



# **OLP060SVC01-06**

## **Silicon-based OLED Microdisplay**

Product Manual

Version 2.0

## Version Release History

Version No.	Date	Page No.	Content
1.0	2021-09-23		Official version release
1.1	2021-10-14	8	Change the figure
2.0	2022-06-14		Adjust content

## Content

<b>1 Product introduction</b>	<b>1</b>
1.1 Major features	1
1.2 Product feature parameters	2
<b>2 Function overview and ports</b>	<b>3</b>
2.1 Functional block diagram	3
2.2 Pinout description	3
<b>3 Electrical features</b>	<b>6</b>
3.1 Absolute Maximum Ratings	6
3.2 DC Characteristics	6
3.3 AC Characteristics	7
3.4 Power Consumption	7
3.5 Power Sequence	8
3.6 Video sequence	9
<b>4 Function description</b>	<b>10</b>
4.1 Register Map	10
4.2 Internal test diagram setting	11
4.3 Video Interface	11
4.3.1 Selection of input signal format	11
4.3.2 ITU-R BT.656 format signal register setting	13
4.3.3 YCbCr signal format description	14
4.4 Up/down and/or right/left inverse display	14
4.5 Image display position	15
4.6 Images move at regular intervals	15
4.7 Temperature detection	16
4.8 Brightness adjustment	16
4.9 Brightness-Temperature compensation	17
4.10 Image brightness digital adjustment	17

4.11 Image contrast adjustment .....	18
4.12 I2C serial port .....	18
4.12.1 Slave address selection .....	18
4.12.2 Data transfer format .....	19
<b>5 Optical features</b> .....	20
5.1 Pixel arrangement .....	20
5.2 Display quality standard .....	20
5.2.1 Display area definition .....	20
5.2.2 Defect point inspection standard .....	21
5.2.3 Test conditions .....	21
<b>6 Structure and package</b> .....	22
6.1 Product structure .....	22
6.2 Connector dimension and FPC design recommendation .....	22
6.3 Product package description .....	23
<b>7 Product precautions</b> .....	24
7.1 Use precautions .....	24
7.2 Cleaning precautions .....	24
7.3 Storage requirements .....	24
7.4 Others .....	25

# 1 Product introduction

OLP060SVC01-06 microdisplay is a silicon-based OLED microdisplay with top-emitting, high-efficiency, and independently developed by Nanjing Guozhao Optoelectronics Technology Co., Ltd. It's silicon-based substrate uses 0.18  $\mu\text{m}$  CMOS technology. This product integrates some modules like signal enhancement circuits, row and column drive circuits, logic control circuits, and other modules. It supports 8/16 / 24bit digital video signal, ITU-R BT656 standard input mode. Through the I2C line serial programming interface, it can realize the control and adjustment of display mode, display direction, brightness, contrast and other functions. This product has the characteristics of low-power consumption, high-resolution, high-integration, miniaturization, etc., and it can be widely used in various near-eye display systems with miniaturization, high-resolution, low-power consumption and wide-temperature range.

## 1.1 Major features

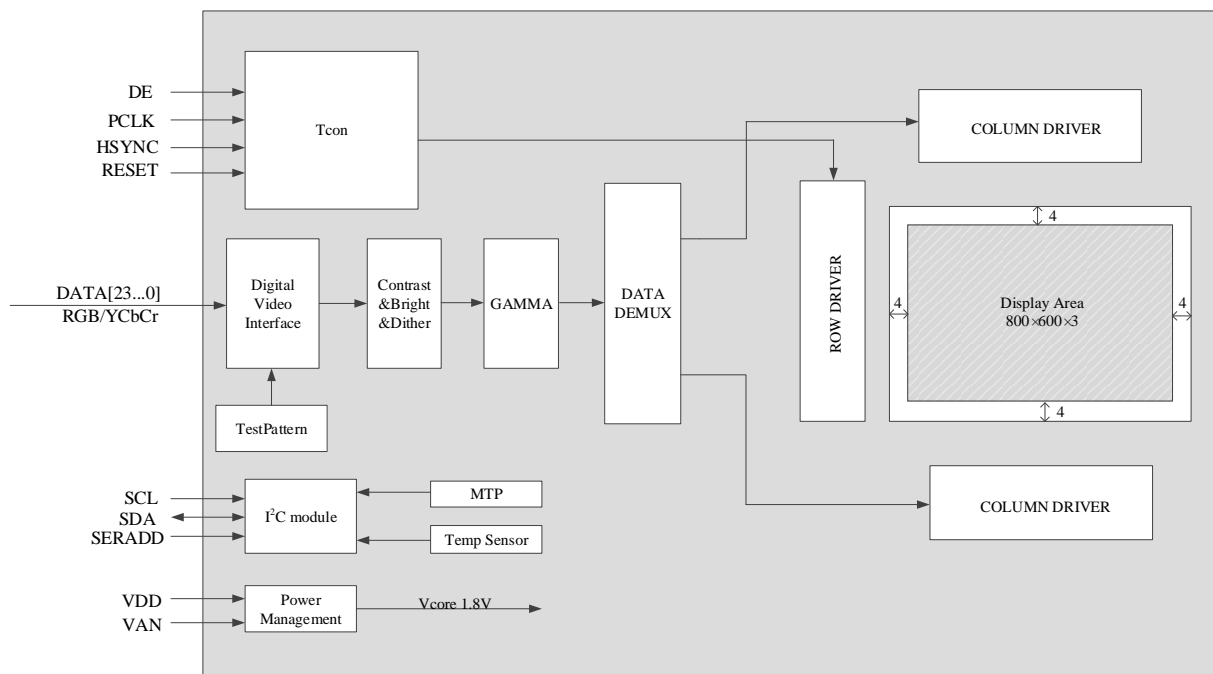
- Low power consumption
- High contrast
- The communication port supports the I2C universal serial protocol
- The input port supports RGB, YCbCr, ITU-R BT.656 encoding formats
- Embedded temperature sensor
- PWM-mode brightness adjustment function
- Brightness adaptive adjustment function supported
- Support horizontal/ vertical image mirroring, and timed movement function

## 1.2 Product feature parameters

Item	Feature parameter
Product category	Colored
Resolution	800×600 (808×608 reserved)
Pixel arrangement	RGB Vertical Stripe
Pixel dimension	15μm×15μm
Active area	12.0mm×9.0mm (0.60 inch diagonally)
Gray level	256-level
Uniformity @150cd/m <sup>2</sup>	≥ 90%
Contrast	>10000:1
Frame rate	25Hz~75Hz
Video interface	24bit-RGB、8/16/24bit-YCbCr、ITU-R BT.656
Typical luminance	150 cd/m <sup>2</sup>
Recommended luminance range	50 cd/m <sup>2</sup> ~ 300 cd/m <sup>2</sup>
Operating voltage	1.8V、5V
Typical power consumption	100mW @60Hz
	75mW @25Hz
Chromaticity	X = 0.290 , Y = 0.320
Weight	<1.5g

## 2 Function overview and ports

### 2.1 Functional block diagram



### 2.2 Pinout description

VDD	1	2	VAN
VDD	3	4	VAN
GND	5	6	GND
SCL	7	8	RESET
NC	9	10	SERADD
HSYNC	11	12	SDA
DATA_22	13	14	GND
DATA_20	15	16	DATA_23
DATA_18	17	18	DATA_21
DATA_16	19	20	DATA_19
DE	21	22	DATA_17
GND	23	24	PCLK
DATA_14	25	26	DATA_15
DATA_12	27	28	DATA_13
DATA_10	29	30	DATA_11
DATA_8	31	32	DATA_9
DATA_6	33	34	DATA_7
DATA_4	35	36	DATA_5
DATA_2	37	38	DATA_3
DATA_0	39	40	DATA_1

Note:

For detailed connector dimensions and connector FPC recommended design sizes, please refer to Section 6.

Pin	Name	Function
1	VDD	Digital circuit power supply
2	VAN	Analog circuit power supply
3	VDD	Digital circuit power supply
4	VAN	Analog circuit power supply
5	GND	Power ground
6	GND	Power ground
7	SCL	I2C clock
8	RESET	Reset signal, active low
9	NC	Internally not connected, no use constraints
10	SERADD	I2C slave address
11	HSYNC	Video horizontal synchronization
12	SDA	I2C data
13	DATA22	Data signal R[6]
14	GND	Power ground
15	DATA20	Data signal R[4]
16	DATA23	Data signal R[7]
17	DATA18	Data signal R[2]
18	DATA21	Data signal R[5]
19	DATA16	Data signal R[0]
20	DATA19	Data signal R[3]
21	DE	Video data enable
22	DATA17	Data signal R[1]
23	GND	Power ground
24	PCLK	Video clock
25	DATA14	Data signal G[6]
26	DATA15	Data signal G[7]
27	DATA12	Data signal G[4]
28	DATA13	Data signal G[5]
29	DATA10	Data signal G[2]
30	DATA11	Data signal G[3]
31	DATA8	Data signal G[0]
32	DATA9	Data signal G[1]
33	DATA6	Data signal B[6]



Pin	Name	Function
34	DATA7	Data signal B[7]
35	DATA4	Data signal B[4]
36	DATA5	Data signal B[5]
37	DATA2	Data signal B[2]
38	DATA3	Data signal B[3]
39	DATA0	Data signal B[0]
40	DATA1	Data signal B[1]

## 3 Electrical features

### 3.1 Absolute Maximum Ratings

Symbol	Item	Min.	Max.	Unit
<b>VDD</b>	Digital circuit power supply	-0.3	2.2	V
<b>VAN</b>	Analog circuit power supply	-0.3	5.5	V
<b>VI</b>	Input digital signal level	-0.3	VAN-0.3	V
<b>Tst</b>	Storage ambient temperature	-55	+75	°C

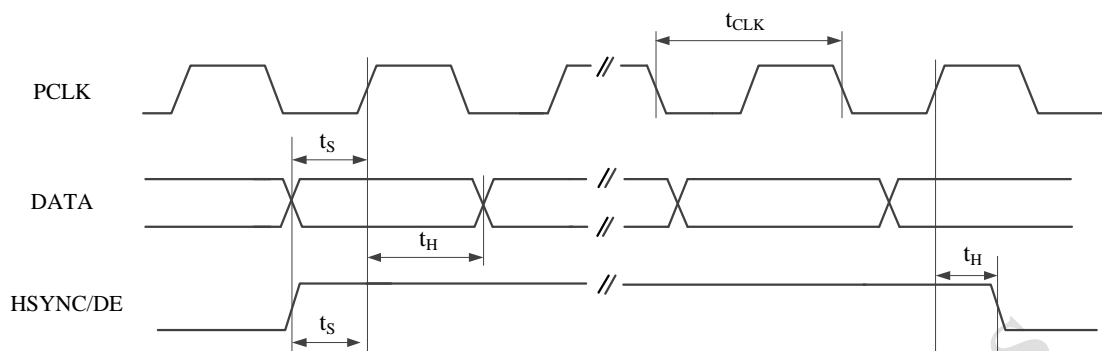
### 3.2 DC Characteristics

Symbol	Item	Min.	Typ.	Max.	Unit
V <sub>D</sub>	VDD voltage	1.75	1.80	1.85	V
I <sub>D</sub>	VDD current	—	—	40	mA
V <sub>A</sub>	VAN voltage	4.90	5.00	5.10	V
I <sub>A</sub>	VAN current	—	—	25	mA
V <sub>IL</sub>	Valid low level of digital signal	-0.3	—	0.5	V
V <sub>IH</sub>	Valid high level of digital signal	1.2	—	3.6 <sup>1</sup>	V
Top	Working ambient temperature	-45	+25	+65	°C

Note:

Digital input signals are compatible with 1.8V, 2.5V, 3.3V standards, but must meet the electrical standards in the table above.

### 3.3 AC Characteristics



Symbol	Item	Min.	Typ.	Max.	Unit
$t_s$	Setup time	4	—	—	ns
$t_H$	Hold time	1.5	—	—	ns
$t_{CLK}$	Clock cycle	—	15.4	—	ns
$d_{CLK}$	Duty cycle	45	50	55	%

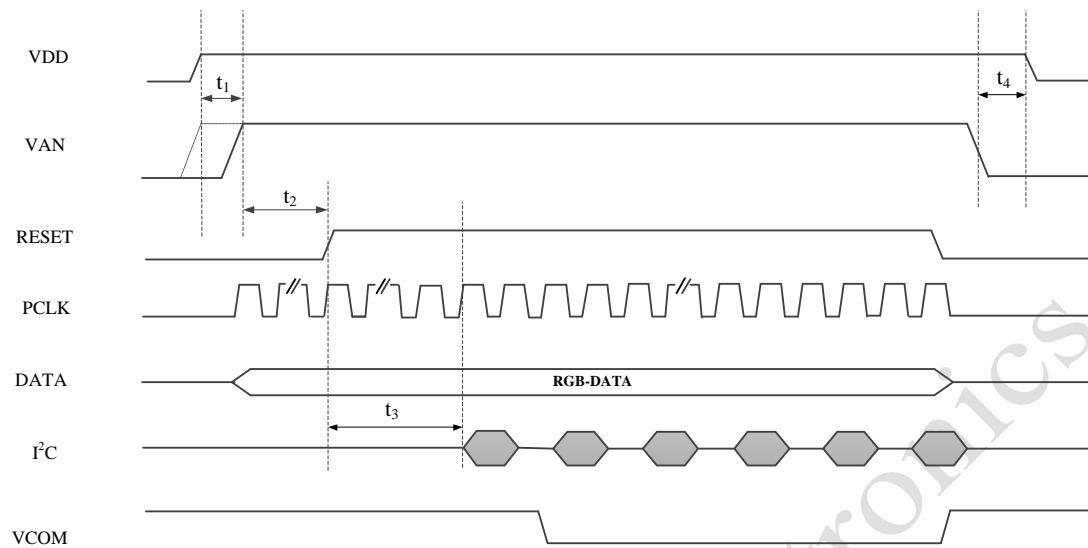
### 3.4 Power Consumption

Symbol	Item	Typ.		Unit
		25Hz	60Hz	
$P_{VDD}$	VDD power consumption	25	50	mW
$P_{VAN}$	VAN power consumption	50	50	mW
$P_{POWER}$	Total power consumption	75	100	mW

Note:

The brightness test condition is 150cd/m<sup>2</sup>, the temperature test condition is +25 °C ± 2 °C, and the test screen is full white.

### 3.5 Power Sequence



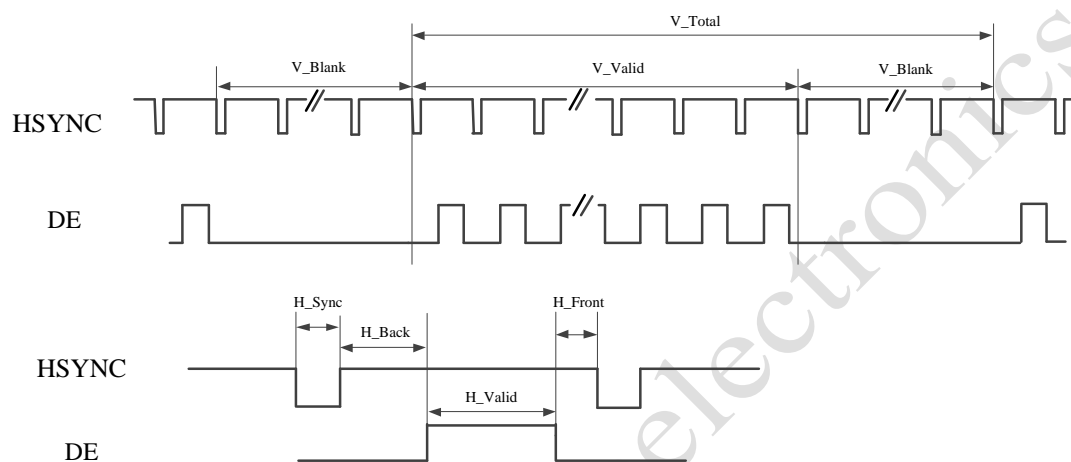
Symbol	Item	Min.	Typ.	Max.	Unit
$t_1$	VAN power-on delay	0	—	—	ms
$t_2$	Power settling time	5	—	—	ms
$t_3$	MTP content loading and data refresh time	frames time $\times 5$	—	—	—
$t_4$	Power-off interval time	0	—	—	ms

Note:

- To avoid the display error, we need to ensure the accuracy of video data and at least a frame of time, then configure the C6H register with 0x01, open VCOM voltage, light up the screen.
- During power-off, if the VDD voltage is not lower than VAN voltage, two power supplies can be turned off at the same time.
- Before RESET is pulled up, the PCLK needs to enter a steady state.

### 3.6 Video sequence

The timing of the video signal input to the microdisplay shall be in accordance with VESA Standard. When the timing of the video signal is not in accordance with VESA Standard, the parameters below can be configured according to the timing requirements as shown in figure.



Symbol	Item	Min.	Typ.	Max.	Unit
V_Blank	Field blanking period	18	28	400	HSYNC
V_Valid	Field validity period	—	600	—	HSYNC
H_Sync	Row blanking period synchronization period	6	128	500	PCLK
H_Back	Row blanking period back porch	6	88	500	PCLK
H_Front	Row blanking period front porch	12	40	500	PCLK
H_Valid	Row validity period	—	800	—	PCLK

## 4 Function description

### 4.1 Register Map

Address	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Default
01H	0	0	Internal test pattern selection			Input video format selection			0x03
02H	R for red, internal 256-level gray scale selection								0x00
03H	G for green, internal 256-level gray scale selection								0x00
04H	B for blue, internal 256-level gray scale selection								0x00
05H	Synchronization mode		1	0	Interlace/ progressive scanning		Vertical scanning	Horizontal scanning	0x60
06H	0	0	Direction of movement	Move the number of columns left/ right					0x00
07H	0	0	Direction of movement	Move the number of columns up/down					0x00
08H	0	Left/ right shift enable	Up/ down shift enable	Timed movement distance (number of rows/ columns).					0x00
09H	Time interval for movement TIME [7:0]								0x00
0AH	Time interval for movement TIME [15:8]								0x00
0BH	Time interval for movement TIME [23:16]								0x00
0CH	Time interval for movement TIME [31:24]								0x00
0EH	Total pixels of rows H_Total [7:0].								0x20
0FH	0	0	0	0	Total pixels of rows H_Total [11:8].				0x04
11H	Valid pixels of rows H_Valid [7:0].								0x20
12H	0	0	0	0	Valid pixels of rows H_Valid [11:8].				0x03
14H	Number of valid lines in a frame V_Valid [7:0].								0x58
15H	0	0	0	0	Number of valid lines in a frame V_Valid				0x02
18H	Number of total lines in a frame V_Total [7:0].								0x74
19H	0	0	0	0	Number of total lines in a frame V_Total [11:8].				0x02
91H	Digital adjustment of image brightness								0x80
95H	Digital adjustment of image contrast								0x00
96H	1	0	0	0	0	0	0	CONT[8]	0x81
9FH	Internal temperature detection readings								read only
A8H	Adjusts the internal VCOM voltage value of the screen								0x36
ADH	VPG_PWM scan method selection, set to 0x30 when the input is in BT.656 interlaced mode								0x00
C3H	PWM value								0x70
C5H	Interlace control signal								0x00
C6H	Internal VCOM voltage enable control								0x00

## 4.2 Internal test diagram setting

The microdisplay has a variety of built-in test diagrams, and different test images can be selected by setting the bit5-bit3 values of register 01H. External data and synchronization signals are not required when selecting an internal test diagram, only a stable clock signal PCLK is required.

Address	Number of bit	Detailed description
01H	bit5 – bit3	000: With registers 02H, 03H, 04H, 0~255 grayscale of R, G, B signals can be selected respectively 001: Pure white field 010: Pure red field 011: Pure green field 100: Pure blue field 101: Transition grayscale plot from left to right 110: Color bar 111: Checkerboard

## 4.3 Video Interface

### 4.3.1 Selection of input signal format

Address	Number of bit	Detailed description
01H	bit2 - bit0	000: 8bit - YCbCr, progressive mode, 8bit - BT.656, interlaced mode; 001: 16bit - YCbCr, 4:2:2 mode; 010: 24bit – YCbCr, 4:4:4 mode; 011: 24bit – RGB, 4:4:4 mode; 101: Internal test diagram;

When inputting video signals in different formats, the pin correspondence is shown as below.

Ports	BT.656 (Interlaced)	YCbCr (Progressive)	YCbCr 4:2:2	YCbCr 4:4:4	RGB 4:4:4
DATA23	GND	GND	GND	Y[7]	R[7]
DATA22				Y[6]	R[6]
DATA21				Y[5]	R[5]
DATA20				Y[4]	R[4]
DATA19				Y[3]	R[3]
DATA18				Y[2]	R[2]
DATA17				Y[1]	R[1]
DATA16				Y[0]	R[0]
DATA15	Y/Cb/Cr[7]	Y/Cb/Cr[7]	Y[7]	Cb[7]	G[7]
DATA14	Y/Cb/Cr[6]	Y/Cb/Cr[6]	Y[6]	Cb[6]	G[6]
DATA13	Y/Cb/Cr[5]	Y/Cb/Cr[5]	Y[5]	Cb[5]	G[5]
DATA12	Y/Cb/Cr[4]	Y/Cb/Cr[4]	Y[4]	Cb[4]	G[4]
DATA11	Y/Cb/Cr[3]	Y/Cb/Cr[3]	Y[3]	Cb[3]	G[3]
DATA10	Y/Cb/Cr[2]	Y/Cb/Cr[2]	Y[2]	Cb[2]	G[2]
DATA9	Y/Cb/Cr[1]	Y/Cb/Cr[1]	Y[1]	Cb[1]	G[1]
DATA8	Y/Cb/Cr[0]	Y/Cb/Cr[0]	Y[0]	Cb[0]	G[0]
DATA7	GND	GND	Cb/Cr[7]	Cr[7]	B[7]
DATA6			Cb/Cr[6]	Cr[6]	B[6]
DATA5			Cb/Cr[5]	Cr[5]	B[5]
DATA4			Cb/Cr[4]	Cr[4]	B[4]
DATA3			Cb/Cr[3]	Cr[3]	B[3]
DATA2			Cb/Cr[2]	Cr[2]	B[2]
DATA1			Cb/Cr[1]	Cr[1]	B[1]
DATA0			Cb/Cr[0]	Cr[0]	B[0]



### 4.3.2 ITU-R BT.656 format signal register setting

The micro display screen supports ITU-R BT.656 signals in embedded synchronous format. Take standard PAL-D video as an example, the register settings when the image is centered are shown as below.

Address	Value	Configuration description
01H	0x00	The BT.656 (interlaced) format is 0x00
05H	0x24	Interlace scanning is selected when it is embedded synchronization
0EH	0x60	H_Total is 0x360
0FH	0x03	
10H	0x04	Redundant pixels (left)
11H	0x20	H_Valid is 0x320
12H	0x03	
13H	0x04	Redundant pixels (right)
14H	0x2C	V_Valid is 0x12C
15H	0x01	
16H	0x02	Redundant row (top)
17H	0x02	Redundant row (below)
18H	0x38	V_Total is 0x138
19H	0x01	
ADH	0x30	VPG_PWM scan method selection, switch to row copy mode
C5H	0x12	Interlace control signal

Note:

When the input video signal is ITU-R BT.656 format, it is incompatible with the default factory 24bit-RGB format. For brightness adjustment and other functions, please contact Guozhao for technical support.

### 4.3.3 YCbCr signal format description

When the input digital video signal is in YCbCr encoding format, YCbCr digital signal needs color space transformation inside the chip, the transformation relationship is shown below follows.

$$R = Y + Cr \times 179/128 - 179$$

$$G = Y - Cb \times 44/128 - Cr \times 91/128 + 135$$

$$B = Y + Cb \times 227/128 - 227$$

Note:

The use status of the YCbCr encoding mode is not compatible with the default factory 24bit-RGB mode, the use scope and method need to be defined again. To use the YCbCr mode, contact Guozhao for technical support.

### 4.4 Up/down and/or right/left inverse display

Each setting mode is shown below.

Address	Number of bit	Detailed description
05H	bit1	Vertical display setting 0: Vertical normal display 1: Vertical mirror display
	bit0	Horizontal display setting 0: Horizontal normal display 1: Horizontal mirror display



(a) Default display



(b) Horizontal inverse



(c) Vertical inverse



(d) Horizontal and vertical inverse

## 4.5 Image display position

The micro display screen supports the display setting of the full-screen image at any position, and the horizontal and vertical offset position values can be set separately, and the max. value is 0x04.

Address	Number of bit	Detailed description
06H	bit5	Enable setting in horizontal position 0: Display start point moves to the right 1: Display start point moves to the left
	bit4-bit0	Number of columns to move, ranging from 0x00 to 0x04
07H	bit5	Enable setting in vertical position 0: Display start point moves down 1: Display start point moves up
	bit4-bit0	Number of columns to move, ranging from 0x00 to 0x04

## 4.6 Images move at regular intervals

The microdisplay supports the dynamic movement in the horizontal or vertical direction. When the timed movement function is turned on, the whole screen image will automatically move at the set time interval in accordance with the order of down, right, up and left, with the same number of rows/ columns moving up and down and left and right, and finally return to the initial position before moving.

Address	Number of bit	Detailed description
08H	bit6	Horizontal timed movement control 0: Dynamic movement function is turned off; 1: Dynamic movement function is turned on;
	bit5	Vertically timed movement control 0: Dynamic movement function is turned off; 1: Dynamic movement function is turned on;
	bit4-bit0	Number of columns/rows to move, range from 0x00 to 0x04
09H	bit7-bit0	The time interval for movement is STICK_TIME, and the unit interval is one frame; Register 09H value is STICK_TIME [7:0]; Register 0AH value is STICK_TIME [15:8]; Register 0BH value is STICK_TIME[23:16]; Register 0CH value is STICK_TIME[31:24];
0AH	bit7-bit0	
0BH	bit7-bit0	
0CH	bit7-bit0	

Note:

There are 4 redundancy pixels on the top, bottom, left and right of the display screen, and when the dynamic movement function is turned on, the range of movement cannot exceed the range of redundant pixels.

## 4.7 Temperature detection

The microdisplay has temperature detection function, and the temperature conversion formula is:

$$T = 0.54 \times \text{Reg}(9FH) - 52$$

Where: T is the actual temperature value and Reg(9FH) is the reading of the temperature register 9FH.

Note:

1. The temperature reading changes greatly during the initialization of the micro display screen, and it is recommended to read the temperature value after a few seconds of stabilization;
2. During normal operation, the temperature reading update cycle is four frame image cycles.

## 4.8 Brightness adjustment

The factory default luminance of the microdisplay is about 150cd/m<sup>2</sup>, and the recommended brightness range is 50cd/m<sup>2</sup>~ 300cd/m<sup>2</sup>. The user can adjust the brightness appropriately according to the needs of the use. The luminance adjustment mode is the built-in PWM mode, the corresponding configuration register address is C3H, adjust the brightness by changing the values of register. The factory default value for the C3H register is 0x70. The recommended configuration parameter value range at normal temperature is between 20H to FFH, and the adjustment step is 0x04. The higher the PWM value, the higher the brightness, and the PWM value corresponding to maximum brightness is 0xFF.

## 4.9 Brightness-Temperature compensation

Due to the varying full temperature features of silicon-based OLED micro display screen, the brightness increases at high temperature and decreases at low temperature. In order to improve the consistency of brightness at different temperatures, it is recommended to perform brightness compensation. The reference formula is as follows:

$$X = X_0 + \frac{T - T_0}{3}$$

Among, X is the sets of the A8H register at the current temperature,  $X_0$  is the sets of the A8H register at the reference temperature, T is the current temperature, and  $T_0$  is the reference temperature (usually around 20 °C).

Note:

At any temperature, the A8H register configuration value cannot be less than 0x20H. If it is less than 0x20H, the product will have overcurrent protection and will be damaged or burned for a long time.

## 4.10 Image brightness digital adjustment

The micro display screen has built-in image brightness digital adjustment function, and the brightness adjustment formula is shown below:

$$Y = Y_0 + (BRT/2 - 64)$$

Y is the adjusted data value,  $Y_0$  is the input image data value, and BRT is the configuration value of the 91H register. After adjustment, the low gray stage and the high gray stage may produce data overflow, resulting in image distortion, and it is recommended to configure it as appropriate.

## 4.11 Image contrast adjustment

The micro display screen has built-in image contrast adjustment function, that is, the input image data is processed in the same proportion multiplier mode to achieve the effect of image contrast change. The image contrast adjustment register address is 95H and 96H, and the adjustment range is 0x00 to 0x1FF.

The contrast adjustment formula is shown below.

$$Y = Y_0 \times C_{\text{ONT}} / 255$$

Y is the adjusted data value, Y0 is the input image data value, and CONT is the 95H and 96H register value.

## 4.12 I2C serial port

The user can set or read the values of the register inside the screen through the I2C serial port. The I2C serial port communication mode conforms to the standard communication protocol, and the host can realize the functions of test screen selection, brightness adjustment, contrast adjustment, temperature reading and so on through the reading and writing of the internal registers of the micro display screen.

The communication rate supports 10KHz~400KHz.

Note:

1. SDA and SCL signals must be pulled up resistors to VIH;
2. When the transmission distance of I2C communication signal is long, please pay attention to the signal integrity and anti-interference measures of SDA and SCL.
3. When the I2C communication signal is seriously disturbed, I2C communication can be carried out during the field blanking interval, or the communication frequency can be appropriately reduced

### 4.12.1 Slave address selection

The microdisplay is used as a slave device, the address can be selected by SERADD pin, which is 0x54 when the SERADD pin is low and 0x55 when the SERADD pin is high. The specific slave address and read/ write instructions shown as below.

Slave address	instructions	Bit7 (MSB)	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1 (SERADD)	Bit0 (R/W)	Valid bytes
0x54	Write	1	0	1	0	1	0	0	0	0xA8
	Read	1	0	1	0	1	0	0	1	0xA9
0x55	Write	1	0	1	0	1	0	1	0	0xAA
	Read	1	0	1	0	1	0	1	1	0xAB

## 4.12.2 Data transfer format

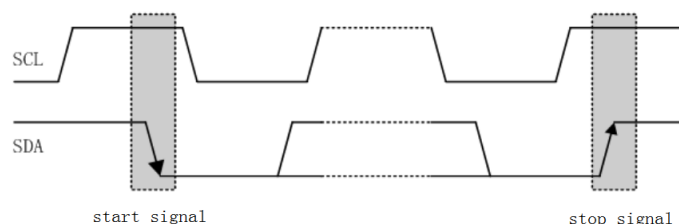
### 4.12.2.1 Mark bit description

Start signal(S): the change of SDA line from high level to low level when the SCL line is high level;

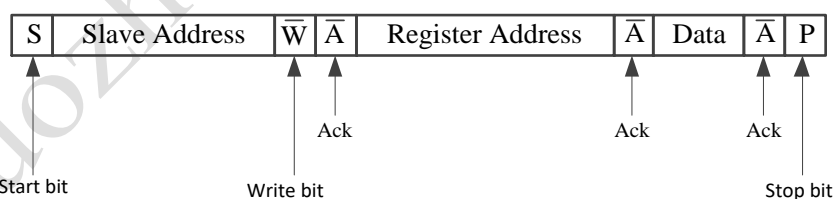
Pause signal (P): the change of SDA line from low level to high level when the SCL line is high level;

Active answer (ACK): SDA at low level indicates active answer;

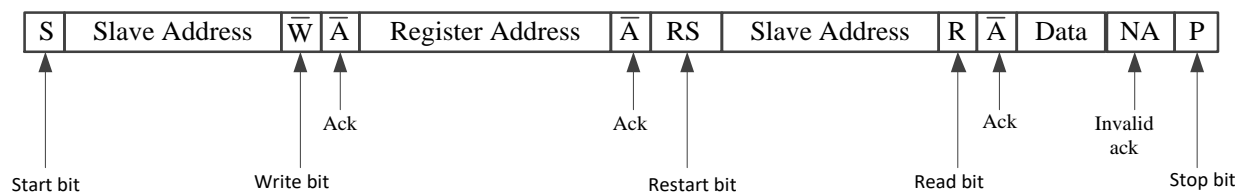
Negative answer (NAK): SDA at high level indicates negative answer;



### 4.12.2.2 Write data

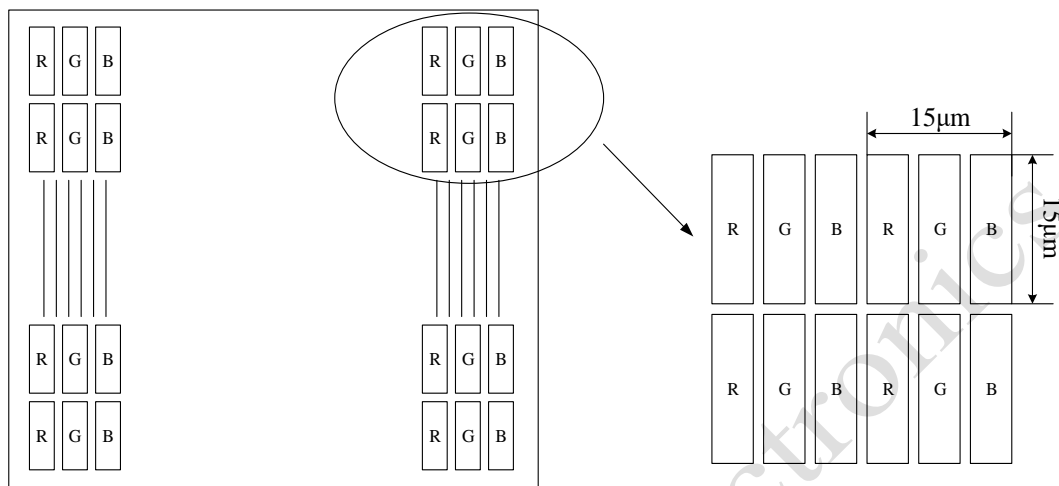


### 4.12.2.3 Read data



## 5 Optical features

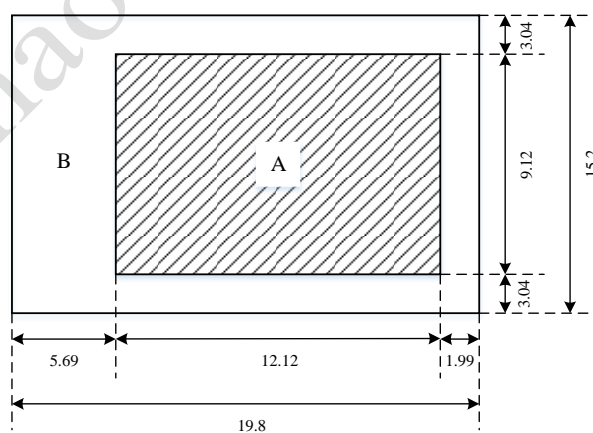
### 5.1 Pixel arrangement



The pixel arrangement of OLP060SVC01-06 silicon-based OLED microdisplay is shown as above, in which each three sub-pixel points form a pixel. The pixel size is 15μm×15μm.

### 5.2 Display quality standard

#### 5.2.1 Display area definition





### 5.2.2 Defect point inspection standard

Defect points and defects refer to subpixels that do not display correctly, such as pixels that are always bright or dim. The inspection standard for defect points are carried out in accordance with the requirements.

No.	Item	Request
1	2 consecutive dead pixels	full-screen $\leq 1$
2	3 or more consecutive dead pixels	0
3	Bright point	No
4	Bad line	No

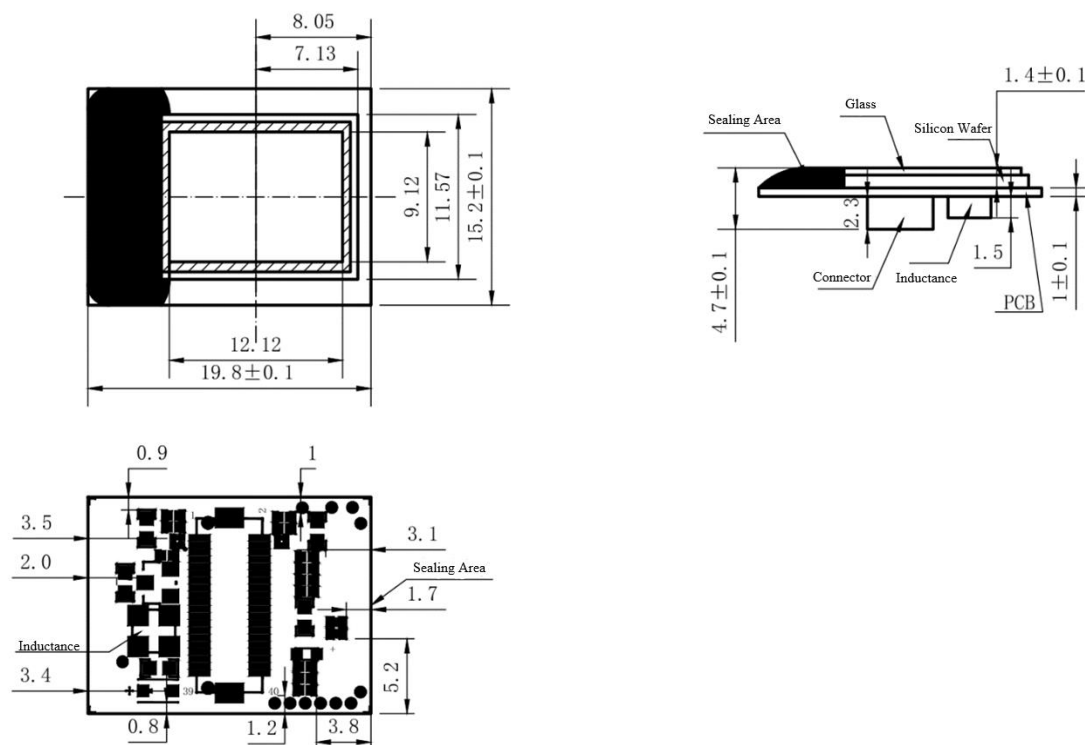
### 5.2.3 Test conditions

- 1) Use special test fixture to light up the micro display screen, and check the white-time display of the micro display screen under the brightfield of the microscope at a magnification of  $100 \times (\text{objective } 10\times, \text{ eyepiece } 10\times)$ ;
- 2) Use special test fixture to light up the micro display screen, the micro display screen shows the black field, and use the  $12\times$  eyepiece to observe the bright points.

## 6 Structure and package

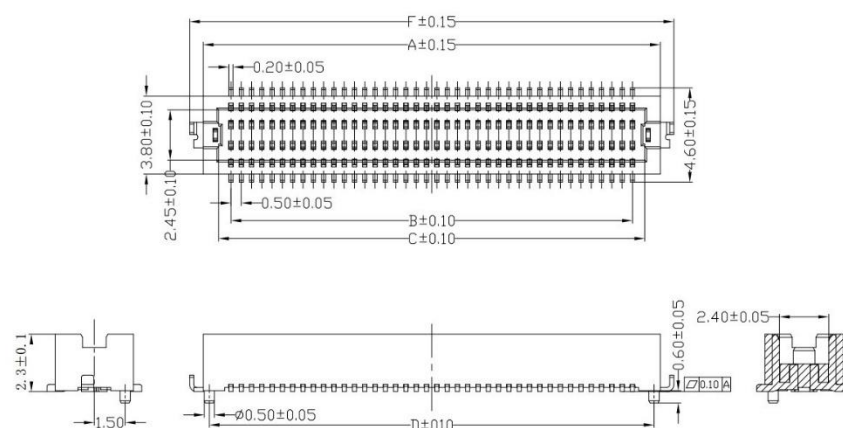
### 6.1 Product structure

The micros display screen is 19.8mm×15.2mm, other dimensions are shown as below.



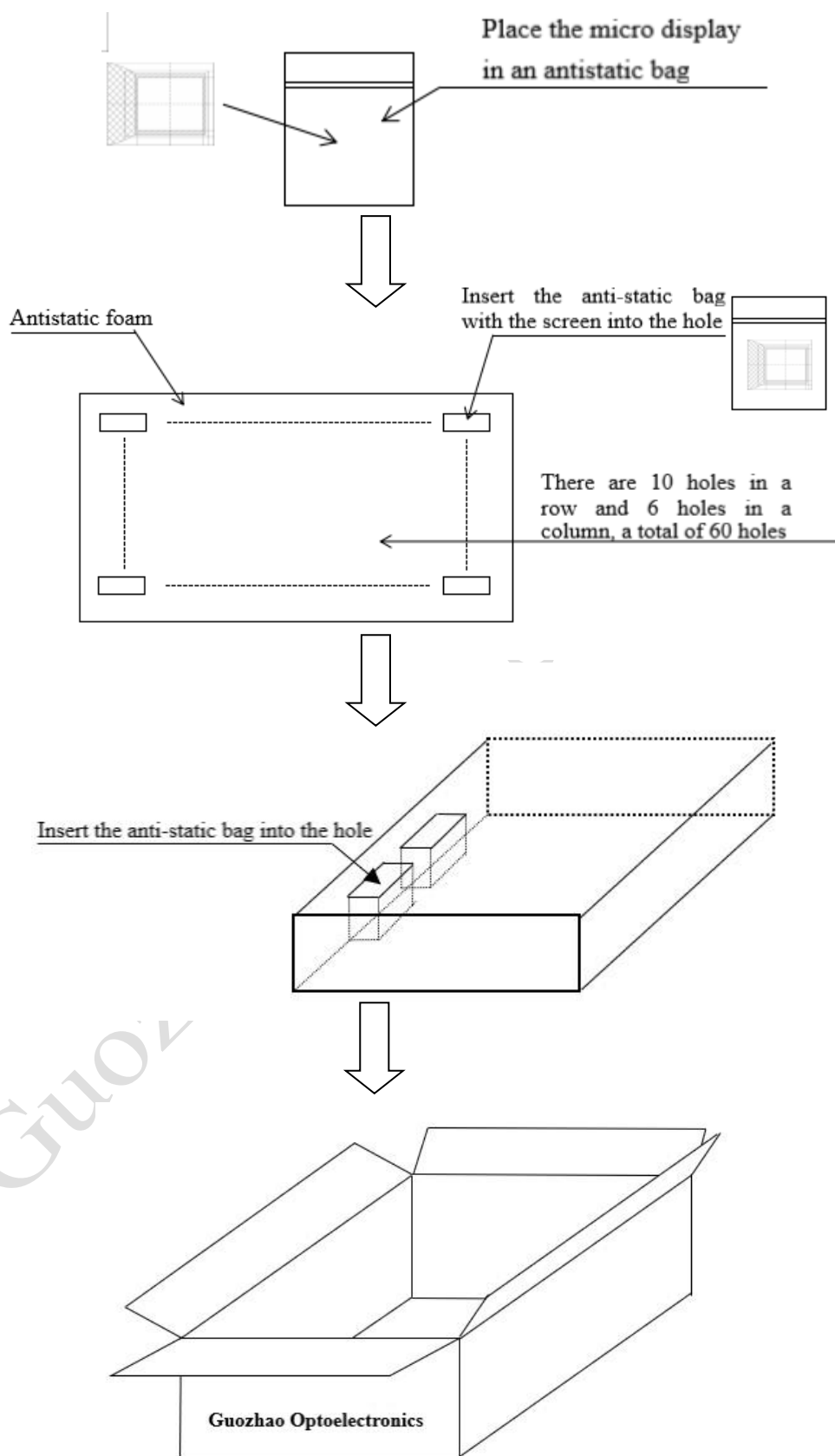
### 6.2 Connector dimension and FPC design recommendation

Unit: mm



Number of Contacts	Dimension(mm)					
	A	B	C	D	E	F
40	12.20	9.50	10.70	11.60	10.80	13.52

## 6.3 Product package description



## 7 Product precautions

### 7.1 Use precautions

1. OLP060SVC01-06 silicon-based OLED micro display screen shall be strictly in accordance with the definition of the electrical interface in this manual for power supply and connection signal lines, and maintain the stability of the power supply, and illegal power supply is not allowed;
2. During the use of micro display screen, if you find abnormalities such as short circuit and hot, do not repeatedly power the machine to test, please timely find the problem or contact Guozhao Optoelectronics for maintenance;
3. In order to improve the service life of the product and avoid the aggravation of residual shadow, try to reduce the time for the product to display a fixed screen under high temperature or high brightness conditions;
4. The glass and silicon edges of the silicon-based OLED micro display screen are easily damaged and shall not be subject to physical stress;

### 7.2 Cleaning precautions

1. Do not use any acid, alkali, organic solution/ reagent and other chemicals to scrub or contact the product;
2. Use lens paper or clean cloth to dip a small amount of water or organic solvent, wring dry and wipe the silicon-based OLED microdisplay surface, do not directly clean with wet cloth;
3. When wiping the screen with organic solvents, try to avoid wiping the edge of the screen, otherwise it may damage the rubber layer.

### 7.3 Storage requirements

1. Short-term storage requirements: silicon-based OLED micro display screen allows short-term storage in a dry environment between -50 °C ~ 70 °C ( $\leq 100$  hours);
2. Long-term storage requirements:

- 1) Room temperature of  $25\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ ;
- 2) Dry nitrogen or vacuum sealed container;
- 3) Avoid violent shaking.

## 7.4 Others

1. Keep the silicon-based OLED micro display screen away from ultraviolet rays and ionizing radiation;
  2. Do not bend the silicon-based OLED micro display screen by external force;
  3. Keep the silicon-based OLED micro display screen away from heat sources during storage or use;
  4. Avoid falling of the silicon-based OLED micro display screen at high altitude.
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