Freescale Semiconductor

MPXHZ6401A
Rev 0, 05/2010

Media Resistant Integrated Silicon Pressure Sensor for Measuring Absolute Pressure, On-Chip Signal Conditioned, Temperature Compensated and Calibrated

MPXHZ6401A Series

50 to 400 kPa (7.25 to 58.02 psi)
0.5 to 4.5 V Output

The MPXHZ6401A series pressure sensor integrates on-chip, bipolar op amp circuitry and thin film resistor networks to provide a high output signal and temperature compensation. The sensor's packaging has been designed to provide resistance to high humidity conditions as well as common automotive media. The small form factor and high reliability of on-chip integration make this sensor a logical and economical choice for the system designer.

The MPXHZ6401A 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.

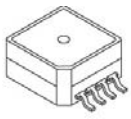
Features

- Resistant to High Humidity and Common Automotive Media
- Improved Accuracy at High Temperature
- 1.5% Maximum Error over 0°C to 85°C
- Temperature Compensated from -40°C to +125°C
- Durable Thermoplastic (PPS) Surface Mount Package (SSOP) with Optional Axial Port
- Ideally Suited for Microprocessor or Microcontroller–Based Systems

ORDERING INFORMATION

Device Name	Device Type	Options	Package Options	Case No.	Device Marking
Super Small Outline Package (MPXHZ6401A Series)					
MPXHZ6401A6U	Basic Element	Absolute, Element Only	Rail	1317	MPXHZ6401A
MPXHZ6401A6T1		Absolute, Element Only	Tape & Reel	1317	MPXHZ6401A

SUPER SMALL OUTLINE PACKAGES



MPXHZ6401A6U/6T1
CASE 1317

Operating Characteristics

Table 1. Operating Characteristics (V_S = 5.1 Vdc, T_A = 25°C unless otherwise noted, P1 > P2.

Characteristic		Symbol	Min	Typ	Max	Unit
Pressure Range		P_{OP}	50	—	400	kPa
Supply Voltage(1)		V_S	4.75	5.0	5.25	Vdc
Supply Current		I_o	—	6.0	10	mAdc
Minimum Pressure Offset @ V_S = 5.0 Volts(2)	(0 to 85°C)	V_{off}	0.437	0.5	0.563	Vdc
Full Scale Output @ V_S = 5.0 Volts(3)	(0 to 85°C)	V_{FSO}	4.438	4.501	4.563	Vdc
Full Scale Span	(0 to 85°C)	V_{FSS}	—	4.0	—	V
Sensitivity		V/P	—	11.43	—	mV/kPa
Accuracy(4)	(0 to 85°C)	—	-1.58	—	1.58	$\%V_{FSS}$

1. Device is ratiometric within this specified excitation range.
2. Offset (V_{off}) is defined as the output voltage at the minimum rated pressure.
3. Full Scale Scan (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. Accuracy (error budget) is the deviation in actual output from nominal output over the entire pressure range and temperature range as a percent of V_{FSS} at 25°C due to all sources of error including 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.
   Offset Stability: Output deviation, after 1000 temperature cycles, -40°C to 125°C and 1.5 million pressure cycles, with minimum rated pressure applied.
   TcSpan: Output deviation over the temperature range of 0°C to 85°C, relative to 25°C.
   TcOffset: Output deviation with minimum rated pressure applied, over the temperature range of 0°C to 85°C, relative to 25°C.

Maximum Ratings

Table 2. Maximum Ratings(1)

Rating	Symbol	Value	Units
Maximum Pressure (P1 > P2)	P_{max}	1200	kPa
Storage Temperature	T_{stg}	-40° to +125°	°C
Operating Temperature	T_A	-40° to +125°	°C
Output Source Current @ Full Scale Output(2)	I_o+	+0.5	mAdc
Output Sink Current @ Minimum Pressure Offset(2)	I_o-	-0.5	mAdc

1. Exposure beyond the specified limits may cause permanent damage or degradation to the device.
2. Maximum Output Current is controlled by effective impedance from V_{OUT} to Gnd or V_{OUT} to V_S in the application circuit.

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

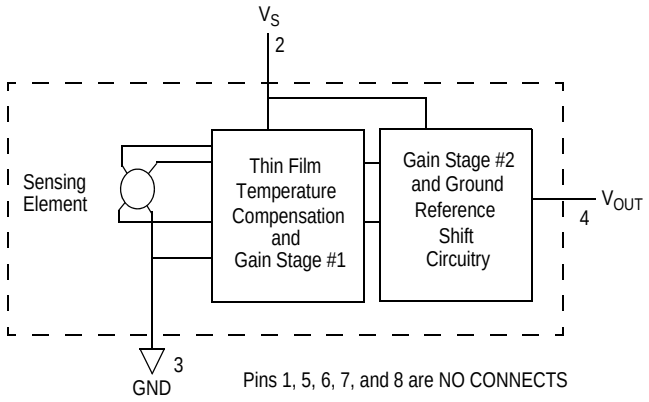


Figure 1. Fully Integrated Pressure Sensor Schematic

On-chip Temperature Compensation and Calibration

The performance over temperature is achieved by integrating the shear–stress strain gauge, temperature compensation, calibration, and signal conditioning circuitry onto a single monolithic chip.

Figure 2 illustrates the configuration in the basic chip carrier (case 1317) prior to porting. A gel die coat isolates the die surface and wire bonds from the environment, while allowing the pressure signal to be transmitted to the sensor diaphragm. The gel die coat and durable thermoplastic package provide a media resistant barrier that allows the sensor to operate reliably in high humidity conditions as well as common automotive media.

NOTE: The MPXHZ6401A series pressure sensor's operating characteristics, internal reliability and qualification tests are based on use of air as the pressure media. Media, other than 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 integrated sensor to the A/D input of a microprocessor or microcontroller. Proper decoupling of the power supply is recommended.

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°C to 85°C using the decoupling circuit shown in Figure 3. The output will saturate outside of the specified pressure range.

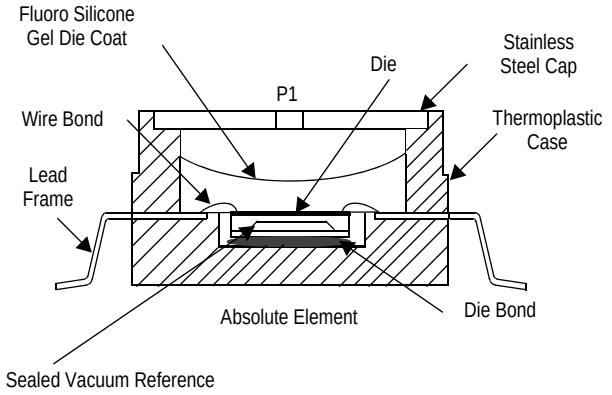


Figure 2. Cross Sectional Diagram SSOP (not to scale)

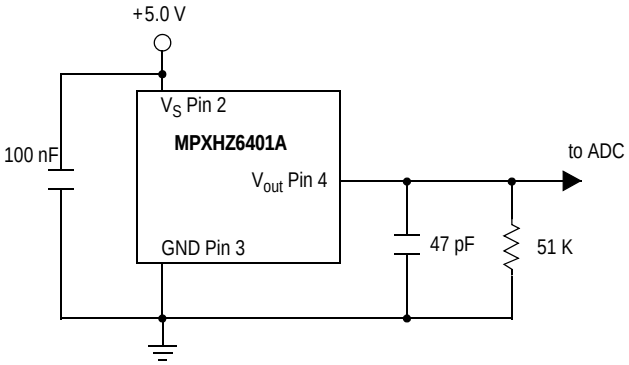


Figure 3. Typical Application Circuit (Output Source Current Operation)

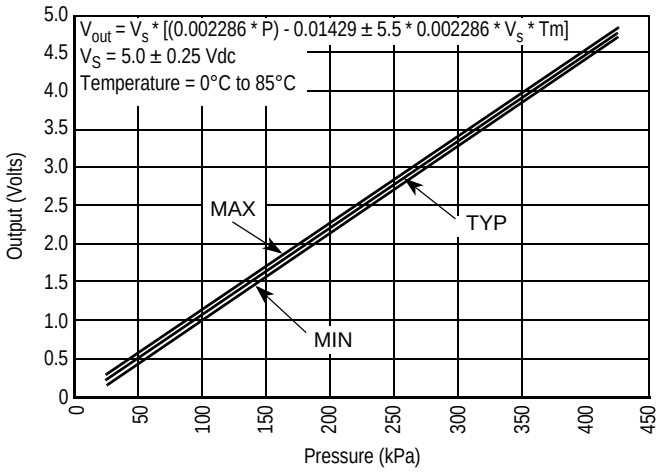
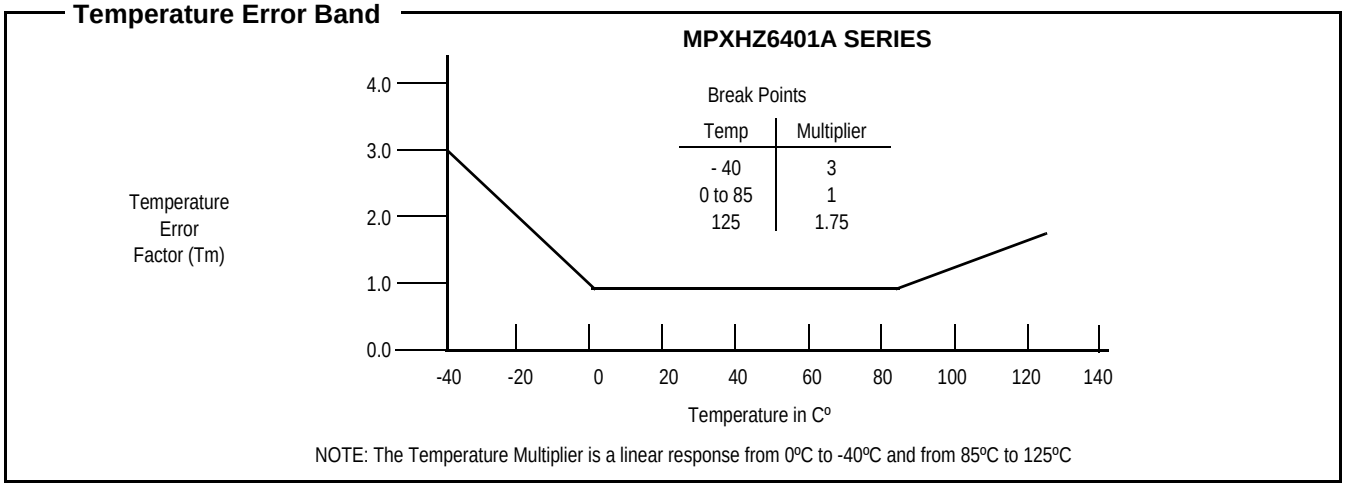


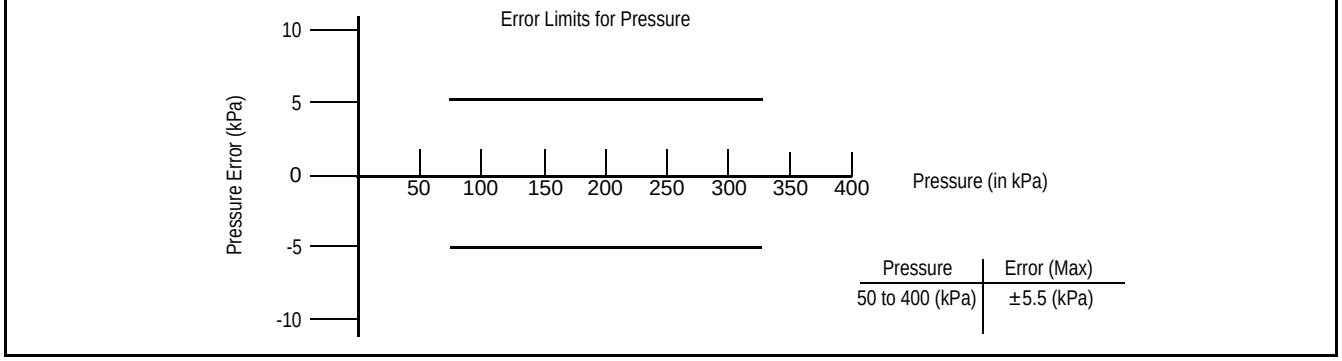
Figure 4. Output vs. Absolute Pressure

Temperature Error Band



NOTE: The Temperature Multiplier is a linear response from 0ºC to -40ºC and from 85ºC to 125ºC

Pressure Error Band



MINIMUM RECOMMENDED FOOTPRINT FOR SUPER SMALL PACKAGES

Surface mount board layout is a critical portion of the total design. The footprint for the semiconductor package must be the correct size to ensure proper solder connection interface between the board and the package. With the correct pad geometry, the packages will self-align when subjected to a solder reflow process. It is always recommended to fabricate boards with a solder mask layer to avoid bridging and/or shorting between solder pads, especially on tight tolerances and/or tight layouts.

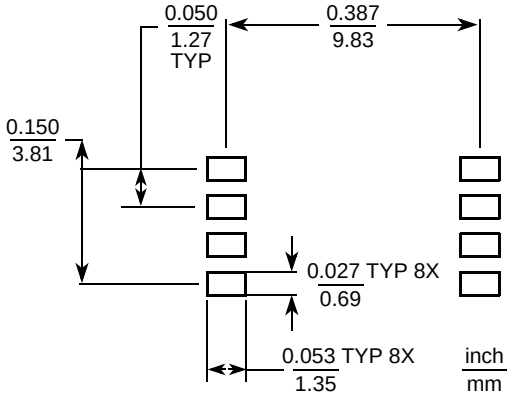
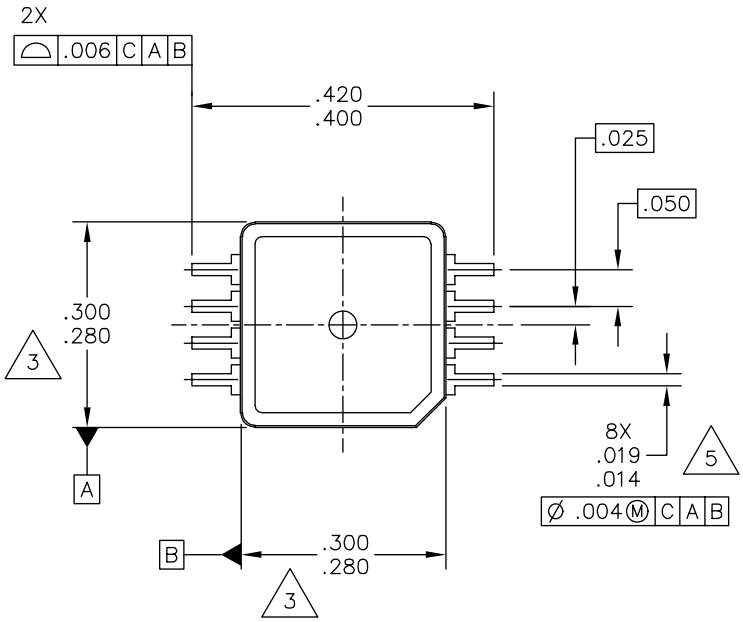
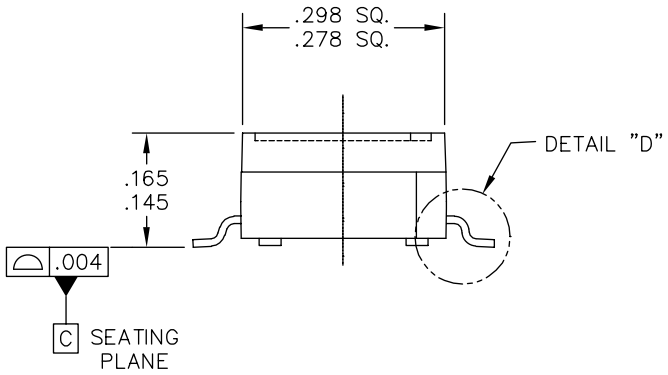


Figure 5. SSOP Footprint (Case 1317)

PACKAGE DIMENSIONS





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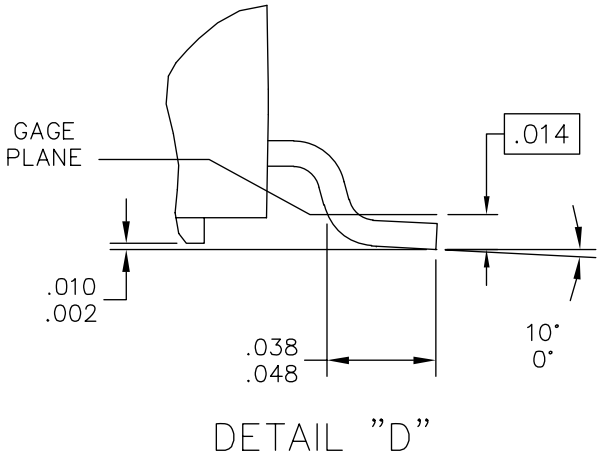
	CASE NUMBER: 1317–04	24 MAY 2005
	STANDARD: NON–JEDEC	

CASE 1317-04
ISSUE F
SUPER SMALL OUTLINE PACKAGE

PACKAGE DIMENSIONS



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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.

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CASE 1317-04
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