DATASHEET PRODUCT SPECIFICATION

Model ： MP6864系列

Rev1 .0 / July. 2024

Pressure sensor

Features

- Supply voltage: 1.8V to 5.5V
- Operating range: 10 to 1300 mbar, -40 to +85 °C
- Integrated digital pressure sensor (24 bit Σ ADC)
- Fully data compensated
- Accuracy Pressure:
- ±0.2 0%(300~1300mbar)
- Excellent long term stability
- Low power:1.5uA(Standby current<0.1μA)
- No external components (Internal oscillator)
- High-speed I²C digital output interface
- Size: 6.9 x 6.4 x 3.2 mm

6.9×6.4×3.2mm

Applications

- Adventure and Sports watches
- Pipe Pressure measurement
- Water Proof Pressure measurement
- Weather Station Equipment
- Gas pressure measurement Industrial Pressure and Temperature Sensor System

Descriptions

The MP6864-01BA employs a MEMS pressure sensor with an I²C interface to provide accurate temperature, pressure data. The sensor pressure and temperature outputs are digitized by a high resolution 24-bit ADC. Data compensation is integrated internally to save the effort of the external host MCU system. Easy command-based data acquisition interface and programmable interrupt control is available. Pressure output can be resolved with output in fractions of a Pascal. Package is surface mount with a stainless steel cap and is RoHS compliant.
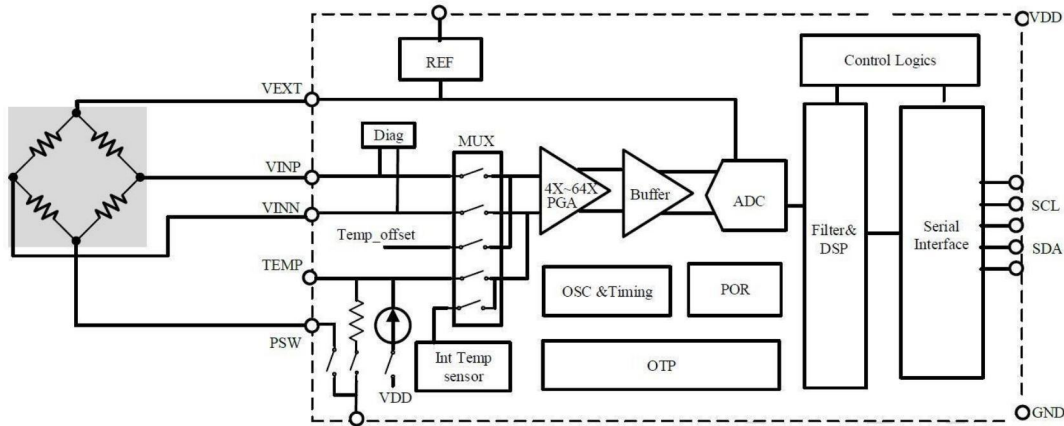
1. Block Diagram

Figure 1: Functional block diagram

2. Electrical Specifications

2.1 Pressure and Temperature Characteristics

Table1: Pressure Output Characteristics @ VDD = 5.0V, T = 25°C unless otherwise noted

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Pressure Measurement Range	P_{FS}		10		1300	mbar
Pressure AbsoluteAccuracy		300 to1300 mbar from -20°C to 85°C	-0.3		+0.3	%
Pressure RelativeAccuracy		300 to 1300 mbar from -20°C to 85°C		±0.3		%
Max Error with Power Supply		Power supply from 1.8V to 5.0V	-0.2		+0.2	%
Pressure Resolution		Pressure Mode		0.01		%
Board Mount Drift		After solder reflow		0.05		%
Long Term Drift		After a period of 1 year		±0.6		%
Reflow soldering impact		IPC/JEDEC J-STD-020C		0.05		%

Table2: Temperature Output Characteristics @ VDD = 5.0V, T = 25°C unless otherwise noted

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Operation Temperature Range	T_{OP}		-20	25	85	°C
Temperature Absolute Accuracy		25°C		±0.5		°C
Temperature Absolute Accuracy		-10°C to +60°C		±1.0		°C
		-20°C to + 85°C		±1.5		°C
Max Error with Power		Power supply from 1.8V to 3.6V			±0.5	°C
Temperature Resolution of Output Data				0.01		°C

2.2 Electrical Characteristics

Table3: DC Characteristics @VDD=5.0 V, T=25℃ unless otherwise noted

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Operation Supply Voltage	V_{DD}		1.8	3.0	5.5	V
Operation Temperature	T_{OP}		-20		85	℃
Supply Current@25°C on during conversion	IBDD_pgaoff	PGA off(Gain<=2)		0.9		mA
	IBDD_pgaon	PGA on (Gain>=4)		1.5		mA
Conversion time	Tc	OSR 4096 2048 1024 512 256		6.34 3.78 2.5 1.86 1.54		ms
Supply current （1 sample per sec.）	Idd	OSR 4096 2048 1024 512 256		5.75 3.45 2.3 1.8 1.4		uA
Standby Supply Current	I_{DDSTB}	At 25℃			0.1	μA
Serial Data Clock Frequency	f_{SCLK}	I^2C protocol, pull-up resistor of 10k		100	400	kHz
Digital Input High Voltage	V_{IH}		0.8			V
Digital Input Low Voltage	V_{IL}				0.2	V
Digital Output High Voltage	V_{OH}	IO = 0.5 mA	0.9			V
Digital Output Low Voltage	V_{OL}	IO = 0.5 mA			0.1	V
Input Capacitance	C_{IN}			4.7		pF

2.3 Absolute Maximum Rating

Table6 Absolute Maximum Rating

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Overpressure	P_{MA}				3	bar
Supply Voltage	V_{DD}		-0.3		5.5	V
Interface Voltage	V_{IF}		-0.3		VDD+0.3	V
Storage Temperature Range	T_{STG}		-50		150	℃
Maximum Soldering Temperature	T_{MS}	40 second maximum			250	℃
ESD Rating		Human body model	-2		+2	kV
Latch-up Current		At 85℃	-100		100	mA

Stresses above those listed as "absolute maximum ratings" may cause permanent damage to the device.
This is a stress rating only and functional operation of the device under these conditions is not implied.
Exposure to maximum rating conditions for extended periods may affect device reliability.

3. Function Descriptions

3.1 General Description

The MP6864-01BA is pressure sensor that measures the pressure and the temperature by an internal 24- bit ADC and compensates them by a patented algorithm. The fully-compensated values can be read out via the I²C interface by external MCU. The uncompensated values can also be read out in case the user wants to perform their own data compensation.

Furthermore, the device allows the user to setup the temperature, pressure threshold values for various events. Once the device detects that a certain event has happened, a corresponding interrupt will be generated and sent to the external MCU. Also, multiple useful interrupt options are available to be used by the user.

3.2 Factory Calibration

Every device is individually factory calibrated for sensitivity and offset for both of the temperature and pressure measurements. The trim values are stored in the on-chip 128-Byte Non-Volatile Memory (NVM). In normal situation, further calibrations are not necessary to be done by the user.

3.3 Automatic power on initialization

Once the device detects a valid VDD is externally supplied, an internal Power-On-Reset (POR) is generated and the device will automatically enter the power-up initialization sequence. After that the device will enter the sleep state. Normally the entire power-up sequence consumes about 400 us.

3.4 Sensor Output Conversion

For each pressure measurement, the temperature is always being measured prior to pressure measurement automatically, while the temperature measurement can be done individually. The conversion results are stored into the embedded memories that retain their contents when the device is in the sleep state.

4 High-Speed I²C Digital Output Interface

The I²C interface is fully compatible to the official I²C protocol specification. All the data are sent starting from the MSB. Successful communication between the host and the device via the I²C bus can be done using the four types of protocol introduced below.

4.1 I²C Specification

Table9:I²CslaveTimingValues

| Parameter	Symbol	Conditions	I²C			Unit
			Min	Typ.	Max	
Clock frequency	fBsclB				400	kHz
SCL low pulse	tBLOWB		1.3			us
SCL high pulse	tBHIGHB		0.6			us
SDA setup time	tBSUDATB		0.1			us
SDA hold time	tBHDDATB		0.0			us
Setup Time for a repeated start condition	tBSUSTAB		0.6			us
Hold time for a start condition	tBHDSTAB		0.6			us
Setup Time for a stop condition	tBSUSTOB		0.6			us
Time before a new transmission can start	tBBUFB		1.3			us
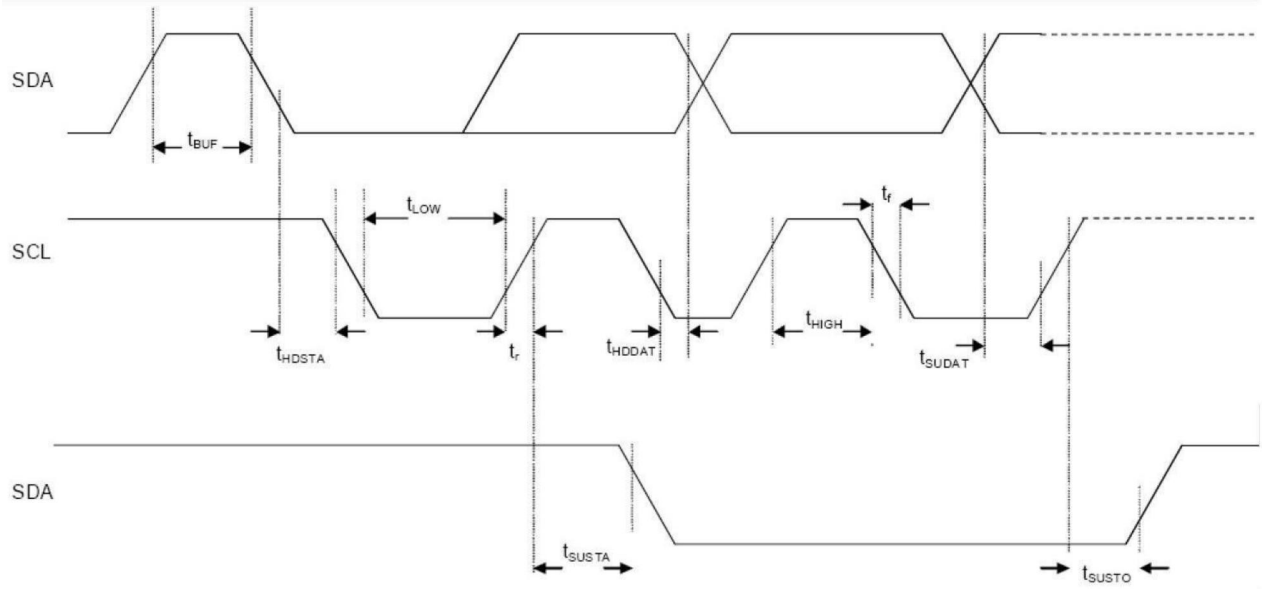
Figure 2: I2C Timing Diagram

The I2C interface protocol has special bus signal conditions. Start (S), stop (P) and binary data conditions are shown below.At start condition, SCL is high and SDA has a falling edge. Then the slave address is sent. After the 7 address bits, the direction control bit R/W selects the read or write operation. When a slave device recognizes that it is being addressed, it should acknowledge by pulling SDA low in the ninth SCL (ACK) cycle.

At stop condition, SCL is also high, but SDA has a rising edge. Data must be held stable at SDA when SCL is high. Data can change value at SDA only when SCL is low.
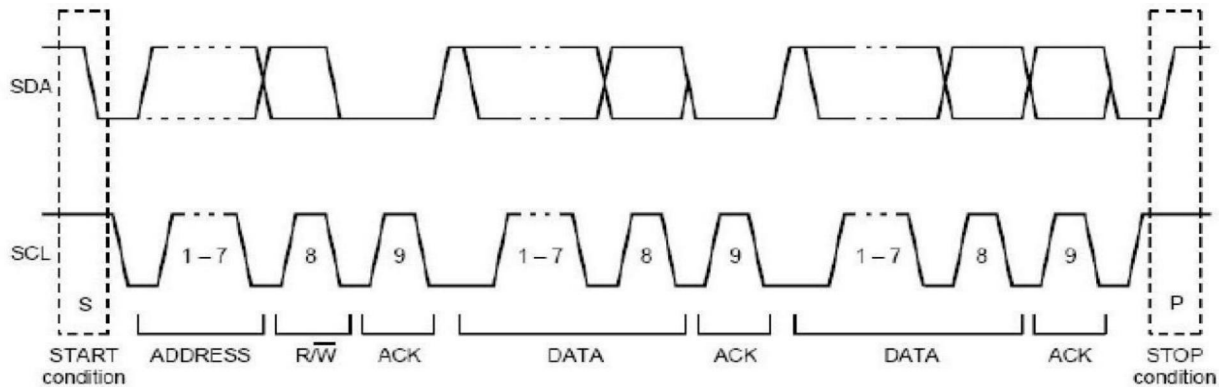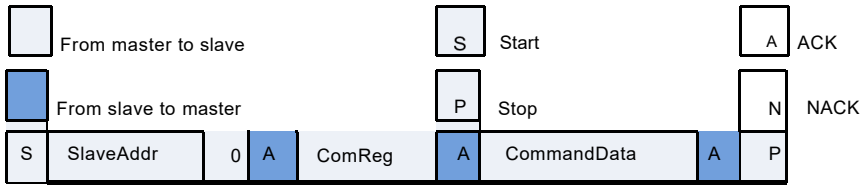

Figure 3: I2C Protocol

4.2 I²C Device Address

The I²C device address is shown below. The LSB of the device address is corresponding to address 0XDA (write) and 0XDB (read).

A7	A6	A5	A4	A3	A2	A1	W/R
1	1	0	1	1	0	SDO/ADDR	0/1

6

4.3 I²C Protocol

4.3.1 Send Command

ComReg=0x30

CommandData:

Address	Description	R/W	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0x30	CMD	RW	Sleep_time<3:0>				Sco	Measurement_ctrl<2:0>		

Sleep_time<3:0>:0000:0ms, 0001:62.5ms,0010:125ms... 1111: 1s, only active during sleep mode conversion.

Measurement_control<1:0>: 000b，indicate a single shot temperature signal conversion. 001b，indicate a single shot sensor signalconversion.010b: indicate a combined conversion (once temperature conversion immediately followed by once sensor signal conversion).011b: indicate a sleep mode conversion (periodically perform once combined conversion with an interval time of „sleep_time").

Sco: 1,Start of conversion, automaticallycome back to 0 afterconversion ends(except sleep mode conversion).
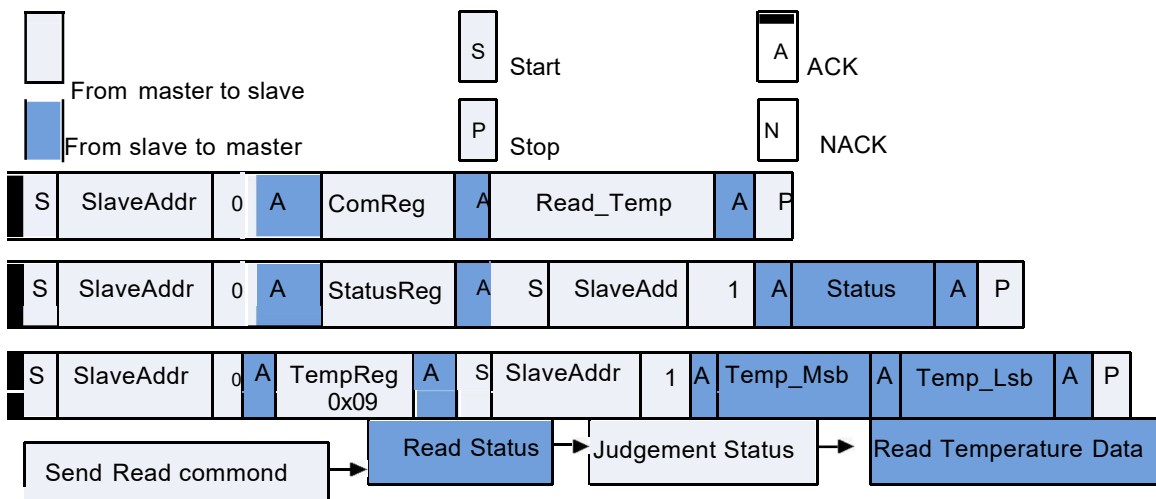
4. 3.2 Read Status
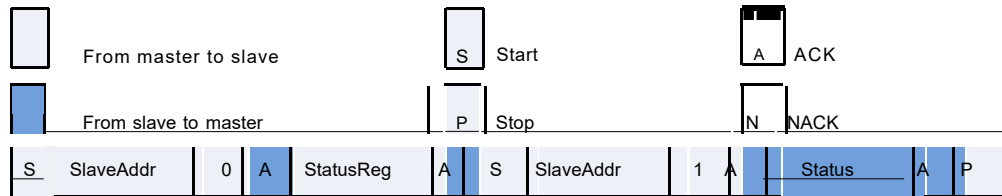
StatusReg=0x02

Status:

Address	Description	R/W	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0x02	Status	R	Error_code<3:0>				1"b0			DRDY

DRDY：1, indicates once conversion complete, and the output data is ready for reading.

4.3.3 Read the Temperature Values

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4. 3.4 Read the Pressure Values

☐	From master to slave	S	Start	A	ACK
▨	From slave to master	P	Stop	N	NACK

S	SlaveAddr	0	A	ComReg	A	Read_Press	A	P

S	SlaveAddr	0	A	StatusReg	A	S	SlaveAddr	1	A	Status	A	P

S	SlaveAddr	0	A	PressReg 0x06	A	S	SlaveAddr	1	A	press Data [23:16]	A	press Data [15:8]	A	press Data [7:0]	A	P

Send Read commond → Read Status → Judgement tatus → Read Pressure Data
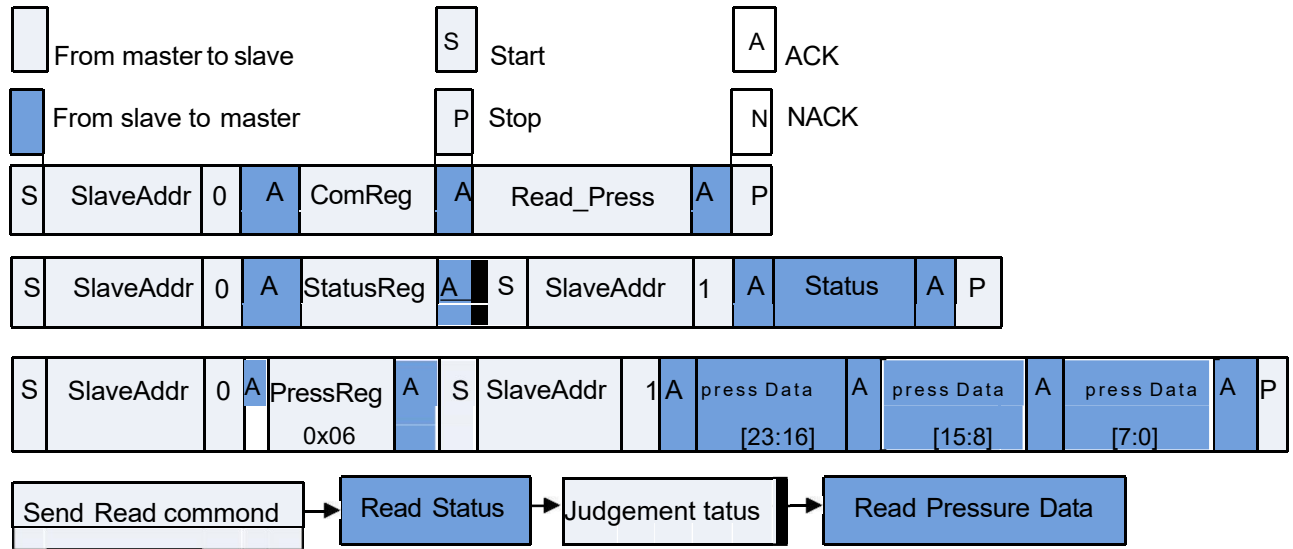
4.3.5 Calculate the pressure data and the temperature data

Pressure data = Pressure Data[23:0]/64;

Temperature data：

Temp_Msb integer part, bit7 is the sign bit,0 for positive, and 1 for negative, bit6~bit0 equals

to °C Temp_Lsb Decimal part equals to (1/256) °C
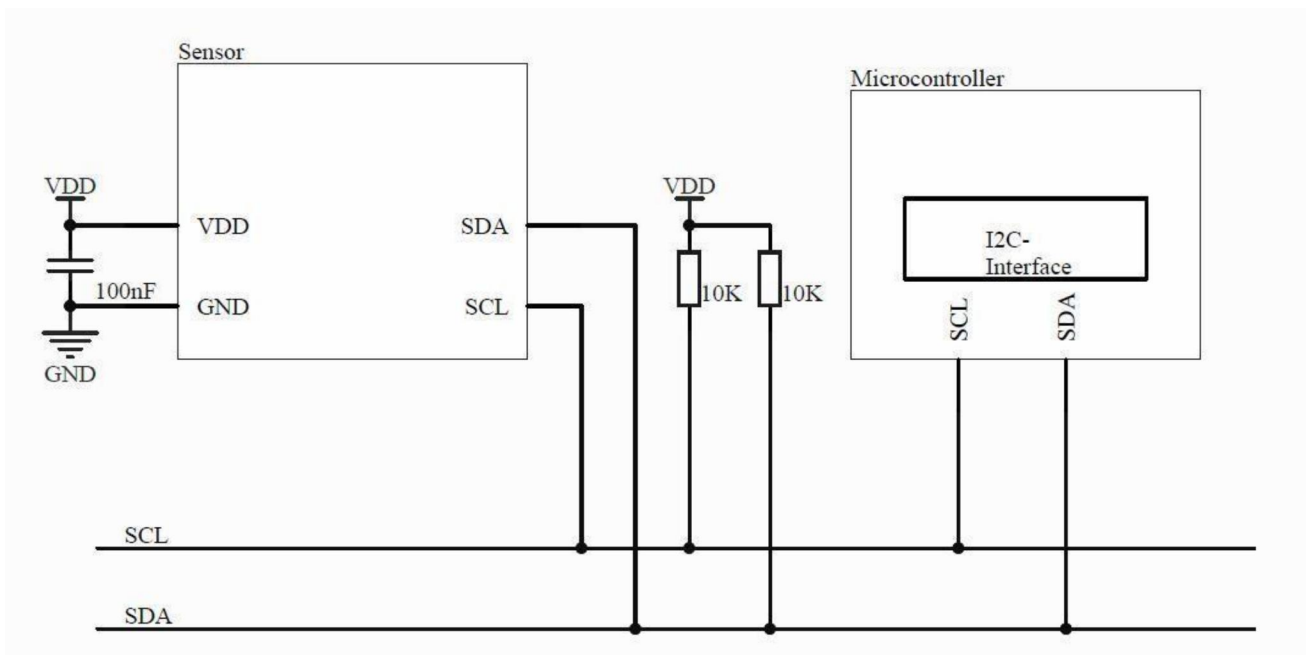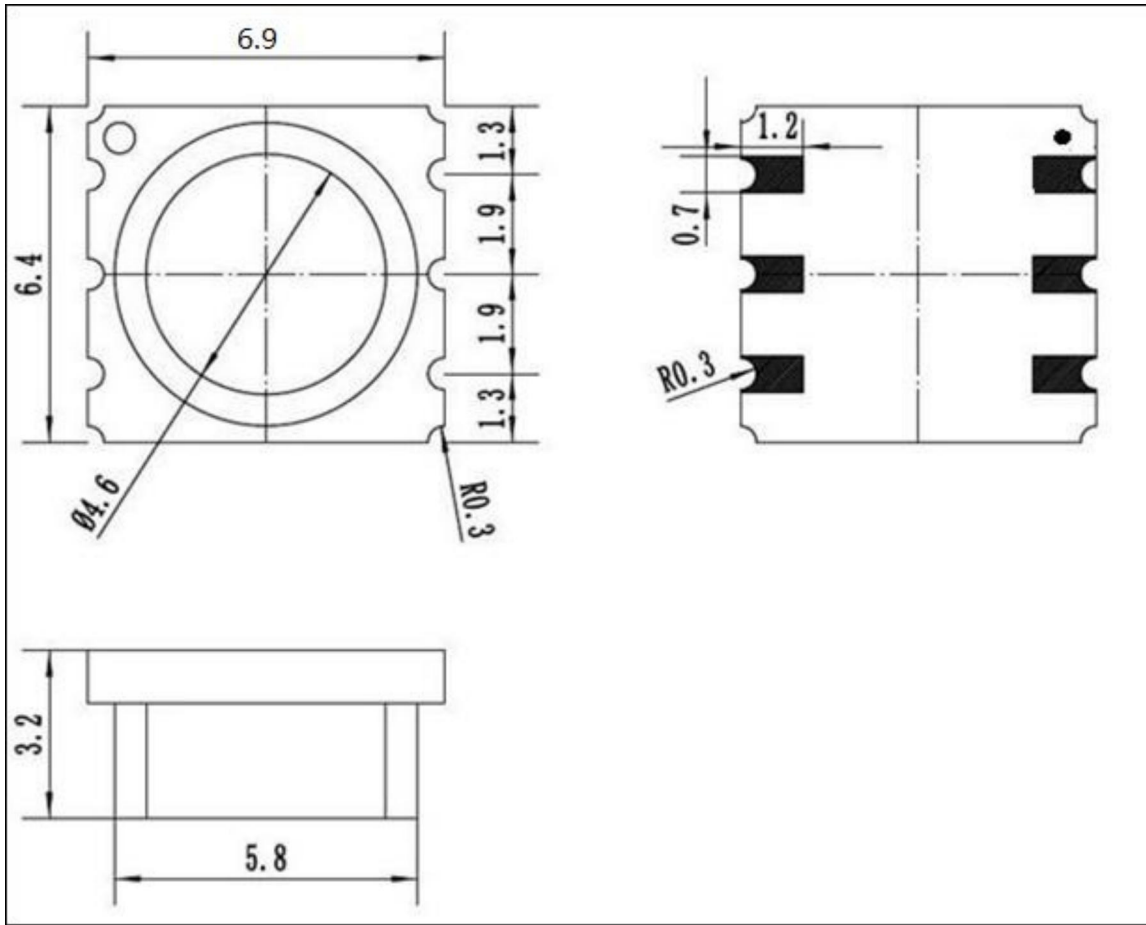
5 Typical Application Circuit for I₂C mode

Figure4: Typical application circuit

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6 Package Information

Pin	Name	Type	Function
1	GND	G	Power Ground
2	VDD	P	Positive supply voltage
3	NC		Not connect
4	NC		Not connect
5	SDA	I/O	Serial data input/output
6	SCL	I	Serial data clock

Figure 5:Pin Information