

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

The MPX5100 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
- Available in Absolute, Differential and Gauge Configurations
- Durable Epoxy Unibody Element
- Easy-to-Use Chip Carrier Option

## Typical Applications

- Patient Monitoring
- Process Control
- Pump/Motor Control
- Pressure Switching

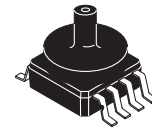
## ORDERING INFORMATION

Device Type	Options	Case No.	MPX Series Order Number	Device Marking
UNIBODY PACKAGE (MPX5100 SERIES)				
Basic Elements	Absolute	867	MPX5100A	MPX5100A
	Differential	867	MPX5100D	MPX5100D
Ported Elements	Differential Dual Ports	867C	MPX5100DP	MPX5100DP
	Absolute, Single Port	867B	MPX5100AP	MPX5100AP
	Gauge, Single Port	867B	MPX5100GP	MPX5100GP
	Gauge, Axial PC Mount	867F	MPX5100GSX	MPX5100D
	Gauge, Axial Port, SMT	482A	MPXV5100GC6U	MPXV5100G
	Gauge, Axial Port, DIP	482C	MPXV5100GC7U	MPXV5100G
	Gauge, Dual Port, SMT	1351	MPXV5100DP	MPXV5100
Gauge, Side Port, SMT	1369	MPXV5100GP	MPXV5100G	

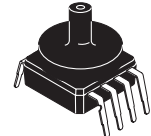
## MPX5100/MPXV5100 SERIES

INTEGRATED PRESSURE SENSOR  
0 to 100 kpa (0 to 14.5 psi)  
15 to 115 kPa  
(2.2 to 16.7 psi)  
0.2 to 4.7 V Output

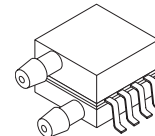
## SMALL OUTLINE PACKAGES



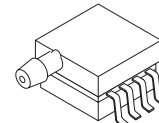
MPXV5100GC6U  
CASE 482A-01



MPXV5100GC7U  
CASE 482C-03



MPXV5100DP  
CASE 1351-01



MPXV5100GP  
CASE 1369-01

## PIN NUMBER<sup>(1)</sup>

1	N/C	5	N/C
2	V <sub>S</sub>	6	N/C
3	GND	7	N/C
4	V <sub>OUT</sub>	8	N/C

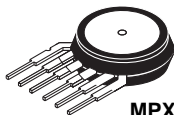
1. Pins 1, 5, 6, 7, and 8 are internal device connections. Do not connect to external circuitry or ground. Pin1 is noted by the notch in the lead.

## PIN NUMBER<sup>(1)</sup>

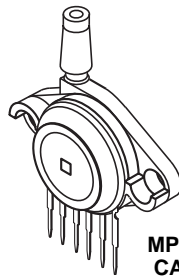
1	V <sub>OUT</sub>	4	N/C
2	GND	5	N/C
3	V <sub>S</sub>	6	N/C

1. 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.

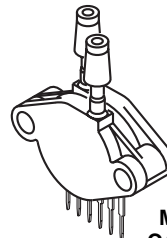
## UNIBODY PACKAGES



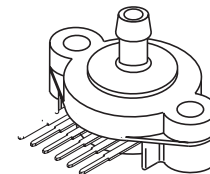
MPX5100A/D  
CASE 867-08



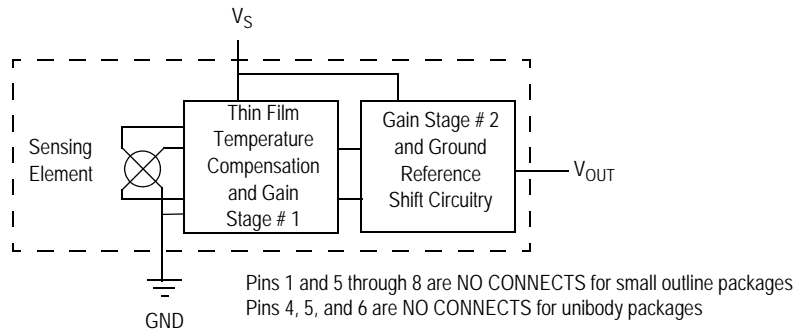
MPX5100AP/GP  
CASE 867B-04



MPX5100DP  
CASE 867C-05



MPX5100GSX  
CASE 867F-03



**Figure 1. Fully Integrated Pressure Sensor Schematic**

**TABLE 1. Maximum Ratings<sup>(1)</sup>**

Rating	Symbol	Value	Unit
Maximum Pressure (P1 > P2)	P <sub>MAX</sub>	400	kPa
Storage Temperature	T <sub>STG</sub>	-40° to +125°C	°C
Operating Temperature	T <sub>A</sub>	-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<sub>S</sub> = 5.0 V<sub>DC</sub>, T<sub>A</sub> = 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 <sup>(1)</sup> Gauge, Differential: MPX5100D/MPX5100G/MPXV5100G Absolute: MPX5100A	P <sub>OP</sub>	0 15	— —	100 115	kPa
Supply Voltage <sup>(2)</sup>	V <sub>S</sub>	4.75	5.0	5.25	V <sub>DC</sub>
Supply Current	I <sub>O</sub>	—	7.0	10	mAdc
Minimum Pressure Offset <sup>(3)</sup> @ V <sub>S</sub> = 5.0 V	V <sub>OFF</sub>	0.088	0.20	0.313	V <sub>DC</sub>
Full Scale Output <sup>(4)</sup> @ V <sub>S</sub> = 5.0 V	V <sub>FSO</sub>	4.587	4.700	4.813	V <sub>DC</sub>
Full Scale Span <sup>(5)</sup> @ V <sub>S</sub> = 5.0 V	V <sub>FSS</sub>	—	4.500	—	V <sub>DC</sub>
Accuracy <sup>(6)</sup>	—	—	—	±2.5	%V <sub>FSS</sub>
Sensitivity	V/P	—	45	—	mV/kPa
Response Time <sup>(7)</sup>	t <sub>R</sub>	—	1.0	—	ms
Output Source Current at Full Scale Output	I <sub>O+</sub>	—	0.1	—	mAdc
Warm-Up Time <sup>(8)</sup>	—	—	20	—	ms
Offset Stability <sup>(9)</sup>	—	—	±0.5	—	%V <sub>FSS</sub>

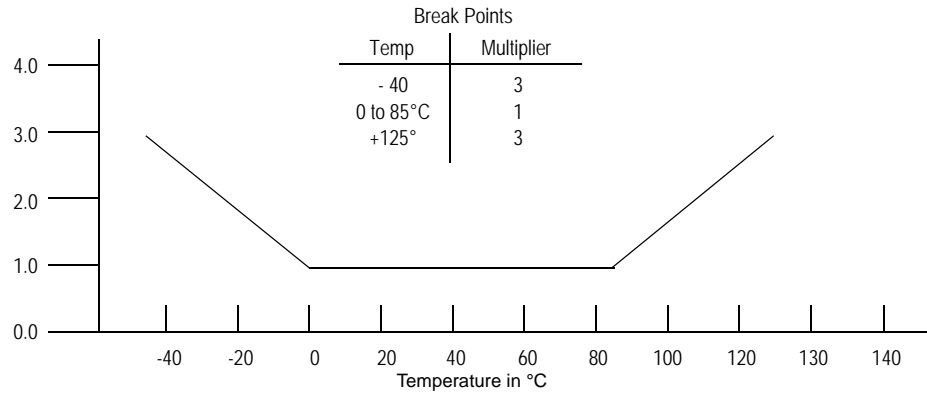
- 1 kPa (kiloPascal) equals 0.145 psi.
- Device is ratiometric within this specified excitation range.
- Offset (V<sub>OFF</sub>) is defined as the output voltage at the minimum rated pressure.
- Full Scale Output (V<sub>FSO</sub>) is defined as the output voltage at the maximum or full rated pressure.
- Full Scale Span (V<sub>FSS</sub>) 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<sub>FSS</sub> at 25°C.

### Transfer Function (MPX5100A)

**Nominal Transfer Value:**  $V_{OUT} = V_S (P \times 0.009 + 0.095)$   
 $\pm (\text{Pressure Error} \times \text{Temp. Mult.} \times 0.009 \times V_S)$   
 $V_S = 5.0 \text{ V} \pm 5\% \text{ P kPa}$

### Temperature Error Multiplier

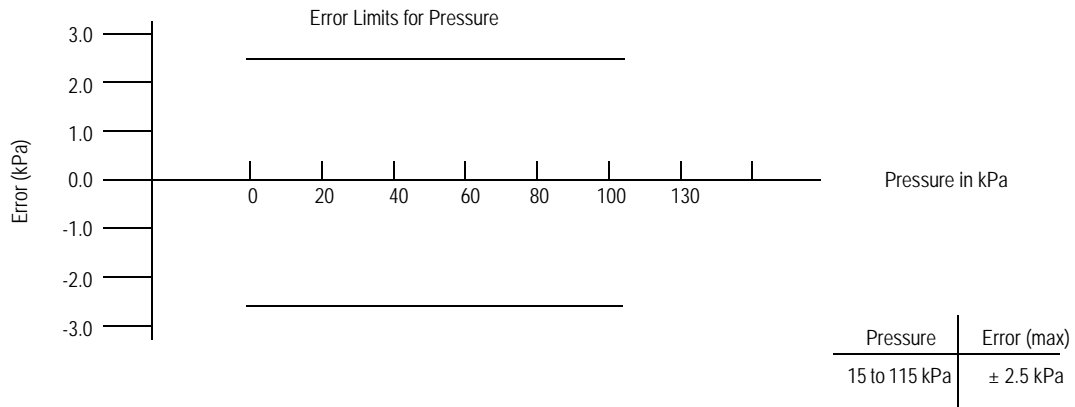
#### MPX5100A Series



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

### Pressure Error Band

#### MPX5100A Series



## 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 fluoro silicone 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
MPX5100A, MPX5100D	867	Stainless Steel Cap
MPX5100DP	867C	Side with Part Marking
MPX5100AP, MPX5100GP	867B	Side with Port Attached
MPX5100GSX	867F	Side with Port Attached
MPXV5100GC6U	482A	Side with Port Attached
MPXV5100GC7U	482C	Side with Port Attached
MPXV5100DP	1351	Side with Part Marking
MPXV5100GP	1369	Side with Port Attached