Freescale Semiconductor

MPXM2051G
Rev 2, 10/2009

50 kPa On-Chip Temperature Compensated and Calibrated Silicon Pressure Sensors

MPXM2051G Series

0 to 50 kPa (0 to 7.25 psi)
40 mV Full Scale Span
(Typical)

The MPXM2051G device is a silicon piezoresistive pressure sensor providing a highly accurate and linear voltage output - directly proportional to the applied pressure. The sensor is a single, monolithic silicon diaphragm with the strain gauge and a thin-film resistor network integrated on-chip. The chip is laser trimmed for precise span and offset calibration and temperature compensation.

Features

- Temperature Compensated Over 0°C to +85°C
- Available in Easy-to-Use Tape & Reel
- Ratiometric to Supply Voltage
- Gauge Ported

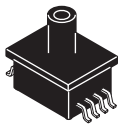
Application Examples

- Pump/Motor Controllers
- Robotics
- Level Indicators
- Medical Diagnostics
- Pressure Switching
- Non-Invasive Blood Pressure Measurement

ORDERING INFORMATION

Device Name	Case No.	# of Ports			Pressure Type			Device Marking
		None	Single	Dual	Gauge	Differential	Absolute	
MPAK Package (MPXM2051 Series)								
MPXM2051GS	1320A		•		•			MPXM2051GS
MPXM2051GST1	1320A		•		•			MPXM2051GS

MPAK PACKAGE



MPXM2051GS/GST1
CASE 1320

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Operating Characteristics

Table 1. Operating Characteristics (V_S = 10 Vdc, T_A = 25°C.)

Characteristic	Symbol	Min	Typ	Max	Unit
Pressure Range[1]	P_{OP}	0	—	50	kPa
Supply Voltage[2]	V_S	—	10	16	Vdc
Supply Current	I_o	—	6.0	—	mAdc
Full Scale Span[3]	V_{FSS}	38.5	40	41.5	mV
Offset[4]	V_{off}	-1.0	—	1.0	mV
Sensitivity	$\Delta V/\Delta P$	—	0.8	—	mV/kPa
Linearity	—	-0.3	—	0.3	$\%V_{FSS}$
Pressure Hysteresis(0 to 50 kPa)	—	—	±0.1	—	$\%V_{FSS}$
Temperature Hysteresis (-40°C to +125°C)	—	—	±0.5	—	$\%V_{FSS}$
Temperature Effect on Full Scale Span	TCV_{FSS}	-1.0	—	1.0	$\%V_{FSS}$
Temperature Effect on Offset	TCV_{off}	-1.0	—	1.0	mV
Input Impedance	Z_{in}	1000	—	2500	Ω
Output Impedance	Z_{out}	1400	—	3000	Ω
Response Time[5] (10% to 90%)	t_R	—	1.0	—	ms
Warm-Up	—	—	20	—	ms
Offset Stability[6]	—	—	±0.5	—	$\%V_{FSS}$

1. 1.0 kPa (kiloPascal) equals 0.145 psi.
2. Device is ratiometric within this specified excitation range. Operating the device above the specified excitation range may induce additional error due to device self-heating.
3. 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.
4. Offset (V_{off}) is defined as the output voltage at the minimum rated pressure.
5. 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.
6. Offset stability is the product's output deviation when subjected to 1000 hours of Pulsed Pressure, Temperature Cycling with Bias Test.

Maximum Ratings

Table 2. Maximum Ratings(1)

Rating	Symbol	Value	Unit
Maximum Pressure	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.

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

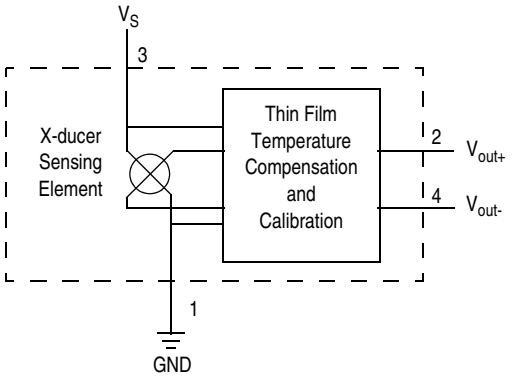


Figure 1. Temperature Compensated Pressure Sensor Schematic

Voltage Output versus Applied Differential Pressure

The differential voltage output of the sensor is directly proportional to the differential pressure applied.

The output voltage of the differential or gauge sensor increases with increasing pressure applied to the pressure side relative to the vacuum side. Similarly, output voltage increases as increasing vacuum is applied to the vacuum side relative to the pressure side.

On-chip Temperature Compensation and Calibration

Figure 2 shows the minimum, maximum and typical output characteristics of the MPXM2051G series at 25°C. The output is directly proportional to the differential pressure and is essentially a straight line.

A silicone gel isolates the die surface and wire bonds from the environment, while allowing the pressure signal to be transmitted to the silicon diaphragm.

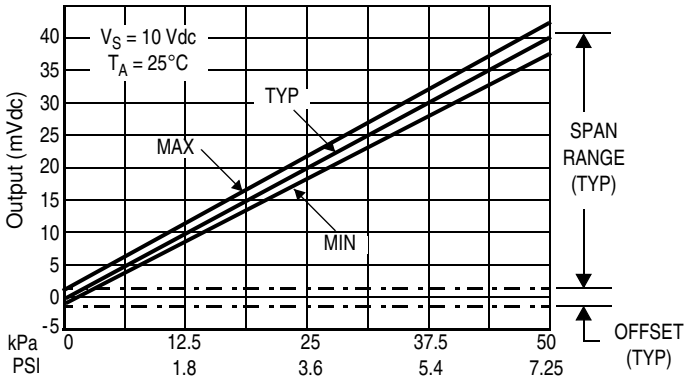


Figure 2. Output vs. Pressure Differential

LINEARITY

Linearity refers to how well a transducer's output follows the equation: $V_{out} = V_{off}$ + sensitivity x P over the operating pressure range. There are two basic methods for calculating nonlinearity: (1) end point straight line fit (see Figure 3) or (2) a least squares best line fit. While a least squares fit gives the “best case” linearity error (lower numerical value), the calculations required are burdensome.
Conversely, an end point fit will give the “worst case” error (often more desirable in error budget calculations) and the calculations are more straightforward for the user. The specified pressure sensor linearities are based on the end point straight line method measured at the midrange pressure.

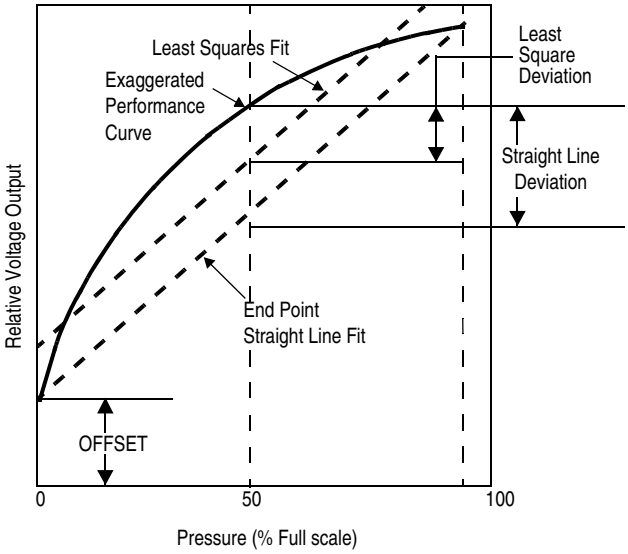
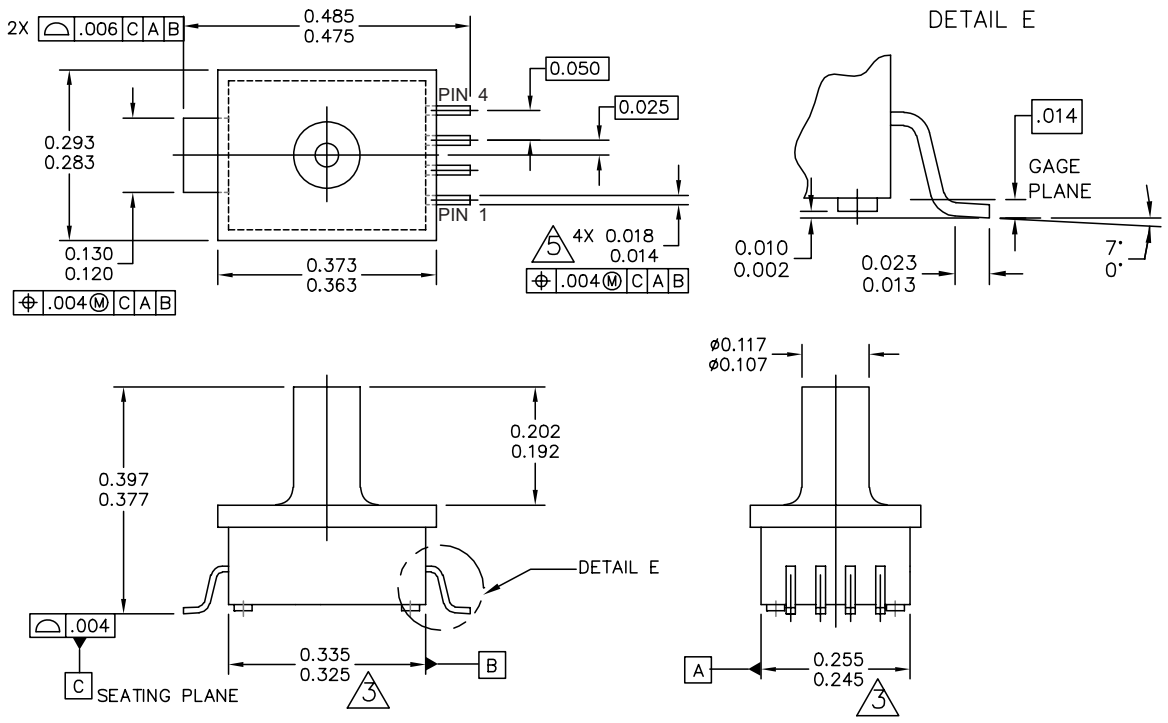


Figure 3. Linearity Specification Comparison

PACKAGE DIMENSIONS



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	CASE NUMBER: 1320A-02	22 JUL 2005
	STANDARD: NON-JEDEC	

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PACKAGE DIMENSIONS

NOTES:

1. DIMENSIONS ARE IN INCHES.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M–1994.
3. DIMENSIONS DOES NOT INCLUDE MOLD FLASH OR PROTRUSION. MOLD FLASH OR PROTRUSION SHALL NOT EXCEED .006" PER SIDE.
4. ALL VERTICAL SURFACES TO BE 5° MAXIMUM.
5. DIMENSION DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE .008 MAXIMUM.

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