



# Integrated Silicon Pressure Sensor On-Chip Signal Conditioned, Temperature Compensated and Calibrated

The MPXT5006D series piezoresistive transducer is a state-of-the-art monolithic silicon pressure sensor designed for a wide range of applications, but particularly those employing a microcontroller or microprocessor with A/D inputs. This sensor combines a highly sensitive implanted strain gauge with advanced micromachining techniques, thin-film metallization, and bipolar processing to provide an accurate, high level analog output signal that is proportional to the applied pressure.

### Features

- Temperature Compensated over 10° to 60°C
- Ideally Suited for Microprocessor or Microcontroller-Based Systems
- Available in Gauge Configurations

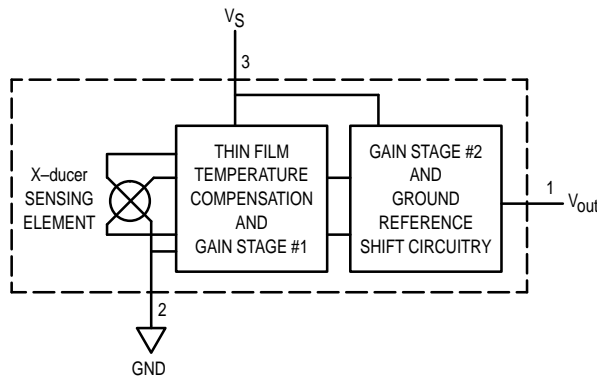


Figure 1. Fully Integrated Pressure Sensor Schematic

### MAXIMUM RATINGS(1)

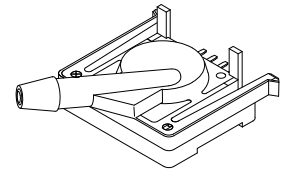
Parametrics	Symbol	Value	Unit
Overpressure <sup>(2)</sup> (P1 > P2)	P <sub>max</sub>	10	kPa
Burst Pressure <sup>(2)</sup> (P1 > P2)	P <sub>burst</sub>	60	kPa
Storage Temperature	T <sub>stg</sub>	-30 to +100	°C
Operating Temperature	T <sub>A</sub>	+10 to +60	°C

1. T<sub>C</sub> = 25°C unless otherwise noted.

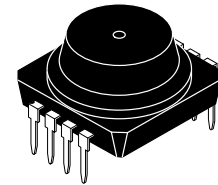
2. Exposure beyond the specified limits may cause permanent damage or degradation to the device.

## MPXT5006D SERIES

**INTEGRATED  
PRESSURE SENSOR**  
0 to 6 kPa (0 to 0.87 psi)  
0.2 to 4.7 V OUTPUT



TOP PISTON FIT — SNAP PORT  
CASE 473B-01, STYLE 1



TOP PISTON FIT PACKAGE  
CASE 473A-01, STYLE 3

### PIN NUMBER

1	V <sub>out</sub>	3	V <sub>S</sub>
2	Gnd	4	N/C

NOTE: Pin 4 is an internal device connection. Do not connect to external circuitry or ground. Pin 1 is noted by the notch in the Lead.

Senseon and X-ducer are trademarks of Motorola, Inc.

## MPXT5006D SERIES

### OPERATING CHARACTERISTICS ( $V_S = 5.0$ Vdc, $T_A = 25^\circ\text{C}$ unless otherwise noted, $P_1 > P_2$ )

Characteristic	Symbol	Min	Typ	Max	Unit
Pressure Range	POP	0	—	6.0	kPa
Supply Voltage <sup>(1)</sup>	$V_S$	4.75	5.0	5.25	Vdc
Supply Current	$I_S$	—	—	10	mAdc
Full Scale Span <sup>(2)</sup>	( $RL = 51\text{k}\Omega$ ) $V_{FSS}$	4.5	4.6	4.7	V
Offset <sup>(3)(5)</sup>	( $RL = 51\text{k}\Omega$ ) $V_{off}$	0.100	0.225	0.430	V
Sensitivity	V/P	—	766	—	mV/kPa
Accuracy <sup>(4)(5)</sup>	(10 to $60^\circ\text{C}$ )	—	—	—	$\pm 3.0$ % $V_{FSS}$

#### NOTES:


- Device is ratiometric within this specified excitation range.
- 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.
- Offset ( $V_{off}$ ) is defined as the output voltage at the minimum rated pressure.
- Accuracy (error budget) consists of 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 the minimum or maximum rated pressure, at  $25^\circ\text{C}$ .
  - Offset Stability: Output deviation, after 1000 temperature cycles,  $-30$  to  $100^\circ\text{C}$ , and 1.5 million pressure cycles, with minimum rated pressure applied.
  - TcSpan: Output deviation over the temperature range of 10 to  $60^\circ\text{C}$ , relative to  $25^\circ\text{C}$ .
  - TcOffset: Output deviation with minimum rated pressure applied, over the temperature range of 10 to  $60^\circ\text{C}$ , relative to  $25^\circ\text{C}$ .
  - Variation from Nominal: The variation from nominal values, for Offset or Full Scale Span, as a percent of  $V_{FSS}$ , at  $25^\circ\text{C}$ .
- Auto Zero at Factory Installation: Due to the sensitivity of the MPXT5006D, external mechanical stresses and mounting position can affect the zero pressure output reading. To obtain the 3% FSS accuracy, the device output must be "autozeroed" after installation. Autozeroing is defined as storing the zero pressure output reading and subtracting this from the device's output during normal operations.

$$\text{Nominal Transfer Value: } V_{out} = V_S * [(0.1533 * P) + 0.045] \pm 3\% V_{FSS}$$

$$V_S = 5.0 \text{ V} \pm 0.25 \text{ Vdc}$$

(See Note 5 in Operating Characteristics)

**Figure 2. Transfer Function**

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.

**ON-CHIP TEMPERATURE COMPENSATION, CALIBRATION AND SIGNAL CONDITIONING**

The performance over temperature is achieved by integrating the shear-stress strain gauge, temperature compensation, calibration and signal conditioning circuitry onto a single monolithic chip.

Figure 3 illustrates the differential or gauge configuration in the basic chip carrier (Case 473). A fluorosilicone gel isolates the die surface and wire bonds from harsh environments, while allowing the pressure signal to be transmitted to the silicon diaphragm.

The MPXT5006D series sensor operating characteristics are based on use of dry air as pressure media. Media, other than dry air, may have adverse effects on sensor performance

and long-term reliability. Internal reliability and qualification test for dry air, and other media, are available from the factory. Contact the factory for information regarding media tolerance in your application.

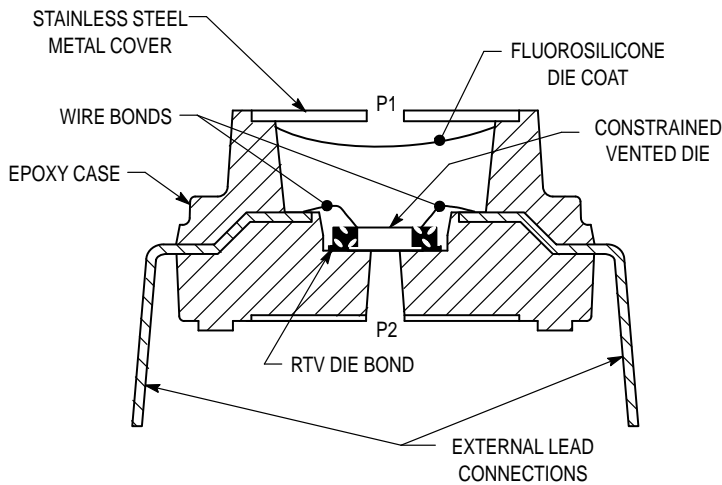
Figure 4 shows a typical decoupling circuit for interfacing the output of the MPXT5006D to the A/D microprocessor. Proper decoupling of the power supply is recommended.

Figure 5 shows the sensor output signal relative to pressure input. Typical, minimum and maximum output curves are shown for operation over 10°C to 60°C. (Device output may be nonlinear outside of the rated pressure range.)

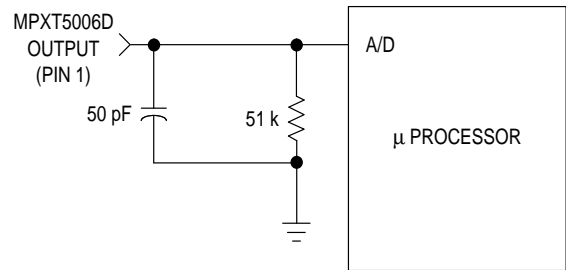
**PRESSURE (P1) / VACUUM (P2) SIDE IDENTIFICATION**

Motorola designates the two sides of the pressure sensor as the Pressure (P1) side and the Vacuum (P2) side. The Pressure (P1) side is the side containing fluorosilicone gel

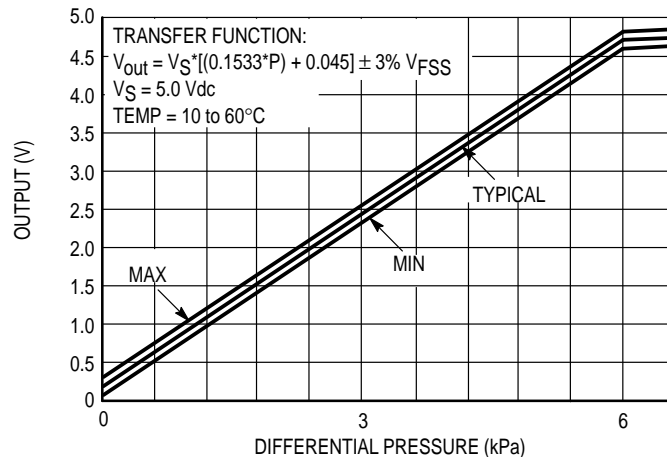
which protects the die from the environment. The Motorola pressure sensor is designed to operate with positive differential pressure applied, P1 > P2.



**Figure 3. Cross-Sectional Diagram (Not to Scale)**



**Figure 4. Typical Decoupling Filter for Sensor to Microprocessor Interface**

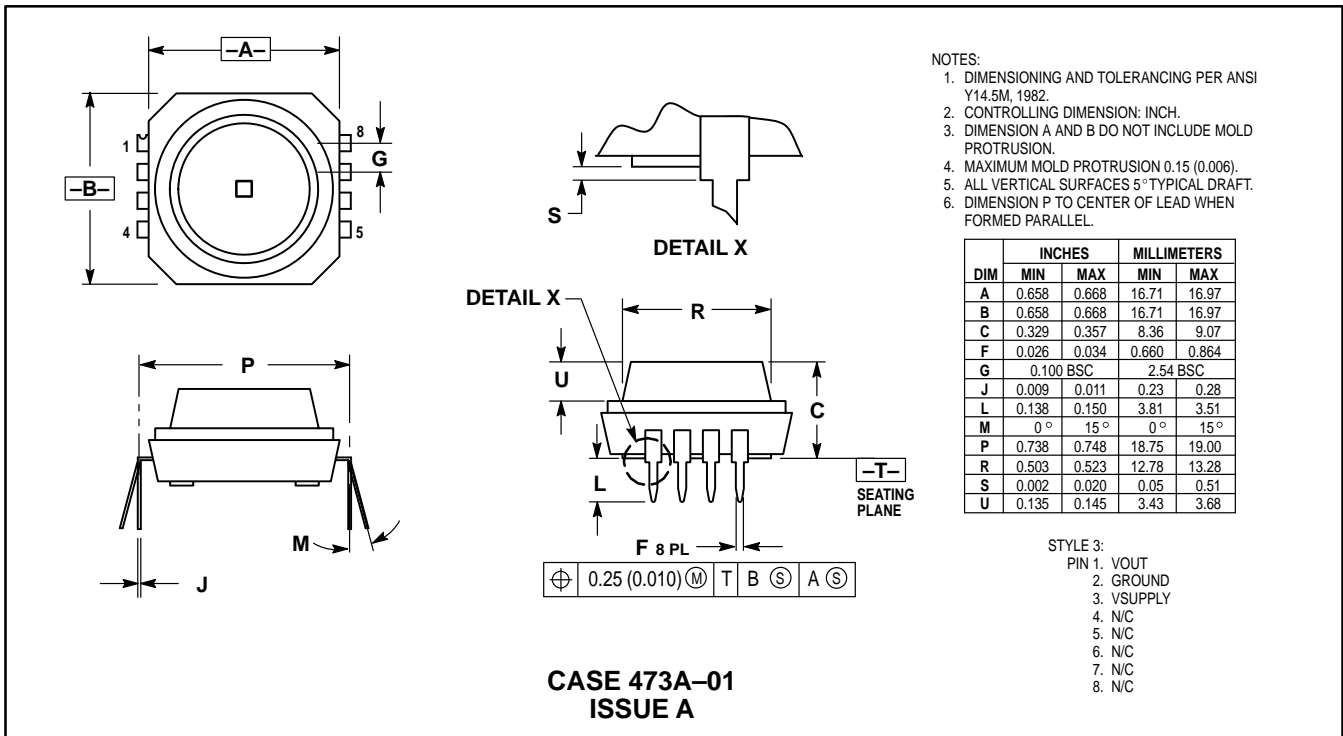
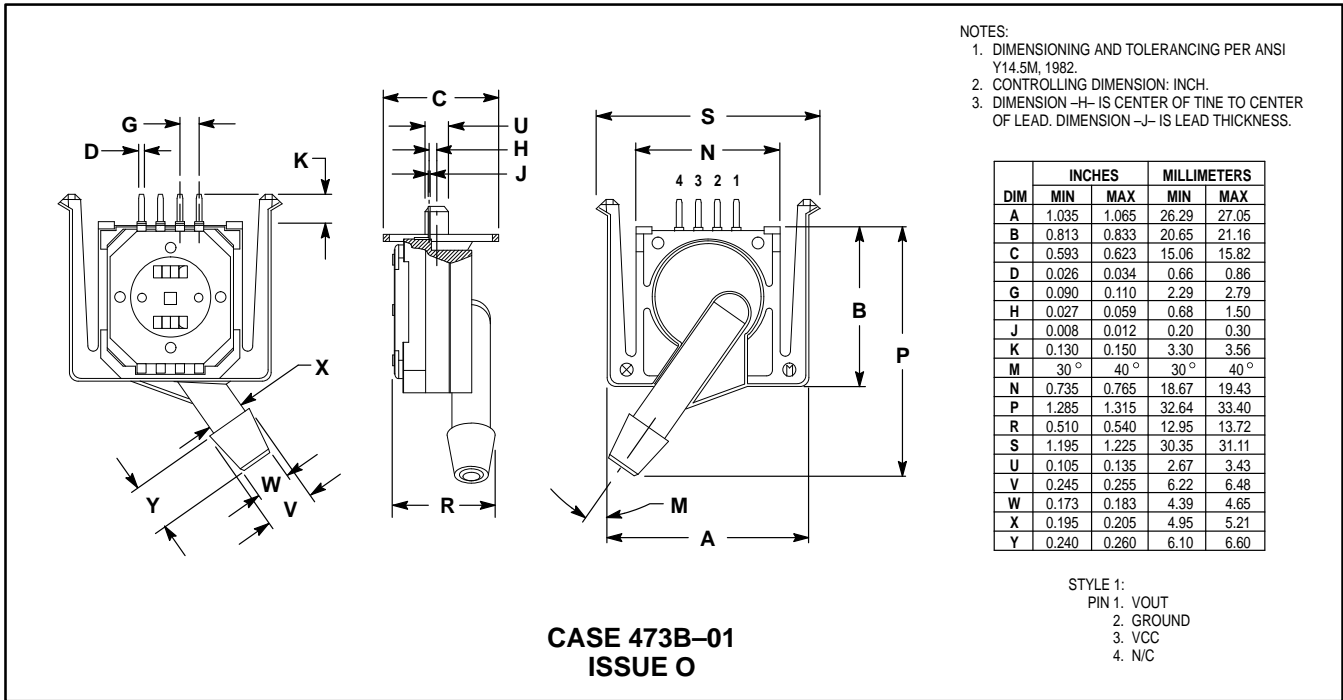


**Figure 5. Output versus Pressure Differential**

(See Note 5 in Operating Characteristics)

**MPXT5006D SERIES**

**PACKAGE DIMENSIONS**



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. 1-303-675-2140 or 1-800-441-2447

**JAPAN:** Nippon Motorola Ltd.: SPD, Strategic Planning Office, 4-32-1,  
 Nishi-Gotanda, Shinagawa-ku, Tokyo 141, Japan. 81-3-5487-8488

**Customer Focus Center: 1-800-521-6274**

**Mfax™:** RMFAX0@email.sps.mot.com – TOUCHTONE 1-602-244-6609  
 Motorola Fax Back System – US & Canada ONLY 1-800-774-1848  
 – http://sps.motorola.com/mfax/

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

**HOME PAGE:** http://motorola.com/sps/

