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

The MPVZ4006G series piezoresistive transducers are state-of-the-art monolithic silicon pressure sensors designed for the appliance, consumer, health care and industrial market. The analog output can be read directly into the A/D input of Freescale microcontrollers. This transducer combines 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. The axial port has been modified to accommodate industrial grade tubing.

Features

- 2.5% Maximum Error over +10°C to +60°C with Auto Zero
- 5% Maximum Error over +10°C to +60°C without Auto Zero
- Durable Thermoplastic (PPS) Package
- Available in Surface Mount (SMT) or Through-Hole (DIP) Configurations

Application Examples

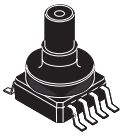
- Washing Machine Water Level Measurement (Reference AN1950)
- Ideally Suited for Microprocessor or Microcontroller-Based Systems
- Appliance Liquid Level and Pressure Measurement
- Respiratory Equipment

ORDERING INFORMATION					
Device Type	**Options**	**Case No.**	**MPX Series Order No.**	**Packing Options**	**Marking**
Ported Element	Surface Mount	1735-01	MPVZ4006GW6U	Rails	MZ4006GW
	Through-Hole	1560-02	MPVZ4006GW7U	Rails	MZ4006GW
	Surface Mount	482-01	MPVZ4006G6U	Rails	MPVZ4006G
	Surface Mount	482-01	MPVZ4006G6T1	Tape & Reel	MPVZ4006G
	Through-Hole	482B-03	MPVZ4006G7U	Rails	MPVZ4006G

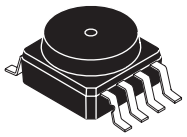
MPVZ4006G

INTEGRATED PRESSURE SENSOR
0 to 6 kPa (0 to 612 mm H_2O)
0.3 to 4.6 V OUTPUT

SMALL OUTLINE PACKAGE SURFACE MOUNT

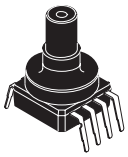


MPVZ4006GW6U
CASE 1735-01

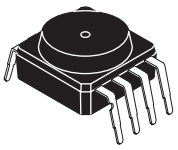


MPVZ4006G6U/T1
CASE 482-01

SMALL OUTLINE PACKAGE THROUGH-HOLE



MPVZ4006GW7U
CASE 1560-02



MPVZ4006G7U
CASE 482B-03

PIN NUMBERS[1]			
1	N/C	5	N/C
2	V_S	6	N/C
3	Gnd	7	N/C
4	V_{out}	8	N/C

1. Pins 1, 5, 6, 7, and 8 are internal device connections. Do not connect to external circuitry or ground. Pin 1 is noted by the notch in the lead.

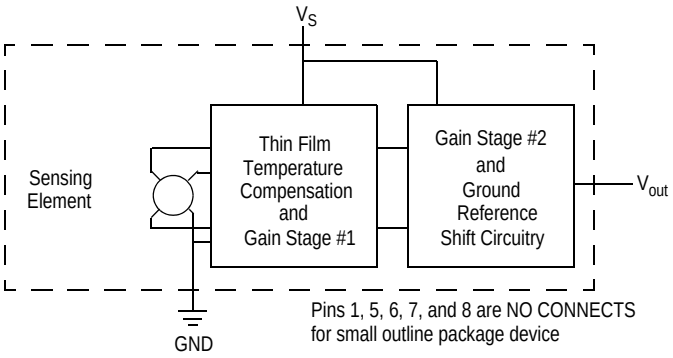


Figure 1. Fully Integrated Pressure Sensor Schematic

Table 1. Maximum Ratings[1]

Parametric	Symbol	Value	Units
Maximum Pressure (P1 > P2)	P_{max}	75	kPa
Storage Temperature	T_{stg}	-30° to +100°	°C
Operating Temperature	T_A	+10° to +60°	°C

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

Table 2. 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	—	6.0 612	kPa mm H_2O
Supply Voltage[1]	V_S	4.75	5.0	5.25	Vdc
Supply Current	I_S	—	—	10	mAdc
Full Scale Output[2]	V_{FSS}	4.374	4.6	4.826	V
Offset[3][5]	V_{off}	0.152	0.265	0.378	V
Sensitivity	V/P	—	766 7.511	—	mV/kPa mV/mm H_2O
Accuracy[4][5] (10 to 60°C)	— —	— —	— —	±2.46 ±5.0	$\%V_{FSS}$ with auto zero $\%V_{FSS}$ without auto zero

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 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 pressure applied, over the temperature range of 10° to 60°C, relative to 25°C.
5. Auto Zero at Factory Installation: Due to the sensitivity of the MPVZ4006G, external mechanical stresses and mounting position can affect the zero pressure output reading. To obtain the 2.46% 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. The specified accuracy assumes a maximum temperature change of ±5°C between autozero and measurement.

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 2 illustrates the Differential or Gauge configuration in the basic chip carrier (Case 482). A gel die coat isolates the die surface and wire bonds from the environment, while allowing the pressure signal to be transmitted to the silicon diaphragm.

The MPVZ4006G 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 3 shows the recommended decoupling circuit for interfacing the output of the integrated sensor to the A/D input of a microprocessor or microcontroller. Proper decoupling of the power supply is recommended.

Figure 4 and Figure 5 shows the sensor output signal relative to pressure input. Typical, minimum and maximum output curves are shown for operation over a temperature range of 10°C to 60°C using the decoupling circuit shown in Figure 3. The output will saturate outside of the specified pressure range.

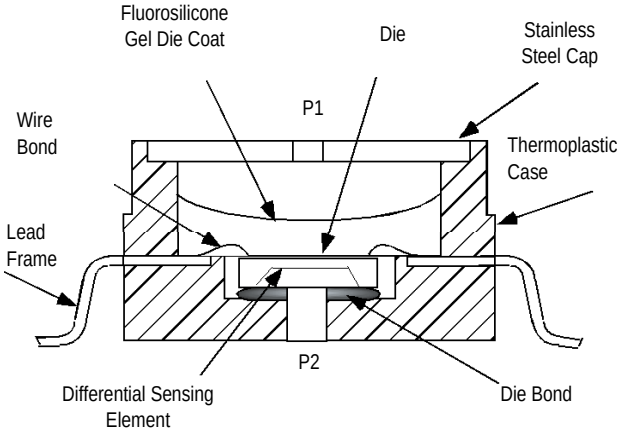


Figure 2. Cross Sectional Diagram SOP (Not to Scale)

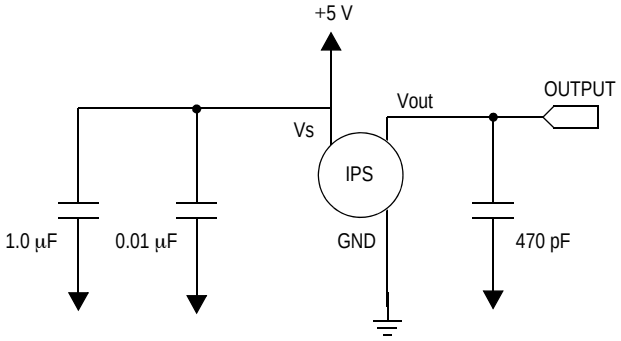


Figure 3. Recommended Power Supply Decoupling and Output Filtering Recommendations
(For additional output filtering, please refer to Application Note AN1646.)

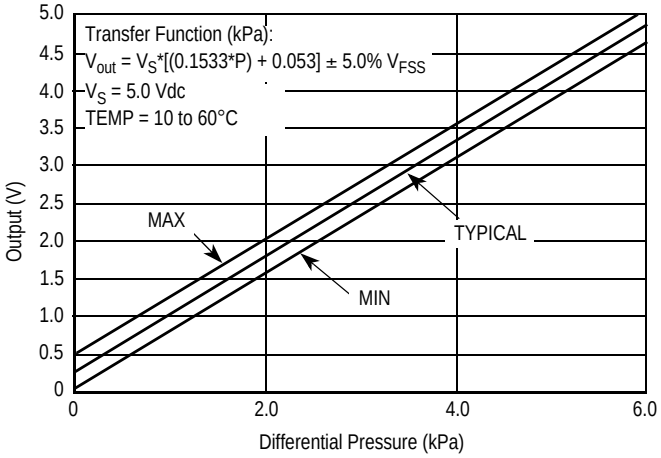


Figure 4. Output versus Pressure Differential at ±5.0% V_{FSS} (without auto zero, note 5 in Operating Characteristics)

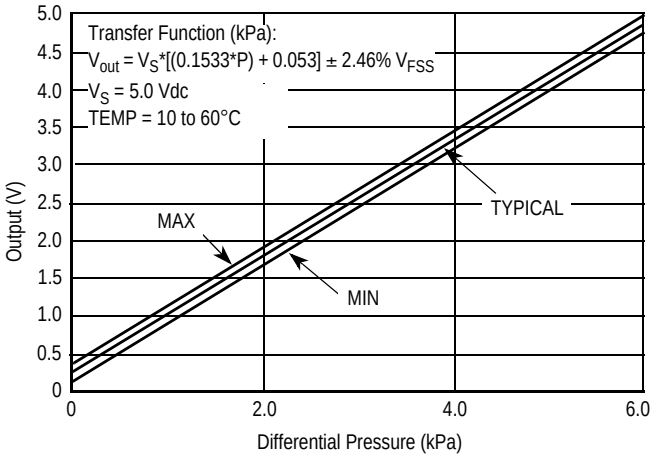


Figure 5. Output versus Pressure Differential at ±2.46% V_{FSS} (with auto zero, note 5 in Operating Characteristics)

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

Freescale 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 a gel die coat which isolates the die from the environment. The pressure sensor is designed to operate with positive differential pressure applied, P1 > P2.

The Pressure (P1) side may be identified by using the table below:

Table 3. Pressure (P1)/Vacuum (P2) Side Identification Table

Part Number	Case Type	Pressure (P1) Side Identifier
MPVZ4006GW6U	1735-01	Vertical Port Attached
MPVZ4006GW7U	1560-02	Vertical Port Attached
MPVZ4006G6U/T1	482-01	Stainless Steel Cap
MPVZ4006G7U	482B-03	Stainless Steel Cap

MINIMUM RECOMMENDED FOOTPRINT FOR SURFACE MOUNTED APPLICATIONS

Surface mount board layout is a critical portion of the total design. The footprint for the surface mount packages must be the correct size to ensure proper solder connection interface between the board and the package. With the correct footprint, the packages will self align when subjected to a solder reflow process. It is always recommended to design boards with a solder mask layer to avoid bridging and shorting between solder pads.

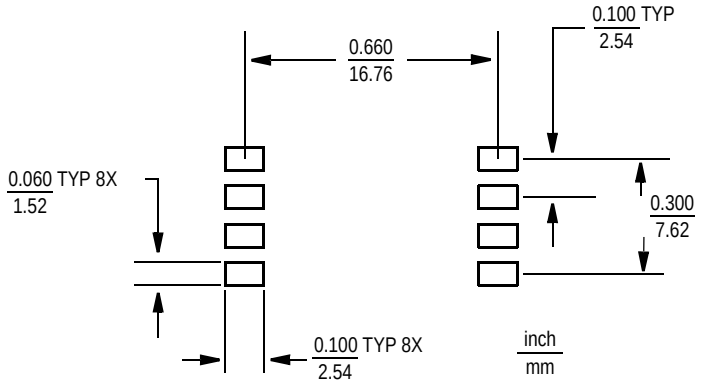
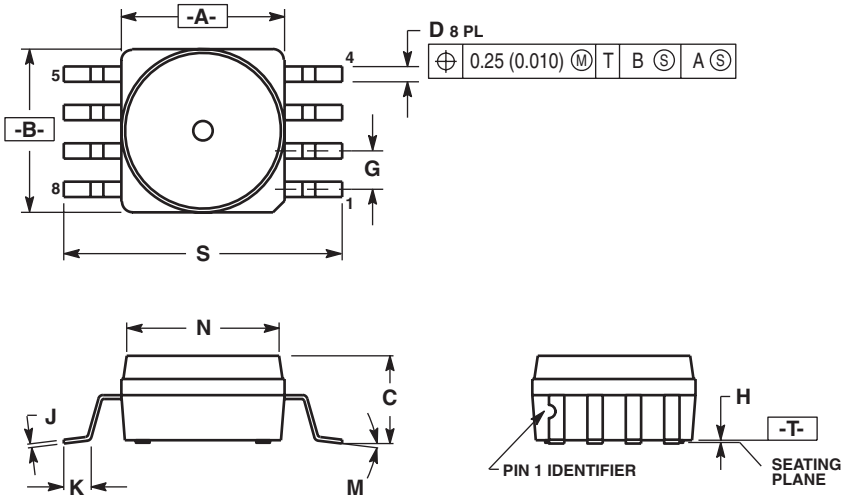


Figure 6. SOP Footprint (Case 482)

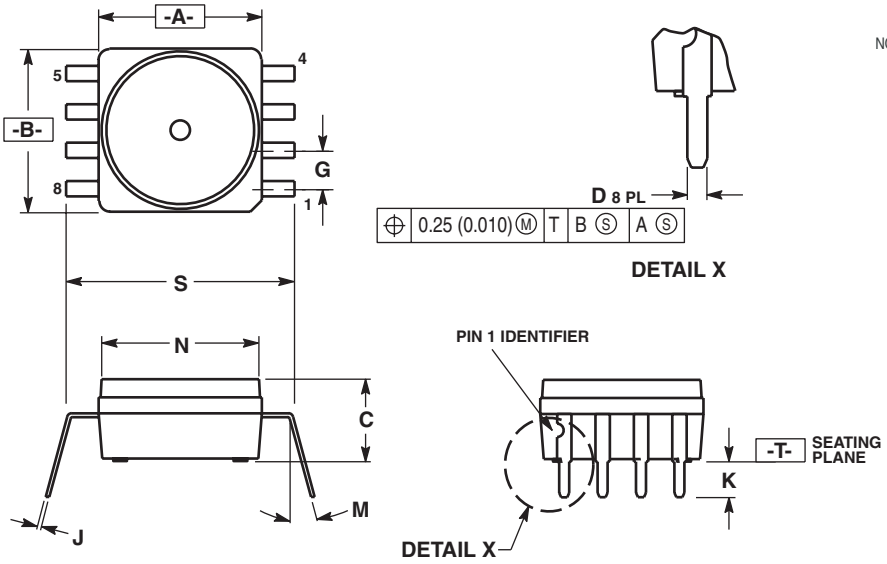
PACKAGE DIMENSIONS



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.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.415	0.425	10.54	10.79
B	0.415	0.425	10.54	10.79
C	0.212	0.230	5.38	5.84
D	0.038	0.042	0.96	1.07
G	0.100 BSC		2.54 BSC	
H	0.002	0.010	0.05	0.25
J	0.009	0.011	0.23	0.28
K	0.061	0.071	1.55	1.80
M	0°	7°	0°	7°
N	0.405	0.415	10.29	10.54
S	0.709	0.725	18.01	18.41

CASE 482-01
ISSUE O
SMALL OUTLINE PACKAGE



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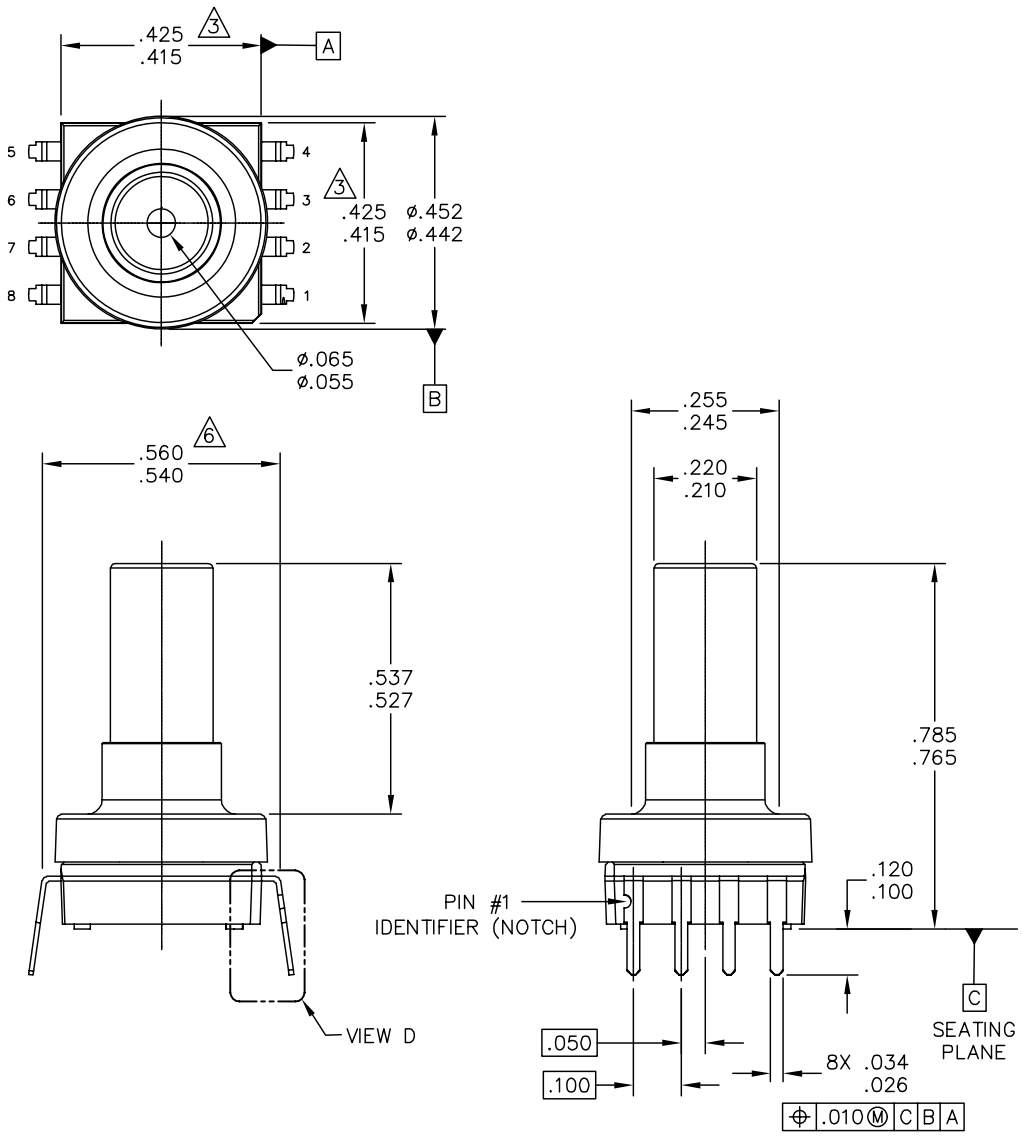
6. DIMENSION S TO CENTER OF LEAD WHEN FORMED PARALLEL.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.415	0.425	10.54	10.79
B	0.415	0.425	10.54	10.79
C	0.210	0.220	5.33	5.59
D	0.026	0.034	0.66	0.864
G	0.100 BSC		2.54 BSC	
J	0.009	0.011	0.23	0.28
K	0.100	0.120	2.54	3.05
M	0°	15°	0°	15°
N	0.405	0.415	10.29	10.54
S	0.540	0.560	13.72	14.22

CASE 482B-03
ISSUE B
SMALL OUTLINE PACKAGE

PACKAGE DIMENSIONS



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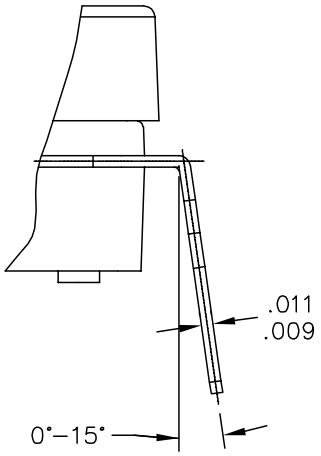
	CASE NUMBER: 1560–02	26 MAY 2005
	STANDARD: NON–JEDEC	

CASE 1560-02
ISSUE C
SMALL OUTLINE PACKAGE

PACKAGE DIMENSIONS



VIEW D

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SMALL OUTLINE PACKAGE

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NOTES:

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2. CONTROLLING DIMENSION: INCH.
3. DIMENSIONS DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION IS .006.
5. ALL VERTICAL SURFACES 5° TYPICAL DRAFT.
6. DIMENSION TO CENTER OF LEAD WHEN FORMED PARALLEL.

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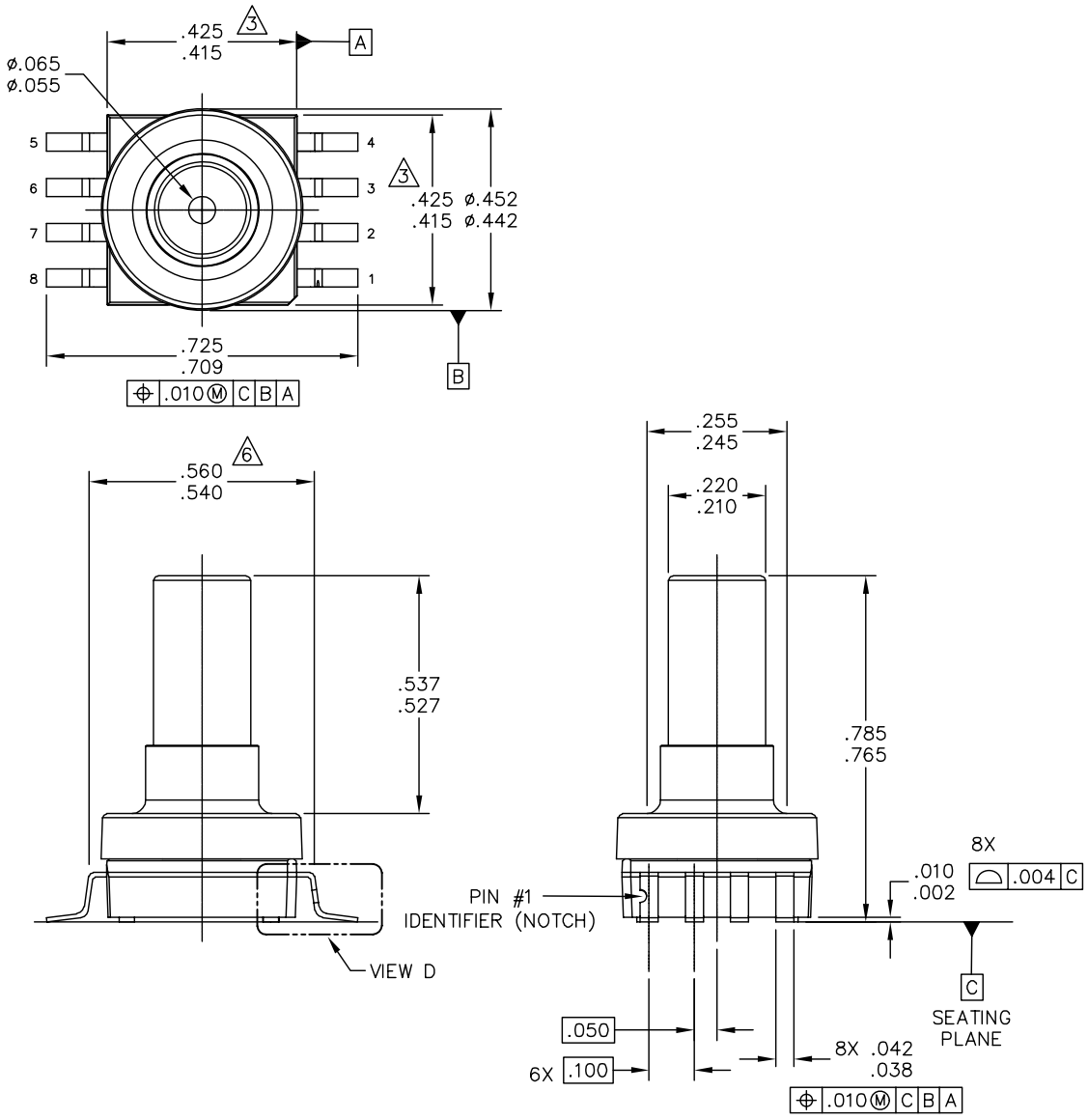

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	STANDARD: NON–JEDEC	

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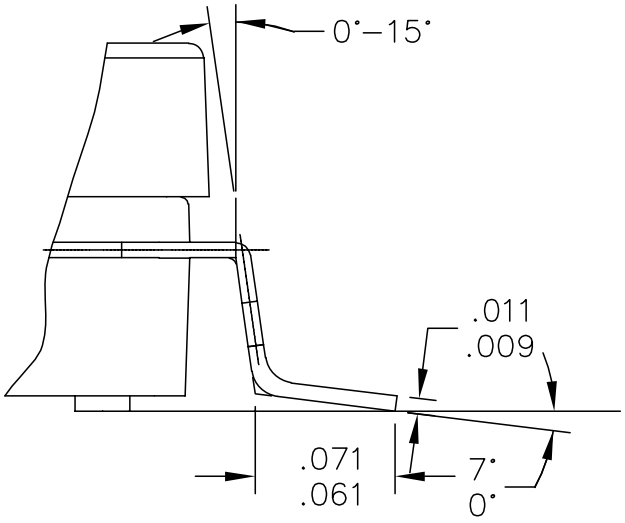
ISSUE A
SMALL OUTLINE PACKAGE

PACKAGE DIMENSIONS



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	STANDARD: NON–JEDEC	

CASE 1735-01
ISSUE A
SMALL OUTLINE PACKAGE

PACKAGE DIMENSIONS

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CASE 1735-01
ISSUE A
SMALL OUTLINE PACKAGE

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