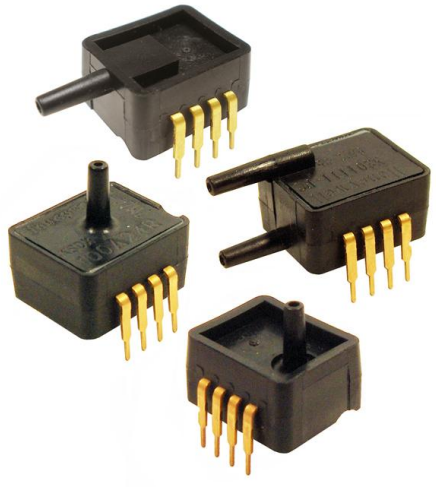
Honeywell

ASDX Series Silicon Pressure Sensors

Low Pressure and Ultra-Low Pressure Digital Output, ±2% Total Error Band, 10 Inches H_2O to 100 psi



DESCRIPTION

The ASDX Series is a Silicon Pressure Sensor offering either an I^2C or SPI digital interface for reading pressure over the specified full scale pressure span and temperature range.

The ASDX is fully calibrated and temperature compensated for sensor offset, sensitivity, temperature effects and non-linearity using an on-board Application Specific Integrated Circuit (ASIC). Calibrated output values for pressure are updated at approximately 1 kHz.

The standard ASDX is calibrated over the temperature range of 0 °C to 85 °C [32 °F to 185 °F]. The sensor is characterized for operation from a single power supply of either 3.3 Vdc or 5.0 Vdc.

These sensors are available to measure absolute, differential and gage pressures. The absolute versions have an internal vacuum reference and an output value proportional to absolute pressure. Differential versions allow application of pressure to either side of the sensing diaphragm. Gage versions are referenced to atmospheric pressure and provide an output proportional to pressure variations from atmosphere.

The ASDX Series sensors are intended for use with non-corrosive, non-ionic working fluids such as air and dry gases. They are designed and manufactured according to standards in ISO 9001.

FEATURES

- Output options: I^2C- or SPI-compatible 12-bit digital
- Precision ASIC conditioning and temperature compensated over 0 °C to 85 °C [32 °F to 185 °F] temperature range
- Low operating voltage
- Absolute, differential and gage types
- Pressure ranges from 10 inches H_2O to 100 psi
- Standard calibrations in inches H_2O, cm H_20, psi, mbar, bar, kPa
- Total error band of ±2.0% of full scale span maximum
- RoHS compliant

POTENTIAL APPLICATIONS

- Flow calibrators
- Ventilation and air flow monitors
- Gas flow instrumentation
- Sleep apnea monitoring and therapy equipment
- Barometry
- Pneumatic controls
- HVAC

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Table 1. Absolute Maximum Ratings[1]

Parameter	Min	Max	Unit
Supply voltage (V_{supply})	-0.3	6.0	Vdc
Voltage to any pin	-0.3	V_{supply} + 0.3	Vdc
Digital clock frequency: I^2C SPI	 100 50	 400 800	kHz
ESD susceptibility (human body model)	3	-	kV
Storage temperature	-50 [-58]	125 [257]	°C [°F]
Lead temperature (2 s to 4 s)	-	250 [482]	°C [°F]
External capacitance between V_{supply} and ground[2]	100	470	nF

Table 2. Operating Specifications

Parameter	Min.	Typ.	Max.	Unit
Supply voltage: (V_{supply})[3] 3.3 Vdc 5.0 Vdc *Sensors are either 3.3 Vdc or 5.0 Vdc per the Order Guide (see Figure 1).*	 3.0 4.75	 3.3[4] 5.0[4]	 3.6 5.25	Vdc
Supply current	2.0	3.5	5.0	mA
Compensated temperature range[5]	0 [32]	-	85 [185]	°C [°F]
Operating temperature range[6]	-20 [-4]	-	105 [221]	°C [°F]
Overpressure[7]	2X operating pressure range minimum			
Burst pressure[8]	3X operating pressure range minimum			
Startup time (power up to data ready)	-	2.8	7.3	ms
Response time	-	0.46	-	ms
I^2C or SPI voltage level low	-	-	0.2	V_{supply}
I^2C or SPI voltage level high	0.8	-	-	V_{supply}
Pull-up on SDA and SCL (I^2C output only)	1	-	-	kOhm
Total error band[9]	-	-	2.0	%FSS[10]
Output resolution	12	-	-	bits

Table 3. Environmental Specifications

Parameter	Characteristic
Humidity	0% to 95% RH non-condensing
Vibration	10 G at 20 Hz to 2000 Hz
Shock	100 G for 11 ms
Life	1 million cycles minimum

Table 4. Wetted Materials[11]

Parameter	Port 1 (Pressure Port)[12]	Port 2 (Reference Port)[12]
Covers	glass-filled PBT	glass-filled PBT
Adhesives	silicone	silicone and epoxy
Electronic components	silicon and glass	silicon, glass, and gold

Notes:

1. Absolute maximum ratings are the extreme limits that the device will withstand without damage to the device.
2. An external bypass capacitor is **required** across the supply voltage (Pins 6 and 3 – see Figure 4) as close to the sensor supply pin as possible for correct sensor operation.
3. Ratiometricity of the sensor (the ability of the output to scale to the input voltage) is achieved within the specified operating voltage for each option. Other custom supply voltages are available, please contact Honeywell Customer Service.
4. The sensor is not reverse polarity protected. Incorrect application of excitation voltage or ground to the wrong pin may cause electrical failure.
5. The compensated temperature range is the temperature range (or ranges) over which the sensor will produce an output proportional to pressure within the specified performance limits.
6. The operating temperature range is the temperature range over which the sensor will produce an output proportional to pressure but may not remain within the specified performance limits.
7. Overpressure is the maximum pressure which may safely be applied to the product for it to remain in specification once pressure is returned to the operating pressure range. Exposure to higher pressures may cause permanent damage to the product.
8. Burst pressure is the maximum pressure that may be applied to any port of the product without causing escape of pressure media. Product should not be expected to function after exposure to any pressure beyond the burst pressure.
9. Total error band is the maximum deviation in output from ideal transfer function over the entire compensated temperature and pressure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability, thermal effect on offset, thermal effect on span and thermal hysteresis. Specification units are in percent of full scale span (%FSS).
10. Full scale span (FSS) is the algebraic difference between the output signal measured at the maximum (Pmax.) and minimum (Pmin.) limits of the pressure range.
11. Consult Honeywell Customer Service for detailed material information.
12. For AC pressure port configuration, the “pressure” and “reference” ports are reversed.

Figure 1. Nomenclature and Order Guide

Package Selection[13] *Calibration Selection*

ASDX **X** _ _ _ _ _ _ _ _ _

Series

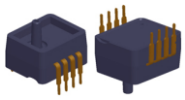
Power Supply Voltage
3 = 3.3 Vdc
5 = 5.0 Vdc

Transfer Function Limits[14]
A = 10% to 90% calibration
B = 5% to 95% calibration

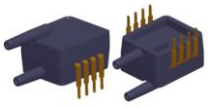
Output Type[15]
S = SPI
2 = I^2C, Address 0x28
3 = I^2C, Address 0x38
4 = I^2C, Address 0x48
5 = I^2C, Address 0x58
6 = I^2C, Address 0x68
7 = I^2C, Address 0x78

Pressure Port

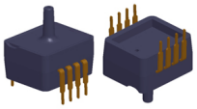
AV = Axial port on top, vented cover on bottom



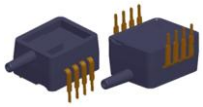
RR = Radial port on top, radial port on bottom



AC = Axial port, sealed cover (commonly used for absolute)



RV = Radial port, single



Future Option

Pressure Range[16, 17, 18]

Gage	Differential	Absolute
-	**005ND =** ±5 in H_2O	-
010NG = 10 in H_2O	**010ND =** ±10 in H_2O	-
-	**015CD =** ±15 cm H_2O	-
025CG = 25 cm H_2O	**025CD =** ±25 cm H_2O	-
001PG = 1 psi	**001PD** = ±1 psi	-
005PG = 5 psi	**005PD** = ±5 psi	-
015PG = 15 psi	**015PD** = ±15 psi	**015PA** = 15 psi
030PG = 30 psi	**030PD** = ±30 psi	**030PA** = 30 psi
100PG = 100 psi	-	**100PA** = 100 psi
-	**015MD** = ±15 mbar	-
025MG = 25 mbar	**025MD** = ±25 mbar	-
050MG = 50 mbar	**050MD** = ±50 mbar	-
100MG = 100 mbar	**100MD** = ±100 mbar	-
200MG = 200 mbar	**200MD** = ±200 mbar	-
500MG = 500 mbar	**500MD** = ±500 mbar	-
001BG = 1 bar	**001BD** = ±1 bar	**001BA** = 1 bar
002BG = 2 bar	**002BD** = ±2 bar	**002BA** = 2 bar
007BG = 7 bar	-	**007BA** = 7 bar
003KG = 3 kPa	**003KD** = ±3 kPa	-
004KG = 4 kPa	**004KD** = ±4 kPa	-
005KG = 5 kPa	**005KD** = ±5 kPa	-
010KG = 10 kPa	**010KD** = ±10 kPa	-
020KG = 20 kPa	**020KD** = ±20 kPa	-
050KG = 50 kPa	**050KD** = ±50 kPa	-
100KG = 100 kPa	**100KD** = ±100 kPa	**100KA** = 100 kPa
200KG = 200 kPa	**200KD** = ±200 kPa	**200KA** = 200 kPa
700KG = 700 kPa	-	**700KA** = 700 kPa

Notes:

13. Other package combinations are possible, please contact Honeywell Customer Service.
14. The transfer function limits define the output of the sensor at a given pressure input. By specifying the output signal at the maximum (Pmax.) and minimum (Pmin.) limits of the pressure range, the complete transfer curve for the sensor is defined. See Figure 2 for a graphical representation of each calibration. For the 12-bit digital output, Table 6 provides the output of the sensor at significant percentages. These outputs are valid at the rated input voltage of the sensor.
15. The output type defines which communication protocol the sensor uses to communicate. Available protocols are I^2C or half duplex SPI (sensor acts only as a slave). This communication protocol is not field selectable, and must be defined when ordering the sensor.
16. Custom pressure ranges are available, please contact Honeywell Customer Service.
17. The pressure units (inches H_2O, cm H_2O, psi, mbar, bar, kPa) define the units used during calibration and in the application.
18. See Table 5 for an explanation of sensor types.

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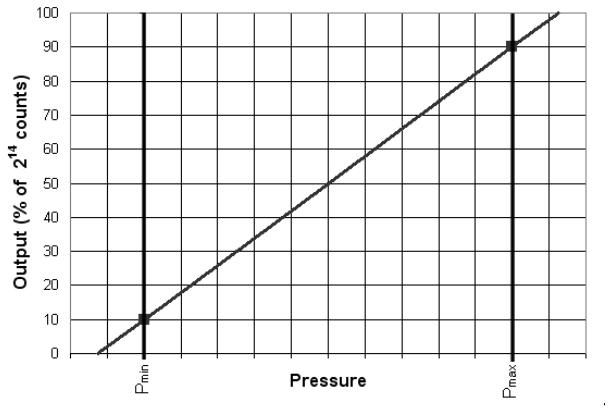
Table 5. Sensor Types

Type	Description
Absolute	Output is proportional to difference between applied pressure and built-in reference to vacuum (zero pressure).
Gage	Output is proportional to difference between applied pressure and atmospheric (ambient) pressure.
Differential	Output is proportional to difference between pressure applied to each of the pressure ports (Port 1 – Port 2).

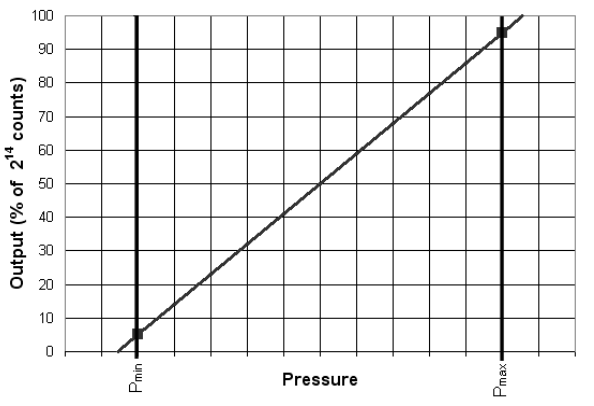
Figure 2. Transfer Functions and Limits

A Calibration, 10% to 90%



$$\text{Output (\% of } 2^{14} \text{ counts)} = \frac{80\%}{P_{max} - P_{min}} \cdot (\text{Pressure}_{applied} - P_{min}) + 10\%$$

B Calibration, 5% to 95%



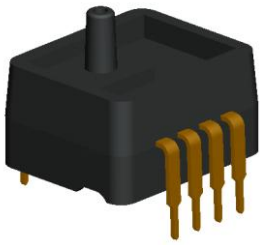
$$\text{Output (\% of } 2^{14} \text{ counts)} = \frac{90\%}{P_{max} - P_{min}} \cdot (\text{Pressure}_{applied} - P_{min}) + 5\%$$

Table 6. Sensor Output at Significant Percentages

% Output	Digital Counts (dec)	Digital Counts (hex)
0%	0	0x0000
5%	819	0x0333
10%	1638	0x0666
50%	8192	0x2000
90%	14746	0x399A
95%	15565	0x3CCD
100%	16383	0x3FFF

Figure 3. Completed Catalog Listing Example

ASDXAVX001PG2A3:
AV pressure port, 1 psi gage, I^2C output (Address 0x28), 10% to 90% calibration at 3.3 Vdc operation.



ASDXAVX001PG2A3 Output vs Pressure

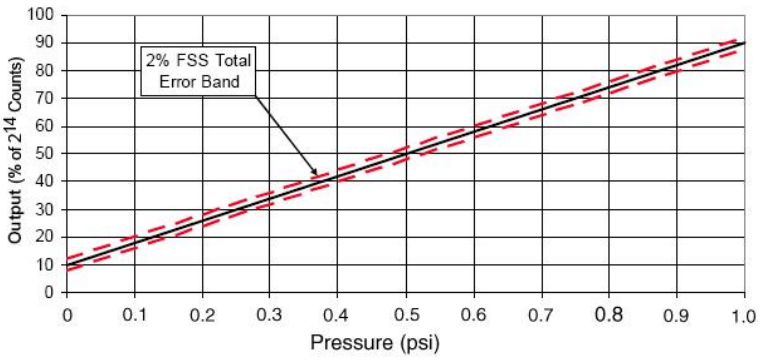
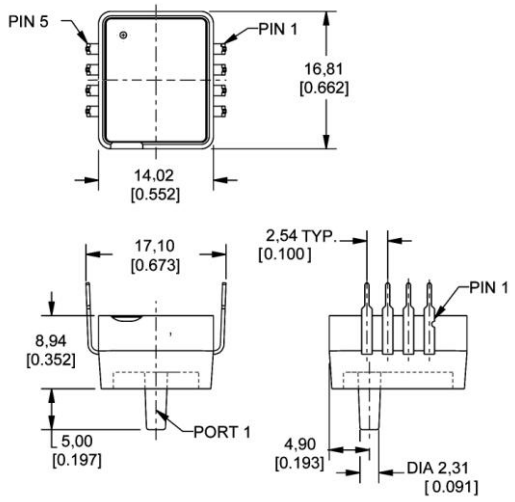
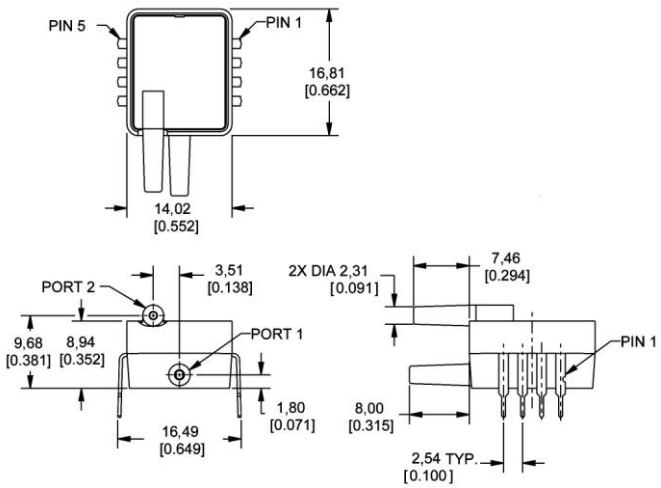


Figure 4. Dimensional Drawings (For reference only: mm [in].)

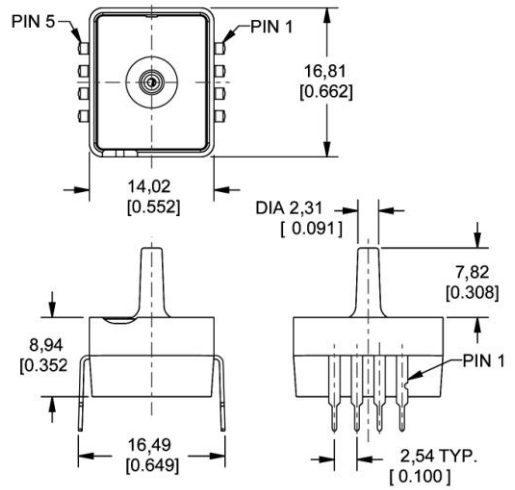
AV Package (Legacy G2)



RR Package (Legacy D4)



AC Package (Legacy A2)



RV Package

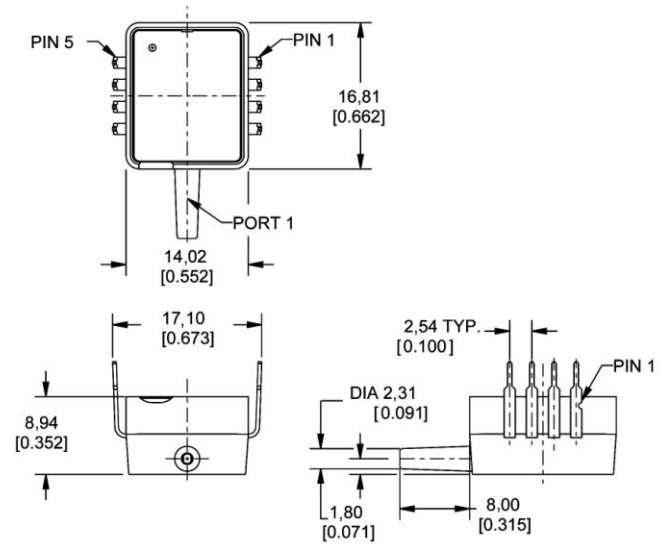


Table 7. Pinout

I²C				SPI			
Pin	**Definition**	**Type**	**Description**	**Pin**	**Definition**	**Type**	**Description**
1	SDA	digital I/O	serial bidirectional data; data is clocked in or out on clock edge of SCL	1	MISO	digital output	"Master In Slave Out" - serial output data; data is clocked out on clock edge of SCK
2	SCL	digital input	serial clock input; used to clock data on SDA	2	SCK	digital input	serial clock input; used to clock data on MISO
3	GND	supply	power supply ground	3	GND	supply	power supply ground
4	N/C	not used	do not connect in the application	4	N/C	not used	do not connect in the application
5	SS	digital output	interrupt signal (conversion complete output)	5	SS	digital input	slave select
6	Vsupply	supply	power supply source	6	Vsupply	supply	power supply source
7	N/C	not used	do not connect in the application	7	N/C	not used	do not connect in the application
8	N/C	not used	do not connect in the application	8	N/C	not used	do not connect in the application

⚠ WARNING

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Failure to comply with these instructions could result in death or serious injury.

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