

# Freescale Semiconductor

MPX4080D  
Rev 4, 1/2009

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

### MPX4080D Series

0 to 80 kPa (0 to 11.6 psi)  
0.6 to 4.9 V Output

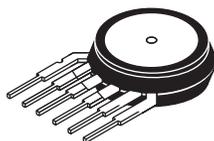
The MPX4080D series piezoresistive transducer is a state-of-the-art monolithic silicon pressure sensor designed for a wide range of applications, but particularly those employing a microcontroller or microprocessor with A/D inputs. This patented, single element transducer combines advanced micromachining techniques, thin-film metallization, and bipolar processing to provide an accurate, high level analog output signal that is proportional to the applied pressure.

### Features

- 3.0% Maximum Error over 0° to 85°C
- Ideally suited for Microprocessor or Microcontroller-Based Systems
- Temperature Compensated from -40° to 105°C
- Easy-to-Use, Durable Epoxy Unibody Package

ORDERING INFORMATION									
Device Name	Package Options	Case No.	# of Ports			Pressure Type			Device Marking
			None	Single	Dual	Gauge	Differential	Absolute	
MPX4080D	Tray	867	•				•		MPX4080D

### UNIBODY PACKAGE



MPX4080D  
CASE 867-08

## Operating Characteristics

**Table 1. Operating Characteristics** ( $V_S = 5.1$  Vdc,  $T_A = 25^\circ\text{C}$  unless otherwise noted,  $P_1 > P_2$ . Decoupling circuit shown in Figure 4 required to meet electrical specifications.)

Characteristic	Symbol	Min	Typ	Max	Unit
Pressure Range <sup>(1)</sup>	$P_{OP}$	0	—	80	kPa
Supply Voltage <sup>(2)</sup>	$V_S$	4.85	5.1	5.35	Vdc
Supply Current	$I_o$	—	7.0	10	mAdc
Minimum Pressure Offset <sup>(3)</sup> (0 to 85°C) @ $V_S = 5.1$ V	$V_{off}$	0.478	0.575	0.672	Vdc
Full Scale Output <sup>(4)</sup> (0 to 85°C) @ $V_S = 5.1$ V	$V_{FSO}$	4.772	4.900	5.020	Vdc
Full Scale Span <sup>(5)</sup> (0 to 85°C) @ $V_S = 5.1$ V	$V_{FSS}$	—	4.325	—	Vdc
Accuracy	—	—	—	3.0	% $V_{FSS}$
Sensitivity	V/P	—	54	—	mV/kPa

- 1 kPa (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 ( $V_{FSO}$ ) 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.

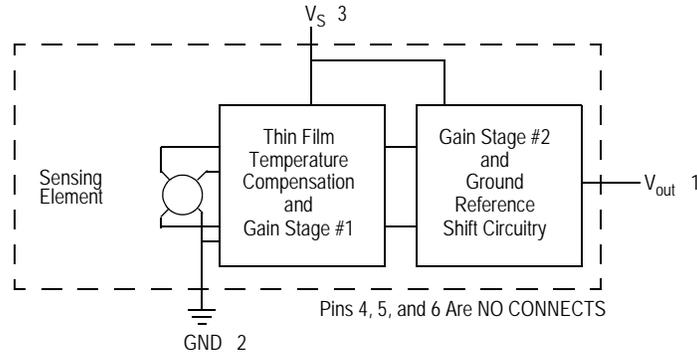
## Maximum Ratings

**Table 2. Maximum Ratings (1)**

Rating	Symbol	Value	Unit
Maximum Pressure (P1 > P2)	$P_{max}$	400	kPa
Operating Temperature	$T_A$	-40 to +105	°C
Storage Temperature	$T_{stg}$	-40 to +125	°C

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

Figure 1 shows a block diagram of the internal circuitry integrated on a pressure sensor chip.



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

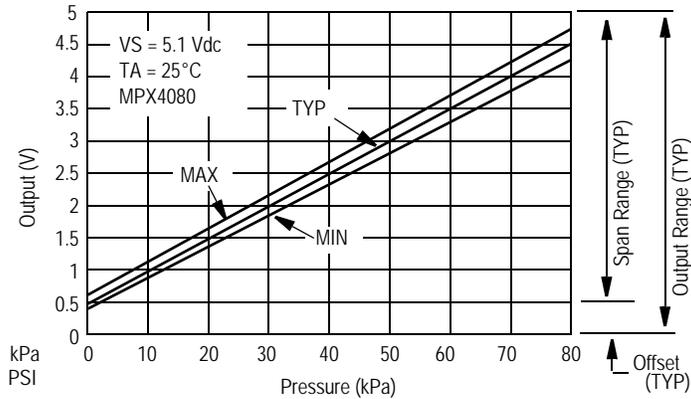
## On-Chip Temperature Compensation and Calibration

Figure 2 shows the sensor output signal relative to differential 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.

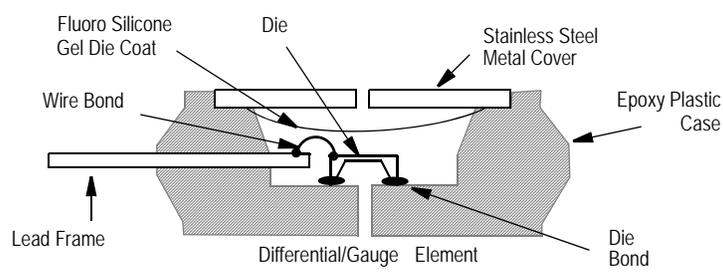
Figure 3 illustrates the differential sensing chip in the basic chip carrier (Case 867). A fluorosilicone gel isolates the die surface and wire bonds from the environment, while allowing the pressure signal to be transmitted to the sensor diaphragm.

The MPX4080D pressure sensor operating characteristics, 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.

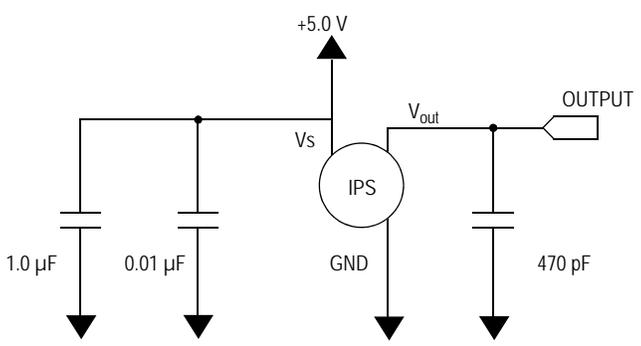
Figure 4 shows the recommended decoupling circuit for interfacing the output of the integrated sensor to the A/D input of a microprocessor or microcontroller. Proper decoupling of the power supply is recommended.



**Figure 2. Output versus Pressure Differential**



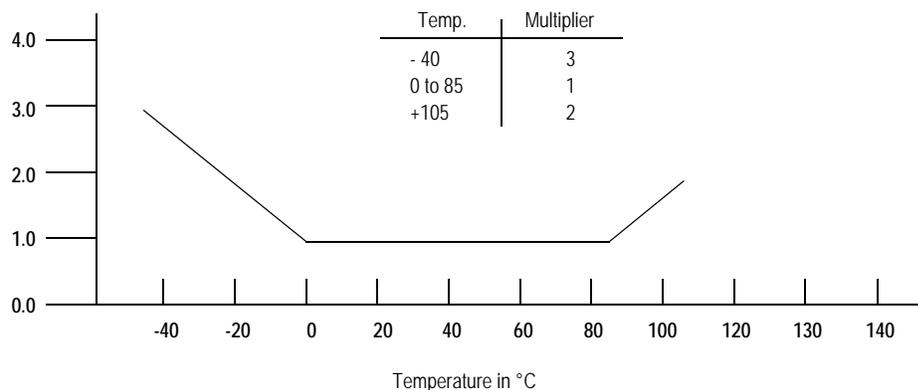
**Figure 3. Cross-Sectional Diagrams (not to scale)**



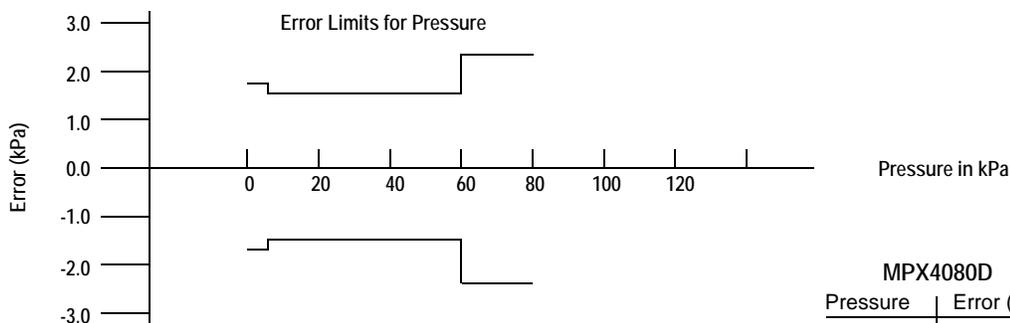
**Figure 4. Recommended Power Supply Decoupling and Output Filter**  
(For additional output filtering information, refer to Application Note AN1646.)

**Transfer Function (MPX4080D)**

**Nominal Transfer Value:**  $V_{out} = V_S (P \times 0.01059 + 0.11280)$   
 $\pm (\text{Pressure Error} \times \text{Temp. Mult.} \times 0.01059 \times V_S)$   
 $V_S = 5.1 \text{ V} \pm 0.25 \text{ V}_{DC}$

**Temperature Error Multiplier**
**MPX4080D**


NOTE: The Temperature Multiplier is a linear response from 0° to -40°C and from 85° to 105°C.

**Pressure Error Band**


MPX4080D	
Pressure	Error (max)
0 to 6 kPa	± 1.8 kPa
0 to 60 kPa	± 1.5 kPa
60 to 80 kPa	± 2.3 kPa

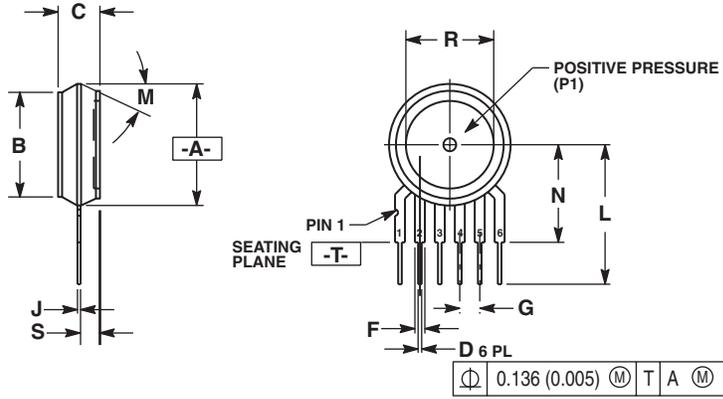
**PRESSURE (P1)/VACUUM (P2) SIDE IDENTIFICATION TABLE**

The two sides of the pressure sensor are designated 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 pressure

sensor is designed to operate with positive differential pressure applied,  $P1 > P2$ .

The Pressure (P1) side is identified by the stainless steel cap.

### PACKAGE DIMENSIONS



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION -A- IS INCLUSIVE OF THE MOLD STOP RING. MOLD STOP RING NOT TO EXCEED 16.00 (0.630).

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.595	0.630	15.11	16.00
B	0.514	0.534	13.06	13.56
C	0.200	0.220	5.08	5.59
D	0.027	0.033	0.68	0.84
F	0.048	0.064	1.22	1.63
G	0.100 BSC		2.54 BSC	
J	0.014	0.016	0.36	0.40
L	0.695	0.725	17.65	18.42
M	30° NOM		30° NOM	
N	0.475	0.495	12.07	12.57
R	0.430	0.450	10.92	11.43
S	0.090	0.105	2.29	2.66

- STYLE 1:  
 PIN 1. VOUT  
 2. GROUND  
 3. VCC  
 4. V1  
 5. V2  
 6. VEX

**CASE 867-08  
 ISSUE N  
 BASIC ELEMENT**

## **How to Reach Us:**

### **Home Page:**

[www.freescale.com](http://www.freescale.com)

### **Web Support:**

<http://www.freescale.com/support>

### **USA/Europe or Locations Not Listed:**

Freescale Semiconductor, Inc.  
Technical Information Center, EL516  
2100 East Elliot Road  
Tempe, Arizona 85284  
1-800-521-6274 or +1-480-768-2130  
[www.freescale.com/support](http://www.freescale.com/support)

### **Europe, Middle East, and Africa:**

Freescale Halbleiter Deutschland GmbH  
Technical Information Center  
Schatzbogen 7  
81829 Muenchen, Germany  
+44 1296 380 456 (English)  
+46 8 52200080 (English)  
+49 89 92103 559 (German)  
+33 1 69 35 48 48 (French)  
[www.freescale.com/support](http://www.freescale.com/support)

### **Japan:**

Freescale Semiconductor Japan Ltd.  
Headquarters  
ARCO Tower 15F  
1-8-1, Shimo-Meguro, Meguro-ku,  
Tokyo 153-0064  
Japan  
0120 191014 or +81 3 5437 9125  
[support.japan@freescale.com](mailto:support.japan@freescale.com)

### **Asia/Pacific:**

Freescale Semiconductor China Ltd.  
Exchange Building 23F  
No. 118 Jianguo Road  
Chaoyang District  
Beijing 100022  
China  
+86 010 5879 8000  
[support.asia@freescale.com](mailto:support.asia@freescale.com)

### **For Literature Requests Only:**

Freescale Semiconductor Literature Distribution Center  
P.O. Box 5405  
Denver, Colorado 80217  
1-800-441-2447 or +1-303-675-2140  
Fax: +1-303-675-2150  
[LDCForFreescaleSemiconductor@hibbertgroup.com](mailto:LDCForFreescaleSemiconductor@hibbertgroup.com)

Information in this document is provided solely to enable system and software implementers to use Freescale Semiconductor products. There are no express or implied copyright licenses granted hereunder to design or fabricate any integrated circuits or integrated circuits based on the information in this document.

Freescale Semiconductor reserves the right to make changes without further notice to any products herein. Freescale Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Freescale Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters that may be provided in Freescale Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals", must be validated for each customer application by customer's technical experts. Freescale Semiconductor does not convey any license under its patent rights nor the rights of others. Freescale Semiconductor products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Freescale Semiconductor product could create a situation where personal injury or death may occur. Should Buyer purchase or use Freescale Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold Freescale Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Freescale Semiconductor was negligent regarding the design or manufacture of the part.

Freescale™ and the Freescale logo are trademarks of Freescale Semiconductor, Inc. All other product or service names are the property of their respective owners.

© Freescale Semiconductor, Inc. 2009. All rights reserved.