ADP3000

Digital Differential Pressure Sensor

- Excellent repeatability without drift
- High reliability and long-term stability
- High signal-to-noise ratio
- Built-in high processing power MCU

Summary

ADP3000 is a digital differential pressure sensor. It measures the pressure difference between air, nitrogen and oxygen through the influence of airflow on the temperature field distribution of the sensor chip. It has the characteristics of high precision, no drift and strong stability, and the response time is as fast as 10ms, it has two ranges of ±500Pa and ±1000Pa, and also has excellent accuracy near zero point. The ADP3000 sensor features a digital I2C interface for simple communication and easy connection to a microprocessor. Ideal for high-quality mass production, ideal for demanding and cost-sensitive OEM applications.

Application

ADP3000 is designed for home appliances and medical industries, and is widely used in HVAC, VAV controllers, gas boilers, pellet stoves and fuel cells, heat recovery systems, filter monitoring, as well as medical breathing devices, fire residual pressure monitoring systems and many other scenarios; Figure 1 when the air inlet on the right side is positive differential pressure, and when the air inlet on the left side is negative differential pressure.

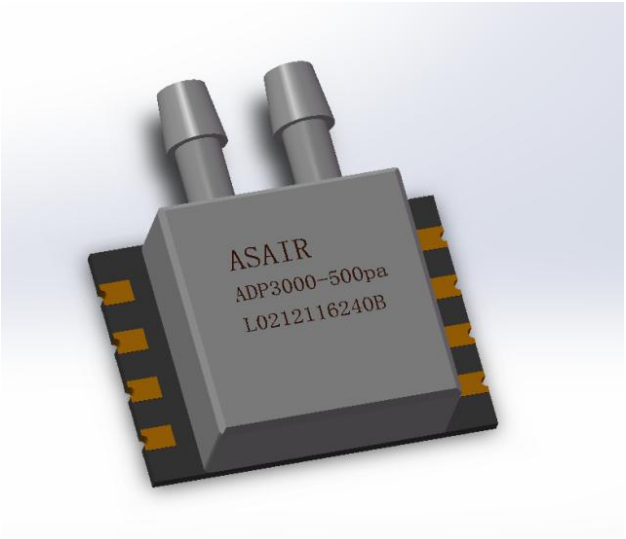


Figure 1. ADP 3000 Differential Pressure Sensor

1. ADP3000 performance parameters and materials

1.1 Technical specification

Table 1. Technical parameters

Parameter	Parameter description
Measuring range	-500 ~ + 500Pa or -1000 ~ + 1000Pa
Zero point accuracy	0.3Pa
Precision	Reading × 3%
Zero point repeatability	0.1Pa
Repeatability	Reading × 0.5%
Year offset	< 0.05 Pa
Response time	10ms
Resolution	24bit
Calibration gas	Air
Fluid Compatibility	Air, nitrogen, Oxygen (non-condensing)
Temperature Compensation Range	0°C to +50°C

Note: Unless otherwise stated, all sensor differential pressure parameters are measured at 25°C, VDD = 3.3 V, and absolute pressure = 966 mbar.

1.2 Temperature performance parameters

Table 2. Temperature performance parameters

Parameter	Parameter description
Measuring range	-40°C ~ +85°C
Resolution	24bit
Accuracy	at -10°C ~60°C , 2°C at -40°C~ -10 °C and 60°C ~85°C , 3°C
Repeatability	0.3°C

Note: The temperature indicated in the table is the temperature inside the sensor. This temperature value depends not only on the gas temperature, but also on the ambient temperature around the sensor.

1.3 Electrical parameters

Table 3. Electrical Parameters

Parameter	State	Minimum	Typical value	Maximum value	Unit
Voltage	-	3.2	3.3	3.5	V
Supply current	Measurement status	-	10	12	mA

1.4 Timing parameters

Table 4. Timing Parameters

Parameter	Minimum	Typical value	Maximum value	Unit	Remark
Power up time	-	-	25	ms	Time required for sensor preparation
I2C SCL frequency –	-	100	200	kHz	-
Update rate of differential pressure value during continuous measurement	-	100	-	Hz	-

1.5 Mechanical parameters

Table 5. Mechanical Parameters

Parameter	Numerical value	Unit
Rated burst pressure	5	bar
Weight	2	g

1.6 Limit parameter table

Table 6. Limit parameter table

Parameter	Minimum	Maximum value	Unit
Voltage	-0.3	5.5	V
Maximum voltage on pins (SDA,SCL)	-0.3	5.6	V
Input current on any pin	-70	70	mA
Storage temperature range	-40	85	°C
ESD HBM (manikin)	-	2	kV

Note: This parameter is for air and nitrogen. Prolonged exposure to oxygen at high temperatures (>50 °C) will shorten product life.

1.7 Material

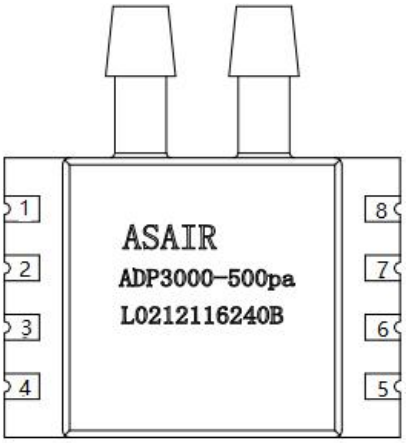
Table 7. Materials

Parameter	Describe
Material	PBT (Polybutylene Terephthalate), Glass (Silicon Nitride, Silica), Silicon, Gold, FR4 (Fiberglass Cloth), Static Seal Silicone, Epoxy, Copper Alloy, Lead Free Solder
Standards / Approvals	Comply with REACH and RoHS standards

2. Pin assignment

Table 8. ADP3000 Digital Pin Description Table

Pin number	Pin name	Describe
2, 8	GND	Ground
3	SCL	Serial data (I2C interface,external 4.7K pull-up resistor is required)
4	SDA	Serial clock (I2C interface,external 4.7K pull-up resistor is required)
6	VDD	Power supply
1 , 5 , 7	N/C	Empty pin



3. I2C and crc check

The I2C address of the ADP3000 is 0x25, or 0100101. The address is followed by a read or write bit. CRC (Cyclic Redundancy Check) is an algorithm that performs polynomial operations on data and appends the result to the back of the data frame. The result obtained has a remainder indicating that there is an error in the data frame during transmission. CRC is mainly used to detect or verify whether there is an error in data transmission or storage, so as to ensure the correctness and integrity of data transmission.

3.1 I2C timing

I2C host writes data and receives commands and data is shown in Figure 2 and Figure 3. The commands in the figures are all 16bit . The sensor data is output in 16bit , and each word is followed by an 8bit checksum to ensure the reliability of communication.

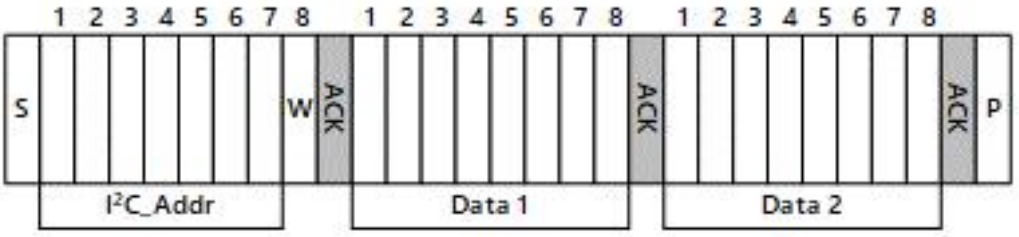


Figure 2. Timing diagram of the I2C master executing the write 16bit data command

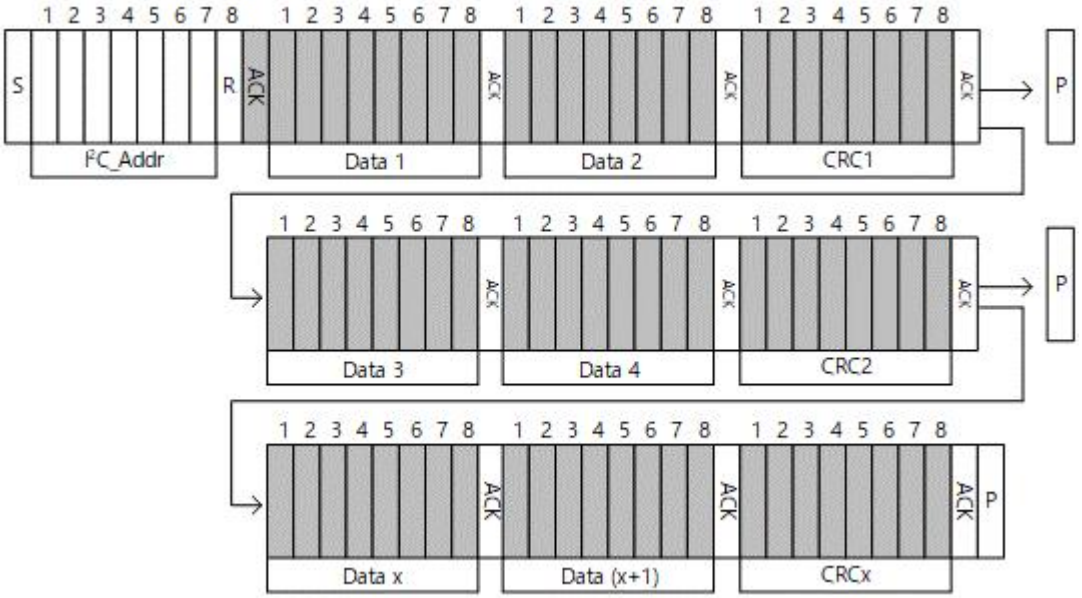


Figure 3. The I2C host executes the read command and receives multiple 16bit data commands and CRC check code timing diagram

3.2 I2C read command

The I2C host can read the differential pressure and temperature measured by the sensor through the I2C read commands in hexadecimal , such as the continuous measurement command (0x361E) and the single measurement command (0x372D) . After the I ^{2}C host sends continuous measurement commands , the sensor will continuously measure and update the measurement results. During continuous measurement, the update time of the measurement results is 10ms . See Table 9 for measurement (continuous and single measurement) command information . Measurements can be read out as soon as a continuous measurement is started; temperature and scale factor do not need to be read out each time. Read operations can be terminated by NACK and STOP conditions.

Table 9. I2Cread instruction bytes and their descriptions

Byte sequence number	Describe
1	Differential pressure raw data high 8 bits
2	Differential pressure raw data lower 8 bits
3	CRC
4	Temperature data high 8 bits
5	Temperature data lower 8 bits
6	CRC
7	Scale factor higher 8 bits
8	Scale factor lower 8 bits
9	CRC

3.3 Checksum calculation

CRC generally has three standards: CRC8 , CRC16 and CRC32 , and CRC8 is used in ADP3000. Taking the polynomial x8 + x5 + x4 + 1 (0x31) as an example, the CRC8 checksum byte is generated by a CRC algorithm with the properties shown in Table 10 .

Table 10. Corresponding values of CRC8 attributes

Attributes	Value
Length	8bit
Polynomial	x8 + x5 + x4 + 1
Initial value	0xFF
Whether the input needs to be reversed	False
Final XOR value	0x00

4. Output signal calculation formula

Table 11. Scale factor

Parameter	ADP3000-500Pa	ADP3000-1000Pa
Differential pressure (Pascal)	60Pa $^{-1}$	30Pa $^{-1}$
Temperature (°C)	200 °C $^{-1}$	200 °C $^{-1}$

The digitally calibrated differential pressure and temperature signal read from the sensor is a signed integer (two's complement). The integer value can be converted to a physical value by dividing it by the scale factor. The scale factor for differential pressure or is 30Pa $^{-1}$ or 60Pa $^{-1}$, and the scale factor for temperature is 200°C $^{-1}$. For example, the calculation formula of differential pressure reading is as follows:

Differential pressure = Sensor output integer value ÷ Differential pressure scaling factor

The temperature calculation formula can refer to the differential pressure calculation formula.

5. Dimensions

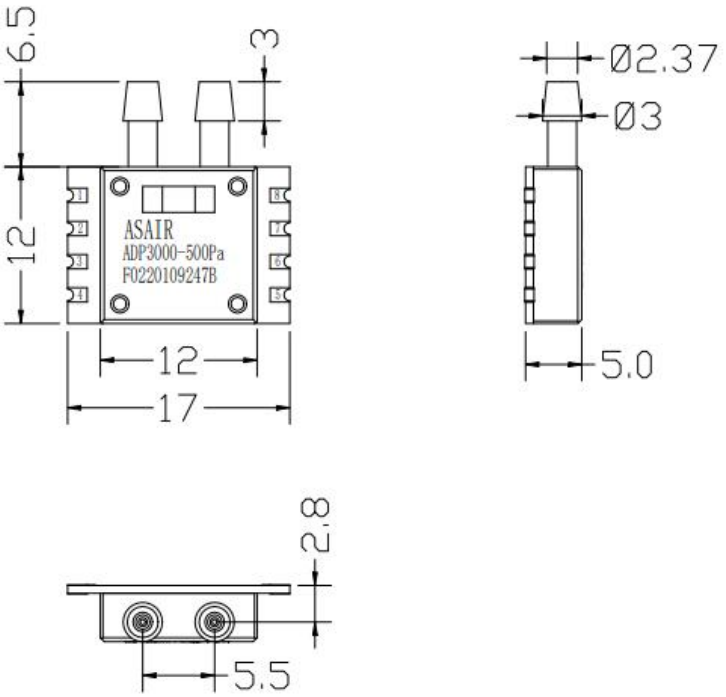


Figure 4. ADP3000 Outline Dimensions (Unit: mm , Unmarked Tolerance: ± 0.2 mm)

6. Welding

Since this product has a small heat capacity, please do not place it at high temperature, otherwise it may be damaged due to thermal deformation. Please use non-corrosive rosin-type flux, and be careful not to get the flux inside.

6.1 Welding Instructions

The SMD I/O pads are made of copper wire leadframe planar substrates, and these pads are exposed for mechanical and circuit connections. When using, both I/O pads and exposed pads need to be soldered on the PCB. To prevent oxidation and optimize soldering, the solder joints on the bottom of the sensor are gold plated.

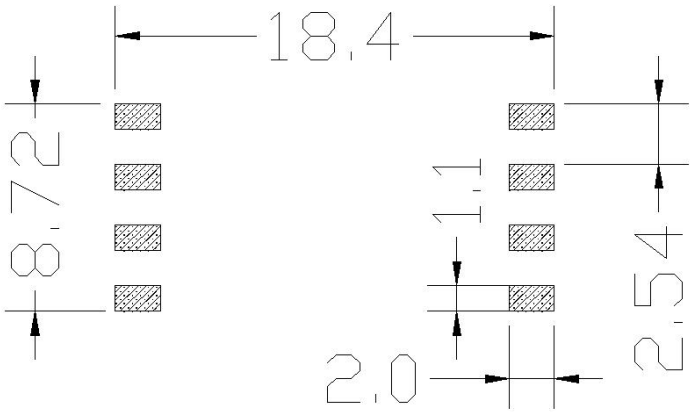


Figure 5. Recommended PCB Design Dimensions for ADP3000, Unit (mm)

6.2 Manual welding

·It is recommended to use low temperature solder paste, the temperature of the electric soldering iron tip should be set below 260℃, and the soldering operation should be completed within 5 seconds.

·Keep a clean soldering iron tip for soldering.

6.3 Reflow soldering

The recommended reflow soldering temperature conditions are as follows:

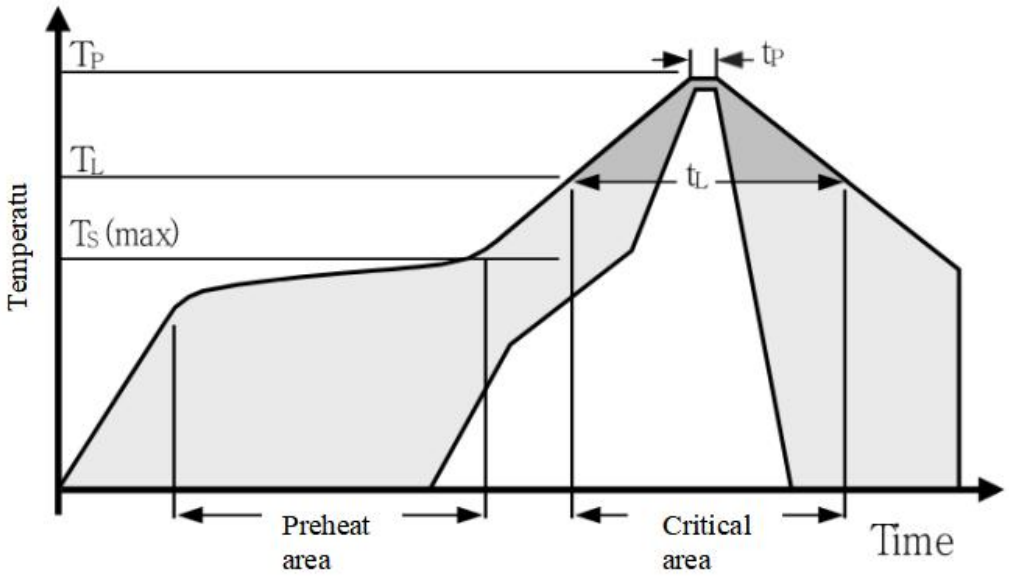


Figure 6. Standard soldering process, Tp <= 260℃, tp < 30sec, TL < 200℃, tl < 100sec, the speed of temperature rise and fall during soldering should be <5℃/sec.

Please use a standard reflow oven to solder the ADP3000. The sensor conforms to the IPC/JEDEC J-STD-020D soldering standard. The limit soldering temperature that reflow soldering can withstand is 260°C. It should be noted that at the highest temperature of 260°C, the contact The time should be less than 30 seconds (see Figure 6). It is recommended to use 190℃~260℃ during reflow soldering.

7. Clean

Since the product is an open type, avoid cleaning liquid from invading the interior; avoid using ultrasonic cleaning, may damage the product.

8. Environment

Please avoid using and storing the product in a harsh environment with corrosive gas (organic solvent, sulfurous acid and other gases).

This product is not waterproof, so do not use it in places where it may be splashed with water.

Do not use it in an environment where condensation occurs. If the moisture adhering to the sensor freezes, it may affect the output of the sensor. and destruction.

Please avoid using it on a platform that applies high-frequency vibration such as ultrasonic waves.

Warning and personal injury

Do not use this product in safety protection devices or emergency stop devices, or in any other application where personal injury may result from failure of this product, unless there is a specific purpose or authorization for use. Refer to the product data sheet and instructions before installing, handling, using or maintaining this product. Failure to follow the recommendations could result in death or serious personal injury. The company will not be liable for all compensation for personal injury and death arising therefrom, and exempts any claims that may arise from company managers and employees, as well as affiliated agents, distributors, etc., including: various costs, claims fees, attorney fees, etc.

Due to the inherent design of the component, it is sensitive to static electricity. In order to prevent damage caused by static electricity or reduce product performance, please take necessary anti-static measures when using this product.

The sensor chip is placed inside the pressure introduction port. Inserting foreign objects through the pressure introduction port will cause chip damage and blockage of the introduction port. Therefore, please avoid the above operations.

Depending on the pressure used, please pay full attention to the fixation of the product, the fixation of the casing, and the fixation and selection of the introduction tube. If you have any questions, please contact us.

If the pressure range and installation method are wrong, it may cause an accident, so please be careful.

please use it within the rated pressure range to avoid damage to the product.

Quality assurance

Guangzhou Aosong Electronics Co., Ltd. provides the direct purchasers of its products with the quality guarantee in the following table (calculated from the date of delivery), and the technical specifications are indicated in the product manual of Aosong Electronics. If the product is found to be defective during the warranty period, the company will provide free repair or replacement services.

Warranty Period Description

Product Category	warranty period
ADP3000 Sensor	12 months

The company is only responsible for products that are defective when used in applications that meet the technical conditions of the product. The company does not make any guarantees that the product is used in special scenarios that are not recommended. The company also does not make any commitment to the reliability of the product applied to other non-company supporting products or circuits.

This manual is subject to change without notice.

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