MPXS4100A SERIES

4100A: 20–105 kPa
X–ducer™
SILICON
PRESSURE SENSOR

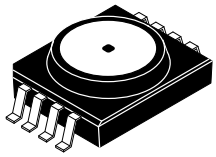
Barometric Absolute Pressure Sensor, On-Chip Signal Conditioned, 0.3 V to 4.9 V Output, Temperature Compensated & Calibrated

The Motorola MPXS4100A series Barometric Absolute Pressure (BAP) sensor for engine control is designed to sense absolute air pressure.

Motorola's BAP sensor integrates on–chip, bipolar op amp circuitry and thin film resistor networks to provide a high output signal and temperature compensation. The small form factor and high reliability of on–chip integration make the Motorola BAP sensor a logical and economical choice for the automotive system designer.

Features

- 1.8% Maximum Error Over 0–85°C
- Surface Mount Package
- Available Tape and Reeled or in Sleeves
- Ideally Suited for Direct Microprocessor Interfacing
- Patented Silicon Shear Stress Strain Gauge
- Temperature Compensated Over –40 to +125°C
- Ideal for Non–automotive applications
- Also Available in Unibody Package (see MPX4100A/D data sheet)



CASE 432–01
Style 1

MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Overpressure(1)	P_{max}	400	kPa
Burst Pressure(1)	P_{burst}	1000	kPa
Storage Temperature	T_{stg}	–40 to +125	°C
Operating Temperature	T_A	–40 to +125	°C

Pin Number							
1	2	3	4	5	6	7	8
N/C	V_S	Ground	V_{out}	N/C	N/C	N/C	N/C

NOTE: Pins 1, 5, 6, 7 and 8 are internal device connections. Do not connect to external circuitry or ground.

The MPXS4100A series piezoresistive transducer is a state–of–the–art, monolithic, signal conditioned, silicon pressure sensor. This sensor, with its patented X–ducer, combines advanced micromachining techniques, thin film metallization and bipolar semiconductor processing to provide an accurate, high level analog output signal that is proportional to applied pressure. A vacuum is sealed behind the sensor diaphragm providing a reliable pressure reference.

Figure 1 shows a block diagram of the internal circuitry integrated on the stand–alone pressure sensing chip.

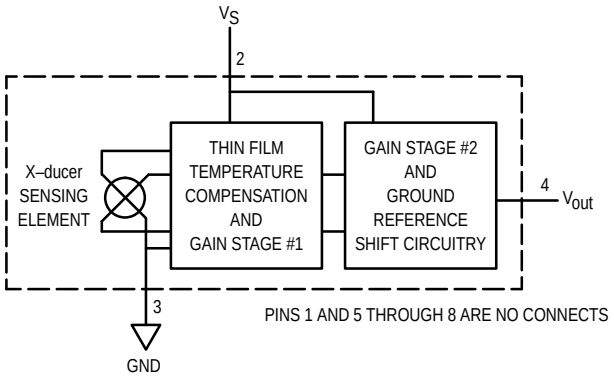


Figure 1. Fully Integrated Pressure Sensor Schematic

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OPERATING CHARACTERISTICS (V_S = 5.1 Vdc, T_A = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Typ	Max	Unit
Pressure Range		P_{OP}	20	—	105	kPa
Supply Voltage(2)		V_S	4.85	5.1	5.35	Vdc
Supply Current		I_o	—	7.0	10	mAdc
Minimum Pressure Offset(3)	(0 to 85°C)	V_{off}	0.225	0.306	0.388	Vdc
Full Scale Output(4)	(0 to 85°C)	V_{FSO}	4.816	4.897	4.978	Vdc
Full Scale Span(5)	(0 to 85°C)	V_{FSS}	—	4.591	—	Vdc
Accuracy(6)	(0 to 85°C)	—	—	—	±1.8	$\%V_{FSS}$
Sensitivity		$\Delta V/\Delta P$	—	54	—	mV/kPa
Response Time(7)		t_R	—	1.0	—	ms
Output Source Current at Full Scale Output		I_{o+}	—	0.1	—	mAdc
Warm–up Time(8)		—	—	20	—	ms
Offset Stability(9)		—	—	±0.65	—	$\%V_{FSS}$

MECHANICAL CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
Weight, Basic Element (Case 432)	—	—	1.5	—	Grams

NOTES:

1. Exposure beyond the specified limits may cause permanent damage or degradation to the device.
2. Device is ratiometric within this specified excitation range.
3. Offset (V_{off}) is defined as the output voltage at the minimum rated pressure.
4. Full Scale Output (V_{FSO}) is defined as the output voltage at the maximum or full rated pressure.
5. Full Scale Span (V_{FSS}) is defined as the algebraic difference between the output voltage at full rated pressure and the output voltage at the minimum rated pressure.
6. Accuracy is the deviation in actual output from nominal output over the entire pressure range and temperature range as a percent of span at 25°C due to all sources of error including the following:
   - Linearity: Output deviation from a straight line relationship with pressure over the specified pressure range.
   - Temperature Hysteresis: Output deviation at any temperature within the operating temperature range, after the temperature is cycled to and from the minimum or maximum operating temperature points, with minimum specified pressure applied.
   - Pressure Hysteresis: Output deviation at any pressure within the specified range, when this pressure is cycled to and from minimum or maximum rated pressure at 25°C.
   - TcSpan: Span deviation per °C over the temperature range of 0° to 85°C, as a percent of span at 25°C.
   - TcOffset: Output deviation per °C with minimum pressure applied, over the temperature range of 0° to 85°C.
7. Response Time is defined as the time for the incremental change in the output to go from 10% to 90% of its final value when subjected to a specified step change in pressure.
8. Warm–up Time is defined as the time required for the product to meet the specified output voltage.
9. Offset Stability is the product's output deviation when subjected to 1000 hours of Pulsed Pressure, Temperature Cycling with Bias Test.
10. Decoupling circuit shown in Figure 2 required to meet specification.

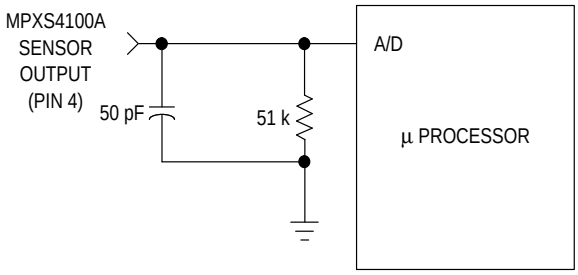


Figure 2. Recommended Decoupling Filter for Sensor to Microprocessor Interface

This surface mount package (Case 432–01) is an absolute sensing configuration package. A fluorosilicone gel isolates the die surface and wire bonds from the environment, while allowing the pressure signal to be transmitted to the silicon diaphragm. The MPXS4100A series pressure sensor operating characteristics, internal reliability and qualification tests are based on use of dry air as the pressure media. Media other than dry air may have adverse effects on sensor performance and long–term reliability. Contact the factory for information regarding media compatibility in your application.

Figure 2 shows the recommended decoupling circuit for interfacing the output of the integrated BAP sensor to the A/D input of a microprocessor (see Note 10).

Figure 3 shows the sensor output signal relative to pressure input. Typical minimum and maximum output curves are shown for operation over 0 to 85°C temperature range. (Output will saturate outside of the rated pressure range.)

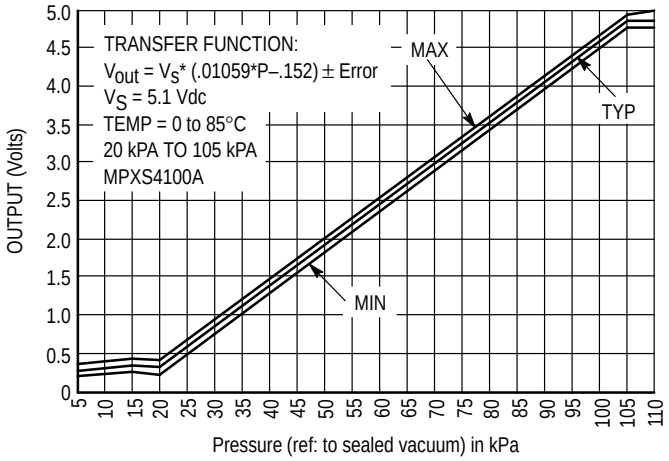


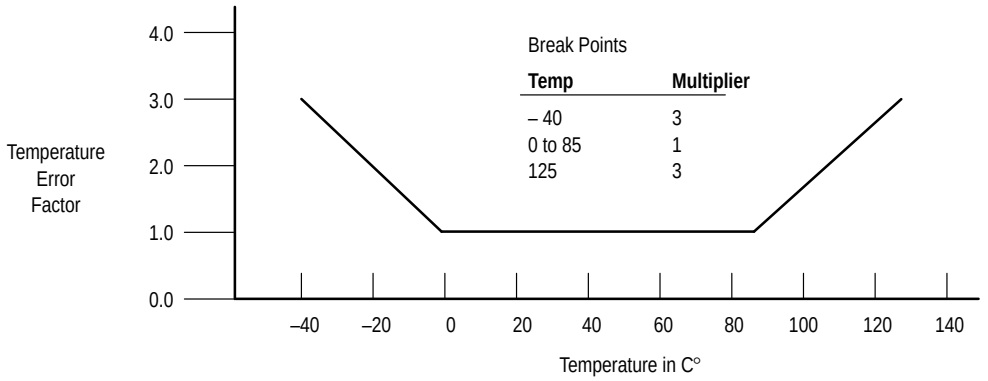
Figure 3. Output versus Absolute Pressure

Transfer Function (MPXS4100A)

Nominal Transfer Value: $V_{out} = V_S (P \times 0.01059 - 0.1518)$
$+/- (\text{Pressure Error} \times \text{Temp. Factor} \times 0.01059 \times V_S)$
$V_S = 5.1\ V \pm 0.25\ Vdc$

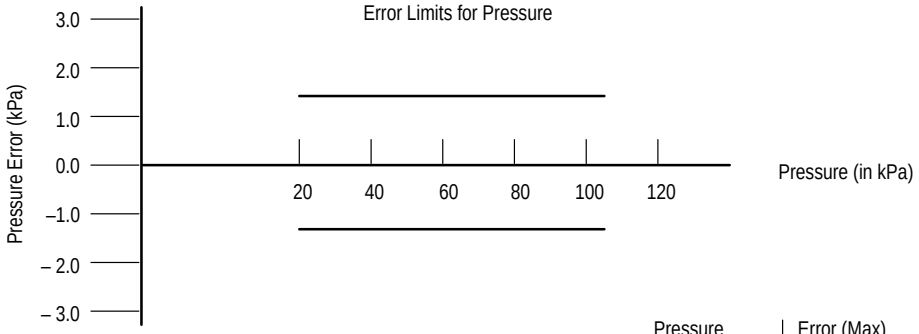
Temperature Error Band

MPXS4100A Series



NOTE: The Temperature Multiplier is a linear response from 0°C to –40°C and from 85°C to 125°C

Pressure Error Band



Pressure	Error (Max)
20 to 105 (kPa)	± 1.5 (kPa)

ORDERING INFORMATION

The MPXS4100A series BAP silicon pressure sensors are available shipped in sleeves or tape and reeled.

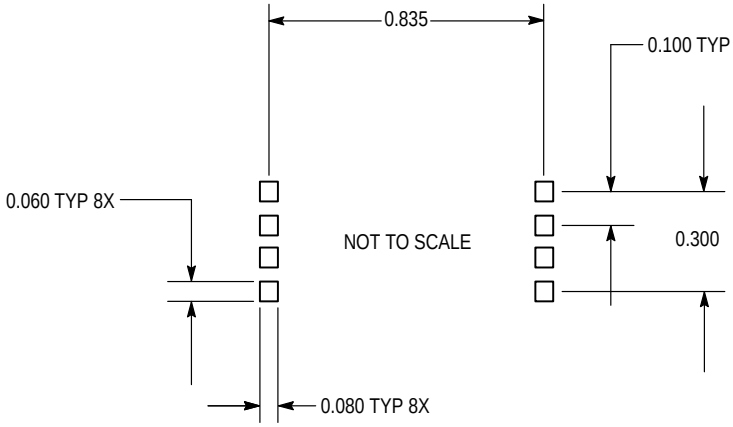
Device Type Options	Case No.	MPX Series Order No.	Marking
Sleeve Pack	432–01	MPXS4100A6U	MPXS4100A
Tape and Reel	432–01	MPXS4100A6T1	MPXS4100A

Device	Reel Size	Tape Width	Quantity
MPXS4100A6T1	13” dia.	44 mm	250

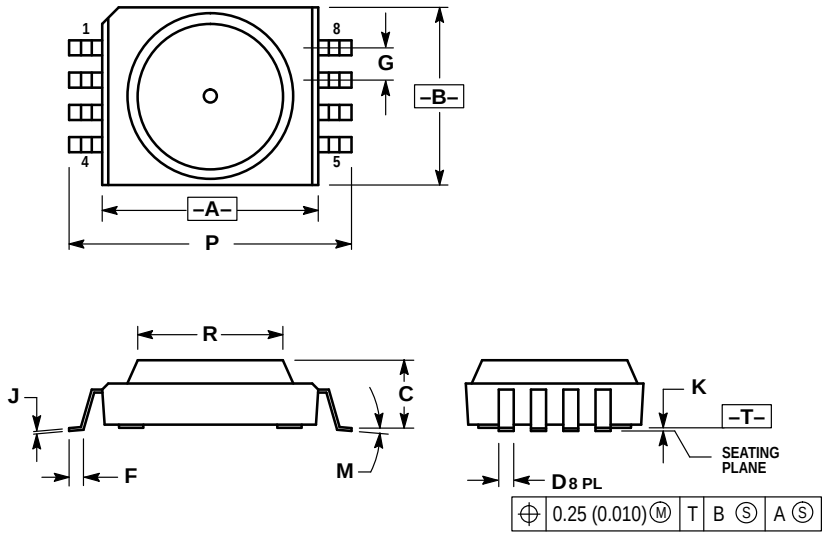
INFORMATION FOR USING THE SURFACE MOUNT PACKAGE

MINIMUM RECOMMENDED FOOTPRINT FOR SURFACE MOUNTED APPLICATIONS

Surface mount board layout is a critical portion of the total design. The footprint for the semiconductor packages must be the correct size to ensure proper solder connection interface between the board and the package. With the correct pad geometry, the packages will self align when subjected to a solder reflow process.



PACKAGE DIMENSIONS



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006).
5. ALL VERTICAL SURFACES 5° TYPICAL DRAFT.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.658	0.668	16.71	16.97
B	0.541	0.551	13.74	13.99
C	0.209	0.231	5.31	5.87
D	0.046	0.054	1.17	1.37
F	0.037	0.053	0.94	1.34
G	0.100 BSC		2.54 BSC	
J	0.009	0.011	0.23	0.28
K	0.002	0.010	0.05	0.25
M	0°	7°	0°	7°
P	0.856	0.880	21.74	22.35
R	0.503	0.523	12.78	13.28

STYLE 1:
PIN 1. NC
2. VSUPPLY
3. GROUND
4. VOUT
5. NC
6. NC
7. NC
8. NC

CASE 432–01
ISSUE A

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