

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

The MPVZ5050G 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

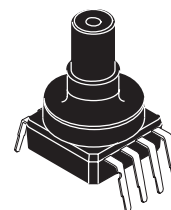
- 2.5% Maximum Error over 0° to 85°C
- Ideally suited for Microprocessor or Microcontroller-Based Systems
- Temperature Compensated Over -40° to +125°C
- Patented Silicon Shear Stress Strain Gauge

| ORDERING INFORMATION | | | | | |
|--|------------|----------|----------------------|-----------------|----------------|
| Device Type | Options | Case No. | MPX Series Order No. | Packing Options | Device Marking |
| SMALL OUTLINE PACKAGE (MPVZ5050G SERIES) | | | | | |
| Ported Elements | Axial Port | 1560 | MPVZ5050GW7U | Rails | MZ5050GW |

MPVZ5050G SERIES

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

SMALL OUTLINE PACKAGE



**MPVZ5050GW7U
CASE 1560-02**

SMALL OUTLINE PACKAGE 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.

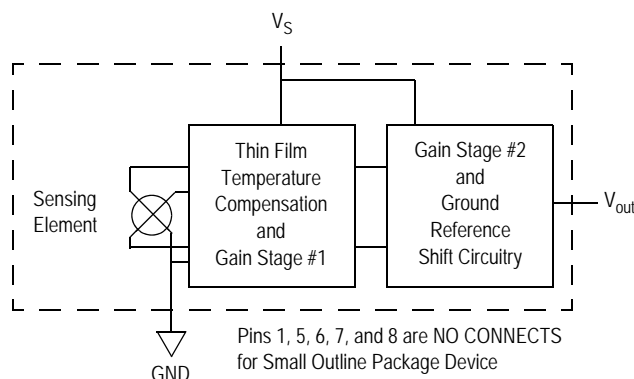


Figure 1. Fully Integrated Pressure Sensor Schematic

Table 1. Maximum Ratings⁽¹⁾

| Rating | 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 |

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. 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 | mAdc |
| Minimum Pressure Offset ⁽³⁾ @ V _S = 5.0 Volts | V _{off} | 0.088 | 0.2 | 0.313 | Vdc |
| Full Scale Output ⁽⁴⁾ @ V _S = 5.0 Volts | V _{FSO} | 4.587 | 4.7 | 4.813 | Vdc |
| Full Scale Span ⁽⁵⁾ @ V _S = 5.0 Volts | V _{FSS} | — | 4.5 | — | 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} |

1. 1.0 kPa (kiloPascal) equals 0.145 psi.
2. Device is ratiometric within this specified excitation range.
3. Offset (V_{off}) is defined as the output voltage at the minimum rated pressure.
4. Full Scale Output (V_{FSO}) is defined as the output voltage at the maximum or full rated pressure.
5. 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.
6. 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.
 - 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.
7. 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.
8. Warm-up Time is defined as the time required for the product to meet the specified output voltage after the Pressure has been stabilized.
9. Offset Stability is the product's output deviation when subjected to 1000 hours of Pulsed Pressure, Temperature Cycling with Bias Test.

Figure 3 illustrates the Differential/Gauge Sensing Chip in the basic chip carrier (Case 482A). 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 MPVZ5050G 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.

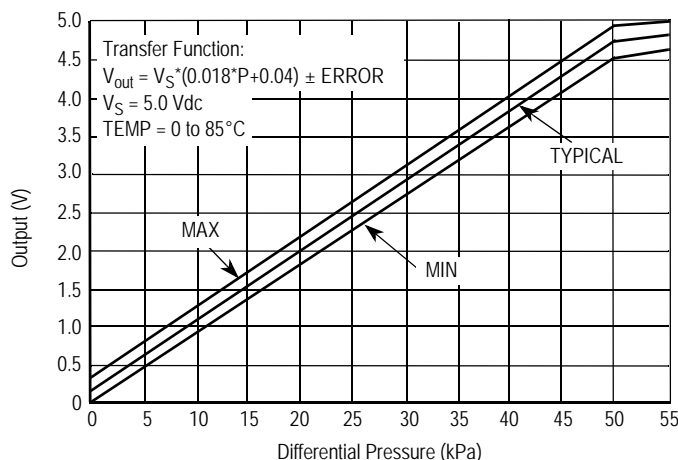


Figure 2. Output versus Pressure Differential

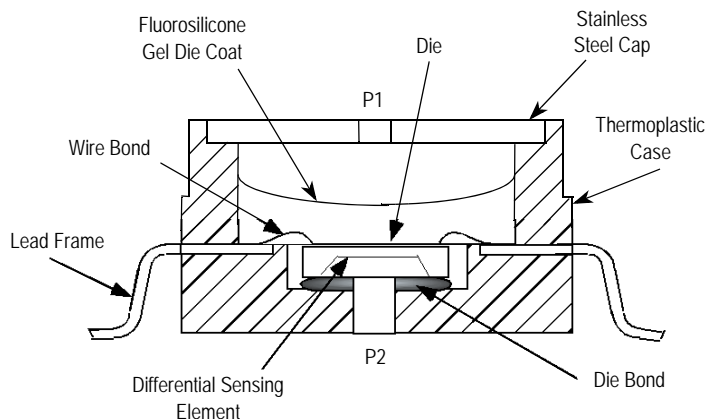


Figure 3. Cross-Sectional Diagram (not to scale)

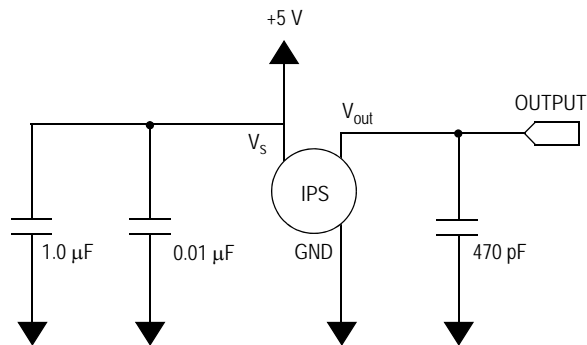


Figure 4. Recommended Power Supply Decoupling and Output Filtering

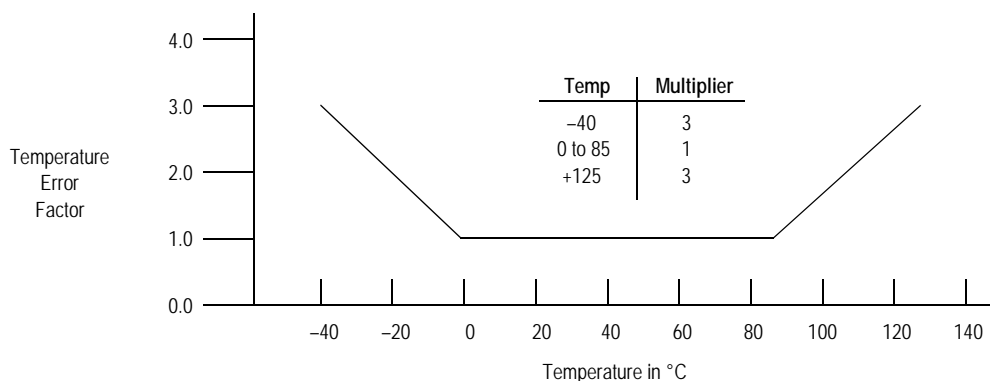
(For additional output filtering, please refer to Application Note AN1646.)

Transfer Function

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

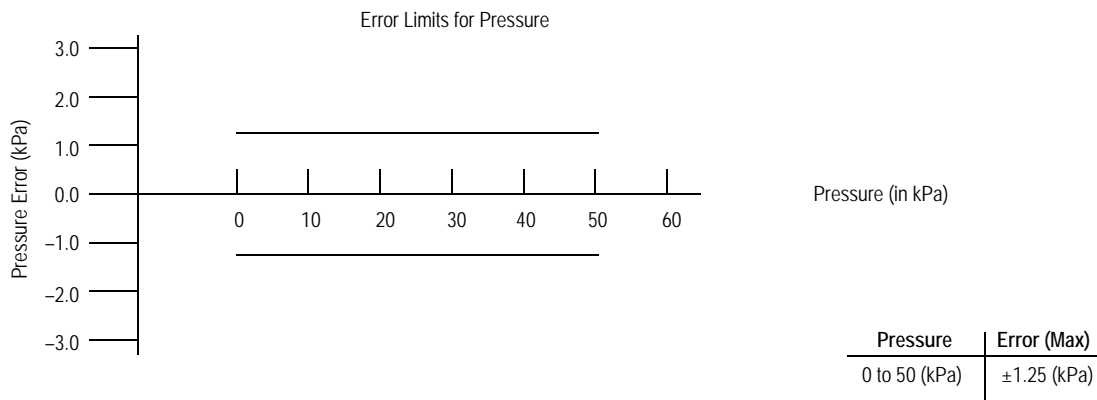
Temperature Error Band

MPVZ5050G SERIES



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

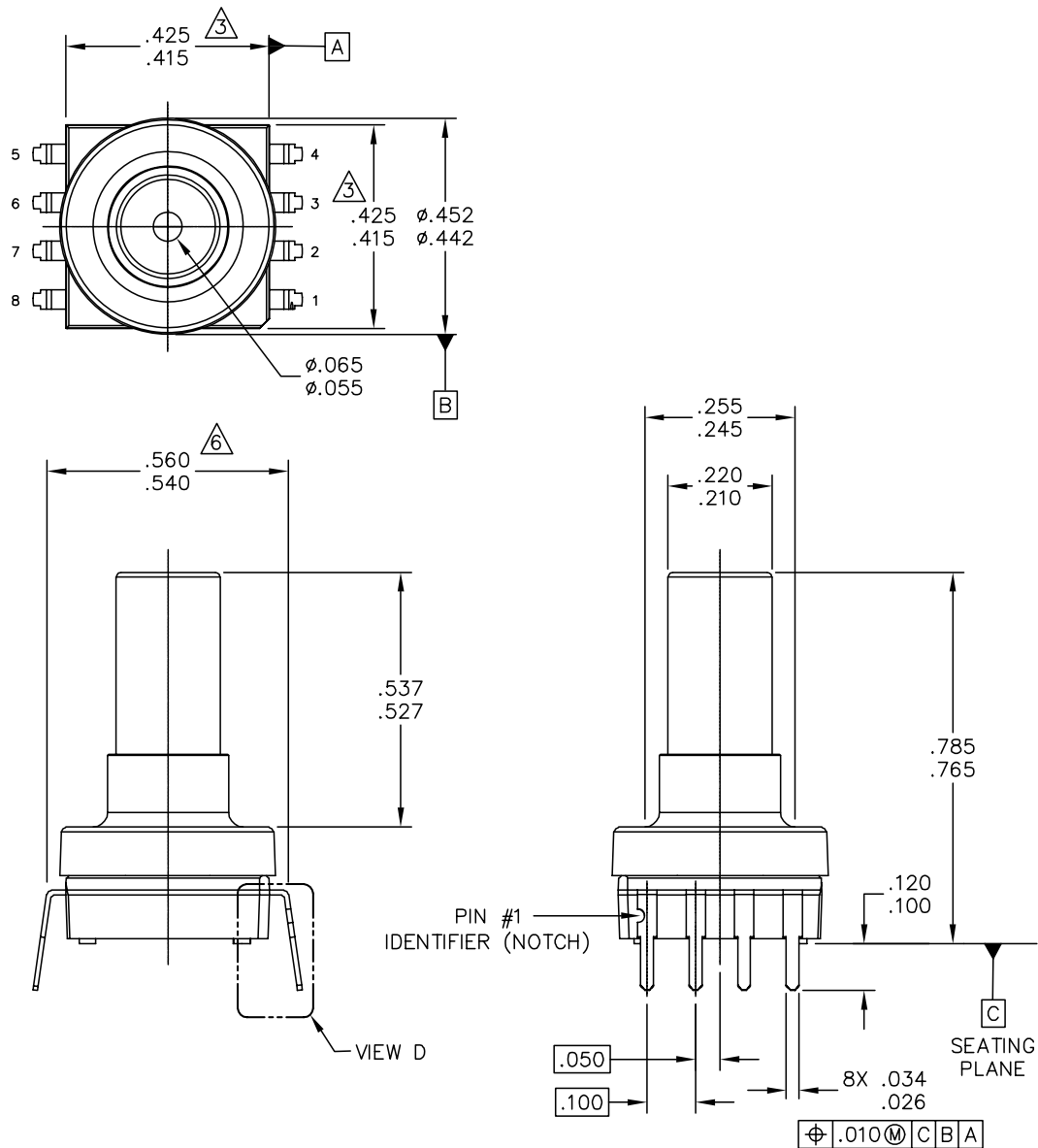
Freescle designates the two sides of the pressure sensor as the Pressure (P1) side and the Vacuum (P2) side. The Pressure (P1) side is the side containing fluorosilicone gel which protects the die from harsh media. The MPX pressure

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 |
|--------------|-----------|-------------------------------|
| MPVZ5050GW7U | 1560-02 | Vertical Port Attached |

PACKAGE DIMENSIONS



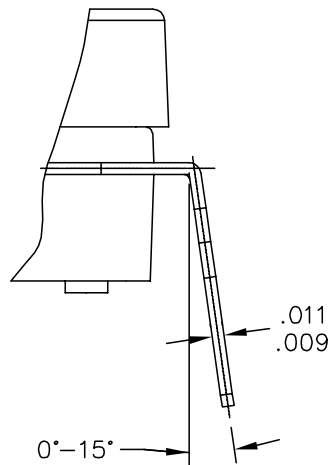
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| TITLE: SO, 8 I/O, .420 X .420 PKG, .100 IN PITCH | DOCUMENT NO: 98ASA10611D | REV: C |
| | CASE NUMBER: 1560-02 | 26 MAY 2005 |
| | STANDARD: NON-JEDEC | |

PAGE 1 OF 3

**CASE 1560-02
ISSUE C
SMALL OUTLINE PACKAGE**

MPVZ5050

PACKAGE DIMENSIONS



VIEW D

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CASE 1560-02
ISSUE C
SMALL OUTLINE PACKAGE

PACKAGE DIMENSIONS

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M – 1994.
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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PAGE 3 OF 3

**CASE 1560-02
ISSUE C
SMALL OUTLINE PACKAGE**

MPVZ5050

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