XGZT2614 Thermopile Sensor（I2C）

● Product Brief

XGZT2614 is a high-precision digital infrared thermopile products

used for a variety of non-contact temperature measurement

Application in medical&healthcare、 consumer electronics、

 Industrial etc,. The sensor include MEMS thermopile sensor chip、

NTC thermistor and specialized signal conditioning ASIC chip.

The ASIC chip is equipped with 24 bits Sigma-Delta high precision

ADC, low noise instrument amplifier PGA and interface circuit.

● Product Features:

- Standard I^2C interface

- High-precision digital temperature measuring sensor

- Temperature calibrated, easy to implement

- Direct temperature measurement without peripheral circuits

- 30 to 50CM measurement distance

- High response rate, and a fast response time

- A 5.5μm long-pass filter

- TO-39 metal tube shell package

● Applied range:

- Intelligent wearable devices

- Intelligent household electrical appliance

- Industrial temperature monitoring

- Non-contact human surfaces temperature measurement

- Intelligent temperature sensing and control

Index

1. Absolute Maximum Rating Value

Table 1. Absolute maximum rating value

Parameter	Symbol	Min.value	Typical value	Max.value	Unit	Remarks
Supply voltage	V DD	-0.3		4.2	V	
Digital output voltage		-0.3		VDDIO+0.3	V	
ESD protect	H BM		±2		k V	
Store humidity				40%	RH	
Storage temperature		-40		100	℃	

2. Performance Parameters

Table 2. Sensor performance parameters

Parameter	Symbol	Min.value	Typical value	Max.value	Unit	Remarks
Angle of field			10		°	
Response Rate			60		V/W	
Working temperature		0		60	℃	Commercial
		-30		80	℃	Industrial
Supply voltage		2.3	3.3	3.6	V	
Operating current(Typ. application mode)	I avdd		733	800	μA	Default configuration
	I sleep		5		μA	
Standby current (25℃)		100			nA	
ADC resolution ratio			24		Bit	
Temperature measurement range		0		150	℃	Object Temp. Application (Commercial)
		-30		500		Object Temp. Application (Industrial)
		28		42		Human body Temp. Application
Temperature measurement accuracy			±2(To ≤100℃) ± 3% reading (To> 100℃)		℃	Object Temp. application
			±0.3			Human body Temp. application

VCC = 3.3 V without specified conditions, ambient temperature 25°C, and PGA gain 64x.
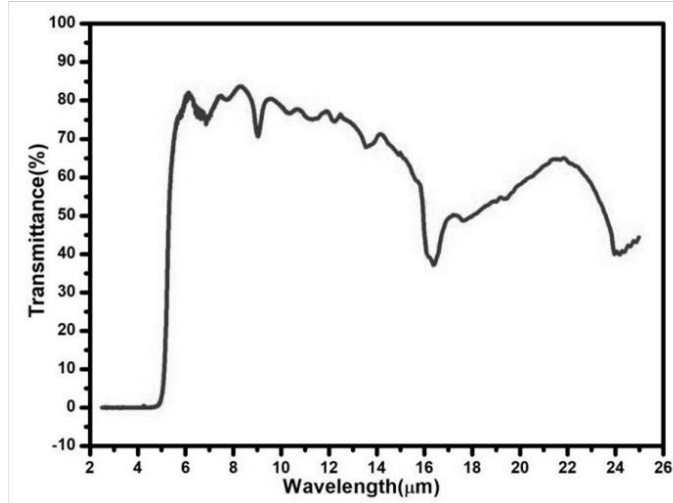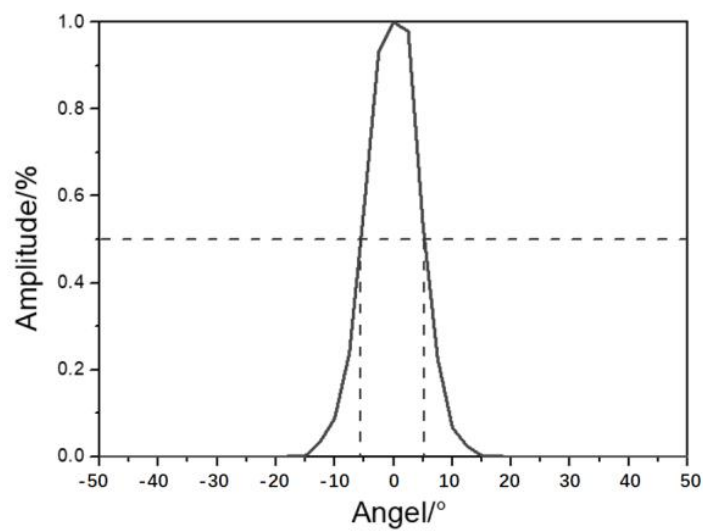
Figure 1. Filter Transmission Spectrum

Figure 2. Field of View Angle

XGZT2614 Industrial Temperature Accuracy

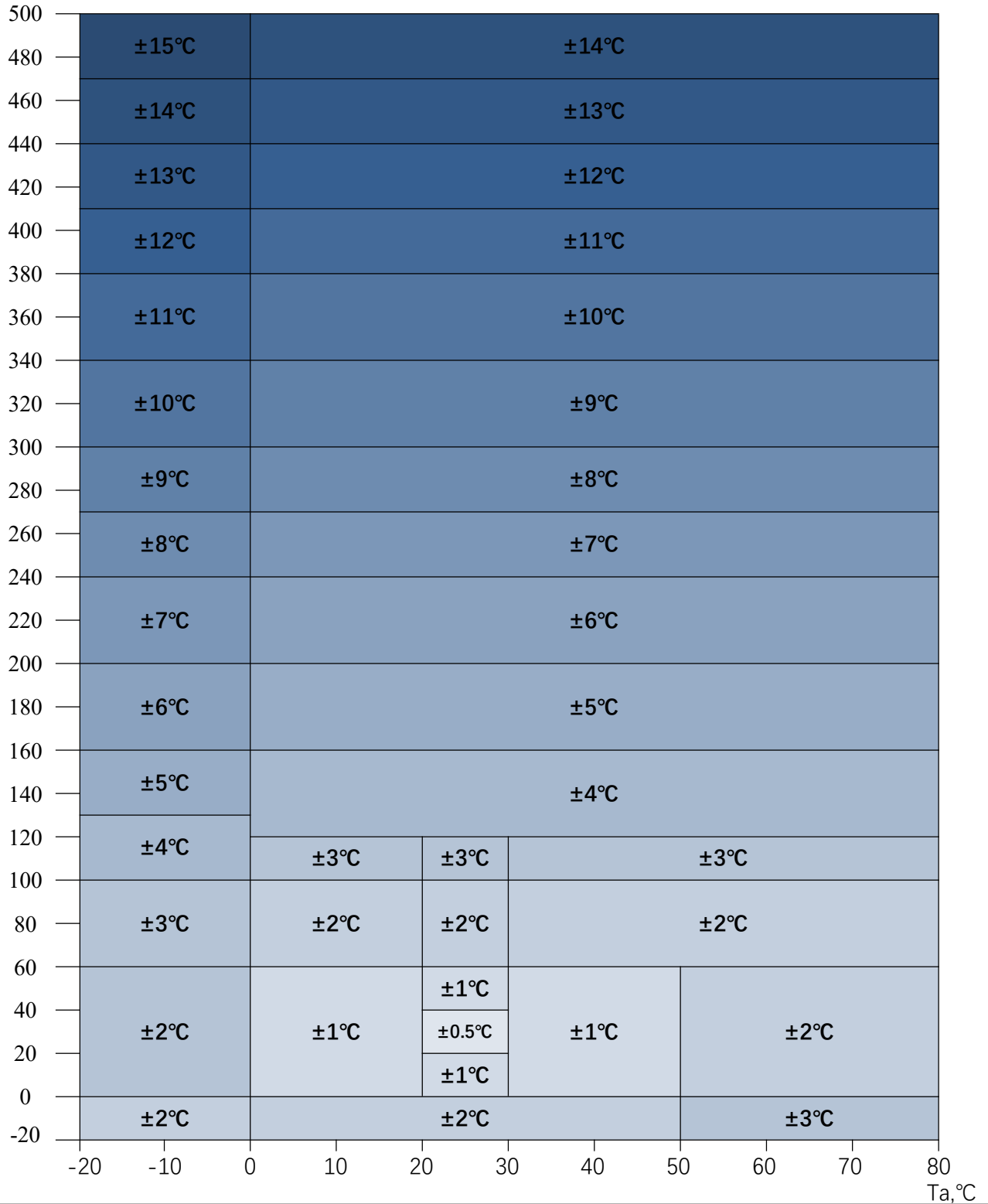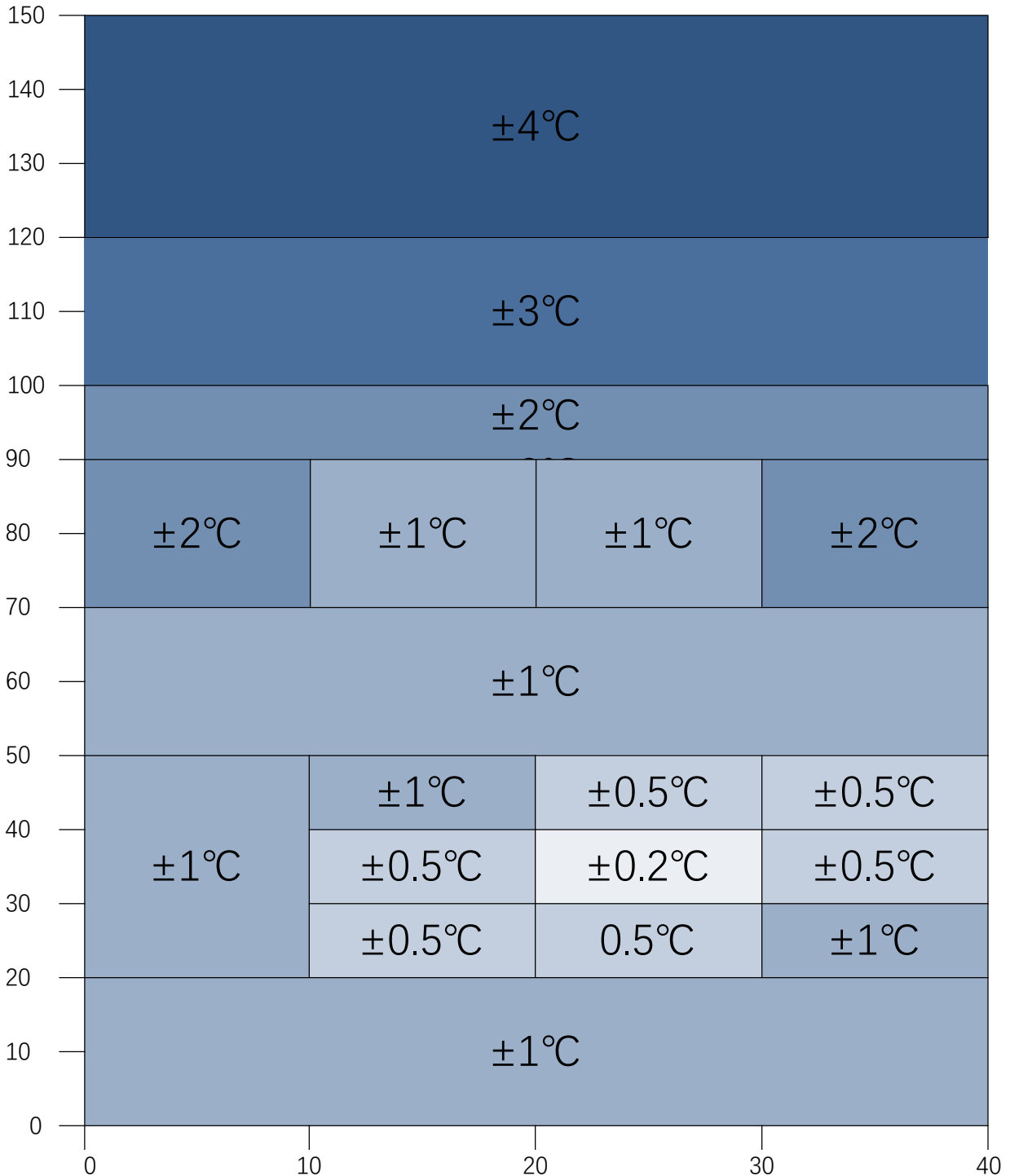All accuracy specifications were measured under stable isothermal and complete FOV conditions.

Figure 3. Industrial Accuracy of XGZT2614 (Ta, To)

XGZT2614 Commercial Temperature Accuracy

All accuracy specifications were measured under stable isothermal and complete FOV conditions Ta between 0°C and 40°C and To between 0°C and 150°C is shown in the following chart.

To. ℃

All the data are tested under typical conditions: the voltage is 3.3V, the distance between the sensor and the measured target is 40cm, the temperature target is standard black body furnace, and the corresponding ambient temperature is realized by changing the temperature of the ambient box.
All precision specifications are only applicable to stable isothermal conditions, and the sensor accuracy does not represent the final product accuracy.

Figure 4. Commercial Accuracy of XGZT2614 (Ta, To)

XGZT2614 Medical Temperature Accuracy

All accuracy specifications were measured under stable isothermal and complete FOV conditions Ta between 15°C and 40°C and To between 28°C and 42°C is shown in the following chart.
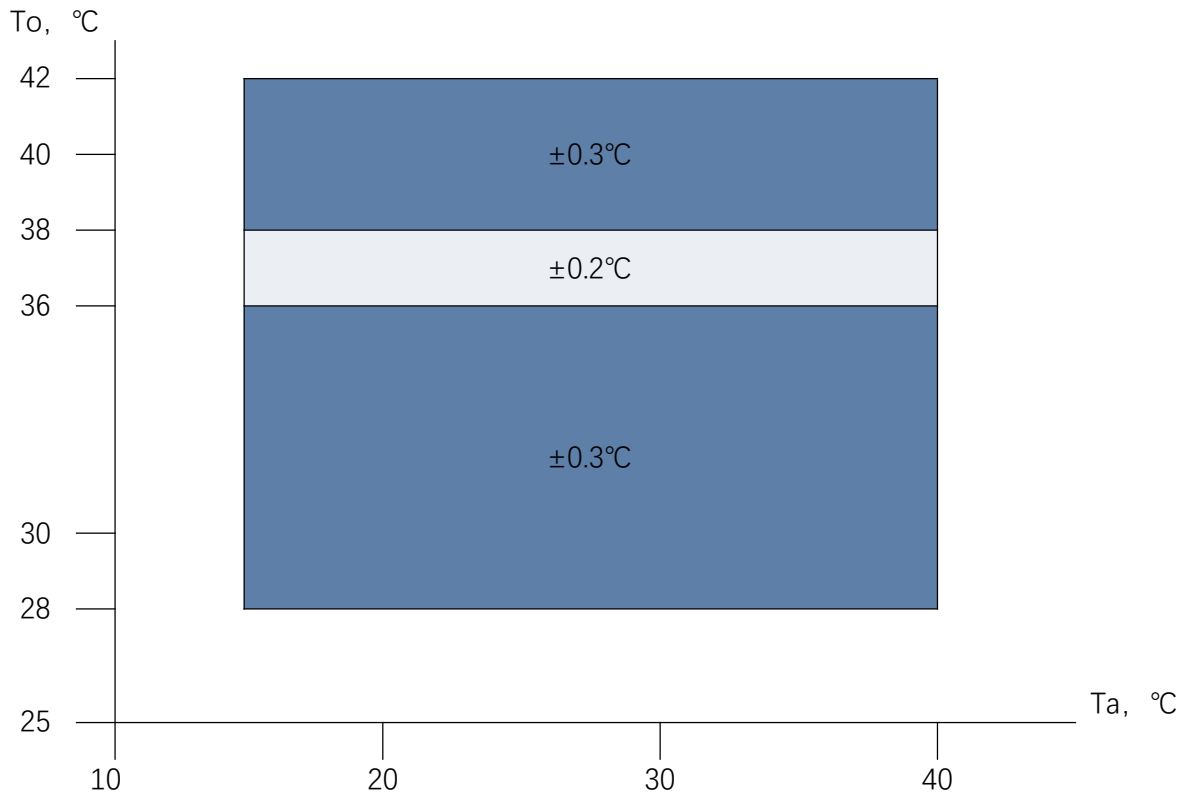
To, ℃

All the data are tested under typical conditions: the voltage is 3.3V, the distance between the sensor and the measured target is 40cm, the temperature target is standard black body furnace, and the corresponding ambient temperature is realized by changing the temperature of the ambient box. All precision specifications are only applicable to stable isothermal conditions, and the sensor accuracy does not represent the final product accuracy.

Figure 5. Medical accuracy of XGZT2614 (Ta, To)

In the application design, the key is to understand that the accuracy given in FIGS. 3 and 4 only ensures that the sensor has this accuracy under thermal equilibrium conditions (there is no temperature difference on the sensor package). If there is a temperature difference on the sensor package, the measurement accuracy will be affected. Can cause the sensor packaging temperature difference, such as the hot (or cold) components on the bottom or side of the sensor, or the sensor is very close to the measured object, the measured object will locally heat the sensor.

3. Universal Register

Table 3. Universal registers

ADD	Description	R/W	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Default
0x00	Soft Reset	W			SOFTRESET			SOFTRESET			0x00
0x02	Data_ready	R					Temp_rdy		To_drdy	Ta_drdy	0x00
0x03	Data_ready	R			To_raw_drdy	Ta_raw_drdy					0x00
0x10	Object temp out Tobj after DSP and IIR filter	R	data1_out<23:16>								0x00
0x11		R	data1_out<15:8>								0x00
0x12		R	data1_out<7:0>								0x00
0x16	Ambient temp out (internal temperature sensor) Ta data after calibration	R	temp_value<23:16>								0x00
0x17		R	temp_value <15:8>								0x00
0x18		R	temp_value <7:0>								0x00
0x22	To raw data before calibration	R	data_raw _out<23:16>								0x00
0x23		R	data_raw _out<15:8>								0x00
0x24		R	data_raw _out<7:0>								0x00
0x30	CMD	RW			sleep_en	clk_mode	mode_en	mode_sel<2:0>			0x00

Reg0x00

Soft_reset: 1: reset the common register, which automatically recovers to 0.

Reg0x02

Temp _ rdy: 1, the data preparation for Tobj after the DSP algorithm.

To _ drdy: 1, the data of To voltage values are ready.

Ta _ drdy: 1, data ready after ambient temperature (internal temperature sensor) calibration.

Reg0x03

To _ raw _ drdy: 1, To raw data was prepared prior to calibration.

Ta _ raw _ drdy: 1, the raw data is prepared before the calibration of the ambient temperature (internal temperature sensor).

Reg0x10-Reg0x12

Data_out: target temperature, output after DSP algorithm processing, output is 2 decimal complement.$DATA1/2^{14}$ （℃）

Data_MSB<23:16> = 0x10<7:0> , Data_ CSB<15:8> = 0x11<7:0> ,Data_ LSB<7:0> = 0x12<7:0>。

Reg0x16-Reg0x18

Temp _ Value: calibrated external ambient temperature (internal temperature sensor) data with an output of 2 decimal complement.$TEMP/2^{14}$ （℃）

Temp_MSB<23:16> = 0x16<7:0> , Temp_ C SB<15:8> = 0x17<7:0> , Temp_ LSB<7:0> = 0x18<7:0>。

Reg0x22-Reg0x24

Data_raw_out: the raw data of the To voltage value before calibration, the output is 2 decimal complement.

Data_Raw_MSB<23:16>=0x22<7:0>, Data_Raw_C SB<15:8> = 0x23<7:0>, Data_Raw_LSB<7:0> = 0x24<7:0>。

Reg0x30

Sleep_en: 1, Enter sleep mode; 0, and exit sleep mode.

Clk_mode：1，600KHz；0，1.2MHz 。

Mode_en：1，start FSM；

Mode_sel <2:0>: 000 / 001: Continuous conversion (Ta-To);.

4, EEPROM Register

Table 4. EEPROM register

ADD	Description	R/W	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
0x92	Chip_Address	RW		Chip_Address<6:0>							
0x93	S ys _config	RW	FILT_COEF<2:0>			output_mode<1:0>		OSR_T<2:0>			
0x94	S ys _config	RW	adc_dither_en	SERIAL_filter_en					VT_scale		
0x95	Sensor_Config	RW			Gain_P<2:0>			OSR_P<2:0>			
0x97	BPS_ Config	RW					RES_DAC<3:0>				

Reg0x92

Chip _ Address <6:0>: I can be configured^{2}Address of C; I^{2}The common 7-bit address of C is always 0x7F.

Reg0x93

FILT _ COEF <2:0>: IIR filter coefficient.

000 Disable IIR filter; 001 suppress 17% signal; 010 inhibit 25% signal;

01150% of signal; 10063%; 10175% of signal;

110 inhibited 88% of the signal; 111 inhibited 94% of the signal.

output_mode <1:0>：00：I^{2}C，01：PWM，10：Relay，11：I^{2}C。EEPROM Latch after loading.

 Changes to that value will only take effect if the value is programmed to EEPROM and then reset the chip.

OSR _ T <1:0>: The OSR used for ambient temperature measurements.

000:512X，011:1024X，010:2048X，011:4096X，100:128X，101:256X，110:110:8192X，11:16384X 。

Reg0x94

 The adc _ dither _ en: 1, enabling the internal ADC jitter.

SERIAL_filter_en: 1, enabling I^{2}C The input de-noise filter.

VT_SCALE: 1 'b0:±16 mv;1 'b1:±128 mv

Reg0x95

Gain _ P <2:0>: Set the gain of the sensor signal acquisition channel.000: gain=8 ，001:gian=12，010:gain=16, 011:gain=32，100:gain=48，101:gain=64，110:gain=96，111:gain=128。

OSR _ P <2:0>: Set the over-sampling rate of the sensor signal acquisition channel.000:512X，011:1024X，010:2048X，011:4096X，100:128X，101:256X，110:110:8192X，111:16384X 。

Reg0x97

RES _ DAC <3:0>: 4'b1101 5 / 16 * AVDD (recommended value)

5. Digital Communication

The digital device provides an used for serial communication I^{2}C protocol. The communication protocol is selected based on the CSB status.

I^{2}C bus uses SCL and SDA as signal lines and both lines are externally connected to VDDIO, via the pull-up resistance, to maintain at high level when the bus is idle. The I^{2}C of the digital device address can be configured by Chip _ Address of register 0x92, The universal distribution 7-bit address of I^{2}C is 0x7F, as shown in the table below.

Table 5. I^{2}C Device distribution address

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	W/R
1	1	1	1	1	1	1	0/1

Table 6. I^{2}C Bus line characteristics of SDA and SCL

| symbol	parameter	least value	crest value	unit
f_{SCL}	The SCL clock frequency		400	k H z
t_{LOW}	Low-level cycle of the SCL clock	1.3		μs
t_{HIGH}	High-level cycle of the SCL clock	0.6		μs
$t_{SU;DAT}$	The SDA establishment time	100		n s
$t_{HD;DAT}$	SDA hold time	0.0		μs
$t_{SU;STA}$	Establishment time of the repeat start conditions	0.6		μs
$t_{HD;STA}$	Starting condition holding time	0.6		μs
$t_{SU;STO}$	Stop the condition for the establishment time	0.6		μs
t_{BUF}	The interval between the two communications	1.3		μs
t_{r}	Time of rise of the SDA and SCL signals		300	ns
t_{f}	Time of decline in SDA and SCL signals		300	ns
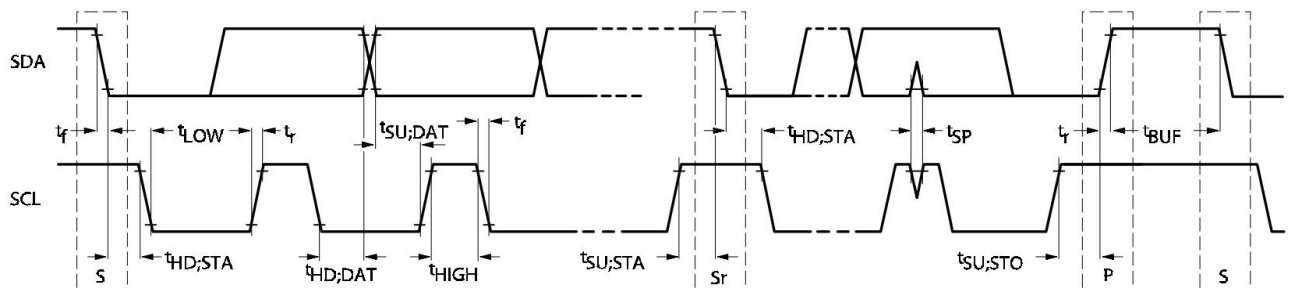
Figure 6. I^{2}C sequence chart

I^{2}The C communication protocol has a special bus signal condition. Start (S), end (P), and binary data conditions are shown in the figure below.

When the SCL is at the high level and the SDA is at the descending edge, mark I^{2}C Data communication begins.I^{2}C The main device sends the address from the device (7 bits) successively, and then selects the read / write operation to the control bit R / W. When this address is identified from the device, a response signal is generated and the SDA is pulled down at the ninth SCL (ACK) cycle.

SCL is at high level and SDA is at rising edge, marking I^{2}C End of data communication. Data transmitted by the SDA must remain stable when the SCL is high. The value of the SDA transmission can only be changed if the SCL is low.
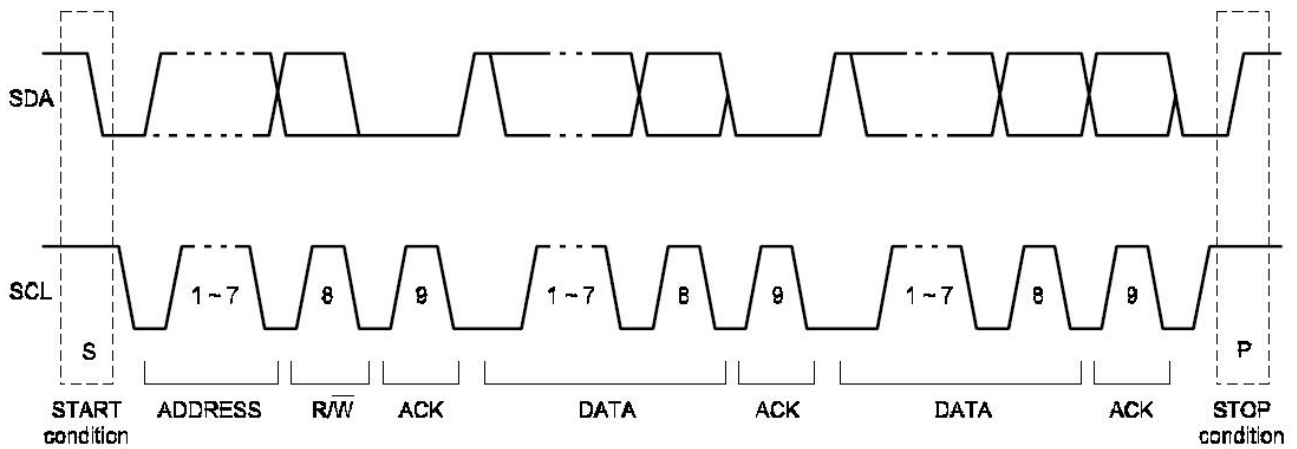

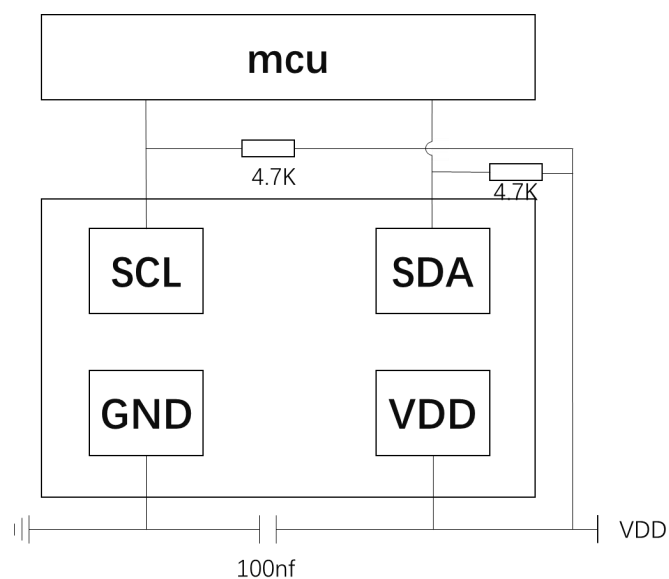Figure 7. I^{2}C protocol

6. General Application Circuit

Figure 8. General application circuit

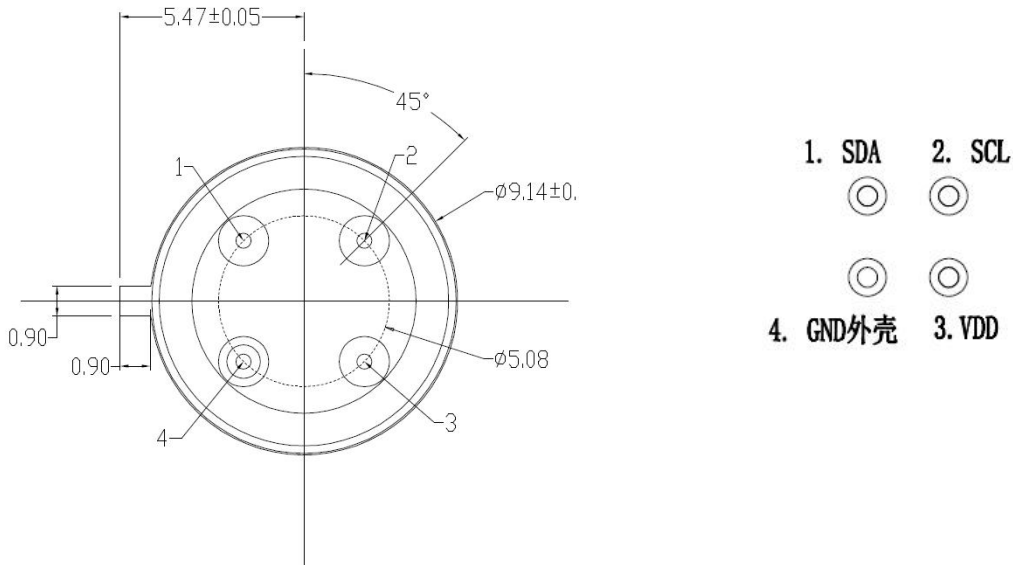# 7. Mechanical specifications

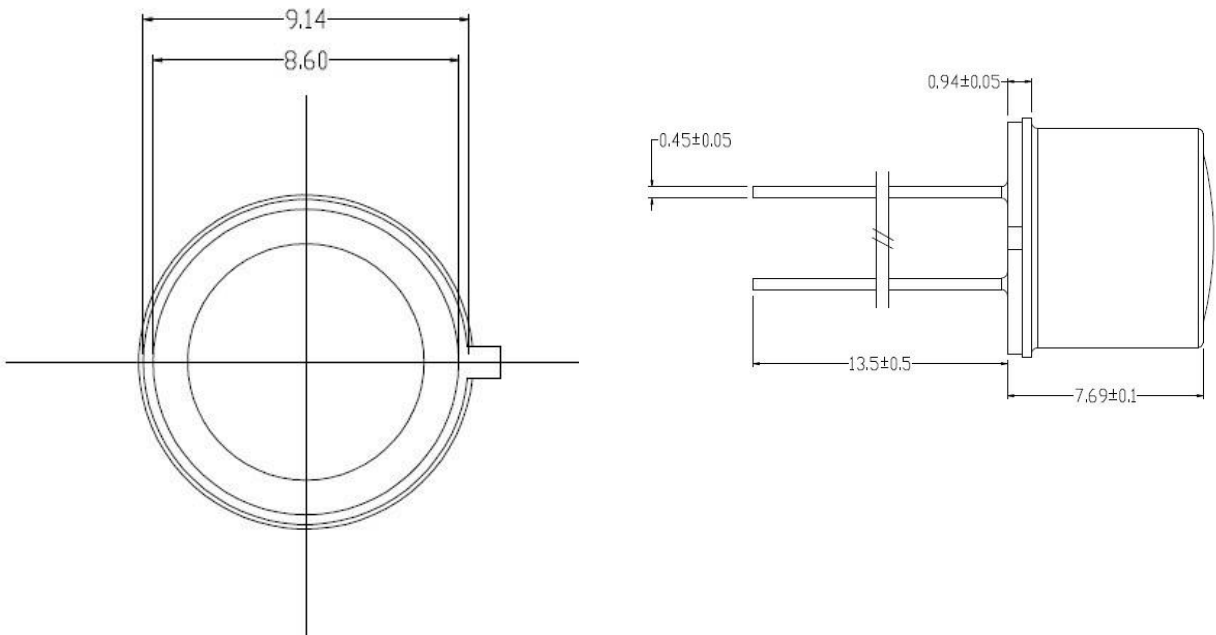1. Definition and Specification

Figure 9. Basal base view

Figure 10. Matrix contour dimensions

Table 7. Pin definitions

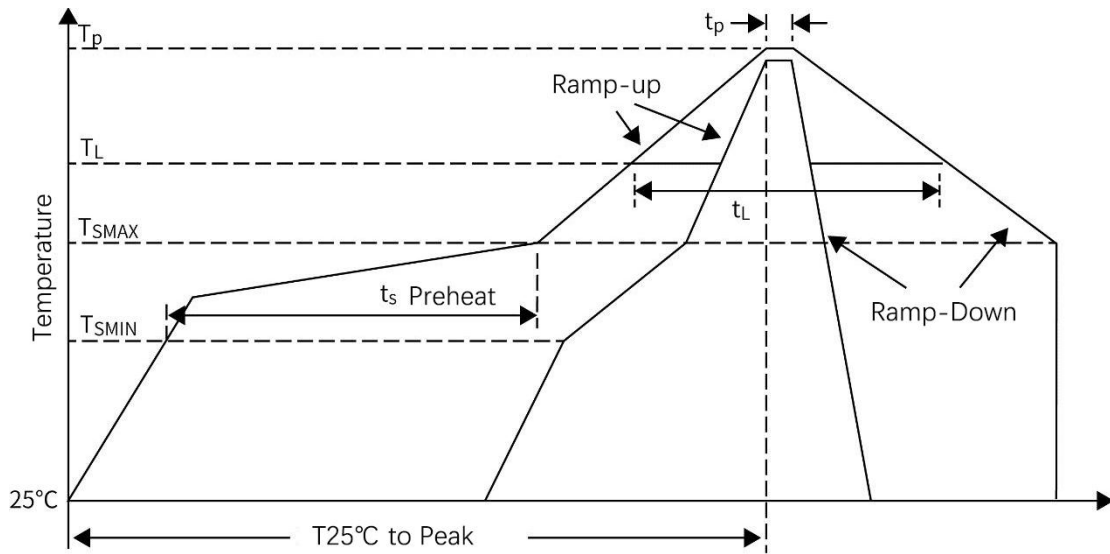| order number	symbol	definition
1	S DA	Serial data input / output (I^2C Data)
2	S CL	Serial Clock input (I^2C Clock)
3	VDD	Core-chip power supply (Supply Voltage)
4	G ND	G ROUND(Ground)

8. Recommended Reflow Curve

Figure 11. Recommended distribution curve of lead-free solder reflux temperature

Table 8. Distribution parameters of recommended lead-free solder reflux temperature curve

Average ramp-up rate(TsMAX to TP)	3°C /seconds max.
Preheat -Temperature Min.(TsMIN) -Temperature Max.(TsMAX) -Time(TsMIN to TsMAX)(Ts)	150°C 200°C 60～80seconds
Time maintained above: -Temperature(TL) -Time(tL)	217°C 60～150seconds
Peak temperature(TP)	260 °C
Time of actual peak temperature(TP, within 5°C)	20-40 seconds
Peak temperature(TP)	245 °C
Ramp-down rate	Max 6°C /seconds
Time from 25°C to Peak temperature	8 minutes Max

Note: After reflow welding, it is recommended to put the tube flat for 5 minutes before moving the PCBA, otherwise the sensor pipe cap is at risk of falling off.

9. Other Suggestions

1. Pressure and electrostatic discharge exceeding the absolute maximum rating may damage the sensor, please take appropriate precautions. Do not allow the sensor to contact the corrosive detergent, the light window can be cleaned with alcohol and cotton swabs.

2. The sensor should be stored in a well-sealed environment and pay attention to moisture, moisture, dustproof and static.

3. Before applying the company's products to some special circumstances (i. e., improper operation will directly affect the semiconductor life or cause physical damage), we should consult CFSensor and agents in advance. The Company will not assume any responsibility for the unauthorized operations.

CFSensor Reserves the right to make changes to its included specifications without notice and product updates without notice. The copyright of the product specification book and the final interpretation right of the product belong to CFSensor.