Freescale Semiconductor

MPXH6101A
Rev 7, 1/2009

Integrated Silicon Pressure Sensor for Manifold Absolute Pressure Applications On-Chip Signal Conditioned, Temperature Compensated and Calibrated

MPXH6101A Series

15 to 105 kPa (2.18 to 15.2 psi)
0.2 to 5.0 V Output

The Freescale MPXH6101A series Manifold Absolute Pressure (MAP) sensor for engine control is designed to sense absolute air pressure within the intake manifold. This measurement can be used to compute the amount of fuel required for each cylinder. The small form factor and high reliability of on-chip integration makes the Freescale MAP sensor a logical and economical choice for automotive system designers.

The MPXH6101A series piezoresistive transducer is a state-of-the-art, monolithic, signal conditioned, silicon pressure sensor. This sensor combines advanced micromachining techniques, thin film metallization, and bipolar semiconductor processing to provide an accurate, high level analog output signal that is proportional to applied pressure.

Features

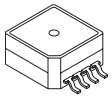
- 1.72% Maximum Error Over 0° to 85°C
- Specifically Designed for Intake Manifold Absolute Pressure Sensing in Engine Control Systems
- Temperature Compensated Over –40°C to +125°C
- Thermoplastic (PPS) Surface Mount Package

Application Examples

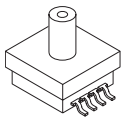
- Manifold Sensing for Automotive Systems
- Ideally Suited for Microprocessor or Microcontroller-Based Systems
- Also Ideal for Non-Automotive Applications

ORDERING INFORMATION											
Device Name	Package Options	Case No.	# of Ports			Pressure Type			Option		Device Marking
			None	Single	Dual	Gauge	Differential	Absolute	Surface Mount	Through-Hole	
Super Small Outline Package (MPXH6101A Series)											
MPXH6101A6U	Rails	1317	•					•	•		MPXH6101A
MPXH6101A6T1	Tape and Reel	1317	•					•	•		MPXH6101A
MPXH6101AC6U	Rails	1317A		•				•	•		MPXH6101A
MPXH6101AC6T1	Tape and Reel	1317A		•				•	•		MPXH6101A

SUPER SMALL OUTLINE PACKAGE SURFACE MOUNT



MPXH6101A6U/6T1
CASE 1317-04



MPXH6115AC6U/C6T1
CASE 1317A-03

Operating Characteristics

Table 1. Operating Characteristics (V_S = 5.0 Vdc, T_A = 25°C unless otherwise noted, P1 > P2. Decoupling circuit shown in Figure 3 required to meet electrical specifications.)

Characteristic		Symbol	Min	Typ	Max	Unit
Pressure Range[1]		P_{OP}	15	—	105	kPa
Supply Voltage[2]		V_S	4.75	5	5.5	Vdc
Supply Current		I_o	—	7.0	10	mAdc
Minimum Pressure Offset @ V_S = 5.0 Volts[3]	(0 to 85°C)	V_{off}	0.117	0.222	0.327	Vdc
Full Scale Output @ V_S = 5.0 Volts[4]	(0 to 85°C)	V_{FSO}	4.933	5.013	5.092	Vdc
Full Scale Span @ V_S = 5.0 Volts[5]	(0 to 85°C)	V_{FSS}	—	4.8	—	Vdc
Accuracy[6]	(0 to 85°C)	—	—	—	±1.72	$\%V_{FSS}$
Sensitivity		V/P	—	53	—	mV/kPa
Response Time[7]		t_R	—	15	—	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 rated 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.

Maximum Ratings

Table 2. Maximum Ratings(1)

Rating	Symbol	Value	Unit
Maximum Pressure (P1 > P2)	P_{MAX}	400	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.

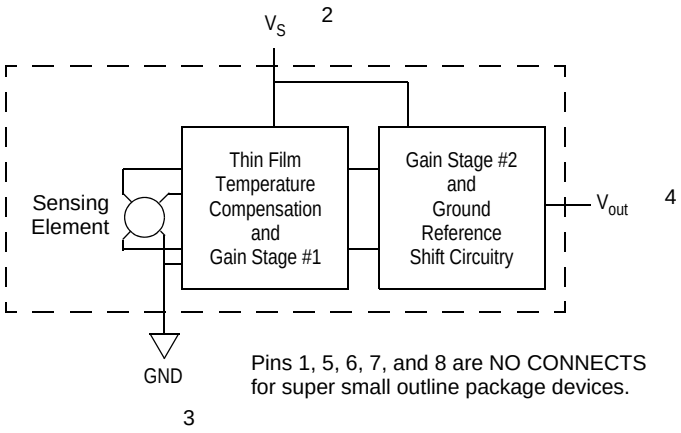


Figure 1. Fully Integrated Pressure Sensor Schematic

On-Chip Temperature Compensation and Calibration

Figure 2 illustrates an absolute sensing chip in the super small outline package (Case 1317).

Figure 4 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. The output will saturate outside of the specified pressure range.

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 MPXH6101A 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 3 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.

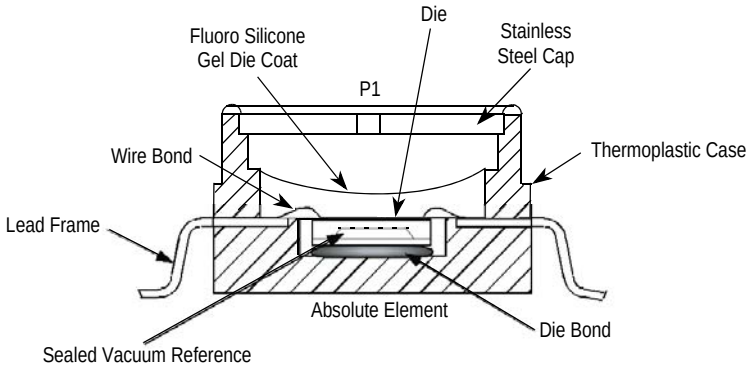


Figure 2. Cross Sectional Diagram SSOP (not to scale)

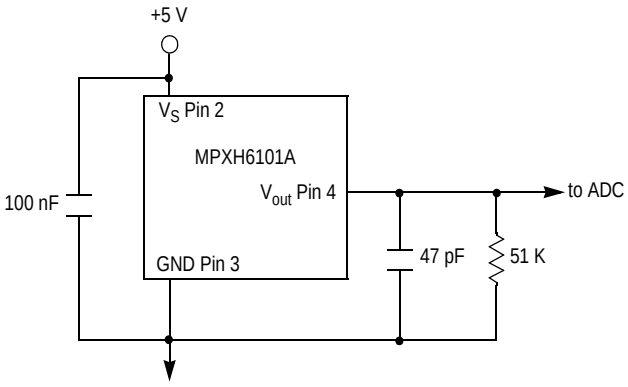


Figure 3. Recommended Power Supply Decoupling and Output Filtering

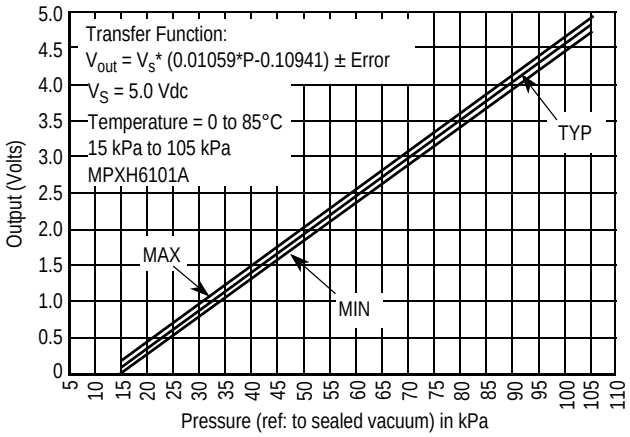


Figure 4. Output versus Absolute Pressure

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 fluorosilicone gel which protects the die from harsh media. The Freescale pressure sensor is designed to operate with positive differential pressure applied, P1 > P2.

The Pressure (P1) side may be identified by using the following table:

Part Number	Case Type	Pressure (P1) Side Identifier
MPXH6101A6U/T1	1317	Stainless Steel Cap
MPXH6101AC6U/T1	1317A	Side with Port Attached

INFORMATION FOR USING THE SMALL OUTLINE PACKAGES

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 pads.

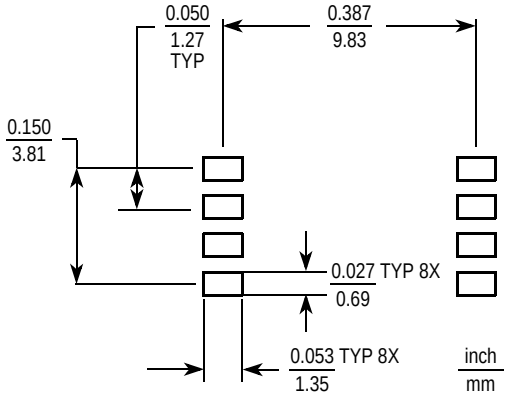
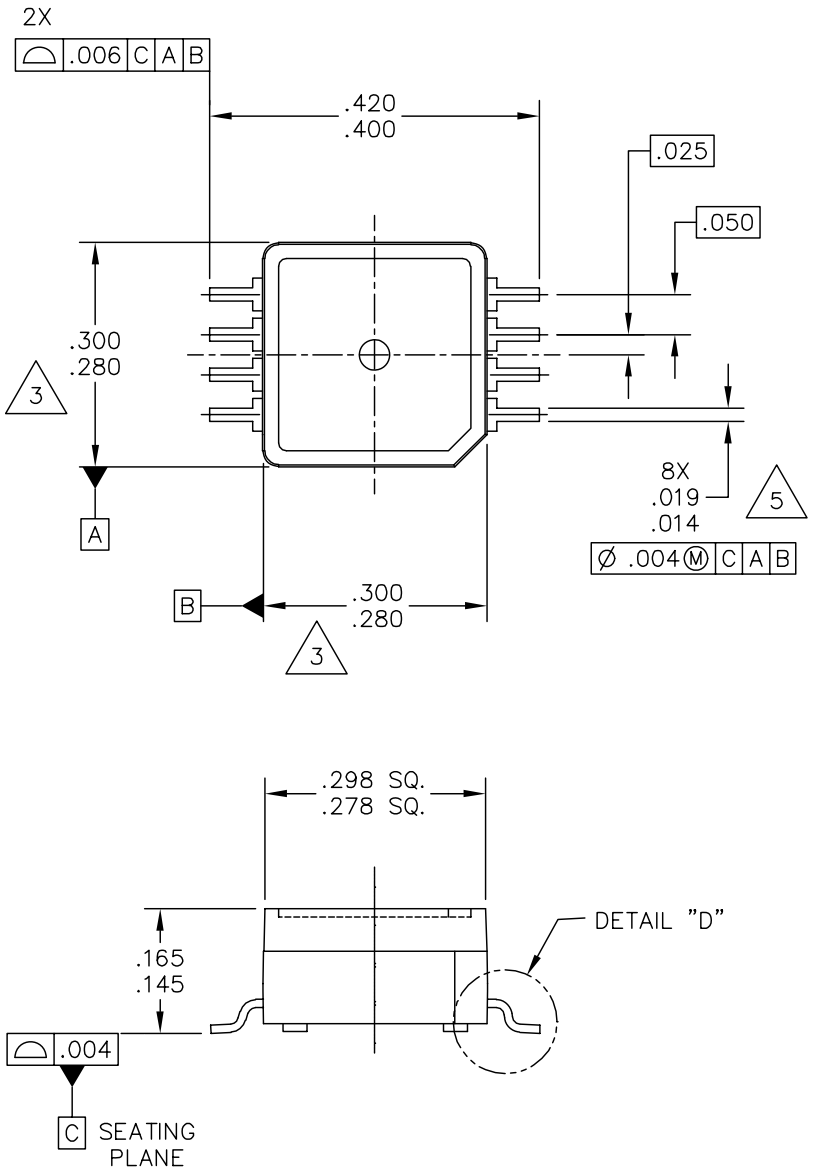


Figure 5. SSOP Footprint (Case 1317)

PACKAGE DIMENSIONS



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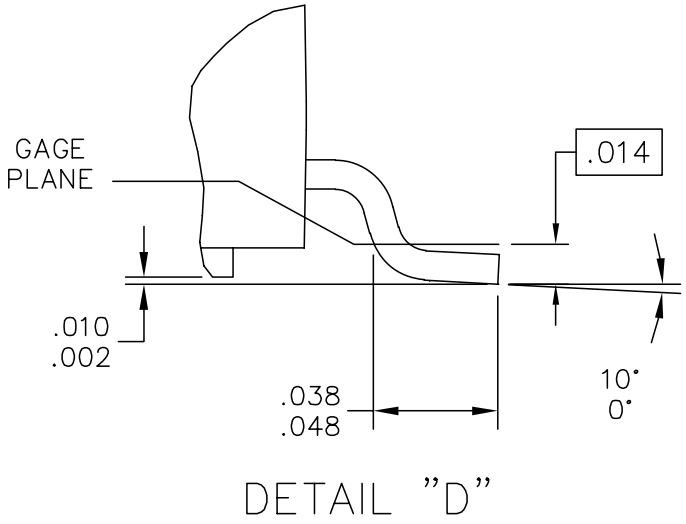
TITLE: 8 LEAD SSOP	DOCUMENT NO: 98ARH99066A	REV: F
	CASE NUMBER: 1317–04	24 MAY 2005
	STANDARD: NON–JEDEC	

CASE 1317-04
ISSUE F
SUPER SMALL OUTLINE PACKAGE

PACKAGE DIMENSIONS



DETAIL "D"

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TITLE: 8 LEAD SSOP	DOCUMENT NO: 98ARH99066A	REV: F
	CASE NUMBER: 1317–04	24 MAY 2005
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CASE 1317-04
ISSUE F
SUPER SMALL OUTLINE PACKAGE

PACKAGE DIMENSIONS

NOTES:

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

	MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE
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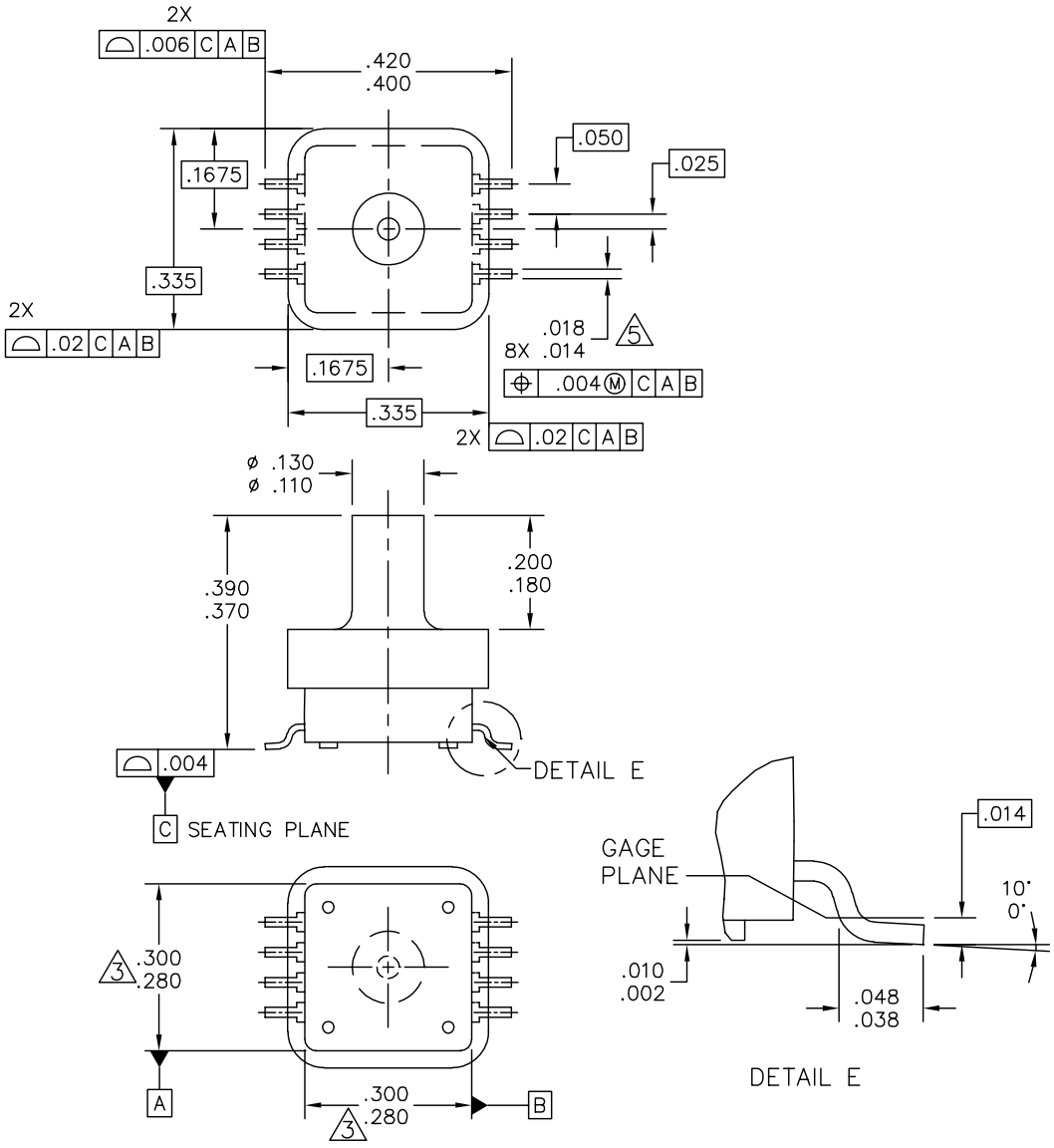
CASE 1317-04
ISSUE F
SUPER SMALL OUTLINE PACKAGE

PACKAGE DIMENSIONS



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	CASE NUMBER: 1317A-04	26 OCT 2006
	STANDARD: NON-JEDEC	

CASE 1317A-04
ISSUE D
SUPER SMALL OUTLINE PACKAGE

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CASE 1317A-04
ISSUE D
SUPER SMALL OUTLINE PACKAGE

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