Freescale Semiconductor
Technical Data

Document Number: MPVZ5150
Rev 0, 11/2006

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

MPVZ5150 SERIES

INTEGRATED PRESSURE SENSOR
0 to 150 kPa (0 to 21.75 PSI)
0.2 to 4.7 V Output

The MPVZ5150 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.

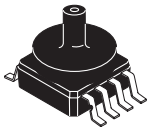
Features

- 2.5% Maximum Error over 0° to 85°C
- Ideally suited for Microprocessor or Microcontroller-Based Systems
- Patented Silicon Shear Stress Strain Gauge
- Easy-to-Use Chip Carrier Option
- Increased media compatibility fluorocarbon gel

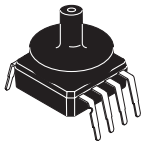
Typical Applications

- Level Indicators
- Process Control
- Pump/Motor Control
- Pressure Switching

SMALL OUTLINE PACKAGES



MPVZ5150GC6T1
CASE 482A-01



MPVZ5150GC7U
CASE 482C-03

PIN NUMBER(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. Pin1 is noted by the notch in the lead.

ORDERING INFORMATION				
Device Type	**Options**	**Case No.**	**MPX Series Order Number**	**Device Marking**
MPVZ5150 SERIES				
Ported Elements	Gauge, Axial Port, SMT	482A	MPVZ5150GC6T1	MPVZ5150G
	Gauge, Axial Port, DIP	482C	MPVZ5150GC7U	MPVZ5150G

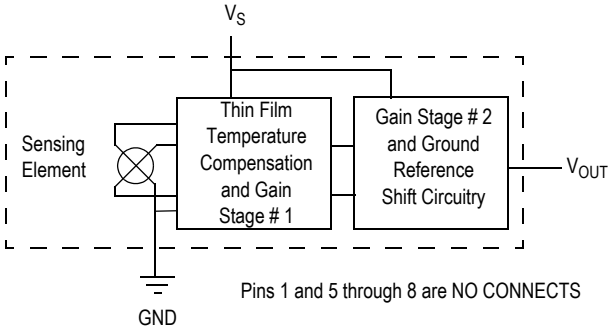


Figure 1. Fully Integrated Pressure Sensor Schematic

TABLE 1. Maximum Ratings(1)

Rating	Symbol	Value	Unit
Maximum Pressure (P1 > P2)	P_{MAX}	400	kPa
Storage Temperature	T_{STG}	-40° to +125°C	°C
Operating Temperature	T_A	-40° to +125°C	°C

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

TABLE 2. Operating Characteristics (V_S = 5.0 V_{DC}, 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	—	150	kPa
Supply Voltage(2)		V_S	4.75	5.0	5.25	V_{DC}
Supply Current		I_O	—	7.0	10	mAdc
Minimum Pressure Offset(3) @ V_S = 5.0 V	(0 to 85°C)	V_{OFF}	0.088	0.200	0.313	V_{DC}
Full Scale Output(4) @ V_S = 5.0 V	Differential and Absolute (0 to 85°C)	V_{FSO}	4.588	4.700	4.813	V_{DC}
Full Scale Span(5) @ V_S = 5.0 V	Differential and Absolute (0 to 85°C)	V_{FSS}	—	4.500	—	V_{DC}
Accuracy(6)		—	—	—	±2.5	$\%V_{FSS}$
Sensitivity		V/P	—	30	—	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 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 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 changed 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.

ON-CHIP TEMPERATURE COMPENSATION, CALIBRATION AND SIGNAL CONDITIONING

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 3 illustrates the Differential or Gauge configuration in the basic chip carrier (Case 482). A gel isolates the die surface and wire bonds from the environment, while allowing the pressure signal to be transmitted to the silicon diaphragm. Operating characteristics, internal reliability and qualification tests are based on use of dry clean air as the pressure media. Media other than dry clean air may have adverse effects on sensor performance and long term reliability. Contact the factory for information regarding media compatibility in your application.

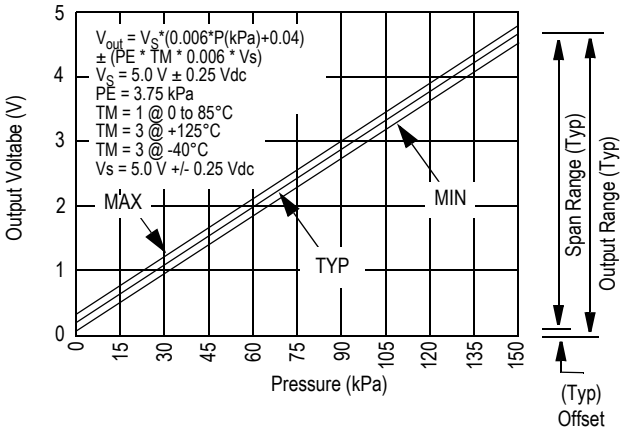


Figure 2. Output Vs. Pressure Differential

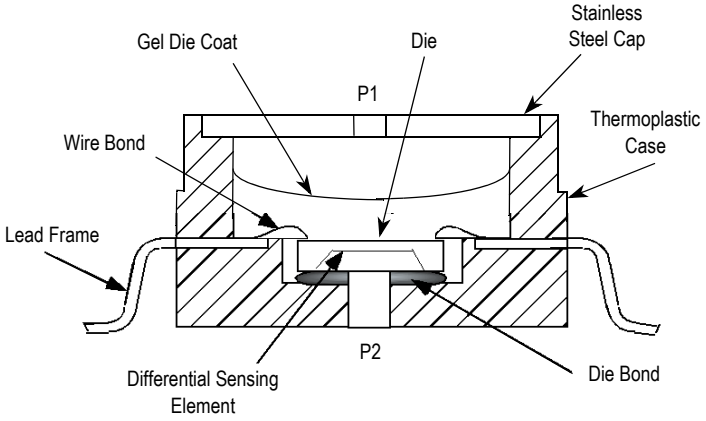


Figure 3. Cross Sectional Diagrams (Not to Scale)

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.

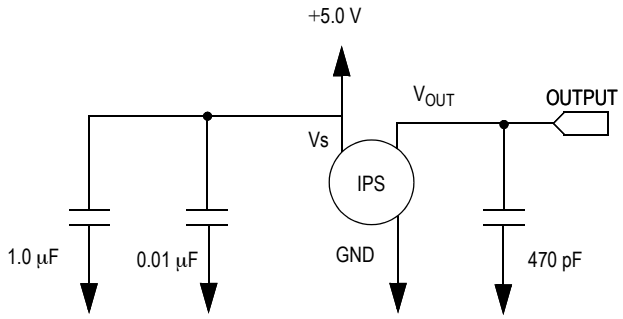


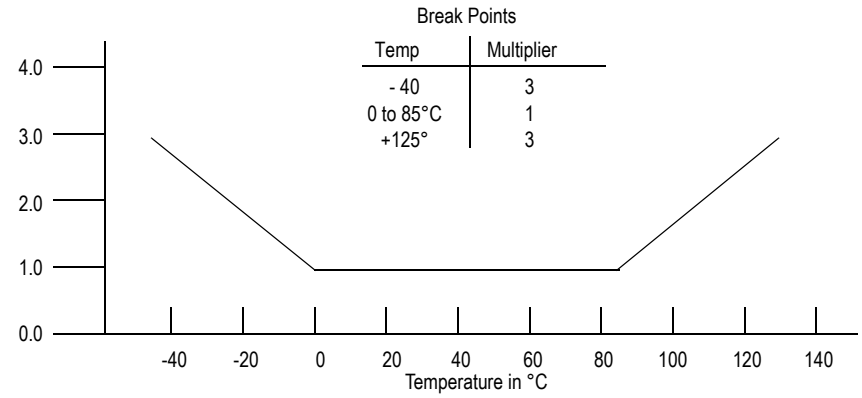
Figure 4. Recommended Power Supply Decoupling and Output Filtering
(For additional output filtering, please refer to Application Note AN1646)

Transfer Function (MPVZ5150 Series)

Nominal Transfer Value: $V_{OUT} = V_S \times (0.006 \times P(kPa) + 0.04)$
$\pm$ (Pressure Error x Temp. Mult. x 0.006 x V_S)
$V_S = 5.0\ V \pm 0.25\ Vdc$

Temperature Error Multiplier

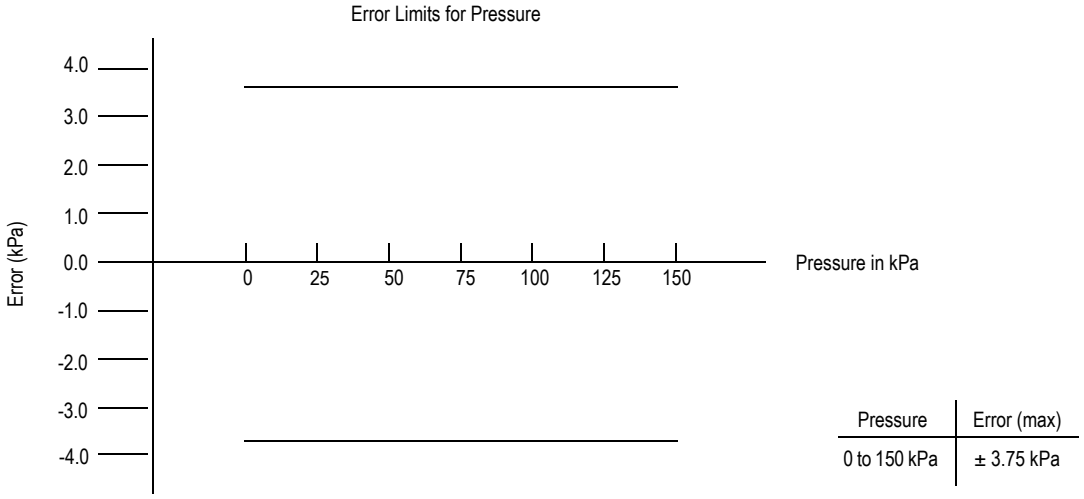
MPVZ5150 Series



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

Pressure Error Band

MPVZ5150 Series



Pressure	Error (max)
0 to 150 kPa	± 3.75 kPa

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 fluorocarbon 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 Table 3 below.

TABLE 3. PRESSURE (P1)/VACUUM (P2) SIDE IDENTIFICATION TABLE

Part Number	Case Type	Pressure (P1) Side Identifier
MPVZ5150GC6T1	482A	Top with Port Attached
MPVZ5150GC7U	482C	Top with Port Attached

INFORMATION FOR USING THE SMALL OUTLINE PACKAGE

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.

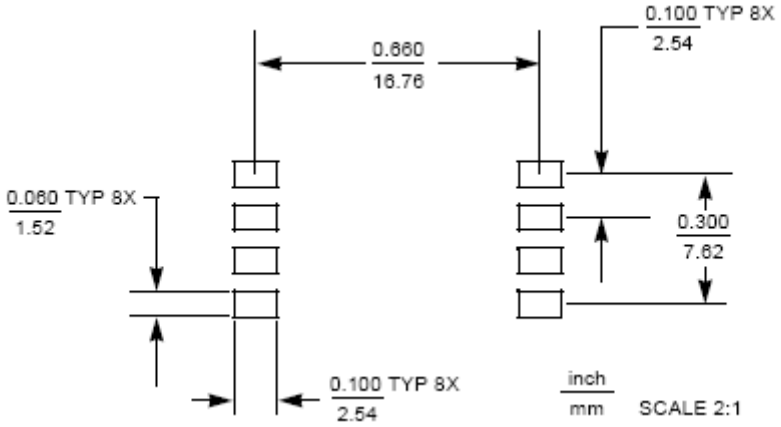
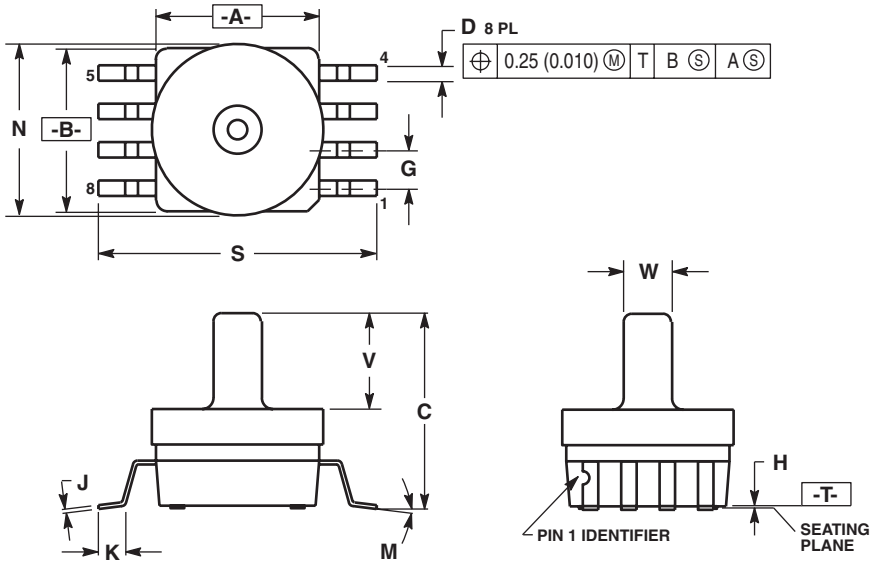


Figure 5. Small Outline Package Footprint

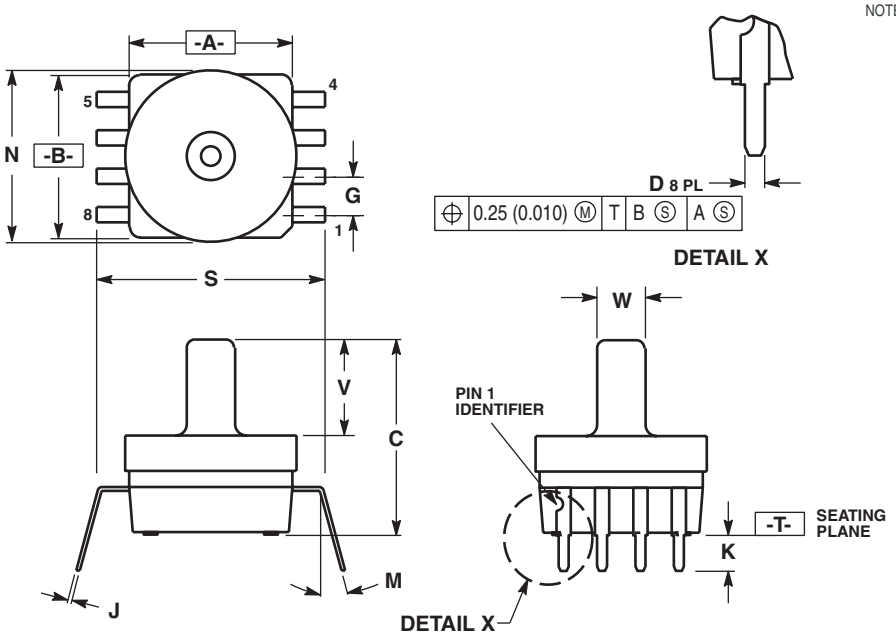
PACKAGE DIMENSIONS



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	0.500	0.520	12.70	13.21
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	0.444	0.448	11.28	11.38
S	0.709	0.725	18.01	18.41
V	0.245	0.255	6.22	6.48
W	0.115	0.125	2.92	3.17

CASE 482A-01
ISSUE A
SMALL OUTLINE PACKAGE



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4. MAXIMUM MOLD PROTRUSION 0.15 (0.006).
5. ALL VERTICAL SURFACES 5˚ TYPICAL DRAFT.
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	0.500	0.520	12.70	13.21
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	0.444	0.448	11.28	11.38
S	0.540	0.560	13.72	14.22
V	0.245	0.255	6.22	6.48
W	0.115	0.125	2.92	3.17

CASE 482C-03
ISSUE B
SMALL OUTLINE PACKAGE

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11/2006

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