GZP6899DC

Pressure Sensor

Digital Output（IIC）

Datasheet

Version：V1.2

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Document Revision History

Revision	Description	Date
V1.0	Initial version	2025.03.07
V1.1	Update the commonly used range models and codes	2025.07.05
V1.2	Modify the routine	2025.09.19

1 Product Description

The GZP6899DC pressure sensor is a state-of-the-art MEMS pressure sensor designed for a wide applications in medical&health care, industry&automation, household appliances and consumer electronics with specific pressure range. It is composed of a silicon piezoresistive pressure sensing chip and a signal conditioning integrated circuit. The initial signal from the sensing chip is amplified, temperature compensated, calibrated and finally converted to a digital signal(I2C) that is corresponding to the applied pressure.

1.1 Features

- Multiple range from -100…0 to 0.5…200kPa
- Differential pressure type
- Air nozzle with anti-detachment structure
- Non-corrosive gases
- SOP8 package
- Power supply voltage: 2.7V ~ 5.5V
- IIC Interface
- Maximum pressure at the low-pressure port: 500kPa

1.2 Applications

- Ventilators, spirometers, negative pressure wound therapy, blood pressure monitoring, sleep apnea treatment, etc. - these are all components of the medical field.
- Air flow measurement, heating ventilation and air conditioning, pneumatic equipment, pressure switches, etc. - these are all components found in the industrial sector.
- Biological science, small household appliances, consumer electronics, sports and fitness equipment, fire-fighting equipment, Internet of Things, etc.
- Gas flow meters, gas emissions, variable air volume control, etc.

2 Function Description

This product is manufactured using advanced micro-electromechanical principles. Its core technologies are a MEMS pressure sensor chip based on the silicon piezoresistive effect and a high-performance signal conditioning AISC chip. The silicon micro-piezoresistive MEMS pressure sensor chip forms a Wheatstone bridge through four strain-sensitive resistors. The output signal is amplified, temperature-compensated, and linearized by the ASIC chip. The linearization and temperature compensation of the transfer function are implemented by the digital processing circuit in the ASIC. Through the polynomial compensation algorithm and multi-point pressure calibration technology at multiple temperatures, high-precision pressure measurement is achieved over the entire operating temperature range.

2.1 Block Diagram

The functional block diagram of the pressure sensor is shown in Figure 1.

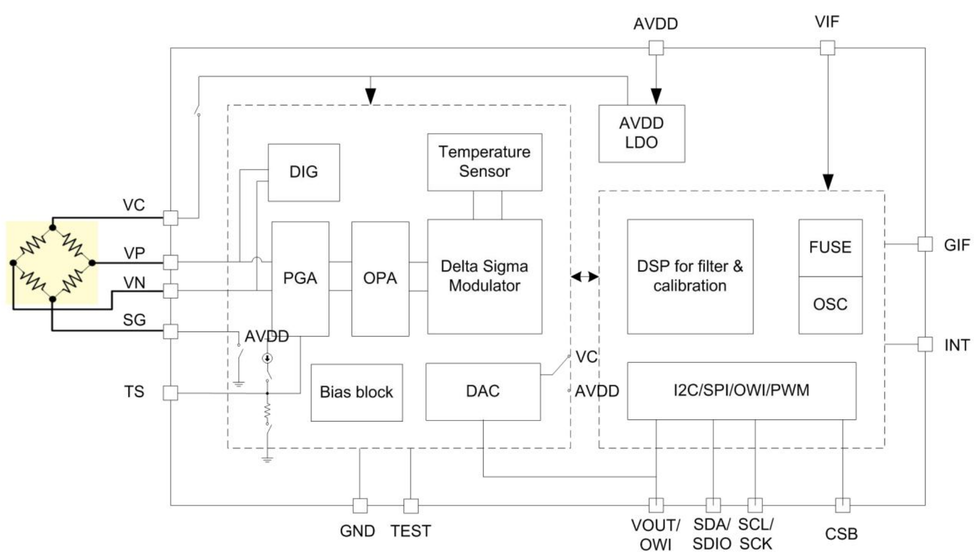


Fig.1 Block Diagram

2.2 Pin Definition

The pin configuration of the pressure sensor is shown in Figure 2.

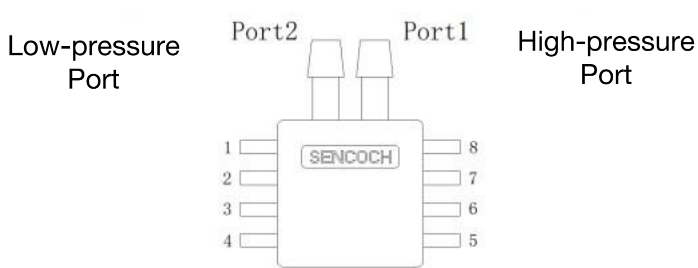


Fig.2 Pin configuration diagram

The corresponding relationship of the pressure sensor pins is shown in Table 1.

Tab.1 Pin Definition

PIN No.	Description	Remark
1	NC	Floating pin
2	GND	Power input negative
3	SCL	Floating pin
4	SDA	Data line in I2C mode
5	NC	Floating pin
6	VDD	Power input positive
7	NC	Floating pin
8	NC	Floating pin

2.3 Accuracy

GZP6899DC pressure sensor is affected by supply voltage, input pressure, ambient temperature, and aging. The value calculated using the transfer function is the sensor's specified value, also known as the theoretical value. The sensor's error is the difference between the actual output value and the specified output value at a specified input pressure.

Overall Accuracy

The overall error includes more accuracy sources based on the product accuracy :

Pressure drift: The output deviation between the actual output voltage at zero point and full scale and the specified output voltage within the specified pressure range.

Temperature effect: The output deviation of zero point and full scale at different temperatures within the temperature range.

The overall accuracy is expressed by error band, and the data are shown in Figure 3 and Table 2 shown.

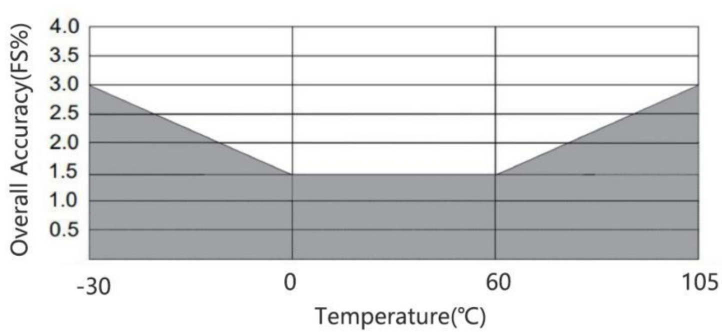


Fig.3 Overall Accuracy vs. Temperature.

Tab.2 Overall Accuracy

Temperature (°C)	Overall Accuracy(Fs%)
-30~105	±3.0%
0~60	±1.5%

* Different pressure ranges have different Overall Accuracy. Please consult customer service for more details.

3 Technical Indicators

The following indicators of the sensor are measured with (5±0.25)V DC and 25°C.

3.1 Maximum Ratings

The maximum rated parameters of the sensor are shown in Table 3.

Tab.3 The maximum rated parameters

Parameter	Min.	Typical Value	Max.	Unit	Remark
Supply Voltage	-0.3		6.5	V	
ESD Protection		±2		kV	HBM
Overload Pressure		5X (Range≤10kPa)		Rated	
		2.5X			
Bursting Pressure		6X (Range≤60kPa)		Rated	
		3X			
Working Temperature	-30		105		
Storage Temperature	-40		125		

1. Different pressure range may have different overload pressure and burst pressure, please consult Sencoch for more details.
2. Long exposure at the specified limits may cause degradation to the device.

3.2 Performance Indicators

The sensor performance indicators are shown in Table 4.

Tab.4 Sensor performance indicators

Parameter	Value	Unit	Remark
Pressure Range	-100…0~0.5…200	kPa	Customizable
Power Supply	2.7 ~ 5.5	V	
Standby Current	100	nA	
Accuracy	±1	%Span	
Pressure Resolution	24	Bits	
Built-in Temperature Accuracy	±2	°C	@0~60°C
Temperature Resolution	16	Bits	LSB =
Compensation Temperature	0 ~ 60	°C	Customizable
Pull-up Resistors	4.7	K ohm	
Clock Frequency	400	KHz	Max.
Response Time	2.5ms	ms	OSR_P=512X

* The different pressure range may have different accuracy, please consult Sencoch for more details.

4 Application Circuit

The recommended application circuit of the sensor is shown in Figure 4.

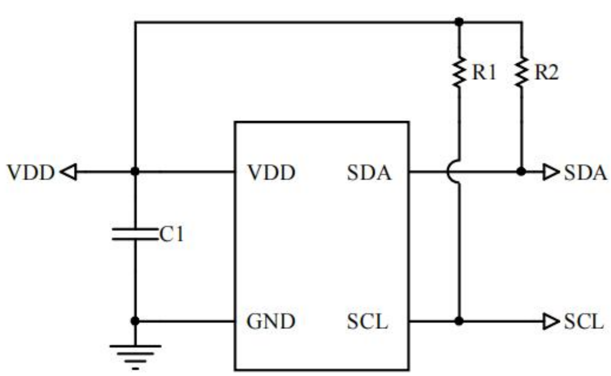


Fig.4 Recommended sensor application circuit diagram

Notice :

- The recommended value of C1 is 100nF, and the recommended values of R1 and R2 are 4.7k
- Please confirm the electrical definition before assembly

- Do not have any electrical connection to the NC pin, otherwise it may cause product failure.
- Provide anti-static protection during welding
- Overload voltage (6.5Vdc) may burn out the circuit chip
- This product has no reverse polarity protection, please pay attention to the power polarity during assembly

5 I²C Communication Protocol

The I²C bus uses SCL and SDA as signal lines. Both lines are connected to VDD through pull-up resistors (typical value 4.7K) and remain high when not communicating. The I²C device address is 0x58.

The I²C communication protocol has specific start (S) and stop (P) conditions. While SCL is high, a falling edge on SDA signals the start of data transmission. The I²C master device sequentially transmits the slave device's address (7 bits) and the read/write control bit. When the slave device recognizes this address, it generates an acknowledge signal and pulls SDA low in the ninth cycle. After receiving the slave device's acknowledgement, the master device continues to transmit the 8-bit register address and, upon receiving the acknowledgement, continues to send or read data. A rising edge on SDA while SCL is high signals the end of I²C communication . In addition to the start and stop signals, data transmitted by SDA must remain stable while SCL is high. The value transmitted by SDA can change while SCL is low. All data transmission in I²C communication is in 8-bit units, and an acknowledge signal is required after every 8 bits of data transmission to ensure continued transmission.

The I²C timing diagrams are shown in Figures 5 and 6.

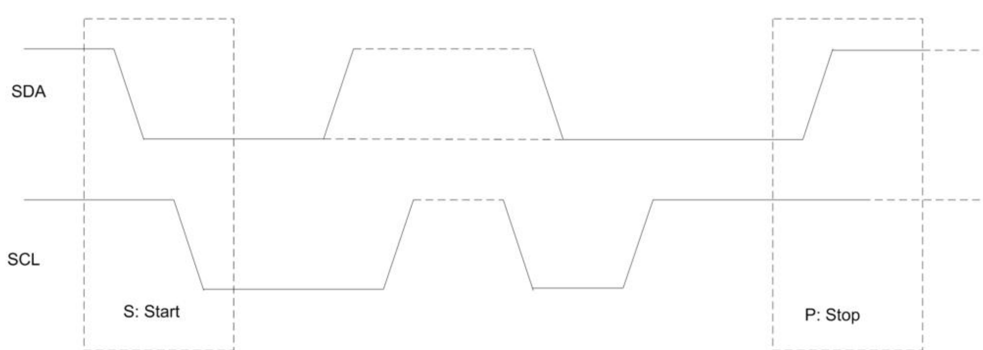


Fig.5 I²C Timing Diagram 1

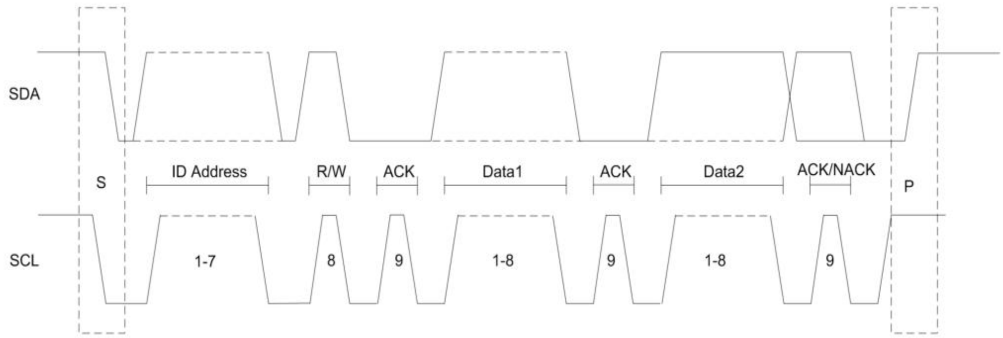


Fig.6 I^{2}C Timing Diagram 2

6 Register Description

The register description is shown in Table 5.

Tab.5 Register description

Add.	Description	R/W	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0x00	ID	R	ID<7:0>							
0x01	Chip_Control	R/W	/		data_ Ready	/	data_ou t	measure ment_ctrl	Active<1:0>	
0x02	CFG_OSR	R/W	OSR_T<7:5>			OSR_P<4:2>			MODE[1:0]	
0x03	CFG_MEAS	R/W	/		T_SB[5:3]			PT_R[2:0]		
0x04	P_data	R	Data out<23:16>							
0x05	P_data	R	Data out<15:8>							
0x06	P_data	R	Data out<7:0>							
0x07	T_data	R	Temp out<15:8>							
0x08	T_data	R	Temp out<7:0>							
0x24	CFG_OPER	R/W	reserved<7:1>						DAC_EN	

Reg0x00 I^{2}C device address, the default address is 0x58.

Reg0x01 (factory pre-configured)

Chip Control Register

active<1:0>: 00, the chip is powered off; 01, the chip is powered on;

measurement_ctrl: 0, pressure measurement; 1, temperature measurement;

data_out: 0, output calibration data; 1, output original data;

data_ready: 0, data conversion is not completed; 1, data conversion is completed.

Reg0x02 (factory pre-configured)

MODE[1:0]: 00: Sleep mode, 01: Normal mode, 10: One shot mode

OSR_P[4:2]: (pressure oversampling):

000: over sampling x 256

001: over sampling x 512

010: over sampling x 1024

011: over sampling x 2048

100: over sampling x 4096

101: over sampling x 8192

110: over sampling x 16384

111: over sampling x 32768

OSR_T[7:5] (temperature oversampling):

000: over sampling x 256

001: over sampling x 512

010: over sampling x 1024

011: over sampling x 2048

100: over sampling x 4096

101: over sampling x 8192

110: over sampling x 16384

111: over sampling x 32768

Reg0x03 (factory pre-configured)

PT_R[2:0]: 000: 64/1, 001: 32/1, 010: 16/1, 011: 8/1, 100: 4/1, 101: 1/1, Others: 128/1 (pressure/temperature measurement ratio in normal mode)

T_SB[5:3]: 000: 0ms, 001: 62.5ms, 010: 125ms, 011: 250ms, 100: 500ms, 101: 750ms, 110: 1000ms, 111: 2000ms (standby time setting in normal mode)

Reg0x04-Reg0x06

Pressure Data Register

Reg0x07-Reg0x08

Temperature Data Register

Reg0x24

DAC_EN: 0: disable DAC, 1: enable DAC

7 Working Mode Description

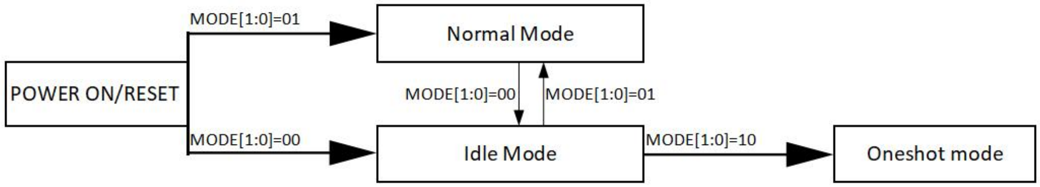


Fig.7 Working Mode

Normal Mode: When powered on, the sensor automatically enters Normal Mode. If switching from another mode to Normal Mode, it can be enabled by writing 01b to the MODE register (0x02[1:0]). The pressure and temperature sensor signals output measurement data cyclically at a predetermined frequency(Normally the standby time was pre-configured with 0mS).

One Shot Mode: It can be enabled by writing 10b to the MODE register (0x02[1:0]). The user can specify whether to measure the temperature or pressure signal by clearing or setting the measurement_ctrl bit (0x01[2]). After completing a single measurement, the sensor enters Idle Mode to await the next command.

Idle Mode: The sensor keep the low-consumption sleep situation till it is activated.

In normal mode, read 5 bytes continuously from 0x04 to 0x08 after power-up (ASIC will automatically refresh the data. The first 3 bytes are the pressure data, later 2 bytes are temperature data.

Pressure Calculation

Sum = (0x04 value * 2^16 + 0x05 value * 2^8 + 0x06 value),

If sum < 8388608, P=sum / 2^21*(PMAX - PMIN) (Unit: Pa)

If sum ≥8388608，P=(sum-2^24)/2^21*(PMAX - PMIN) (Unit: Pa)

※PMAX is the upper value of pressure range, PMIN is the lower value of pressure range.

Tab.6 Range calibration parameters

Pressure range	Calibration parameters	
	PMIN	PMAX
0-1kPa	0	1000
0~2.5kPa	0	2500
0~10kPa	0	10000
-100~200kPa	-100000	200000

8 Structure Specification (unit:mm)

Refer to Figure 8 for the sensor's dimensions (error is ±0.1mm if not specified).

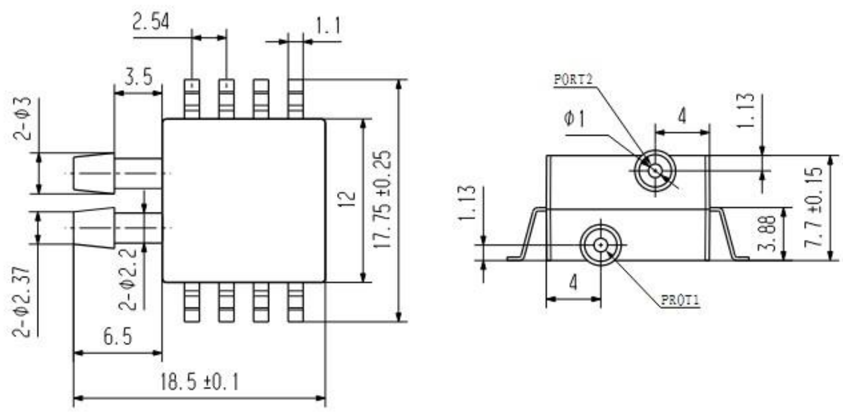


Fig.8 Product dimensions

The recommended pad dimensions are shown in Figure 9.

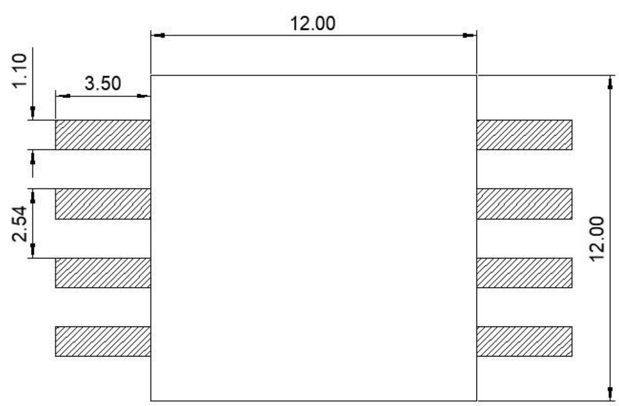


Fig.9 Recommended footprint

9 Order Guide

GZP 6899 D C - 001KPP F01 WX

Tab.7 Order Guide

GZP	Pressure Sensor Series
6899	Product Series
D	Output type A: Analog output D: IIC output
C	Communication protocol
001KPP	Pressure range: 001 means the measured pressure value is 1 (including 0~1, -1~0, -1~1) Pressure unit: KP: KPa MP: MPa PS: PSI BA: Bar Pressure Type: P: positive pressure (e.g. 0~1) N: negative pressure (e.g. -1~0) W: negative pressure to positive pressure (e.g. -1~1) Therefore, 001KPP represents the measured pressure from 0KPA to 1KPA
F 01	Packaging Method: B01: Reel&Tape F01: Tube
WX	Company interior code

10 Model Example

Tab.8 Model example

Pressure Range	**Model**
0～1kPa	GZP6899DC001KPP F01WX
0～2.5kPa	GZP6899DC2.5KPP F01WX
0～10kPa	GZP6899DC010KPP F01WX
0～200kPa	GZP6899DC201KPP F01WX
-0.5～0.5kPa	GZP6899DC0.5KPW F01WX
-1～1kPa	GZP6899DC001KPW F01WX
-2.5～2.5kPa	GZP6899DC2.5KPW F01WX
-100～200kPa	GZP6899DC201KPW F01WX

1 Above model example is for order information only, contact Sencoch for production and stock status.

2 For more customized ranges and special parameter part numbers, please consult Sencoch or agents.

11 Instruction for Use

11.1 Soldering

Since this product has a small structure with low heat capacity, please minimize the influence of heat from the outside. Otherwise, it may be damaged due to thermal deformation and cause changes in characteristics. Please use non-corrosive rosin type flux. In addition, since the product is exposed to the outside, please be careful not to allow flux to penetrate into the inside.

(1) Manual soldering

- Use a soldering iron with a head temperature between 260 and 300°C (30 W) and perform the work within 5 seconds.
- Please note that the output may change when soldering with a load applied to the terminals.
- Please keep the soldering iron tip clean.

(2) Reflow soldering (SMD terminal type)

- To minimize the zero drift as soldering, especially for the low pressure range, the recommended reflow oven temperature setting conditions are shown:

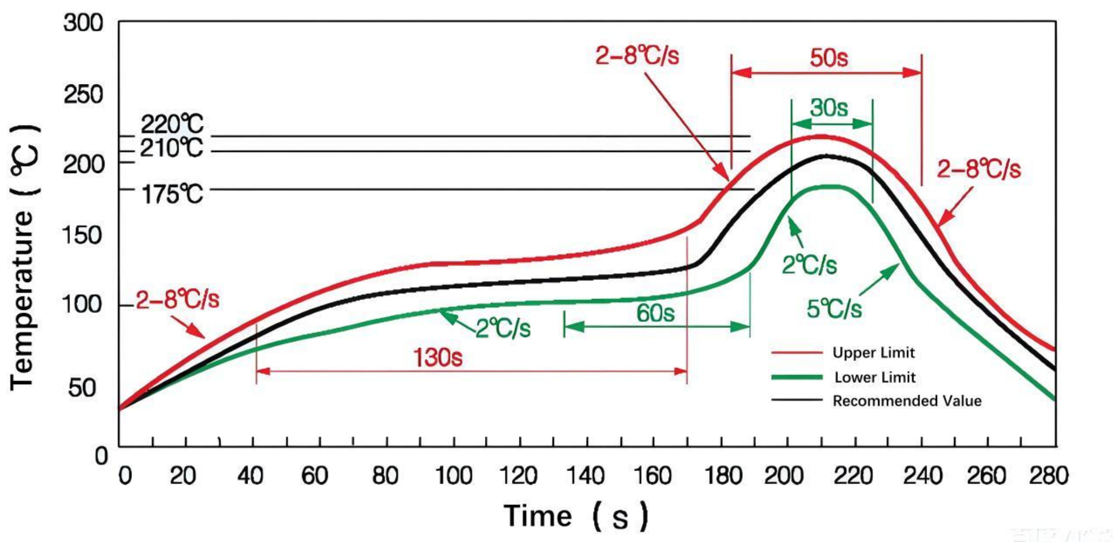


Fig.10 Remelting temperature setting conditions

(3) The warping of the printed circuit board relative to the entire sensor should be kept below 0.05mm. Please manage this.

(4) After installing the sensor, be careful not to generate stress on the solder joint when cutting and bending the substrate.

(5) Since the sensor terminals are exposed, contact with metal pieces or other objects may cause abnormal output. Be careful not to touch the terminals with metal pieces or your hands.

(6) When applying coating to prevent insulation degradation of the substrate after soldering, be careful not to allow chemicals to adhere to the sensor.

11.2 Cleaning Requirements

(1) Since the product is open type, please be careful not to allow cleaning fluid to enter the interior.

(2) Please avoid using ultrasonic cleaning as it may cause product failure.

11.3 Storage and Transportation

(1) This product is not drip-proof, so do not use it in places where it may be splashed with water.

(2) Do not use in an environment where condensation occurs. In addition, if moisture attached to the sensor chip freezes, it may cause fluctuations in sensor output or damage.

(3) Due to the structure of the pressure sensor chip, the output will fluctuate when it is exposed to light. Especially when applying pressure through a transparent cover, etc., please avoid light from reaching the sensor chip.

(4) Normally packaged pressure sensors can be transported by ordinary transportation vehicles. Please note: The product must be protected from moisture, shock, sunburn and pressure during transportation.

11.4 Other Precautions

(1) If the installation method is incorrect, it may cause an accident, so please be careful.

(2) Avoid using the product in a manner that applies high-frequency vibrations, such as ultrasonic waves.

(3) The only pressure medium that can be used directly on P1 Port is non-corrosive gas and P2 Port is dry, non-corrosive gas. Other media, especially corrosive media or media containing foreign matter, may cause malfunction and damage. Therefore, please avoid using it in the above environment.

(4) A pressure sensor chip is located inside the pressure inlet. Inserting a needle or other foreign object into the pressure inlet can damage the chip and clog the inlet, so please avoid such an operation.

(5) Regarding the operating pressure, please use it within the rated pressure range. Using it outside the range may cause damage.

(6) Since static electricity may cause damage, please be careful to ground charged objects on the table and operators when using it to allow the surrounding static electricity to discharge safely.

If you have any questions, please feel free to ask.

12 Packaging Information

Tube Packing: Quantity per tube: 26 PCS

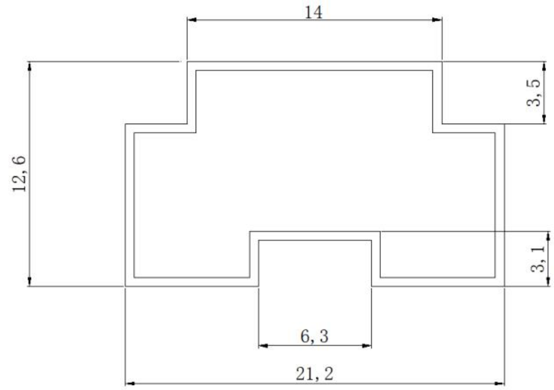
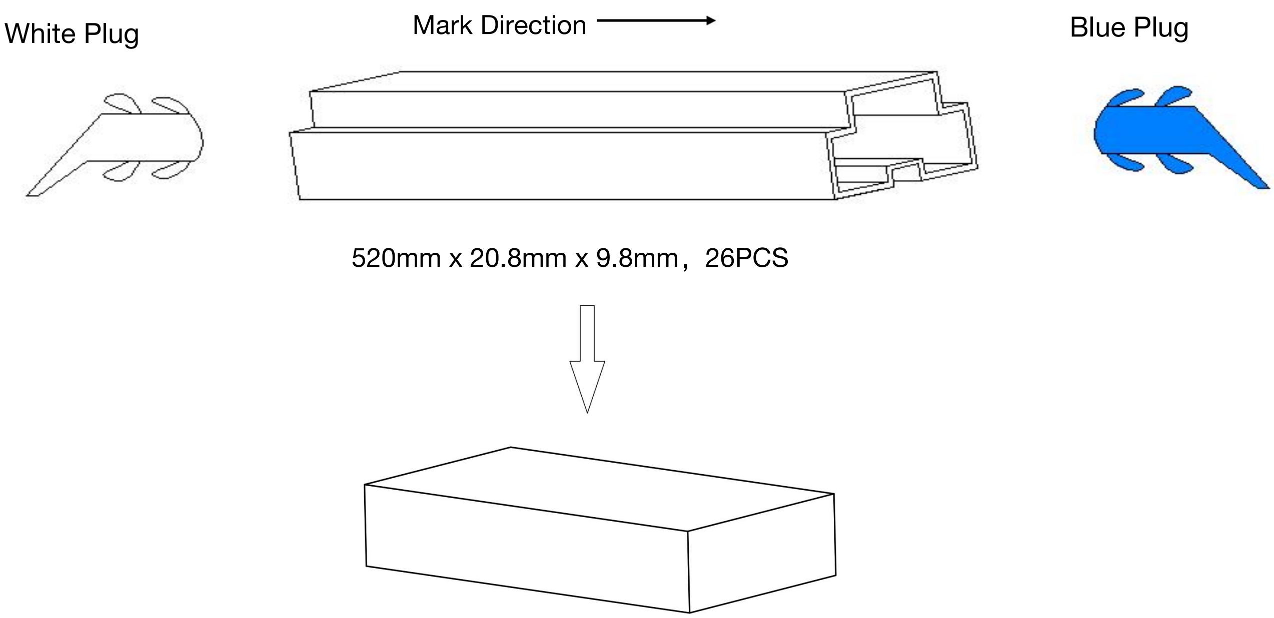


Fig.11 Section schematic diagram



530mm x 145mm x 53mm，780PCS

Fig.12 Outer Packing

Safety Precautions

This product is made of semiconductor components for general electronic equipment (communication equipment, measuring equipment, working machinery, etc.). Products using these semiconductor components may malfunction and fail due to external interference and surges, so please confirm the performance and quality under actual use. To be on the safe side, please perform safety design on the device (setting of protection circuits such as fuses and circuit breakers, multiple devices, etc.) so that life, body, property, etc. will not be harmed in the event of a malfunction. To prevent injuries and accidents, please be sure to comply with the following matters:

·The driving current and voltage should be used below the rated values.

Please wire according to the electrical definition . In particular, reverse connection of the power supply may cause accidents due to circuit damage such as heat, smoke, and fire, so please be careful.

·Be careful when fixing the product and connecting the pressure inlet .

Warranty and Disclaimer

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IIC Example Code (Attachment: IIC Code Example)

```
#include "stm32f10x.h"

// Define SCL and SDA pins
#define SCL_PIN GPIO_Pin_6
#define SDA_PIN GPIO_Pin_7
#define I2C_GPIO_PORT GPIOB

// Pressure range
#define PMIN -100000.0
#define PMAX 200000.0
/*
Common range            PIN           PMAX
0 ~ 1kPa                0.0           1000.0
0 ~ 2.5kPa              0.0           2500.0
0 ~ 10kPa               0.0           10000.0
0 ~ 200kPa              0.0           200000.0
-0.5 ~ 0.5kPa           -500.0        500.0
-1 ~ 1kPa               -1000.0       1000.0
-2.5 ~ 2.5kPa           -2500.0       2500.0
-100 ~ 200kPa           -100000.0     200000.0
*/

// Delay function
void delay_us(uint32_t us)
{
uint32_t count = us * 7;
while (count--);
}

// I2C initialization function
void I2C_Init(void)
{
GPIO_InitTypeDef GPIO_InitStructure;
// Enable GPIOB clock
```

```
RCC_APB2PeriphClockCmd(RCC_APB2Periph_GPIOB, ENABLE);
// Configure the SCL and SDA pins as open-drain outputs
GPIO_InitStructure.GPIO_Pin = SCL_PIN | SDA_PIN;
GPIO_InitStructure.GPIO_Mode = GPIO_Mode_Out_OD;
GPIO_InitStructure.GPIO_Speed = GPIO_Speed_50MHz;
GPIO_Init(I2C_GPIO_PORT, &GPIO_InitStructure);
// Initial state, SCL and SDA are high
GPIO_SetBits(I2C_GPIO_PORT, SCL_PIN | SDA_PIN);
}

// void I2C_Start(void)
{
    GPIO_SetBits(I2C_GPIO_PORT, SDA_PIN);
    delay_us(5);
    GPIO_SetBits(I2C_GPIO_PORT, SCL_PIN);
    delay_us(5);
    GPIO_ResetBits(I2C_GPIO_PORT, SDA_PIN);
    delay_us(5);
    GPIO_ResetBits(I2C_GPIO_PORT, SCL_PIN);
    delay_us(5);
}

// void I2C_Stop(void)
{
    GPIO_ResetBits(I2C_GPIO_PORT, SDA_PIN);
    delay_us(5);
    GPIO_SetBits(I2C_GPIO_PORT, SCL_PIN);
    delay_us(5);
    GPIO_SetBits(I2C_GPIO_PORT, SDA_PIN);
    delay_us(5);
}

// void I2C_SendByte(uint8_t byte)
{
    for (uint8_t i = 0; i < 8; i++) {
        if (byte & 0x80) {
```

```
            GPIO_SetBits(I2C_GPIO_PORT, SDA_PIN);
        } else {
            GPIO_ResetBits(I2C_GPIO_PORT, SDA_PIN);
        }
        byte <<= 1;
        delay_us(5);
        GPIO_SetBits(I2C_GPIO_PORT, SCL_PIN);
        delay_us(5);
        GPIO_ResetBits(I2C_GPIO_PORT, SCL_PIN);
        delay_us(5);
    }
}

// I2C reads a byte and sends ACK or NACK
uint8_t I2C_ReadByte(uint8_t ack)
{
uint8_t byte = 0;
GPIO_SetBits(I2C_GPIO_PORT, SDA_PIN);
for (uint8_t i = 0; i < 8; i++) {
byte <<= 1;
GPIO_SetBits(I2C_GPIO_PORT, SCL_PIN);
delay_us(5);
if (GPIO_ReadInputDataBit(I2C_GPIO_PORT, SDA_PIN)) {
byte |= 0x01;
}
GPIO_ResetBits(I2C_GPIO_PORT, SCL_PIN);
delay_us(5);
}
if (ack) {
GPIO_ResetBits(I2C_GPIO_PORT, SDA_PIN); // Send ACK
} else {
        GPIO_SetBits(I2C_GPIO_PORT, SDA_PIN); // 发送 NACK
    }
    delay_us(5);
    GPIO_SetBits(I2C_GPIO_PORT, SCL_PIN);
    delay_us(5);
```

```
    GPIO_ResetBits(I2C_GPIO_PORT, SCL_PIN);
    delay_us(5);
    return byte;
}

// uint8_t I2C_WaitAck(void)
{
    uint8_t ack = 0;
    GPIO_SetBits(I2C_GPIO_PORT, SDA_PIN);
    GPIO_SetBits(I2C_GPIO_PORT, SCL_PIN);
    delay_us(5);
    if (GPIO_ReadInputDataBit(I2C_GPIO_PORT, SDA_PIN)) {
        ack = 1;
    } else {
        ack = 0;
}
GPIO_ResetBits(I2C_GPIO_PORT, SCL_PIN);
delay_us(5);
return ack;
}

// Read multiple bytes from the specified slave address and register address
void I2C_ReadBytes(uint8_t slave_addr, uint8_t reg_addr, uint8_t *data, uint8_t len)
{
I2C_Start();
//Send slave address, write operation
I2C_SendByte(slave_addr << 1);
I2C_WaitAck();
//Send register address
I2C_SendByte(reg_addr);
I2C_WaitAck();
I2C_Start();
//Send slave address, read operation
I2C_SendByte((slave_addr << 1) | 0x01);
I2C_WaitAck();
for (uint8_t i = 0; i < len; i++) {
```

```
if (i == len - 1) {
// Last byte, send NACK
data[i] = I2C_ReadByte(0);
} else {
// Send ACK
data[i] = I2C_ReadByte(1);
}
}
I2C_Stop();
}


int main(void)
{
uint8_t received_data[5];
uint8_t temp_coeff_data[2];
uint32_t pressure_data;
	uint16_t temperature_data;
	float shiftN;
int EOFFout;
float actual_pressure,actual_temperature;
I2C_Init();
// Slave address 0x58, register address 0x04, read 5 bytes continuously
I2C_ReadBytes(0x58, 0x04, received_data, 5);
// Combined pressure data
pressure_data = ((uint32_t)received_data[0] << 16) | ((uint32_t)received_data[1] << 8) |
(uint32_t)received_data[2];
// Combined temperature data
temperature_data = ((uint16_t)received_data[3] << 8) | (uint16_t)received_data[4];
// Read two bytes from register 0x20 as temperature coefficient
I2C_ReadBytes(0x58, 0x20, temp_coeff_data, 2);
// Calculate shiftN
shiftN = (float)temp_coeff_data[1] / 10.0;
// Set EOFFout according to temperature coefficient [0]
	switch (temp_coeff_data[0])
	{
```

```
        case 0x0C:
            EOFFout = 4096;
            break;
        case 0x8C:
            EOFFout = -4096;
            break;
        case 0x0D:
            EOFFout = 8192;
            break;
        case 0x8D:
            EOFFout = -8192;
            break;
        case 0x0E:
            EOFFout = 16384;
            break;
        case 0x8E:
            EOFFout = -16384;
            break;
        default:
// You can add default processing, temporarily set it to 0 here
EOFFout = 0;
break;
}

// Process pressure data
if (pressure_data > 8388608)
    {
pressure_data -= 16777216;
}
// Process temperature data
if (temperature_data > 32768)
    {
temperature_data -= 65536;
}
// Calculate actual pressure
actual_pressure = ((float)pressure_data / (1 << 21)) * (PMAX -PMIN); // Unit is Pa
```

```
// Calculate actual temperature
actual_temperature = ((float)(temperature_data - EOFFout) / (1 << (int)shiftN)) + 25; //Unit is °C
while (1)
    {
// Code to process received pressure, temperature, and temperature coefficient data can be added here
// For example, print data
// Note: To use printf you need to configure the serial port first
// printf("Pressure: %f, Temperature: %f,\n",actual_pressure,actual_temperature);
}
}
```