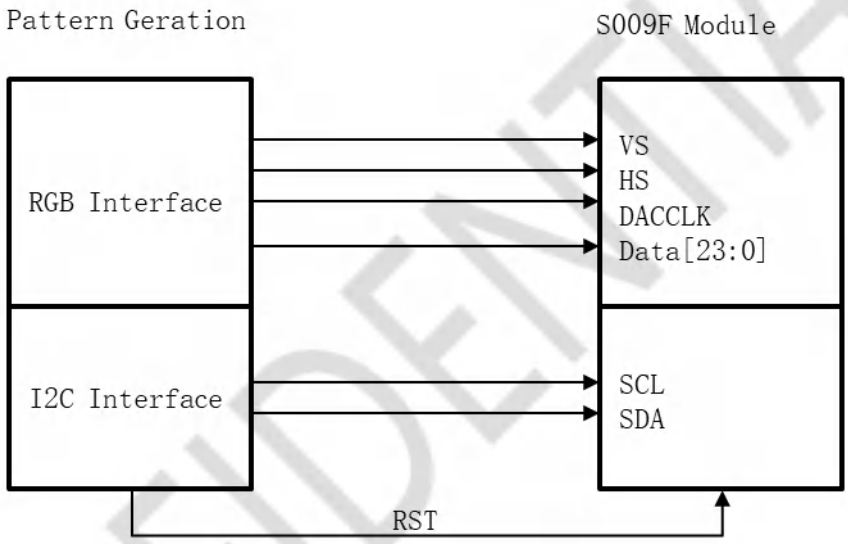
9	VID0	I	Video data B[0], connected ground when not used	
10	VID1	I	Video data B[1], connected ground when not used	
11	VID2	I	Video data B[2], connected ground when not used	
12	VID3	I	Video data B[3], connected ground when not used	
13	VID4	I	Video data B[4], connected ground when not used	
14	VID5	I	Video data B[5], connected ground when not used	
15	VID6	I	Video data B[6], connected ground when not used	
16	VID7	I	Video data B[7], connected ground when not used	
17	VBH	P	Voltage of brightness adjusting	
18	VID8	I	Video data G[0], connected ground when not used	
19	VID9	I	Video data G[1], connected ground when not used	
20	VID10	I	Video data G[2], connected ground when not used	
21	VID11	I	Video data G[3], connected ground when not used	
22	VID12	I	Video data G[4], connected ground when not used	
23	VID13	I	Video data G[5], connected ground when not used	
24	VID14	I	Video data G[6], connected ground when not used	
25	VID15	I	Video data G[7], connected ground when not used	
26	VID16	I	Video data R[0], connected ground when not used	
27	VID17	I	Video data R[1], connected ground when not used	
28	VID18	I	Video data R[2], connected ground when not used	
29	VID19	I	Video data R[3], connected ground when not used	
30	VID20	I	Video data R[4], connected ground when not used	
31	VID21	I	Video data R[5], connected ground when not used	
32	VID22	I	Video data R[6], connected ground when not used	
33	VID23	I	Video data R[7], connected ground when not used	
34	VID_DE	I	Video data enable (data valid)	
35	VID_VSY	I	Vertical sync signal	
36	VID_HSY	I	Horizontal sync signal	
37	VID_CLK	I	Clock signal	
38	GND	P	Ground	
39	GND	P	Ground	
40	RST	I	Global reset	
41	GND	P	Ground	
42	AVDDP	P	Power supply for the entire pixel array	
43	AVDD5	P	Power supply for data processing circuits after DAC	
44	DVDD	P	Digital circuit power supply such as digital module and	
45	AVDD	P	Analog circuit power supply	

Note (1): I (input); O (output); P (Power); I/O (input /output).

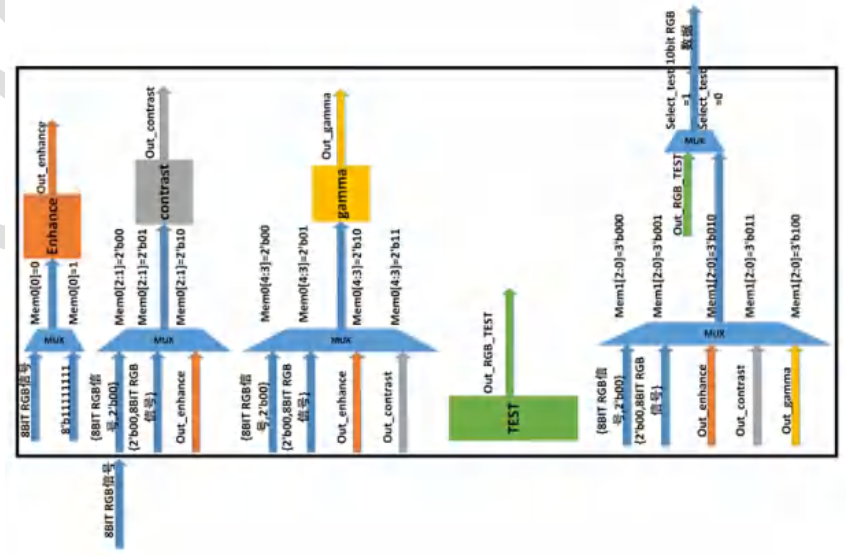
8.2 Functional Block Diagram



8.3 RGB Interface



8.4 Recommended Signal Processing



The signal processing includes a video data expansion module, a contrast adjustment module, and gamma correction module. these modules are controlled by I2C controlled

registers.

8.5 I2C Interface Timing

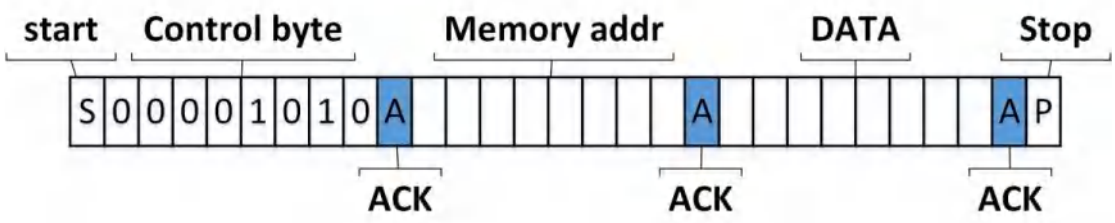
The chip integrates a functional module (8bit transmission protocol) suitable for I2C standard protocol. Through the preparation of different registers by this module, the adjustment of the contrast adjustment, gamma correction, display position movement and other functions of the internal chip can be realized. It can directly communicate with the I2C host computer chip.

This I2C is only a slave and can only be used for reception.

This chip provides two slaves with addresses 7’b0000101 and 7’b0000001, and a read and write bit also becomes a control byte.

PMO039XGAM chip integrated I2C read and write operation instructions (take address 7’b0000101 as an example):

8.5.1Write data to one address at a time



The process can be divided into:

the master sends a start signal start;

the master then sends controlbyte and indicates to write data to the slave;

the slave responds;

the master sends the register address to be written;

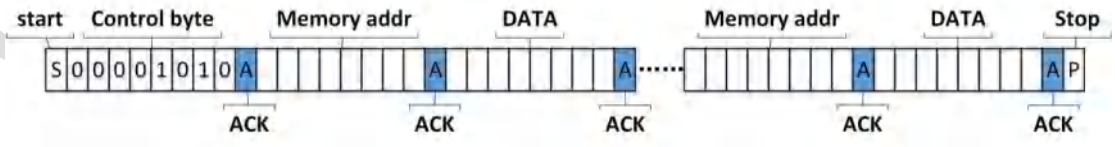
the slave responds;

the master sends the data to be written in the register;

the slave answers;

the master generates an end signal.

8.5.2Write data to multiple different registers



The process can be divided into:

the master sends a start signal start;

the master then sends controlbyte and indicates to write data to the slave;

the slave responds;

the master sends the register address to be written;