

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

The MPX5050/MPXV5050G 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 patented, single element 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.

Features

- 2.5% Maximum Error over 0° to 85°C
- Ideally suited for Microprocessor or Microcontroller-Based Systems
- Temperature Compensated Over – 40° to +125°C
- Patented Silicon Shear Stress Strain Gauge
- Durable Epoxy Unibody Element
- Easy-to-Use Chip Carrier Option

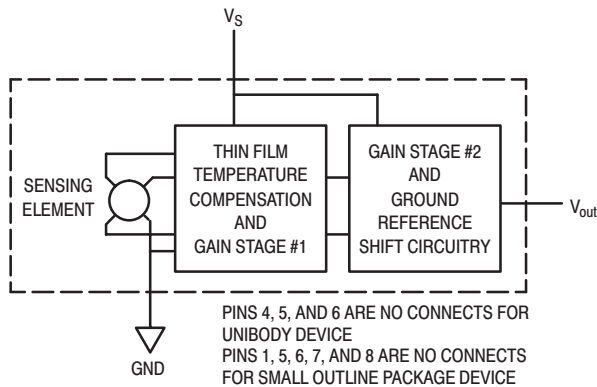


Figure 1. Fully Integrated Pressure Sensor Schematic

**SMALL OUTLINE PACKAGE
SURFACE MOUNT**

**MPXV5050GP
CASE 1369**

**MPXV5050DP
CASE 1351**

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. Pin 1 is noted by the notch in the lead.

**MPX5050
MPXV5050G
SERIES**

Motorola Preferred Device

**INTEGRATED
PRESSURE SENSOR**
0 to 50 kPa (0 to 7.25 psi)
0.2 to 4.7 Volts Output

UNIBODY PACKAGE

**MPX5050D
CASE 867**

**MPX5050GP
CASE 867B**

**MPX5050DP
CASE 867C**

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

NOTE: Pins 4, 5, and 6 are internal device connections. Do not connect to external circuitry or ground. Pin 1 is noted by the notch in the lead.

MPX5050 MPXV5050G SERIES

MAXIMUM RATINGS(NOTE)

Parametrics	Symbol	Value	Unit
Maximum Pressure (P1 > P2)	P _{max}	200	kPa
Storage Temperature	T _{stg}	-40° to +125°	°C
Operating Temperature	T _A	-40° to +125°	°C

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

OPERATING CHARACTERISTICS (V_S = 5.0 Vdc, T_A = 25°C unless otherwise noted, P1 > P2. Decoupling circuit shown in Figure 4 required to meet electrical specifications.)

Characteristic	Symbol	Min	Typ	Max	Unit
Pressure Range ⁽¹⁾	P _{OP}	0	—	50	kPa
Supply Voltage ⁽²⁾	V _S	4.75	5.0	5.25	Vdc
Supply Current	I _o	—	7.0	10.0	mAdc
Minimum Pressure Offset ⁽³⁾ @ V _S = 5.0 Volts	V _{off}	0.088	0.20	0.313	Vdc
Full Scale Output ⁽⁴⁾ @ V _S = 5.0 Volts	V _{FSSO}	4.587	4.70	4.813	Vdc
Full Scale Span ⁽⁵⁾ @ V _S = 5.0 Volts	V _{FSS}	—	4.50	—	Vdc
Accuracy ⁽⁶⁾	—	—	—	± 2.5	%V _{FSS}
Sensitivity	V/P	—	90	—	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⁾	—	—	± 0.5	—	%V _{FSS}

NOTES:

- 1.0kPa (kiloPascal) equals 0.145 psi.
- Device is ratiometric within this specified excitation range.
- Offset (V_{off}) is defined as the output voltage at the minimum rated pressure.
- Full Scale Output (V_{FSSO}) is defined as the output voltage at the maximum or full rated pressure.
- 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.
- 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.
 - 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.
 - Variation from Nominal: The variation from nominal values, for Offset or Full Scale Span, as a percent of V_{FSS} at 25°C.
- 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.
- Warm-up Time is defined as the time required for the product to meet the specified output voltage after the Pressure has been stabilized.
- Offset Stability is the product's output deviation when subjected to 1000 hours of Pulsed Pressure, Temperature Cycling with Bias Test.

MECHANICAL CHARACTERISTICS

Characteristics	Typ	Unit
Weight, Basic Element (Case 867)	4.0	grams
Weight, Basic Element (Case 1369)	1.5	grams

Figure 3 illustrates the Differential/Gauge Sensing Chip in the basic chip carrier (Case 867). A fluorosilicone gel isolates the die surface and wire bonds from the environment, while allowing the pressure signal to be transmitted to the sensor diaphragm.

The MPX5050/MPXV5050G series pressure sensor operating characteristics, and 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 sensor output signal relative to pressure input. Typical, minimum, and maximum output curves are shown for operation over a temperature range of 0° to 85°C using the decoupling circuit shown in Figure 4. The output will saturate outside of the specified pressure range.

Figure 4 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.

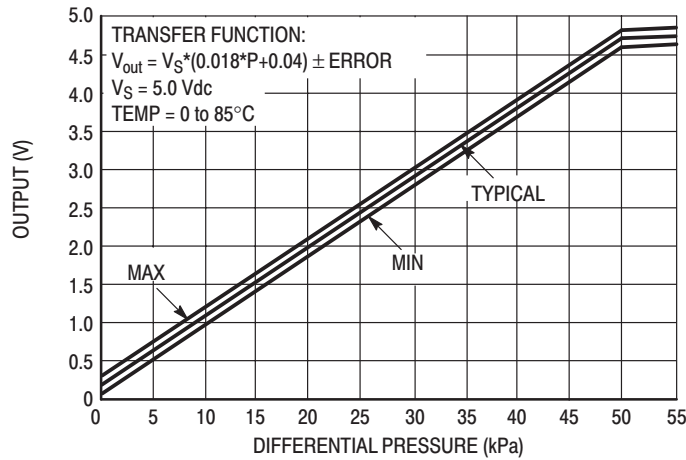


Figure 2. Output versus Pressure Differential

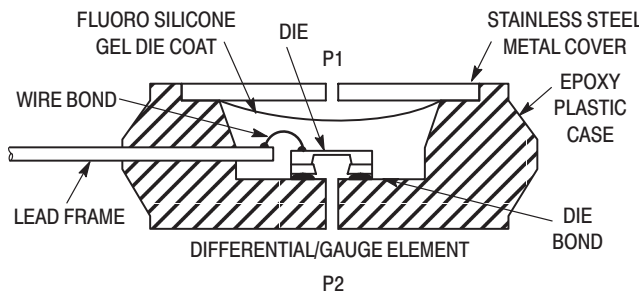


Figure 3. Cross-Sectional Diagram (Not to Scale)

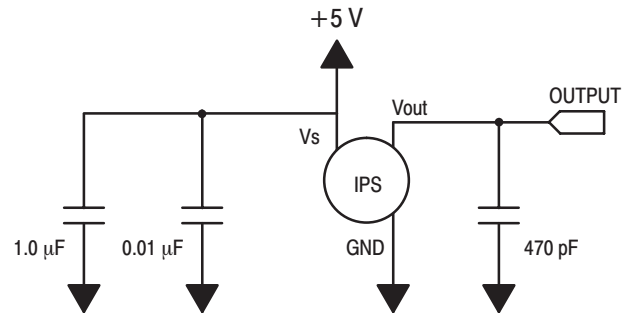


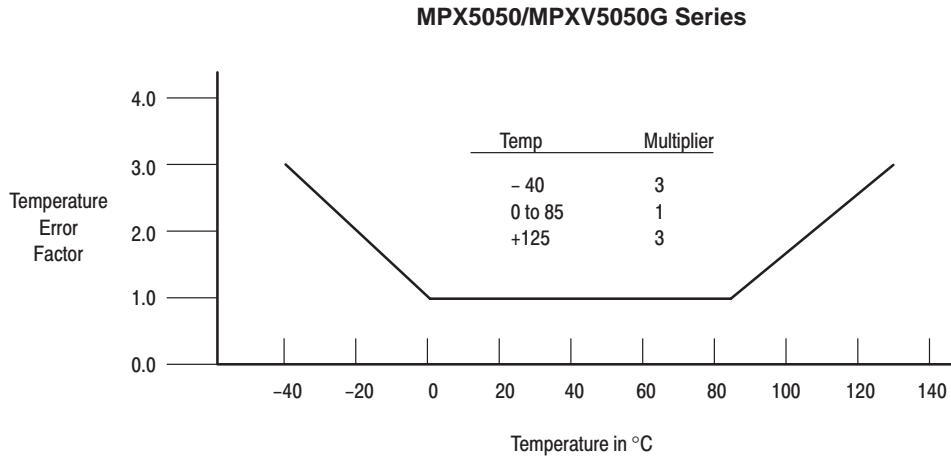
Figure 4. Recommended power supply decoupling and output filtering.
 For additional output filtering, please refer to Application Note AN1646.

MPX5050 MPXV5050G SERIES

Transfer Function

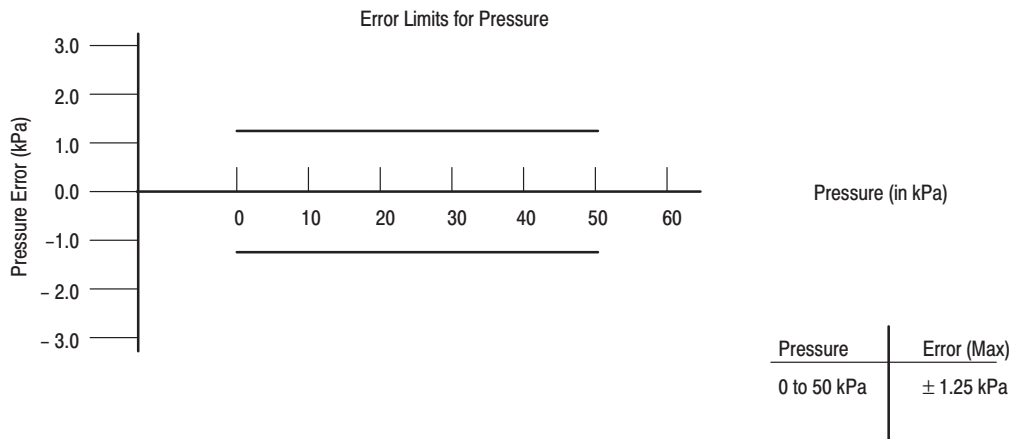
Nominal Transfer Value: $V_{out} = V_S (P \times 0.018 + 0.04)$
 \pm (Pressure Error x Temp. Factor x 0.018 x V_S)
 $V_S = 5.0 \text{ V} \pm 0.25 \text{ Vdc}$

Temperature Error Band



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

Pressure Error Band



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

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 harsh media. The Motorola MPX

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:

Part Number	Case Type	Pressure (P1) Side Identifier
MPX5050D	867	Stainless Steel Cap
MPX5050DP	867C	Side with Part Marking
MPX5050GP	867B	Side with Port Attached
MPXV5050GP	1369	Side with Port Attached
MPXV5050DP	1351	Side with Part Marking

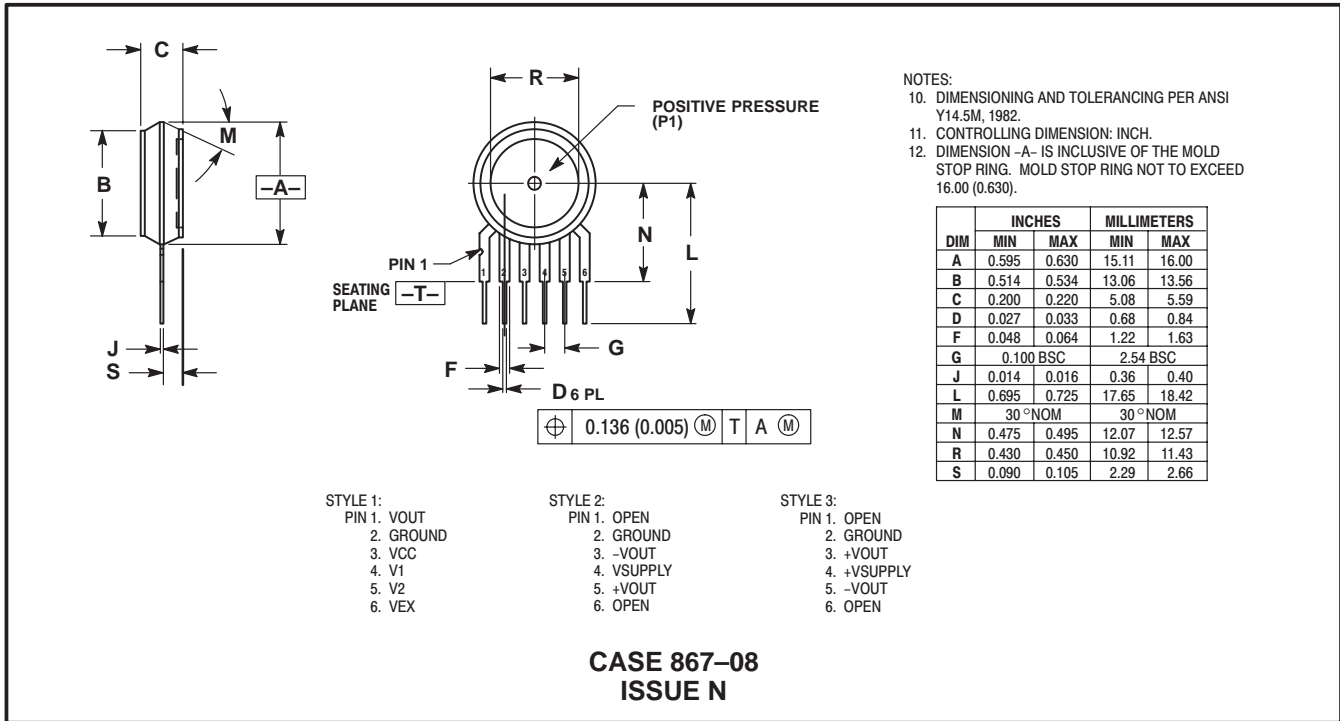
ORDERING INFORMATION — UNIBODY PACKAGE (MPX5050 SERIES)

Device Type	Options	Case Type	MPX Series	
			Order Number	Device Marking
Basic Element	Differential	867	MPX5050D	MPX5050D
Ported Elements	Differential Dual Ports	867C	MPX5050DP	MPX5050DP
	Gauge	867B	MPX5050GP	MPX5050GP

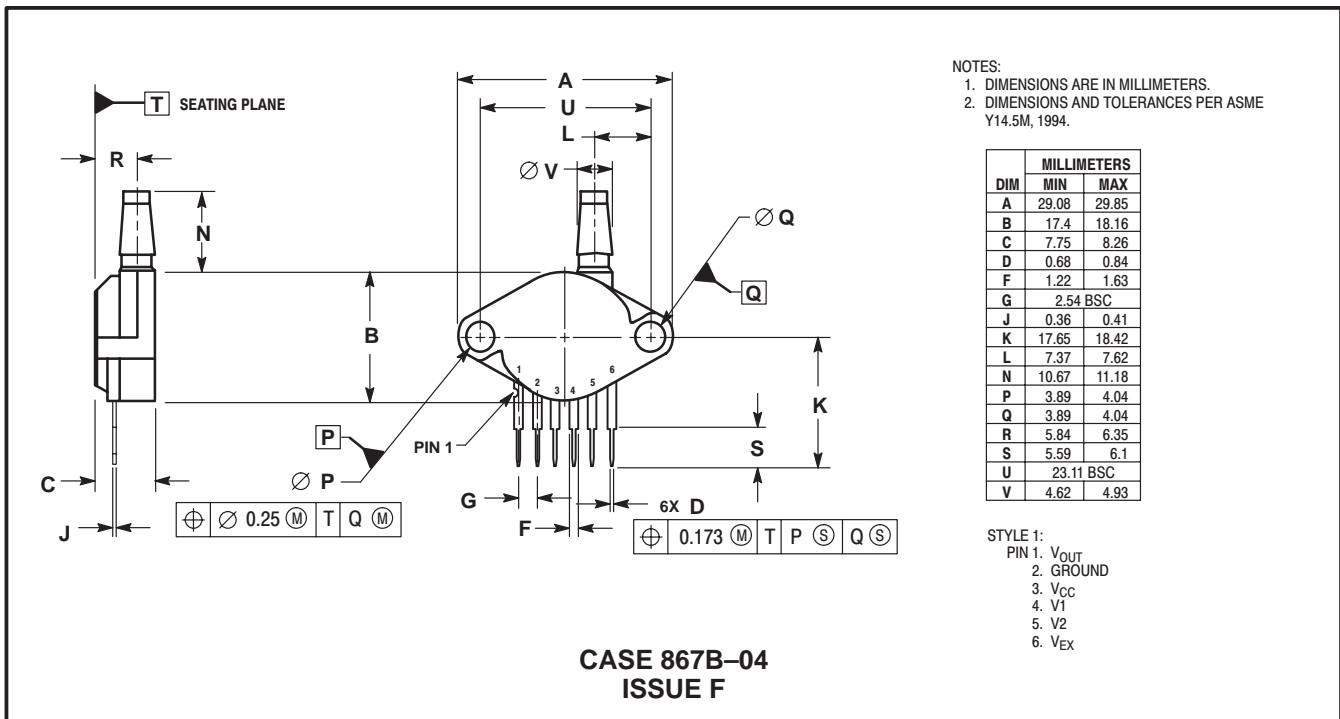
ORDERING INFORMATION — SMALL OUTLINE PACKAGE (MPXV5050G SERIES)

Device Type	Options	Case No.	MPX Series Order No.	Packing Options	Marking
Ported Elements	Side Port	1369	MPXV5050GP	Trays	MPXV5050G
	Dual Port	1351	MPXV5050DP	Trays	MPXV5050G

PACKAGE DIMENSIONS
UNIBODY PACKAGE



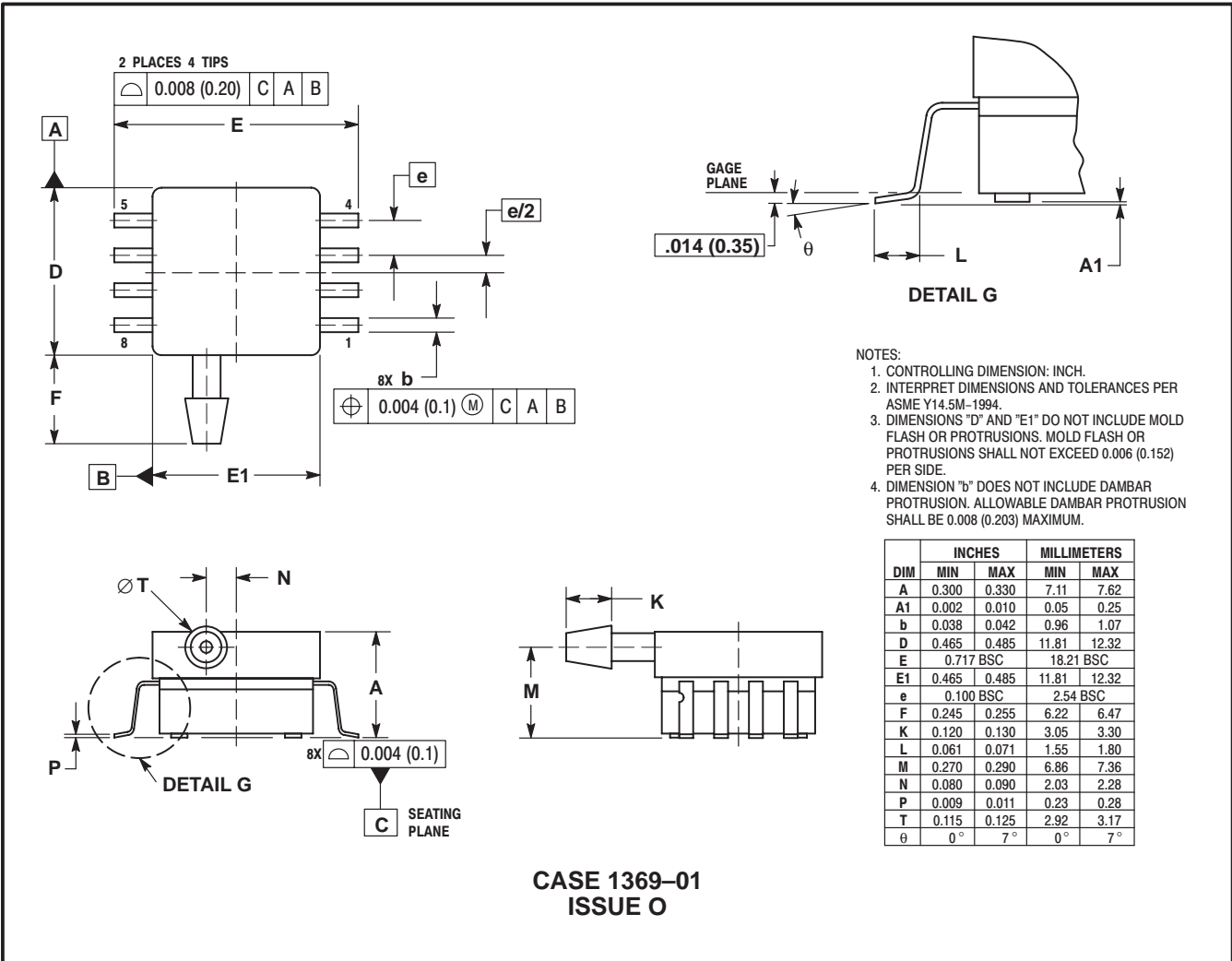
BASIC ELEMENT



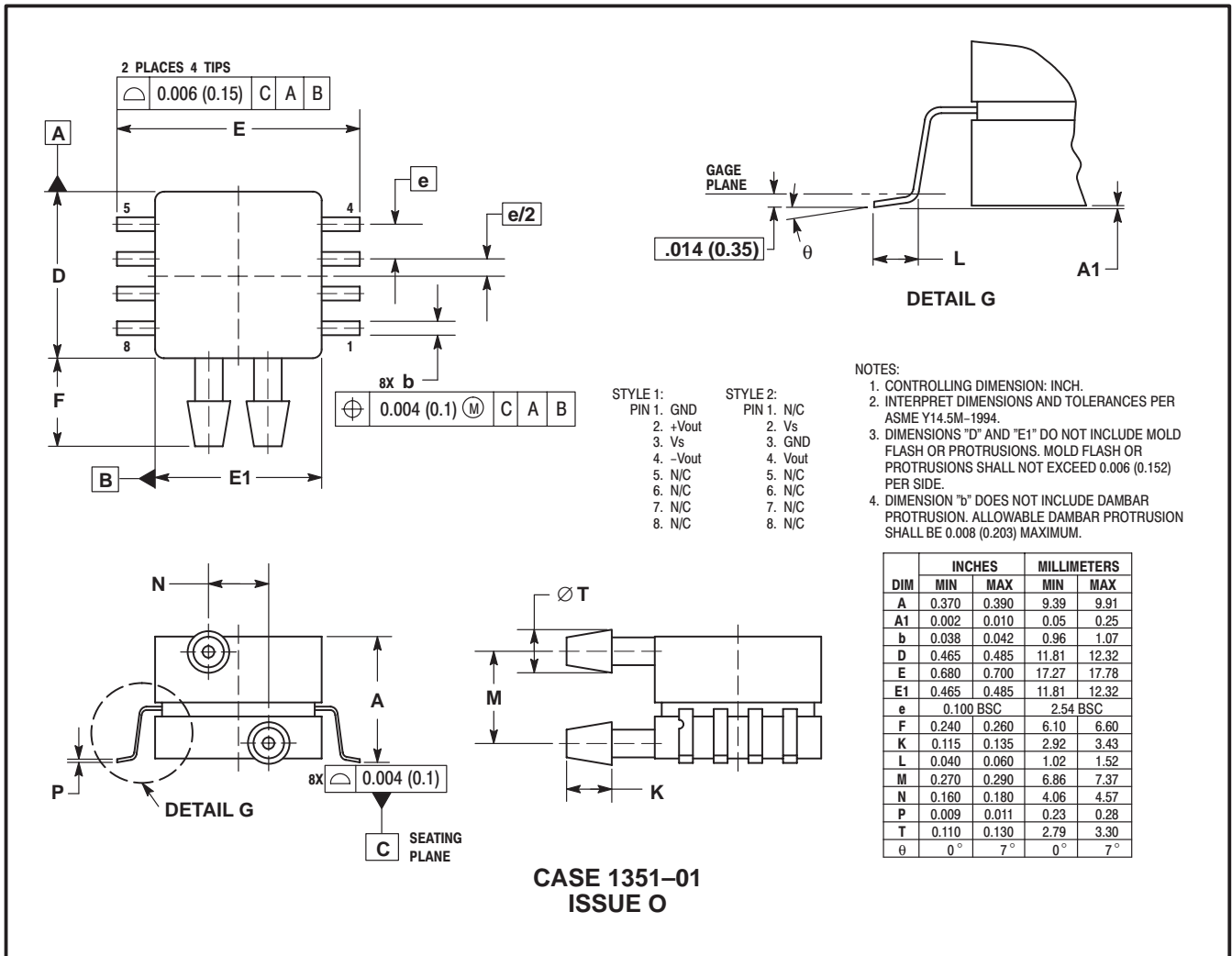
PRESSURE SIDE PORTED (AP, GP)

MPX5050 MPXV5050G SERIES

**SMALL OUTLINE PACKAGE DIMENSIONS
SURFACE MOUNT**



SMALL OUTLINE PACKAGE DIMENSIONS – CONTINUED
SURFACE MOUNT



NOTES

NOTES

MPX5050 MPXV5050G SERIES

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