MPXT5006D SERIES

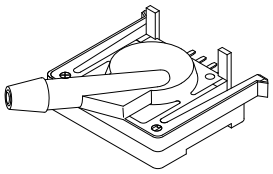
INTEGRATED PRESSURE SENSOR 0 to 6 kPa (0 to 0.87 psi) 0.2 to 4.7 V OUTPUT

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

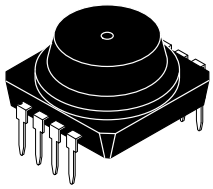
The MPXT5006D series piezoresistive transducer is a state–of–the–art monolithic silicon pressure sensor designed for a wide range of applications, but particularly those employing a microcontroller or microprocessor with A/D inputs. This sensor combines a highly sensitive implanted strain gauge with 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



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



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

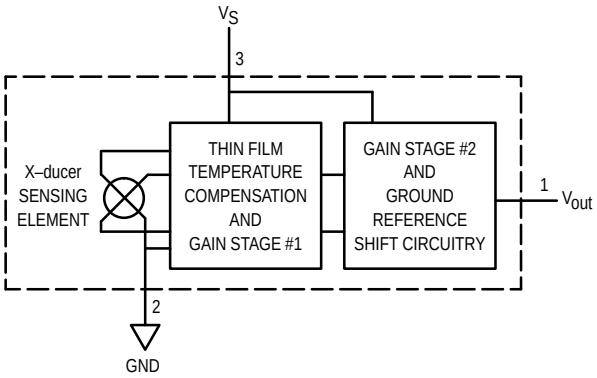


Figure 1. Fully Integrated Pressure Sensor Schematic

PIN NUMBER			
1	V_{out}	3	V_S
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.

MAXIMUM RATINGS(1)

Parametrics	Symbol	Value	Unit
Overpressure(2) (P1 > P2)	P_{max}	10	kPa
Burst Pressure(2) (P1 > P2)	P_{burst}	60	kPa
Storage Temperature	T_{stg}	–30 to +100	°C
Operating Temperature	T_A	+10 to +60	°C

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

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OPERATING CHARACTERISTICS (V_S = 5.0 Vdc, T_A = 25°C unless otherwise noted, P1 > P2)

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

NOTES:

1. Device is ratiometric within this specified excitation range.
2. 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.
3. Offset (V_{off}) is defined as the output voltage at the minimum rated pressure.
4. 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°C.
   - Offset Stability: Output deviation, after 1000 temperature cycles, −30 to 100°C, and 1.5 million pressure cycles, with minimum rated pressure applied.
   - TcSpan: Output deviation over the temperature range of 10 to 60°C, relative to 25°C.
   - TcOffset: Output deviation with minimum rated pressure applied, over the temperature range of 10 to 60°C, relative to 25°C.
   - Variation from Nominal: The variation from nominal values, for Offset or Full Scale Span, as a percent of V_{FSS}, at 25°C.
5. 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.

Nominal Transfer Value: $V_{out} = V_S*[(0.1533*P) + 0.045] \pm 3\% V_{FSS}$
$V_S = 5.0 V \pm 0.25$ Vdc

(See Note 5 in Operating Characteristics)

Figure 2. Transfer Function

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.

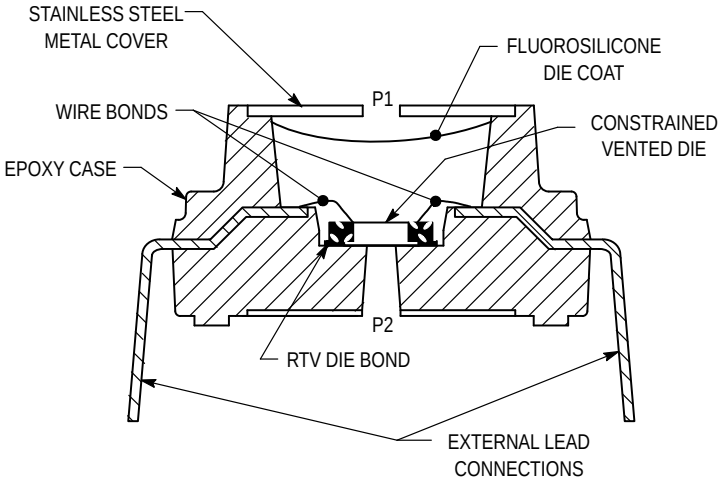


Figure 3. Cross–Sectional Diagram (Not to Scale)

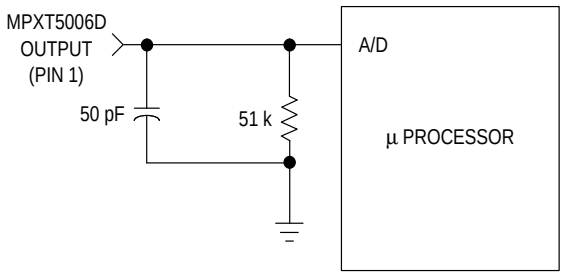


Figure 4. Typical Decoupling Filter for Sensor to Microprocessor Interface

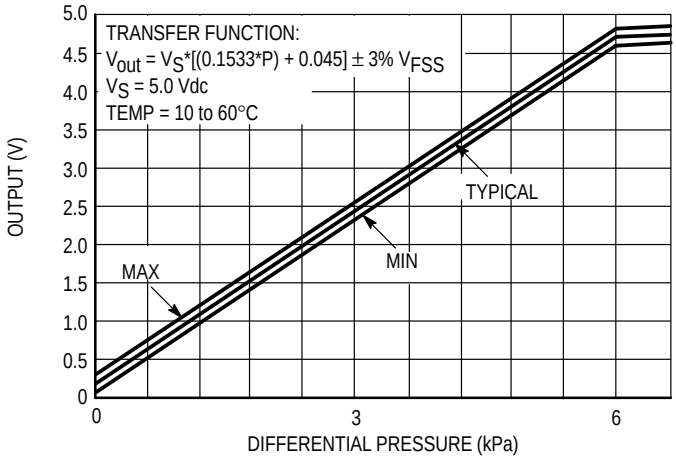
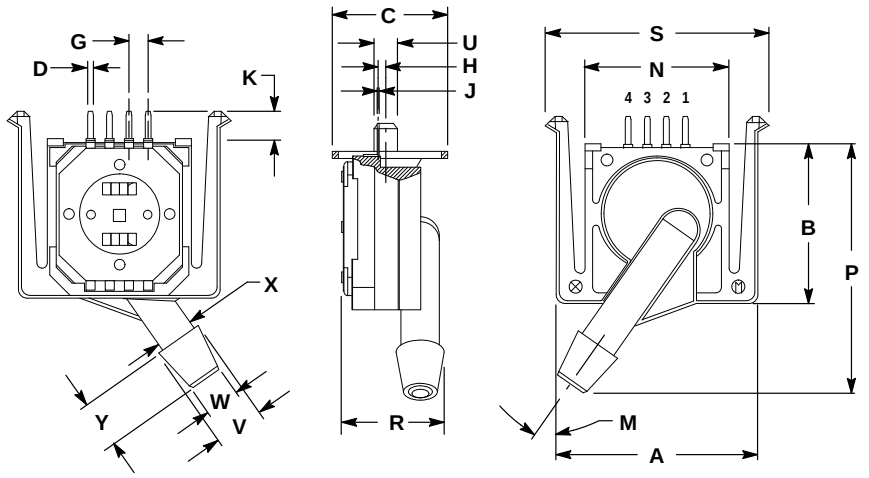


Figure 5. Output versus Pressure Differential

(See Note 5 in Operating Characteristics)

PACKAGE DIMENSIONS

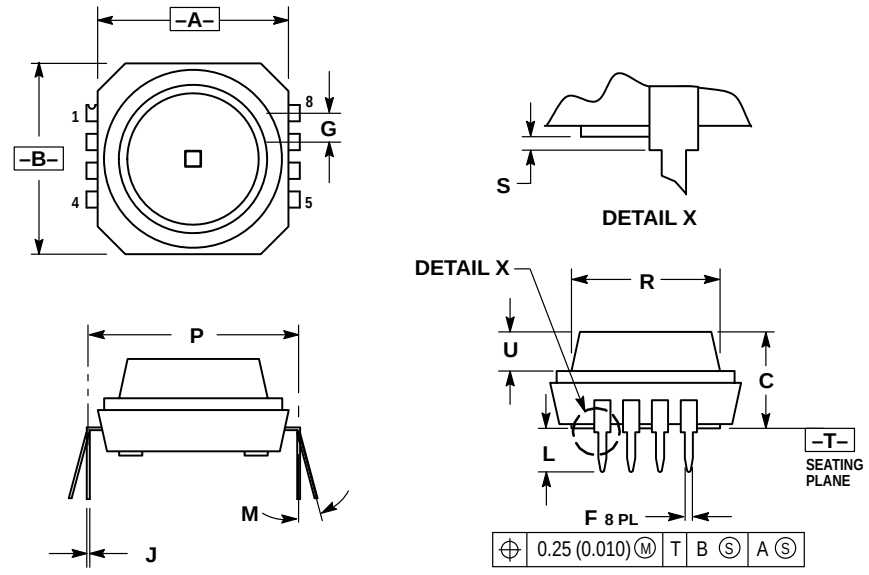


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION –H– IS CENTER OF TINE TO CENTER OF LEAD. DIMENSION –J– IS LEAD THICKNESS.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	1.035	1.065	26.29	27.05
B	0.813	0.833	20.65	21.16
C	0.593	0.623	15.06	15.82
D	0.026	0.034	0.66	0.86
G	0.090	0.110	2.29	2.79
H	0.027	0.059	0.68	1.50
J	0.008	0.012	0.20	0.30
K	0.130	0.150	3.30	3.56
M	30 °	40 °	30 °	40 °
N	0.735	0.765	18.67	19.43
P	1.285	1.315	32.64	33.40
R	0.510	0.540	12.95	13.72
S	1.195	1.225	30.35	31.11
U	0.105	0.135	2.67	3.43
V	0.245	0.255	6.22	6.48
W	0.173	0.183	4.39	4.65
X	0.195	0.205	4.95	5.21
Y	0.240	0.260	6.10	6.60

STYLE 1:
PIN 1. VOUT
2. GROUND
3. VCC
4. N/C

CASE 473B–01
ISSUE O



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006).
5. ALL VERTICAL SURFACES 5° TYPICAL DRAFT.
6. DIMENSION P TO CENTER OF LEAD WHEN FORMED PARALLEL.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.658	0.668	16.71	16.97
B	0.658	0.668	16.71	16.97
C	0.329	0.357	8.36	9.07
F	0.026	0.034	0.660	0.864
G	0.100 BSC		2.54 BSC	
J	0.009	0.011	0.23	0.28
L	0.138	0.150	3.81	3.51
M	0 °	15 °	0 °	15 °
P	0.738	0.748	18.75	19.00
R	0.503	0.523	12.78	13.28
S	0.002	0.020	0.05	0.51
U	0.135	0.145	3.43	3.68

STYLE 3:
PIN 1. VOUT
2. GROUND
3. VSUPPLY
4. N/C
5. N/C
6. N/C
7. N/C
8. N/C

CASE 473A–01
ISSUE A

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