Datasheet ADP8xx-Digital

Digital Differential Pressure Sensor

- Excellent repeatability, no drift, no offset
- Extended feature set – smart averaging
- Calibrated and temperature compensated

Product Summary

The ADP800 sensor family is Aosong's series of digital differential pressure sensors designed for high-volume applications. The sensors measure the pressure of air and non-aggressive gases with superb accuracy and no offset drift. The sensors cover a pressure range of up to ±500 Pa (±2 inch H_2O / ±5 mbar) and deliver outstanding accuracy, also at the bottom end of the measuring range.

The ADP800 Series features a digital 2-wire I^2C interface, which makes it easy to connect directly to a microprocessor.

The outstanding performance of these sensors is based on Aosong's patented sensor technology. The differential pressure is measured by a thermal sensor element using flow-through technology. The well-proven technology is perfectly suited for high-quality mass production and is the ideal choice for demanding and cost-sensitive OEM applications.

Benefits of Aosong's Asair® Technology

- High reliability and long-term stability
- Best signal-to-noise ratio
- Industry-proven technology with a track record of more than 15 years
- Designed for mass production
- High process capability

Content

1. Ordering Information

Use the part name and order number shown in the following table when ordering ADP800 series differential pressure sensor.

Part name	Form Factor	Range	I²C address
ADP800-500Pa	Manifold mount	500Pa - bidirectional	0x25
ADP810-500Pa	Tube connection	500Pa - bidirectional	0x25

2. Sensor Performance

2.1 Differential Pressure Specification[1]

Parameter	ADP8xx-500Pa
Measurement range	-500 to 500 Pa (-2 to 2 inH_2O)
Zero point accuracy [2,3]	0.3 Pa
Span accuracy [2,3]	3% of reading
Zero point repeatability [3]	0.1 Pa
Span repeatability [3]	0.5% of reading
Span shift due to temperature variation	< 0.5% of reading per 10°C
Offset stability	< 0.05 Pa/year
Flow step response time (T_{63})	< 10ms
Resolution	24 bit
Calibrated for	Air, N_2
Media compatibility	Air, N_2, O_2, non-condensing
Temperature compensation range	0 °C to +50 °C

2.2 Temperature Specification[4]

Parameter	Value
Measurement range	-40 °C to +85 °C
Resolution	24 bit
Accuracy	2 °C (-10 °C to +60 °C) 3 °C (-40 °C to +85 °C)
Repeatability	0.3°C

[1] Unless otherwise noted, all sensor specifications are valid at 25°C with VDD = 5 V and absolute pressure = 966 mbar.

[2] Includes repeatability

[3] Total accuracy/repeatability is a sum of zero-point and span accuracy/repeatability.

[4] The measured temperature is the temperature of the bulk silicon in the sensor. This temperature value is not only depending on the gas temperature, but also on the sensor's surroundings. Using the signal to measure solely the gas temperature will need special precautions, such as isolating the sensor from external temperate influences.

3. Specifications

3.1 Electrical Specifications

Parameter	Symbol	Condition	Min.	Typ.	Max.	Units	Comments
Supply Voltage	V_{DD}		4.75	5	5.25	V	
Supply current	I_{DD}	Measuring		3.8	5.5	mA	
		Idle state			1.1	mA	
		Sleep mode			1	uA	

3.2 Timing Specifications

Parameter	Symbol	Condition	Min.	Typ.	Max.	Units	Comments
Power-up time	t_{PU}				25	ms	Time to sensor ready
Soft reset time	t_{SR}				2	ms	Time between soft reset command or exit sleep mode and sensor ready
I2C SCL frequency	f_{I2C}			100		kHz	
Update rate differential pressure value		Continuous mode		200		Hz	

3.3 Mechanical Specifications

Parameter	Symbol	Condition	Min.	Typ.	Max.	Units	Comments
Allowable overpressure	P_{max}				1	bar	
Rated burst pressure	P_{burst}		5			bar	
Weight	W				8	g	

3.4 Materials

Parameter	
Wetted materials	PBT (polybutylene terephthalate), glass (silicon nitride, silicon oxide), silicon, gold, FR4, silicone as static sealing, epoxy, copper alloy, lead-free solder
REACH, RoHS	REACH and RoHS compliant

3.5 Absolute Minimum and Maximum Ratings

Parameter	Rating	Units
Supply Voltage V_{DD}	-0.3 to 5.5	V
Max Voltage on pins (SDA, SCL)	-0.3 to V_{DD}+0.3	V
Input current on any pin	±70	mA
Operating temperature range[1]	-40 to +85	°C
Storage temperature range	-40 to +85	°C
Max. humidity for long term exposure	40°C dew point	
ESD HBM (human body model)	2	kV

[1] For Air and N_2. Long term exposure to (high concentrations of) O_2 at high temperatures can reduce the product lifetime

4. Pin Assignment

The pin assignments of the ADP8xx-Digital can be found in Table 1

Pin no.	Name	Description
1	SCL	Serial Clock (I²C Interface)
2	VDD	VDD Supply
3	GND	Connect to ground
4	SDA	Bidirectional Serial Data (I²C Interface)

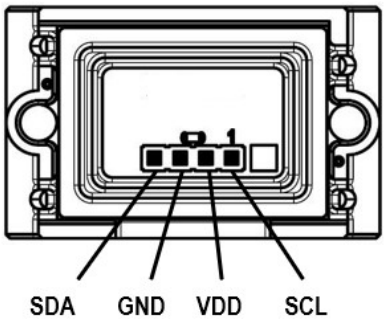


Table 1: *ADP8xx-Digital pin assignment (bottom view).*

5. Digital Interface Description

The ADP8xx-digital interface is compatible with the I²C protocol. This chapter describes the command set for ADP8xx-digital. For detailed information about the I²C protocol, please check the document "NXP I²C-bus specification and user manual".

5.1 I²C Addresses

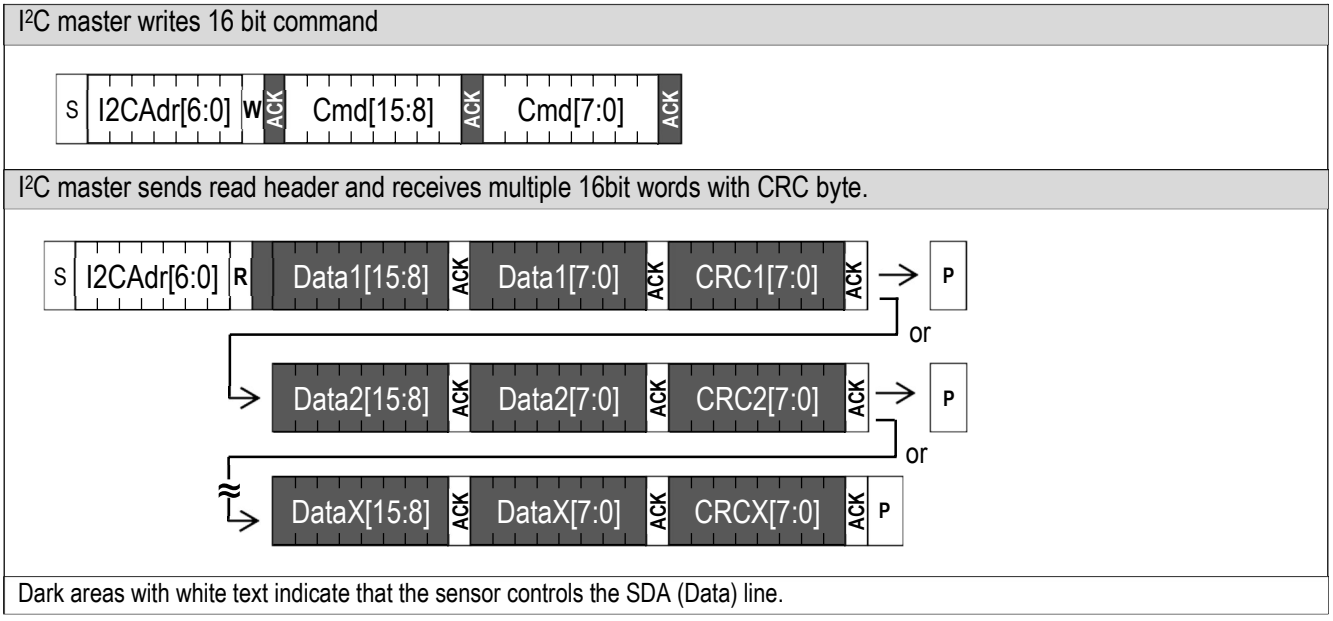
The following table lists the ADP8xx-digital product variants and its I²C addresses.

Product Variant	I²C address
ADP800-500Pa / ADP810-500Pa	0x25 (b 0100101)

The address is followed by a read or write bit.

5.2 I²C Sequences

The commands are 16-bit. Data is read from the sensor in multiples of 16-bit words, each followed by an 8-bit checksum to ensure communication reliability.



I²C sequences can be aborted with a NACK and STOP condition.

5.3 I²C Commands

5.3.1 Triggered Measurement

During a triggered measurement the sensor measures both differential pressure and temperature. The measurement starts directly after the command has been sent. The command needs to be repeated with every measurement.

Command code (Hex)	Temperature compensation	Average update rate
0x372D	Differential pressure	10ms

When new measurement data is available it can be read out by sending an I²C read header and reading out the data from the sensor. In the table below the data layout of the results can be found.

Preceding command	Consecutive read	Description
Triggered measurement	Byte1: DP 8msb Byte2: DP 8lsb Byte3: CRC Byte4: Temp 8msb Byte5: Temp 8lsb Byte6: CRC Byte7: Scale Factor differential pressure 8msb Byte8: Scale Factor differential pressure 8lsb Byte9: CRC	After a triggered measurement command, the results can be read out when the sensor is finished with the measurement. The temperature and scale factor don't need to be read out (every time). The read sequence can be aborted by a NACK and a STOP condition. The scale factor is for differential pressure in Pascal.

5.4 Checksum Calculation

The checksum byte is generated by a CRC algorithm with the following properties:

Property	Value
Name	CRC-8
Protected data	read data
Width	8 bit
Polynomial	0x31 (x8 + x5 + x4 +1)
Initialization	0xFF
Reflect input	False
Reflect output	False
Final XOR	0x00
Example	CRC(0xBEEF) = 0x92

5.5 Conversion to Physical Values

Conversion of the differential pressure and temperature sensor signals to a physical value is done with the scale factor.

5.5.1 Scale Factors

Parameter	ADP8xx-**500Pa**
Differential Pressure (Pascal)	60 Pa^{-1}
Differential Pressure (inches H_2O)	14'945 $(inH_2O)^{-1}$
Temperature (°C)	200 $°C^{-1}$

5.5.2 Differential Pressure

The digital calibrated differential pressure signal read from the sensor is a signed integer number (two's complement number). The integer value can be converted to the physical value by dividing it by the scale factor.

differential pressure = sensor output ÷ scale factor

5.5.3 Temperature

The digital calibrated temperature signal read from the sensor is a signed integer number (two's complement number). The integer value can be converted to the physical value by dividing it by the scale factor.

temperature in °C = sensor output ÷ scale factor

6. Package Outline

6.1 Dimensions ADP80x – Manifold Connection

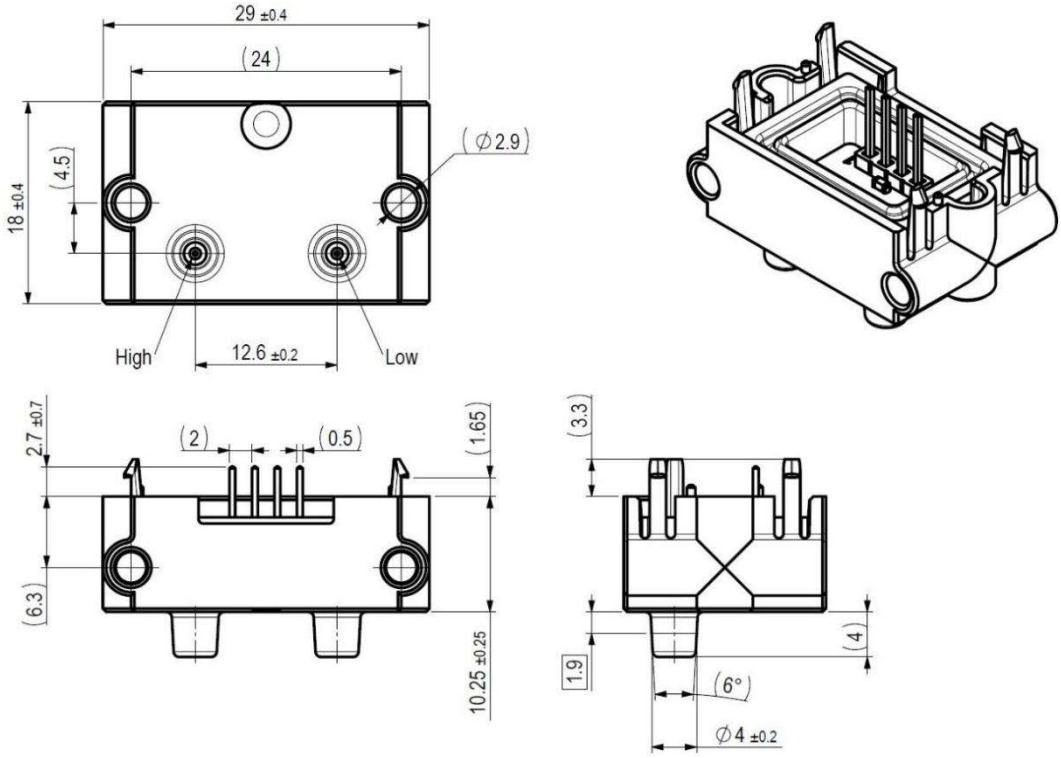


Figure 1*: ADP80x. All dimensions in mm.*

6.2 Dimensions ADP81x – Tube Connection

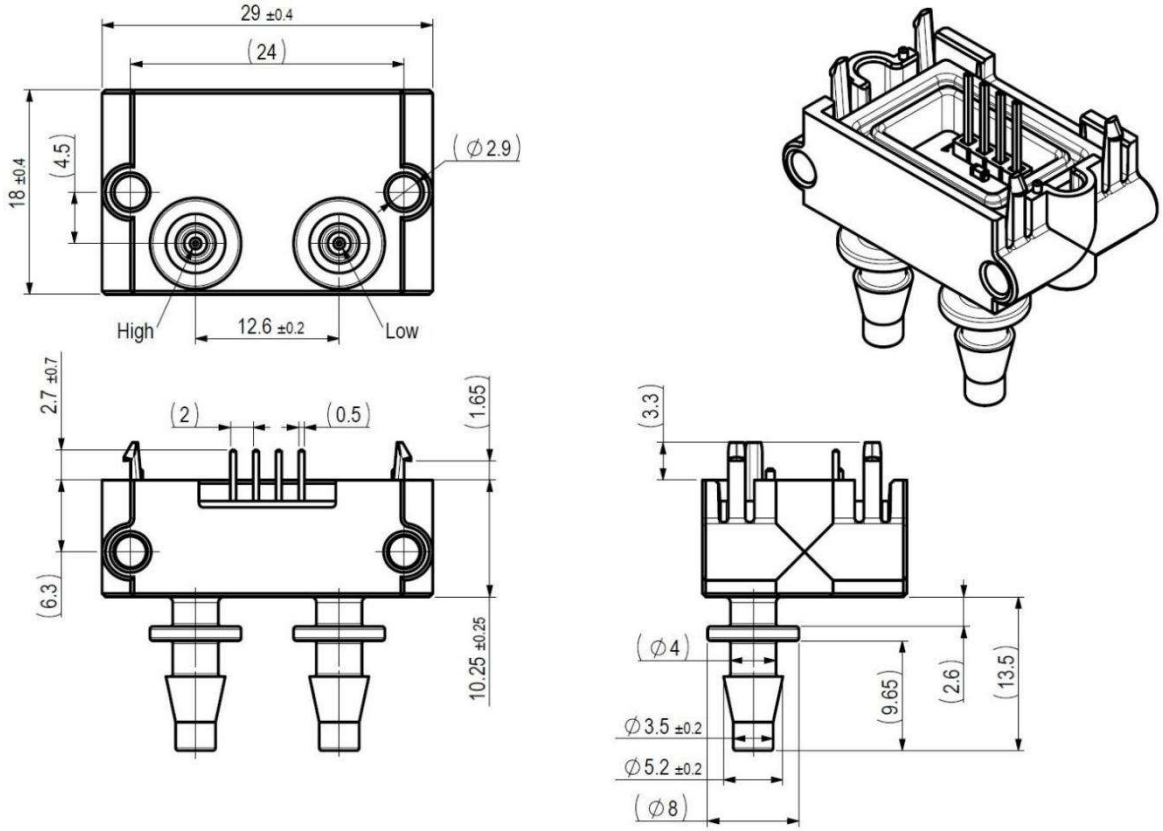


Figure 2: *ADP81x. All dimensions in mm.*

6.3 Footprint

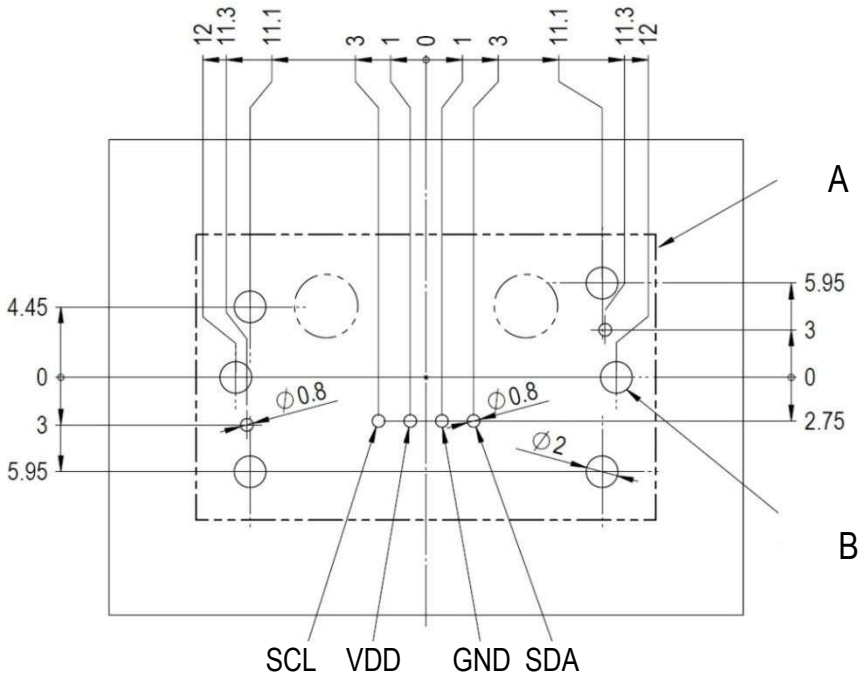


Figure 3*: Footprint for PCB mounting (top view = sensor side). All dimensions in mm.*

A: Overall sensor dimensions
B: Holes for additional mounting screws (optional)

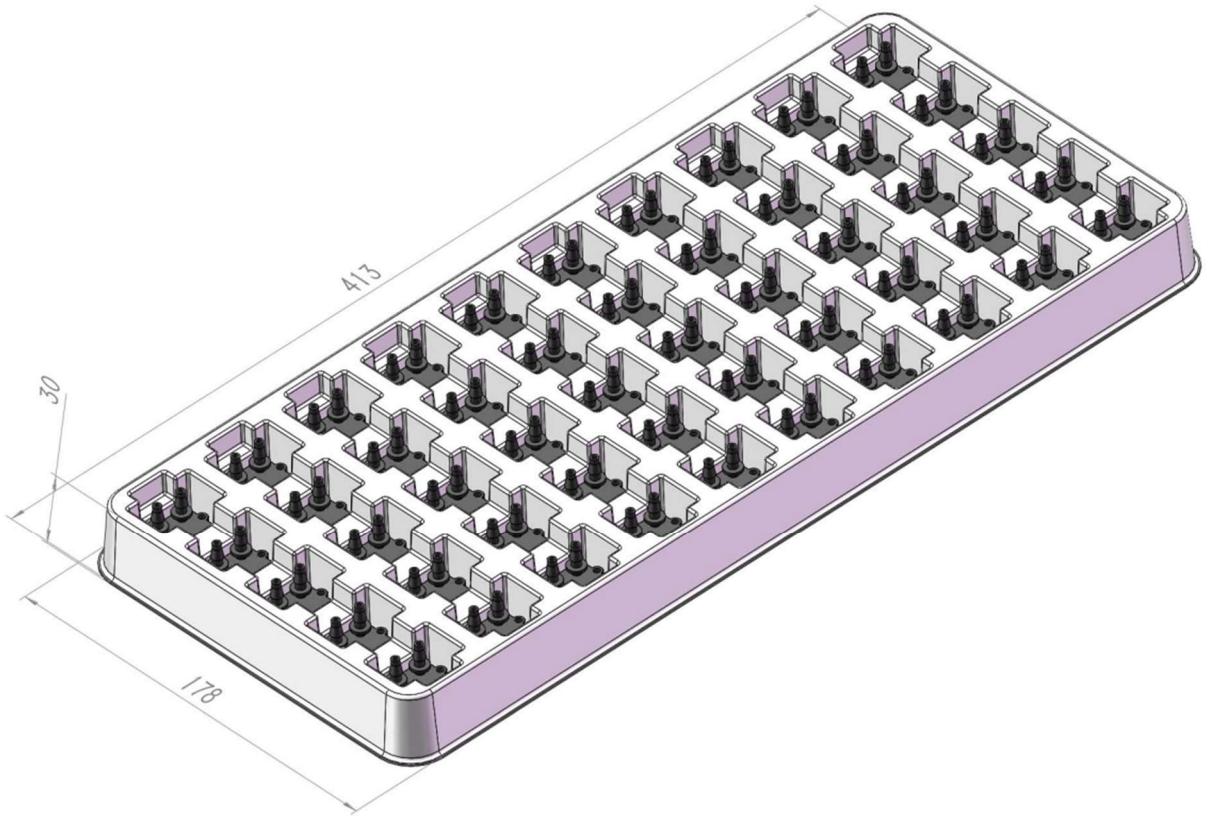
In case the sensor is not mounted on a PCB and is connected with a cable, the ADP800 series cap is recommended.

7. Soldering

Standard wave soldering systems may be used for soldering ADP800 series sensors. Reflow soldering is **not** feasible and may damage the sensor.

8. Shipping Package

ADP8xx are shipped in trays of 50pcs. The tray dimension is 413mm x 178mm x 30mm. By piling them up.



9. Important Notices

Warning, personal injury

The product may not be used in safety equipment or equipment to stop an emergency, or where personal injury has occurred as a result of product failure.Failure to follow these instructions can result in death or serious personal injury.

In case of any purchase or use of the products in violation of the above provisions, compensation shall be made and Aosong and its personnel, subsidiaries, branches and distributors shall be indemnified against any claims and other expenses.

ESD Precautions

The design of ADP8xx circuit elements is susceptible to electromagnetic interference.Therefore, Aosong recommends the use of standard ESD precautions when operating equipment.

Warranty

Aosong makes no warranties, warranties or indications as to the use of the products, or assumes any responsibility for the use or use of any products or circuits.The "typical value" coefficient varies from application to application.All operating coefficients, including "typical values", must be validated by the customer's technical expertise.

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