



Preliminary Information

Altimeter or Barometer Applications Integrated Silicon Pressure Sensor On-Chip Signal Conditioned, Temperature Compensated and Calibrated

The Motorola MPXS4115A series Manifold Absolute Pressure (MAP) sensor for engine control is designed to sense absolute air pressure.

Motorola's MAP 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 MAP sensor a logical and economical choice for the automotive system designer.

Features

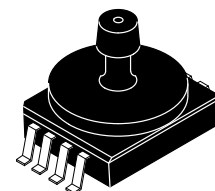
- 1.5% Maximum Error over 0° to 85°C
- Ideally suited for Microprocessor or Microcontroller-Based Systems
- Patented Silicon Shear Stress Strain Gauge
- Temperature Compensated from -40° to +125°C
- Durable Epoxy Unibody Element
- Also Available in Unibody Package (See MPX4115A/D Data Sheet)

Application Examples

- Aviation Altimeters
- Industrial Controls
- Engine Control
- Weather Stations and Weather Reporting Devices

MPXS4115A SERIES

OPERATING OVERVIEW
INTEGRATED
PRESSURE SENSOR
15 to 115kPa (2.2 to 16.7 psi)
0.2 to 4.8 Volts Output



AXIAL PORT OPTION
CASE 471B-01

PIN NUMBER			
1	N/C	5	N/C
2	V _S	6	N/C
3	Gnd	7	N/C
4	V _{out}	8	N/C

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

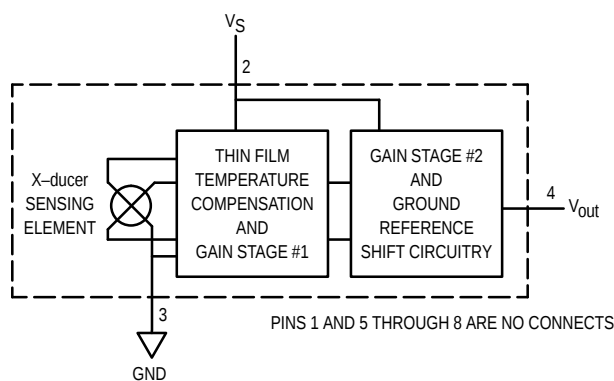


Figure 1. Fully Integrated Pressure Sensor Schematic

This document contains information on a new product. Specifications and information herein are subject to change without notice. Senseon and X-ducer are trademarks of Motorola, Inc.



MPXS4115A SERIES

MAXIMUM RATINGS⁽¹⁾

Parametrics	Symbol	Value	Units
Overpressure ⁽⁹⁾ (P1 > P2)	P _{max}	400	kPa
Burst Pressure ⁽⁹⁾ (P1 > P2)	P _{burst}	1000	kPa
Storage Temperature	T _{stg}	–40° to +125°	°C
Operating Temperature	T _A	–40° to +125°	°C

1. T_C = 25°C unless otherwise noted.
2. Exposure beyond the specified limits may cause permanent damage or degradation to the device.

OPERATING CHARACTERISTICS (V_S = 5.1 Vdc, T_A = 25°C unless otherwise noted, P1 > P2)

Characteristic	Symbol	Min	Typ	Max	Unit
Pressure Range	P _{OP}	15	—	115	kPa
Supply Voltage ⁽¹⁾	V _S	4.85	5.1	5.35	Vdc
Supply Current	I ₀	—	7.0	10	mAdc
Minimum Pressure Offset ⁽²⁾ @ V _S = 5.1 Volts (0 to 85°C)	V _{off}	0.135	0.204	0.273	Vdc
Full Scale Output ⁽³⁾ @ V _S = 5.1 Volts (0 to 85°C)	V _{FSO}	4.725	4.794	4.863	Vdc
Full Scale Span ⁽⁴⁾ @ V _S = 5.1 Volts (0 to 85°C)	V _{FSS}	—	4.590	—	Vdc
Accuracy ⁽⁵⁾ (0 to 85°C)	—	—	—	±1.5	%V _{FSS}
Sensitivity	V/P	—	45.9	—	mV/kPa
Response Time ⁽⁶⁾	t _R	—	1.0	—	mS
Output Source Current at Full Scale Output	I ₀₊	—	0.1	—	mAdc
Warm-Up Time ⁽⁷⁾	—	—	20	—	mSec
Offset Stability ⁽⁸⁾	—	—	±0.5	—	%V _{FSS}

Decoupling circuit shown in Figure 2 required to meet Electrical Specifications.

MECHANICAL CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
Weight, Basic Element (Case 471)	—	—	1.5	—	Grams

NOTES:

1. Device is ratiometric within this specified excitation range.
2. Offset (V_{off}) is defined as the output voltage at the minimum rated pressure.
3. Full Scale Output (V_{FSO}) is defined as the output voltage at the maximum or full rated pressure.
4. 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.
5. 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 zero differential 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: Output deviation over the temperature range of 0° to 85°C, relative to 25°C.
 - TcOffset: Output deviation with minimum pressure applied, over the temperature range of 0° to 85°C, relative to 25°C.
6. 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.
7. Warm-up is defined as the time required for the product to meet the specified output voltage after the pressure has been stabilized.
8. Offset stability is the product's output deviation when subjected to 1000 cycles of Pulsed Pressure, Temperature Cycling with Bias Test.
9. Exposure beyond these limits may cause permanent damage or degradation to the device.

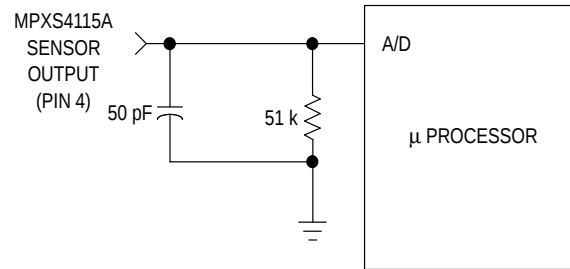


Figure 2. Recommended Decoupling Filter for Sensor to Microprocessor Interface

This surface mount package (Case 471–01) 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 MPXS4115A 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.)

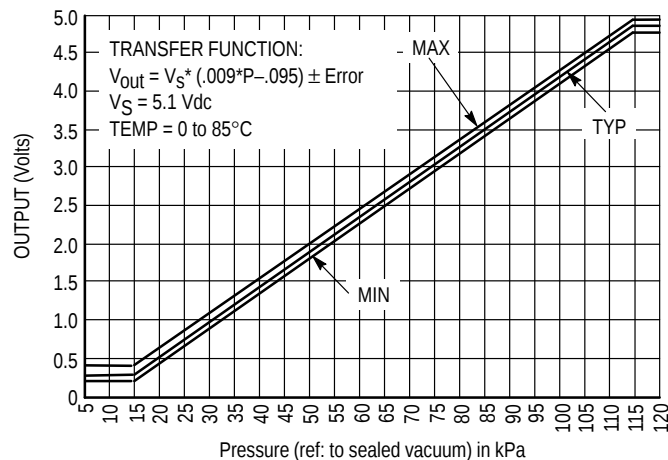


Figure 3. Output versus Absolute Pressure

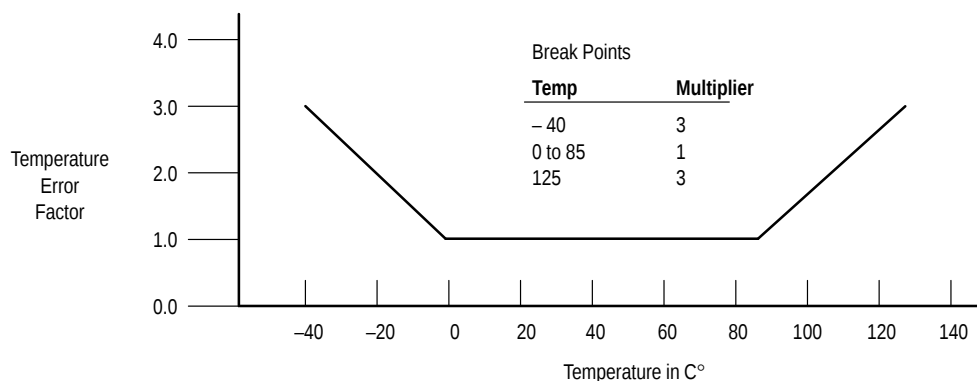
MPXS4115A SERIES

Transfer Function (MPXS4115A)

Nominal Transfer Value: $V_{out} = V_S \times (0.009 \times P - 0.095)$
 $\pm (\text{Pressure Error} \times \text{Temp. Factor} \times 0.009 \times V_S)$
 $V_S = 5.1 \pm 0.25 \text{ Vdc}$

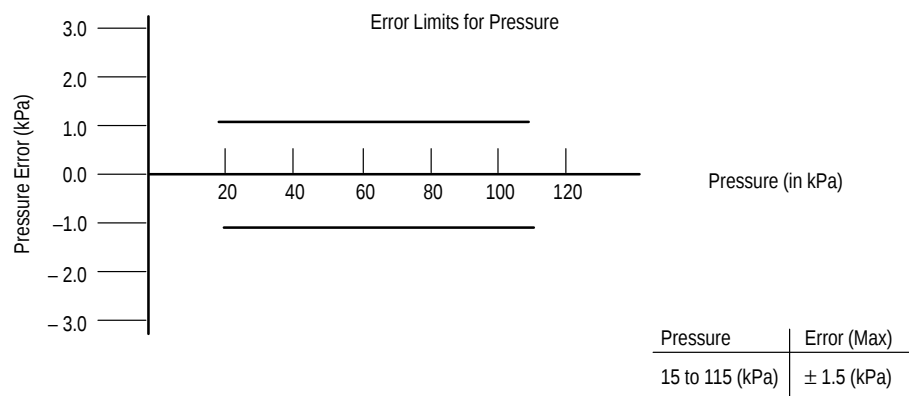
Temperature Error Band

MPXS4115A 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



ORDERING INFORMATION

Depending upon the Options, the MPXS4115A pressure sensors are available shipped in Sleeves, Tape and Reel, and Trays.

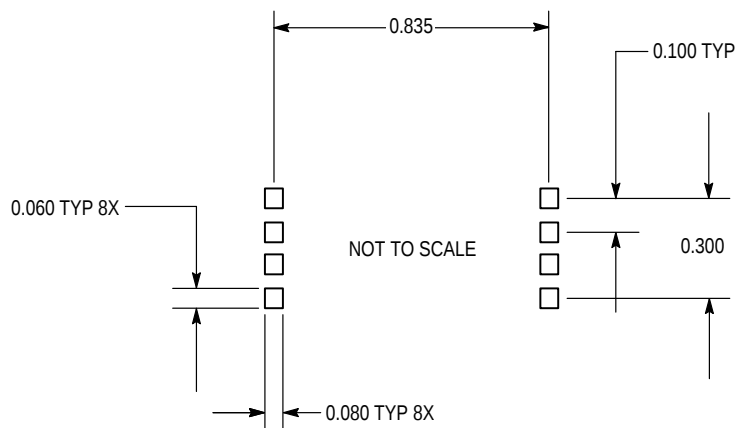
Packing Options	Port Options	Leadform	Case No.	MPXS Series Order No.	Marking
Sleeve Pack	Axial	Gull Wing	471B-01	MPXS4115AC6U	MPXS4115A

INFORMATION FOR USING THE SURFACE MOUNT PACKAGE

MINIMUM RECOMMENDED FOOTPRINT FOR SURFACE MOUNTED APPLICATIONS

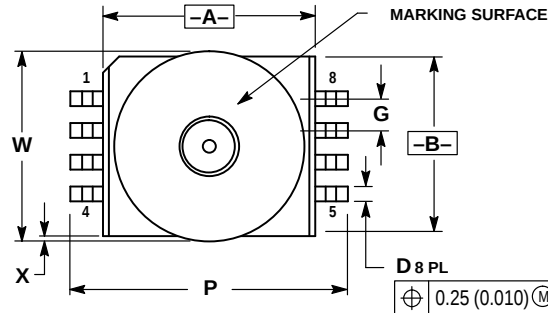
Surface mount board layout is a critical portion of the total design. The footprint for the semiconductor packages must be the correct size to ensure proper solder connection inter-

face between the board and the package. With the correct pad geometry, the packages will self align when subjected to a solder reflow process.

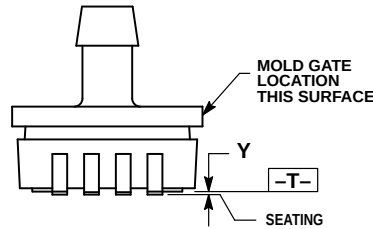
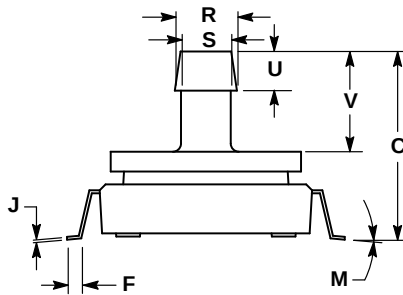


MPXS4115A SERIES

PACKAGE DIMENSIONS



D 8 PL
 $\oplus$ 0.25 (0.010) M T B S A S



CASE 471B-01
 ISSUE O

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.

DIM	MIN	MAX	MIN	MAX
A	0.658	0.668	16.71	16.97
B	0.541	0.551	13.74	13.99
C	0.555	0.585	14.10	14.86
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
M	0°	7°	0°	7°
P	0.856	0.880	21.74	22.35
R	0.185	0.195	4.69	4.95
S	0.155	0.165	3.94	4.19
U	0.120	0.130	3.05	3.30
V	0.305	0.315	7.75	8.00
W	0.561	0.571	14.25	14.50
X	0.010	0.025	0.25	0.63
Y	0.002	0.010	0.05	0.25

STYLE 1:

- PIN 1. NC
- V SUPPLY
- GROUND
- V OUT
- NC
- NC
- NC
- NC

Motorola reserves the right to make changes without further notice to any products herein. Motorola makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Motorola assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters which may be provided in Motorola data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. Motorola does not convey any license under its patent rights nor the rights of others. Motorola products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Motorola product could create a situation where personal injury or death may occur. Should Buyer purchase or use Motorola products for any such unintended or unauthorized application, Buyer shall indemnify and hold Motorola and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Motorola was negligent regarding the design or manufacture of the part. Motorola and  are registered trademarks of Motorola, Inc. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer.

Mfax is a trademark of Motorola, Inc.

How to reach us:

USA/EUROPE/Locations Not Listed: Motorola Literature Distribution;
 P.O. Box 5405, Denver, Colorado 80217. 303-675-2140 or 1-800-441-2447

JAPAN: Nippon Motorola Ltd.; Tatsumi-SPD-JLDC, 6F Seibu-Butsuryu-Center,
 3-14-2 Tatsumi Koto-Ku, Tokyo 135, Japan. 81-3-3521-8315

Mfax™: RMFAX0@email.sps.mot.com – TOUCHTONE 602-244-6609
 – US & Canada ONLY 1-800-774-1848

ASIA/PACIFIC: Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,
 51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852-26629298

INTERNET: <http://motorola.com/sps>



MPXS4115A/D