

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

The MP3V5050 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.

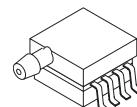
Features

- 2.5% Maximum Error over 0° to 85°C
- Ideally suited for Microprocessor or Microcontroller-Based Systems
- Temperature Compensated Over -40° to +125°C
- Patented Silicon Shear Stress Strain Gauge
- Durable Epoxy Small Outline Package (SOP)
- Easy-to-Use Chip Carrier Option
- Multiple Porting Options for Design Flexibility
- Barbed Side Ports for Robust Tube Connection

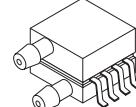
MP3V5050 SERIES

INTEGRATED
PRESSURE SENSOR
0 to 50 kPa (0 to 7.25 psi)
0.06 to 2.82 V Output

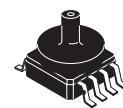
SMALL OUTLINE PACKAGE SURFACE MOUNT



MP3V5050GP
CASE 1369-01



MP3V5050DP
CASE 1351-01



MP3V5050GC6U
CASE 482A-01

SMALL OUTLINE PACKAGE PIN NUMBERS⁽¹⁾

1	N/C	5	N/C
2	V _S	6	N/C
3	Gnd	7	N/C
4	V _{out}	8	N/C

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

ORDERING INFORMATION					
Device Type	Options	Case No.	MP3V Series Order No.	Packing Options	Device Marking
SMALL OUTLINE PACKAGE (MP3V5050 SERIES)					
Ported Elements	Side Port	1369	MP3V5050GP	Trays	MP3V5050G
	Dual Port	1351	MP3V5050DP	Trays	MP3V5050G
Axial Port		482A	MP3V5050GC6U	Rails	MP3V5050G
		482A	MP3V5050GC6T1	Tape & Reel	MP3V5050G

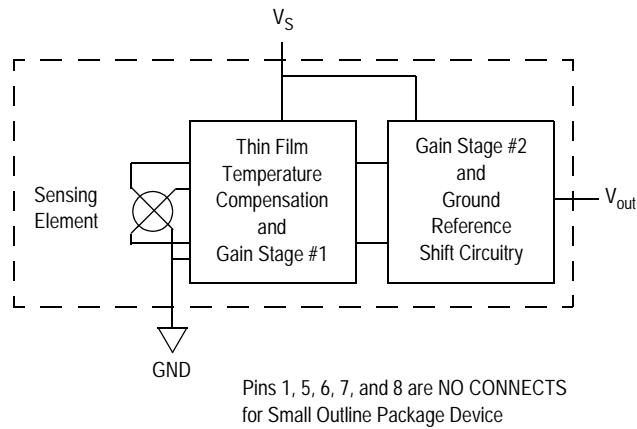


Figure 1. Fully Integrated Pressure Sensor Schematic

Table 1. Maximum Ratings⁽¹⁾

Rating	Symbol	Value	Unit
Maximum Pressure ($P_1 > P_2$)	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.

Table 2. . Operating Characteristics ($V_S = 3.0$ Vdc, $T_A = 25^\circ\text{C}$ unless otherwise noted, $P1 > P2$. Decoupling circuit shown in Figure 4 required to meet electrical specifications.)

Characteristic	Symbol	Min	Typ	Max	Unit
Pressure Range ⁽¹⁾	P_{OP}	0	—	50	kPa
Supply Voltage ⁽²⁾	V_S	2.7	3.0	3.3	Vdc
Supply Current	I_o	—	7.0	10	mAdc
Minimum Pressure Offset ⁽³⁾ @ $V_S = 3.0$ Volts	V_{off}	0.053	0.12	0.188	Vdc
Full Scale Output ⁽⁴⁾ @ $V_S = 3.0$ Volts	V_{FSO}	2.752	2.8	2.888	Vdc
Full Scale Span ⁽⁵⁾ @ $V_S = 3.0$ Volts	V_{FSS}	—	2.7	—	Vdc
Accuracy ⁽⁶⁾	(0 to 85°C)	—	—	—	± 2.5 % V_{FSS}
Sensitivity	V/P	—	54	—	mV/kPa
Response Time ⁽⁷⁾	t_R	—	1.0	—	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 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.

Figure 3 illustrates the Differential/Gauge Sensing Chip in the basic chip carrier (Case 482). 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 MP3V5050 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 2 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 using the decoupling circuit shown in **Figure 4**. The output will saturate outside of the specified pressure range.

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.

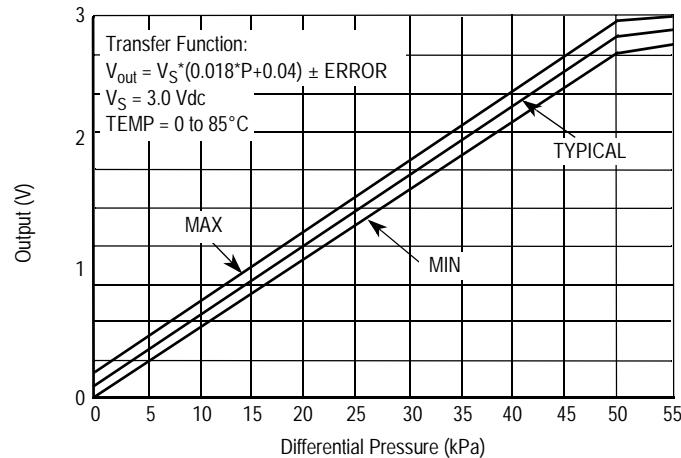
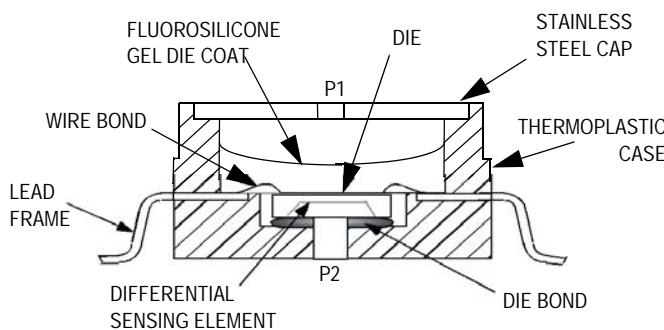
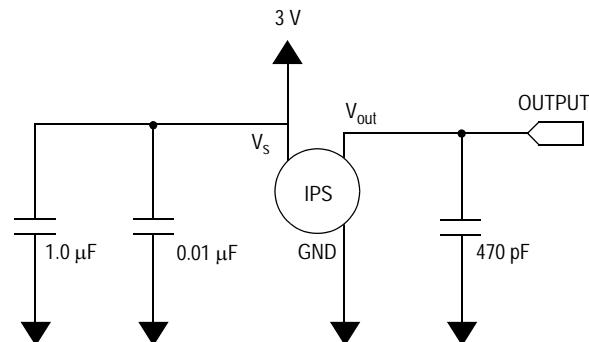


Figure 2. Output versus Pressure Differential



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



**Figure 4. Recommended Power Supply Decoupling
and Output Filtering**

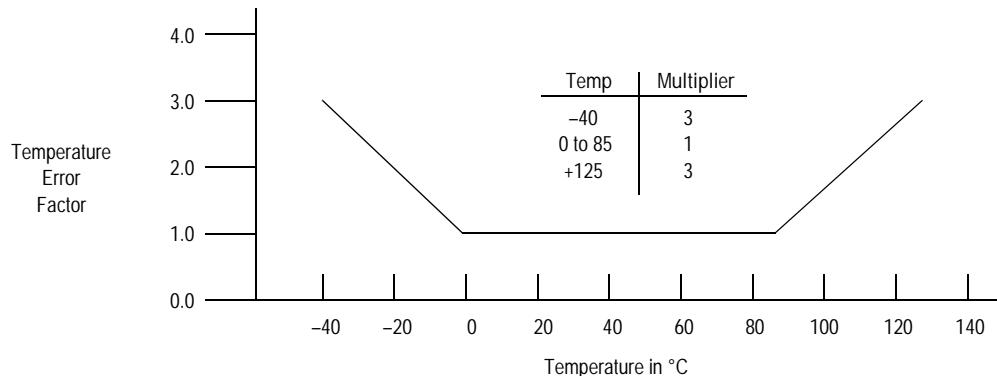
(For additional output filtering, please refer to Application Note AN1646.)

Transfer Function

Nominal Transfer Value: $V_{out} = V_S (P \times 0.018 + 0.04)$
 $\pm (\text{Pressure Error} \times \text{Temp. Factor} \times 0.018 \times V_S)$
 $V_S = 3.0 \text{ V} \pm 0.30 \text{ Vdc}$

Temperature Error Band

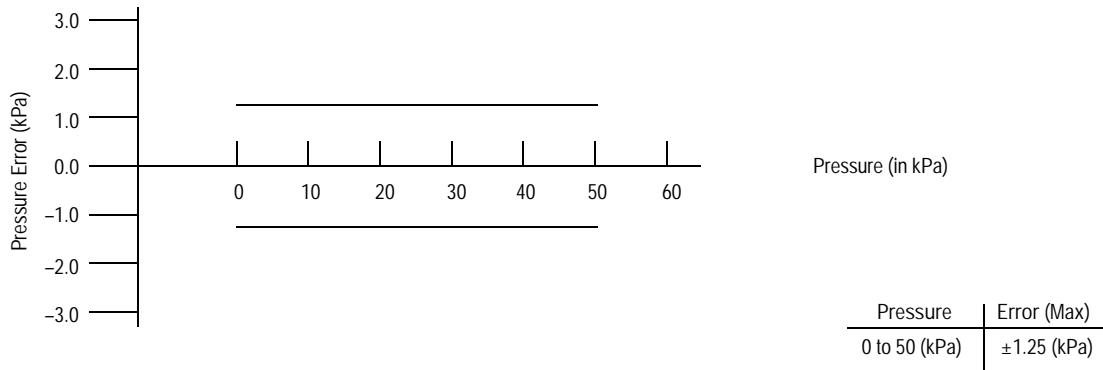
MP3V5050 SERIES



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

Pressure Error Band

Error Limits for Pressure



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

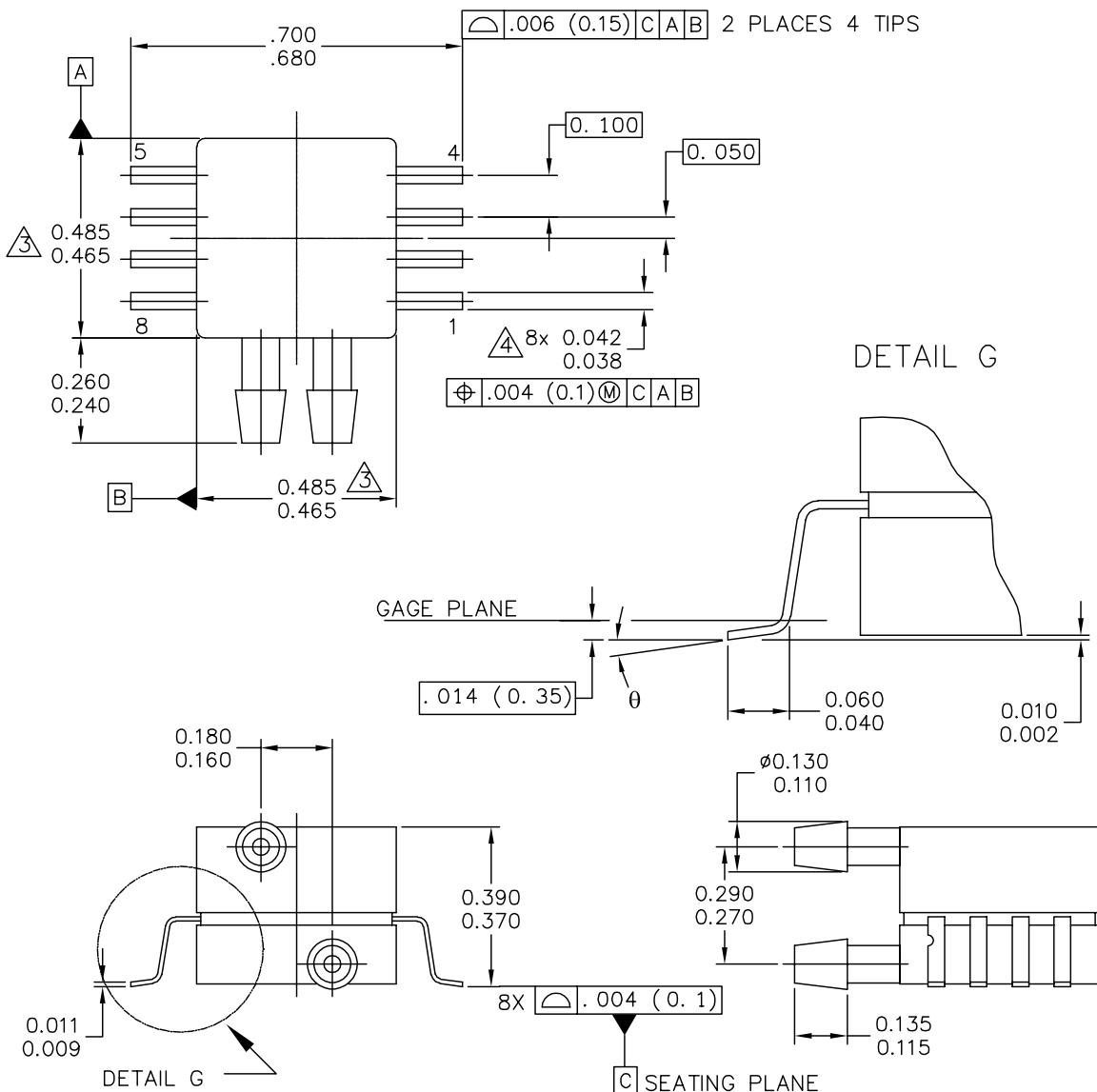
Freescale designates the two sides of the pressure sensor as the Pressure (P1) side and the Vacuum (P2) side. The Pressure (P1) side is the side containing fluorosilicone gel which protects the die from harsh media. The MP3V pressure

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

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

Part Number	Case Type	Pressure (P1) Side Identifier
MP3V5050GP	1369	Side with Port Attached
MP3V5050DP	1351	Side with Part Marking
MP3V5050GC6U/T1	482A	Vertical Port Attached

PACKAGE DIMENSIONS



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TITLE: 8 LD SNSR, DUAL PORT	DOCUMENT NO: 98ASA99255D CASE NUMBER: 1351-01	REV: A 27 JUL 2005
		STANDARD: NON-JEDEC

PAGE 1 OF 2

**CASE 1351-01
ISSUE A
SMALL OUTLINE PACKAGE**

MP3V5050

PACKAGE DIMENSIONS

NOTES:

1. CONTROLLING DIMENSION: INCH
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.

 **3** DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
MOLD FLASH AND PROTRUSIONS SHALL NOT EXCEED .006 PER SIDE.

 **4** DIMENSION DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE .008 MAXIMUM.

STYLE 1:

PIN 1: GND
PIN 2: +Vout
PIN 3: Vs
PIN 4: -Vout
PIN 5: N/C
PIN 6: N/C
PIN 7: N/C
PIN 8: N/C

STYLE 2:

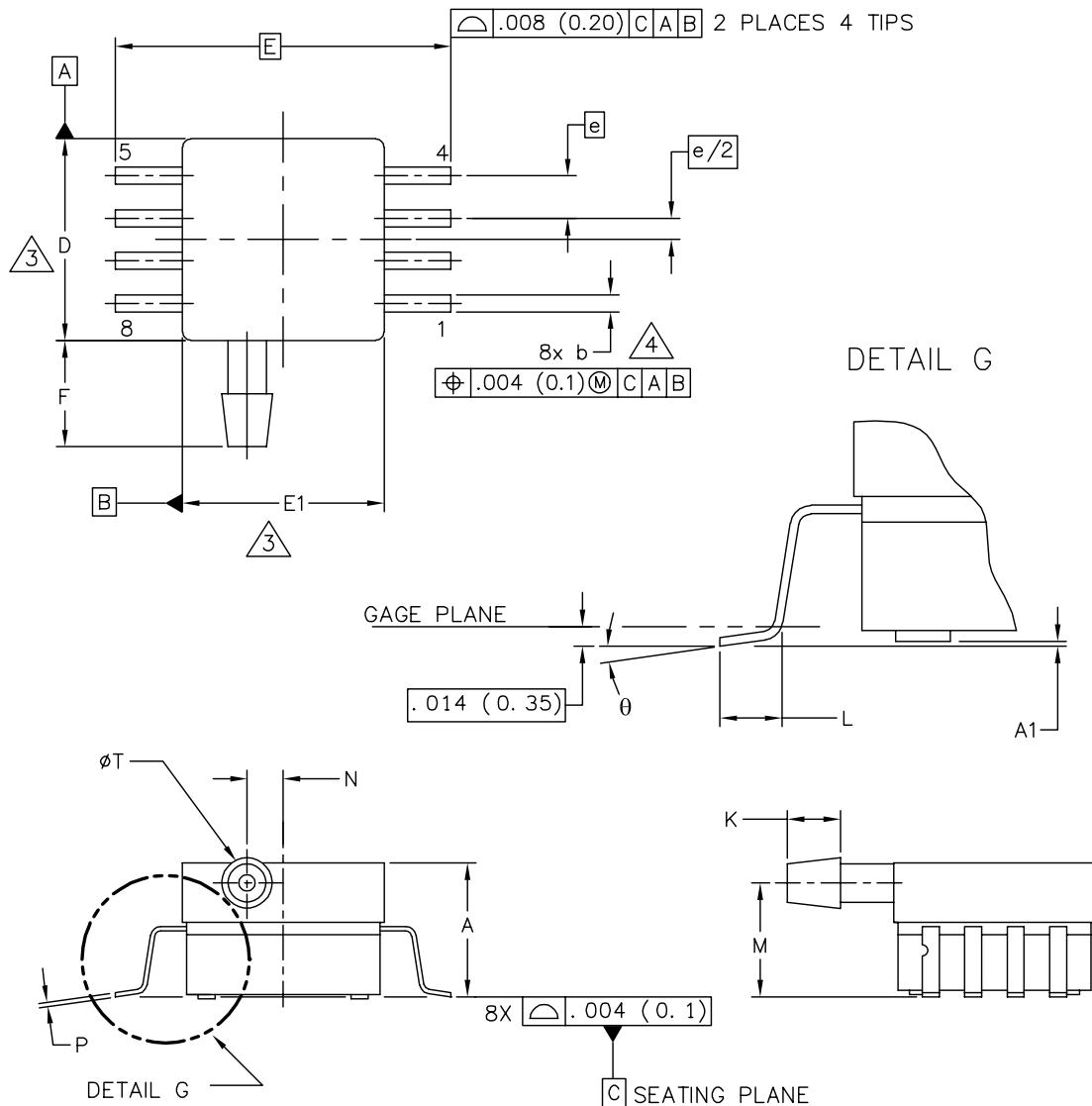
PIN 1: N/C
PIN 2: Vs
PIN 3: GND
PIN 4: Vout
PIN 5: N/C
PIN 6: N/C
PIN 7: N/C
PIN 8: N/C

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TITLE: 8 LD SNSR, DUAL PORT	DOCUMENT NO: 98ASA99255D CASE NUMBER: 1351-01 STANDARD: NON-JEDEC	REV: A 27 JUL 2005

PAGE 2 OF 2

**CASE 1351-01
ISSUE A
SMALL OUTLINE PACKAGE**

PACKAGE DIMENSIONS



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TITLE:	DOCUMENT NO: 98ASA99303D	REV: B
8 LD SOP, SIDE PORT	CASE NUMBER: 1369-01	24 MAY 2005
	STANDARD: NON-JEDEC	

PAGE 1 OF 2

**CASE 1369-01
ISSUE B
SMALL OUTLINE PACKAGE**

MP3V5050

PACKAGE DIMENSIONS

NOTES:

1. CONTROLLING DIMENSION: INCH
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.

⚠ DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
MOLD FLASH AND PROTRUSIONS SHALL NOT EXCEED .006 (0.152) PER SIDE.

⚠ DIMENSION DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE .008 (0.203) MAXIMUM.

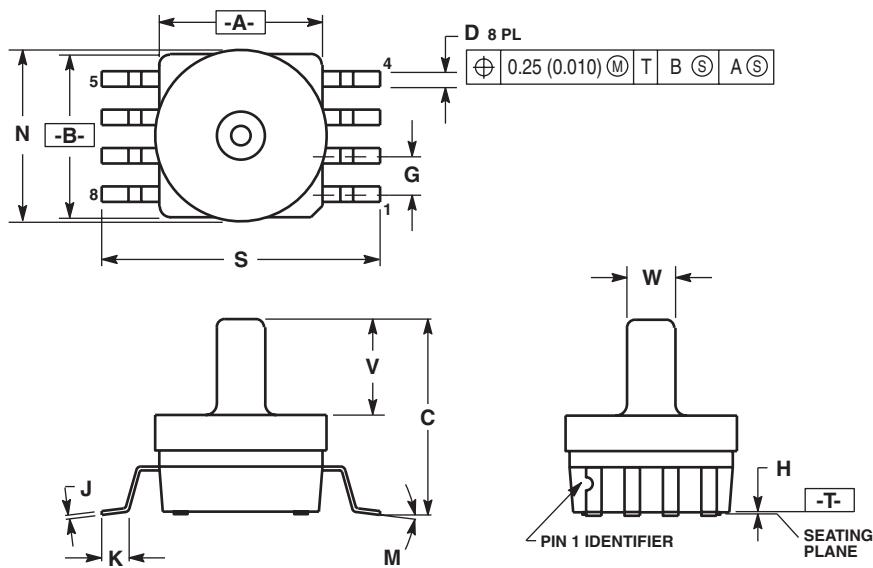
DIM	INCHES		MILLIMETERS		DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX		MIN	MAX	MIN	MAX
A	.300	.330	7.11	7.62	θ	0°	7°	0°	7°
A1	.002	.010	0.05	0.25	-	---	---	---	---
b	.038	.042	0.96	1.07	-	---	---	---	---
D	.465	.485	11.81	12.32	-	---	---	---	---
E	.717 BSC		18.21 BSC		-	---	---	---	---
E1	.465	.485	11.81	12.32	-	---	---	---	---
e	.100 BSC		2.54 BSC		-	---	---	---	---
F	.245	.255	6.22	6.47	-	---	---	---	---
K	.120	.130	3.05	3.30	-	---	---	---	---
L	.061	.071	1.55	1.80	-	---	---	---	---
M	.270	.290	6.86	7.36	-	---	---	---	---
N	.080	.090	2.03	2.28	-	---	---	---	---
P	.009	.011	0.23	0.28	-	---	---	---	---
T	.115	.125	2.92	3.17	-	---	---	---	---

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TITLE: 8 LD SOP, SIDE PORT	DOCUMENT NO: 98ASA99303D CASE NUMBER: 1369-01 STANDARD: NON-JEDEC	REV: B 24 MAY 2005

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**CASE 1369-01
ISSUE B
SMALL OUTLINE PACKAGE**

PACKAGE DIMENSIONS



**CASE 482A-01
ISSUE A
SMALL OUTLINE PACKAGE**

NOTES:
 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
 4. MAXIMUM MOLD PROTRUSION 0.15 (0.006).
 5. ALL VERTICAL SURFACES 5° TYPICAL DRAFT.

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