

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

The MPX2053 series devices are silicon piezoresistive pressure sensors that provide a highly accurate and linear voltage output directly proportional to the applied pressure. A single, monolithic silicon diaphragm with the strain gauge and an integrated thin-film resistor network. Precise span and offset calibration with temperature compensation are achieved by laser trimming.

MPX2053 Series
 0 to 50 kPa (0 to 7.25 psi)
 40 mV Full Scale
 (Typical)

Features

- Temperature Compensated Over 0°C to +85°C
- Easy-to-Use Chip Carrier Package Options
- Ratiometric to Supply Voltage
- Gauge Ported and Non Ported Options
- Available in Easy-to-Use Tape & Reel
- Differential and Gauge Pressure Options

Application Examples

- Pump/Motor Control
- Robotics
- Level Detectors
- Medical Diagnostics
- Pressure Switching
- Blood Pressure Measurement

| ORDERING INFORMATION | | | | | | | | |
|---|----------|------------|--------|------|---------------|--------------|----------|----------------|
| Device Name | Case No. | # of Ports | | | Pressure Type | | | Device Marking |
| | | None | Single | Dual | Gauge | Differential | Absolute | |
| Small Outline Package (MPXV2053G Series) | | | | | | | | |
| MPXV2053GP | 1369 | | • | | • | | | MPXV2053GP |
| MPXV2053DP | 1351 | | | • | | • | | MPXV2053DP |
| Unibody Package (MPX2053 Series) | | | | | | | | |
| MPX2053D | 344 | • | | | | • | | MPX2053D |
| MPX2053DP | 344C | | | • | | • | | MPX2053DP |
| MPX2053GP | 344B | | • | | • | | | MPX2053GP |
| MPAK Package (MPXM2053 Series) | | | | | | | | |
| MPXM2053D | 1320 | • | | | | • | | MPXM2053D |
| MPXM2053DT1 | 1320 | • | | | | • | | MPXM2053D |
| MPXM2053GS | 1320A | | • | | • | | | MPXM2053GS |
| MPXM2053GST1 | 1320A | | • | | • | | | MPXM2053GS |

UNIBODY PACKAGES



MPX2053D
CASE 344-15

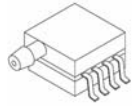


MPX2053GP
CASE 344B-01

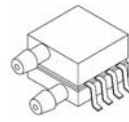


MPX2053DP
CASE 344C-01

SMALL OUTLINE PACKAGES

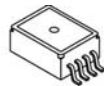


MPXV2053GP
CASE 1369-01

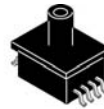


MPXV2053DP
CASE 1351-01

MPAK PACKAGES



MPXM2053D/DT1
CASE 1320-02



MPXM2053GS/GST1
CASE 1320A-02

Operating Characteristics

Table 1. Operating Characteristics ($V_S = 10 V_{DC}$, $T_A = 25^\circ C$ unless otherwise noted, $P1 > P2$)

| Characteristic | Symbol | Min | Typ | Max | Units |
|---|-------------|---------------------|-----------|------|------------|
| Pressure Range ⁽¹⁾ | P_{OP} | 0 | — | 50 | kPa |
| Supply Voltage ⁽²⁾ | V_S | — | 10 | 16 | V_{DC} |
| Supply Current | I_O | — | 6.0 | — | mAdc |
| Full Scale Span ⁽³⁾ | V_{FS} | 38.5 | 40 | 41.5 | mV |
| Offset ⁽⁴⁾ | — | -1.0 | — | 1.0 | mV |
| Sensitivity | — | $\Delta V/\Delta P$ | — | 0.8 | — |
| Non-Linearity | — | -0.6 | — | 0.4 | % V_{FS} |
| Pressure Hysteresis (0 to 50 kPa) | — | — | ± 0.1 | — | % V_{FS} |
| Temperature Hysteresis (-40° to 125°C) | — | — | ± 0.5 | — | % V_{FS} |
| Temperature Coefficient of Full Scale | TCV_{FS} | -2.0 | — | 2.0 | % V_{FS} |
| Temperature Coefficient of 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 Time | — | — | 20 | — | ms |
| Offset Stability ⁽⁶⁾ | — | — | ± 0.5 | — | % V_{FS} |

- 1.0 kPa (kiloPascal) equals 0.145 psi.
- 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.
- 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.
- Offset (V_{off}) is defined as the output voltage at the minimum rated pressure.
- 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.
- 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 | Max Value | Unit |
|-----------------------------|-------------|------------|
| Supply Voltage | 16 | V |
| Pressure ($P1 > P2$) | 200 | kPa |
| Storage Temperature | -40 to +125 | $^\circ C$ |
| Operating Temperature Range | -40 to +125 | $^\circ C$ |

- 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.

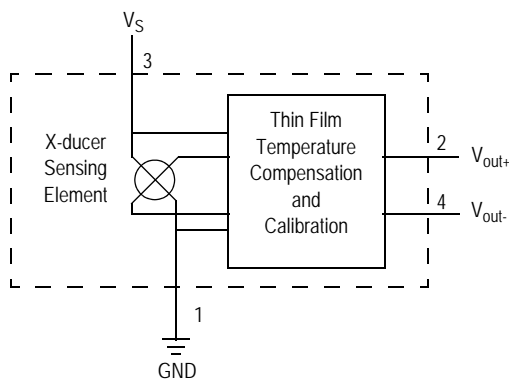


Figure 1. Temperature Compensated Pressure Sensor Schematic

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 MPX2053 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.

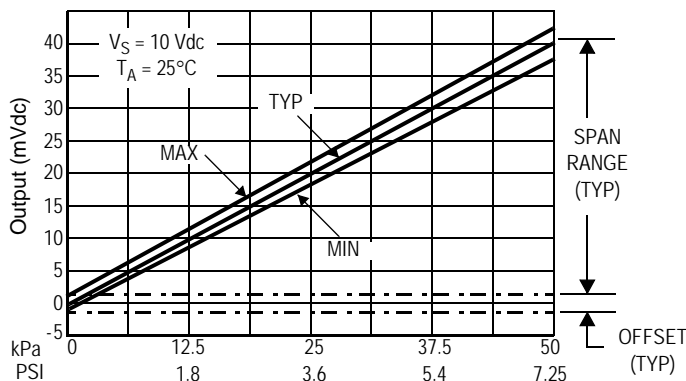


Figure 2. Output vs. Pressure Differential

LINEARITY

Linearity refers to how well a transducer's output follows the equation: $V_{out} = V_{off} + \text{sensitivity} \times P$ 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.

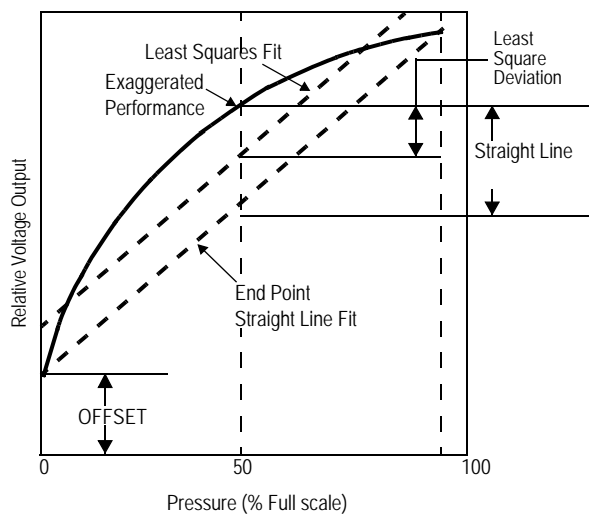


Figure 3. Linearity Specification Comparison

Figure 4 illustrates the differential or gauge configuration in the basic chip carrier (Case 344). 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.

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. Refer to application note AN3728, for more information regarding media compatibility.

The MPX2053 series pressure sensor operating characteristics and internal reliability and qualification tests

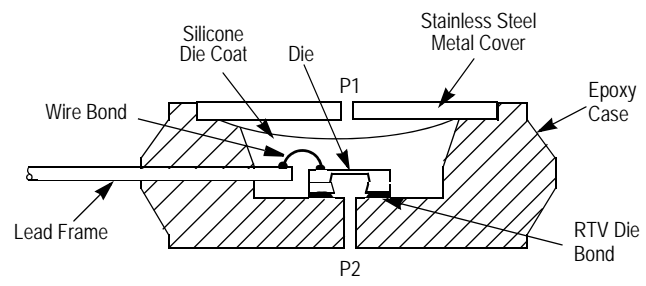
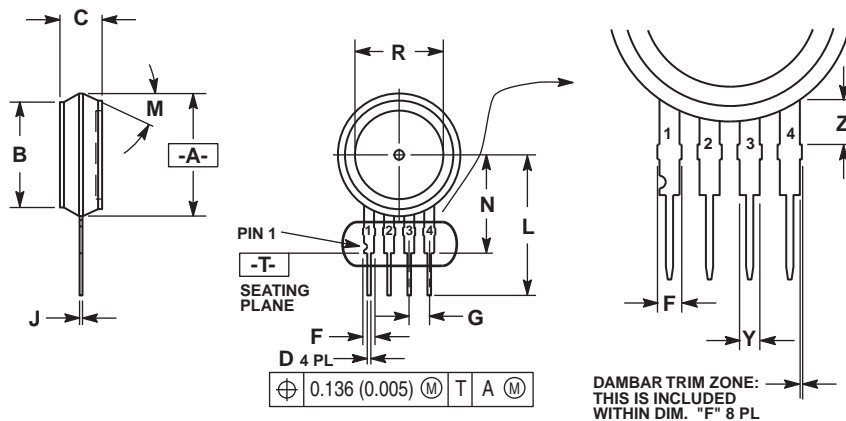


Figure 4. Unibody Package — Cross-Sectional Diagram (Not to Scale)

PACKAGE DIMENSIONS

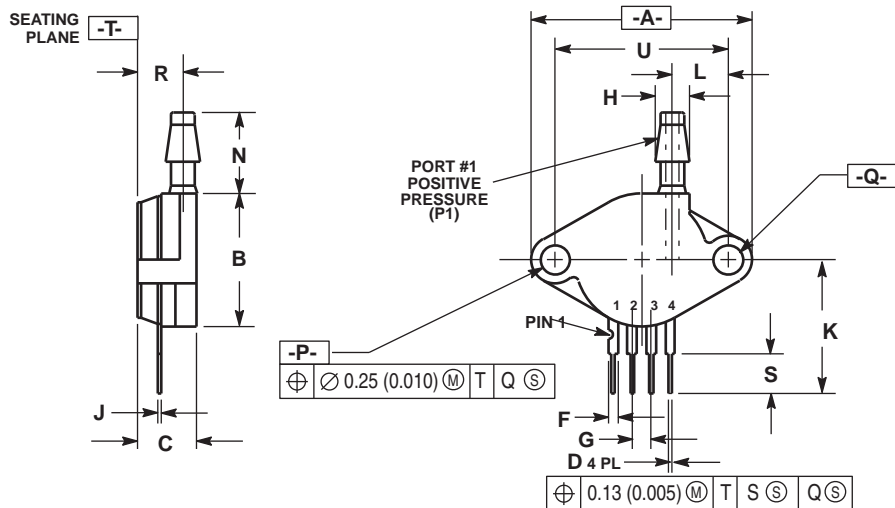


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
 2. CONTROLLING DIMENSION: INCH.
 3. DIMENSION -A- IS INCLUSIVE OF THE MOLD STOP RING. MOLD STOP RING NOT TO EXCEED 16.00 (0.630).

| 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 | 0.016 | 0.020 | 0.41 | 0.51 |
| 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 |
| Y | 0.048 | 0.052 | 1.22 | 1.32 |
| Z | 0.106 | 0.118 | 2.68 | 3.00 |

- | | | |
|--|---|---|
| STYLE 1: PIN 1. GROUND 2. + OUTPUT 3. + SUPPLY 4. - OUTPUT | STYLE 2: PIN 1. V _{cc} 2. - SUPPLY 3. + SUPPLY 4. GROUND | STYLE 3: PIN 1. GND 2. -VOUT 3. VS 4. +VOUT |
|--|---|---|

CASE 344-15 ISSUE AA UNIBODY PACKAGE



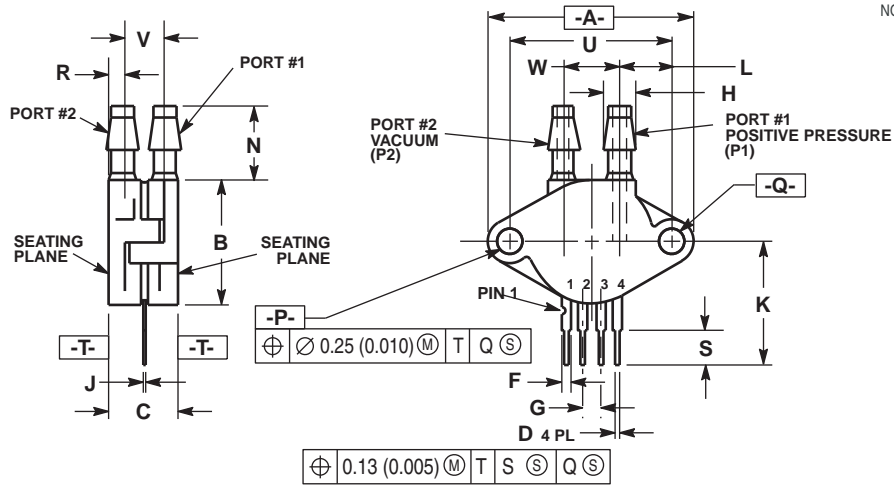
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 1.145 | 1.175 | 29.08 | 29.85 |
| B | 0.685 | 0.715 | 17.40 | 18.16 |
| C | 0.305 | 0.325 | 7.75 | 8.26 |
| D | 0.016 | 0.020 | 0.41 | 0.51 |
| F | 0.048 | 0.064 | 1.22 | 1.63 |
| G | 0.100 BSC | | 2.54 BSC | |
| H | 0.182 | 0.194 | 4.62 | 4.93 |
| J | 0.014 | 0.016 | 0.36 | 0.41 |
| K | 0.695 | 0.725 | 17.65 | 18.42 |
| L | 0.290 | 0.300 | 7.37 | 7.62 |
| N | 0.420 | 0.440 | 10.67 | 11.18 |
| P | 0.153 | 0.159 | 3.89 | 4.04 |
| Q | 0.153 | 0.159 | 3.89 | 4.04 |
| R | 0.230 | 0.250 | 5.84 | 6.35 |
| S | 0.220 | 0.240 | 5.59 | 6.10 |
| U | 0.910 BSC | | 23.11 BSC | |

- STYLE 1:
PIN 1. GROUND
2. + OUTPUT
3. + SUPPLY
4. - OUTPUT

CASE 344B-01 ISSUE B UNIBODY PACKAGE

PACKAGE DIMENSIONS



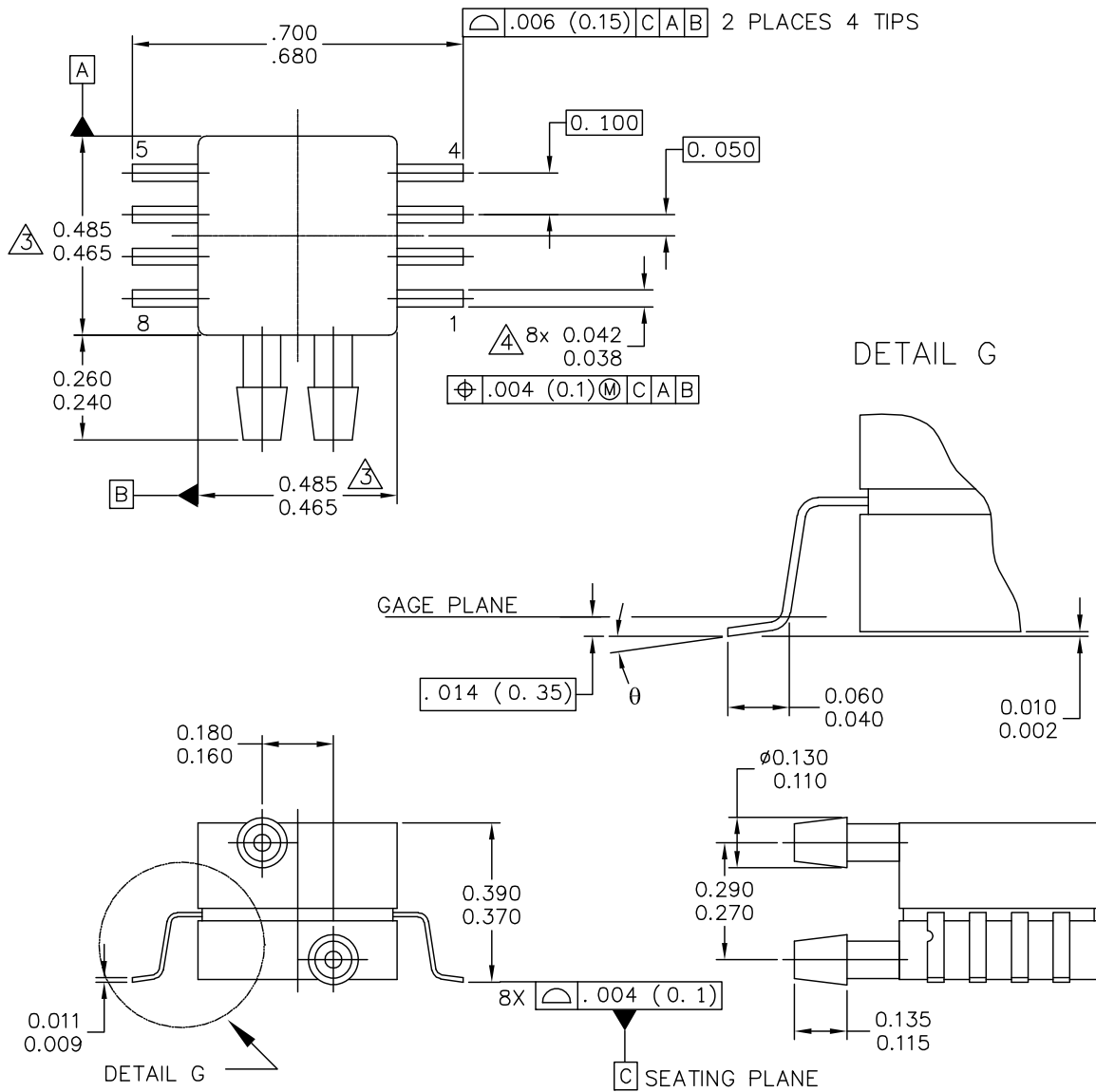
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 1.145 | 1.175 | 29.08 | 29.85 |
| B | 0.685 | 0.715 | 17.40 | 18.16 |
| C | 0.405 | 0.435 | 10.29 | 11.05 |
| D | 0.016 | 0.020 | 0.41 | 0.51 |
| F | 0.048 | 0.064 | 1.22 | 1.63 |
| G | 0.100 BSC | | 2.54 BSC | |
| H | 0.182 | 0.194 | 4.62 | 4.93 |
| J | 0.014 | 0.016 | 0.36 | 0.41 |
| K | 0.695 | 0.725 | 17.65 | 18.42 |
| L | 0.290 | 0.300 | 7.37 | 7.62 |
| N | 0.420 | 0.440 | 10.67 | 11.18 |
| P | 0.153 | 0.159 | 3.89 | 4.04 |
| Q | 0.153 | 0.159 | 3.89 | 4.04 |
| R | 0.063 | 0.083 | 1.60 | 2.11 |
| S | 0.220 | 0.240 | 5.59 | 6.10 |
| U | 0.910 BSC | | 23.11 BSC | |
| V | 0.248 | 0.278 | 6.30 | 7.06 |
| W | 0.310 | 0.330 | 7.87 | 8.38 |

- STYLE 1:
1. GROUND
 2. + OUTPUT
 3. + SUPPLY
 4. - OUTPUT

CASE 344C-01 ISSUE B UNIBODY PACKAGE

PACKAGE DIMENSIONS



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

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:

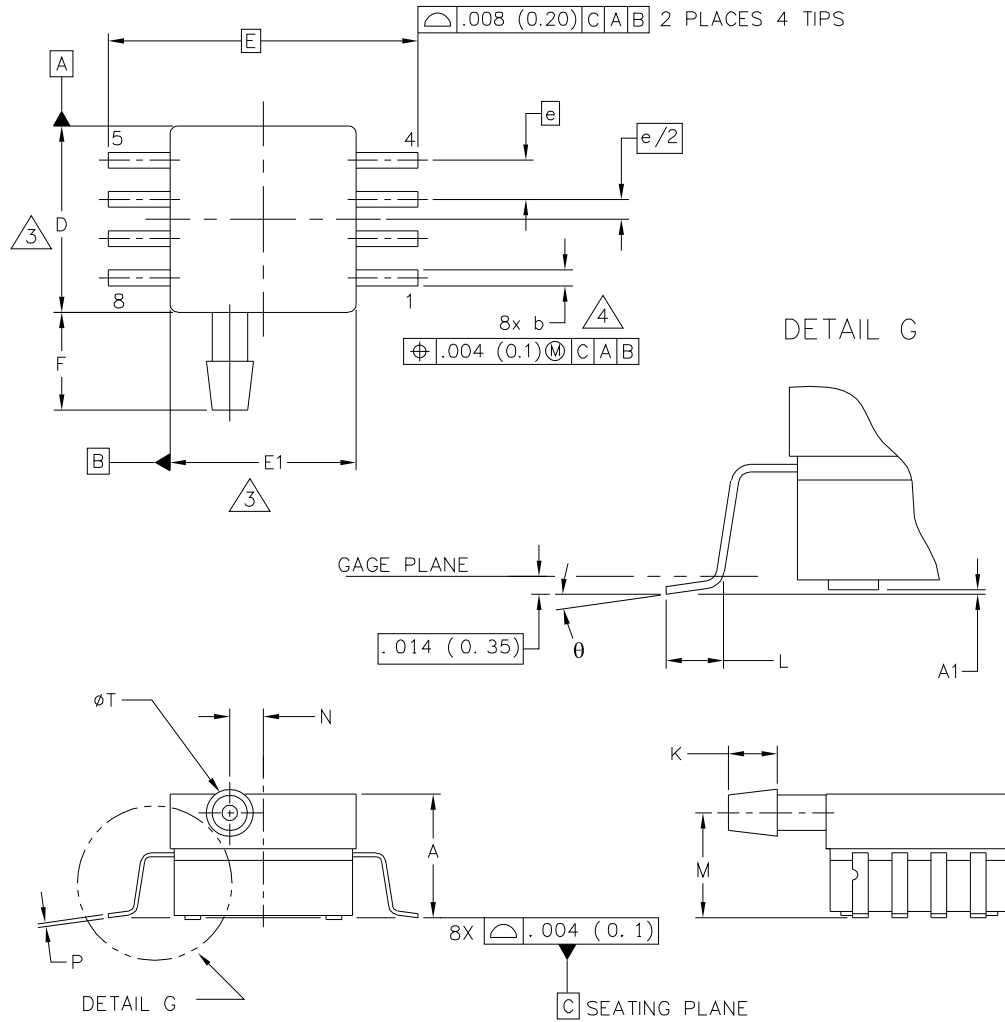
PIN 1: N/C
 PIN 2: Vs
 PIN 3: GND
 PIN 4: Vout
 PIN 5: N/C
 PIN 6: N/C
 PIN 7: N/C
 PIN 8: N/C

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

PAGE 2 OF 2

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

PACKAGE DIMENSIONS



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| TITLE: 8 LD SOP, SIDE PORT | DOCUMENT NO: 98ASA99303D | REV: D |
| | CASE NUMBER: 1369-01 | 13 DEC 2010 |
| | STANDARD: NON-JEDEC | |

CASE 1369-01
ISSUE D
SMALL OUTLINE PACKAGE

PACKAGE DIMENSIONS

NOTES:

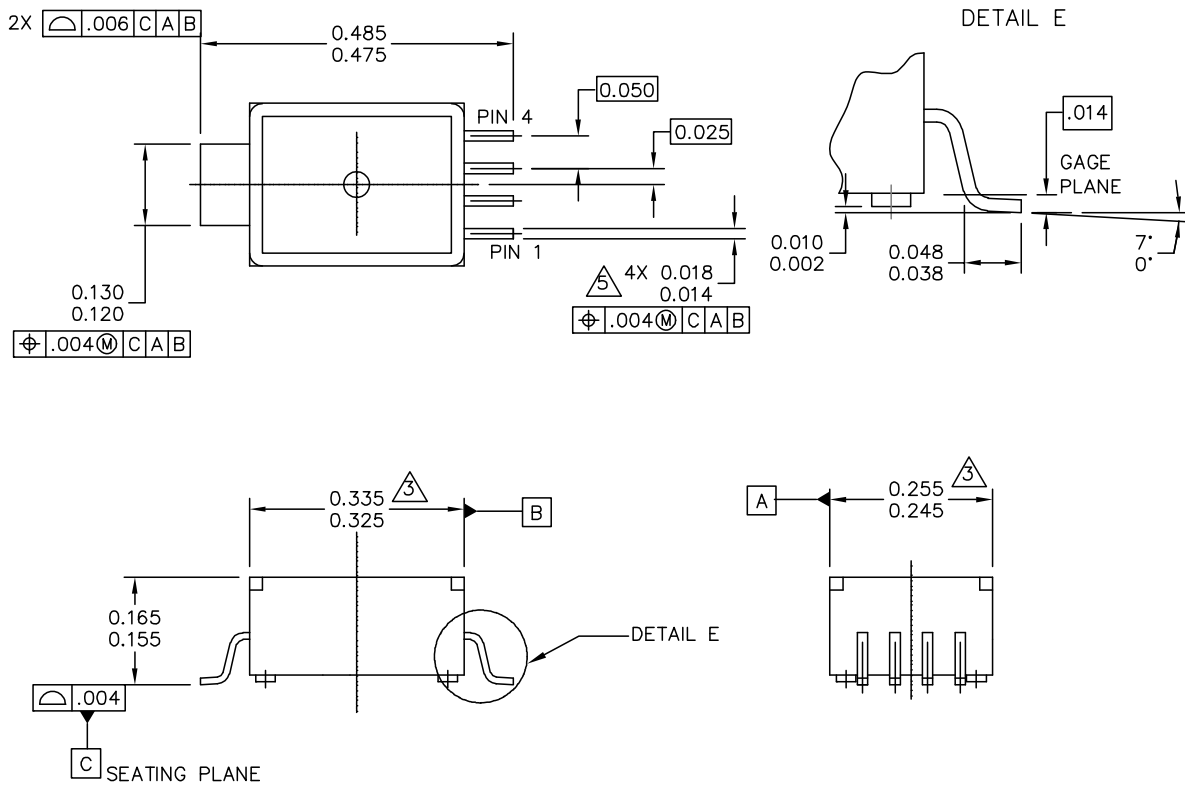
1. CONTROLLING DIMENSION: INCH
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.
3. DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
MOLD FLASH AND PROTRUSIONS SHALL NOT EXCEED .006 (0.152) PER SIDE.
4. DIMENSION DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE .008 (0.203) MAXIMUM.

| DIM | INCHES | | MILLIMETERS | | DIM | INCHES | | MILLIMETERS | |
|---|----------|------|--------------------|-------|--------------------------|----------------------------|-----|-------------|-----|
| | MIN | MAX | MIN | MAX | | MIN | MAX | MIN | MAX |
| A | .300 | .330 | 7.62 | 8.38 | Ø | 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 | | | REV: D | |
| | | | | | CASE NUMBER: 1369-01 | | | 13 DEC 2010 | |
| | | | | | STANDARD: NON-JEDEC | | | | |

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

PACKAGE DIMENSIONS



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| TITLE: 5 LD M-PAC | | DOCUMENT NO: 98ARH99088A | | REV: B | |
| | | CASE NUMBER: 1320-02 | | 22 JUL 2005 | |
| | | STANDARD: NON-JEDEC | | | |

PACKAGE DIMENSIONS

NOTES:

1. DIMENSIONS ARE IN INCHES.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.
3. DIMENSION 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.

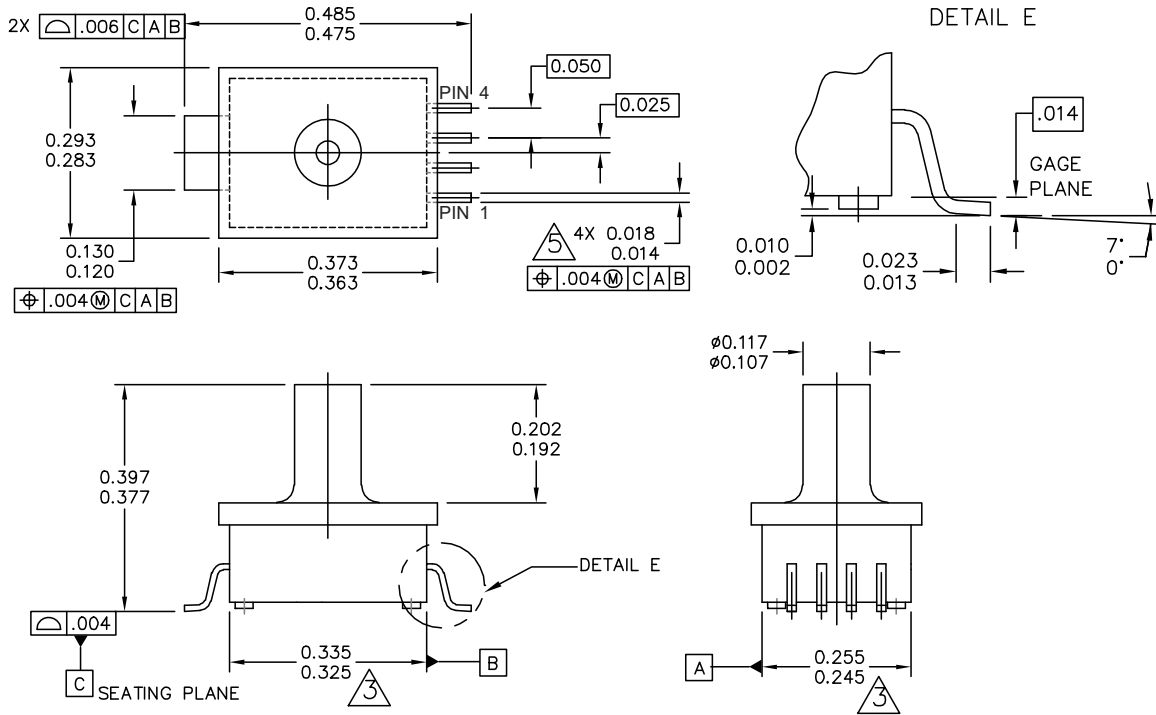
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 PIN 2: +Vout
 PIN 3: Vs
 PIN 4: -Vout

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

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**CASE 1320-02
ISSUE B**

PACKAGE DIMENSIONS



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| TITLE: 5 LD M-PAC, PORTED | DOCUMENT NO: 98ARH99087A | REV: A | |
| | CASE NUMBER: 1320A-02 | 22 JUL 2005 | |
| | STANDARD: NON-JEDEC | | |

**CASE 1320A-02
ISSUE A**

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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| TITLE: 5 LD M-PAC, PORTED | DOCUMENT NO: 98ARH99087A | REV: A | |
| | CASE NUMBER: 1320A-02 | 22 JUL 2005 | |
| | STANDARD: NON-JEDEC | | |

PAGE 2 OF 2

**CASE 1320A-02
ISSUE A**

Table 3. Revision History

| Revision number | Revision date | Description of changes |
|-----------------|---------------|--|
| 9 | 10/2012 | <ul style="list-style-type: none"><li data-bbox="435 239 1295 268">• Deleted references to device number MPXV2053GVP throughout the document |

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[MPX2053DP](#) [MPXM2053GST1](#) [MPX2053D](#) [MPXV2053GVP](#)