



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

The MPX4250D 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

- Differential and Gauge Applications Only
- 1.4% Maximum Error Over 0° to 85°C
- Ideally suited for Microprocessor Interfacing
- Patented Silicon Shear Stress Strain Gauge
- Temperature Compensated Over -40° to +125°C
- Offers Reduction in Weight and Volume Compared to Existing Hybrid Modules
- Durable Epoxy Unibody Element

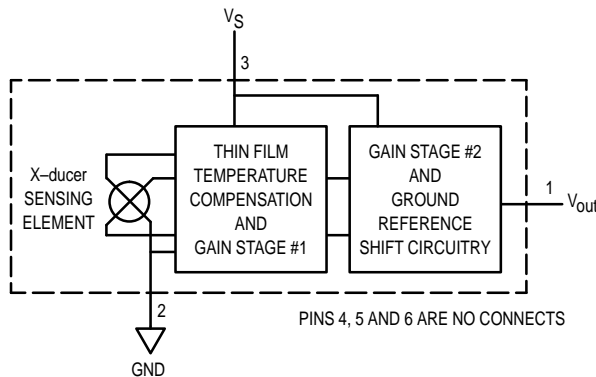


Figure 1. Fully Integrated Pressure Sensor Schematic

MAXIMUM RATINGS(1)

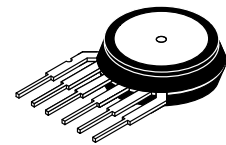
| Parametrics | Symbol | Value | Unit |
|---|--------------------|---------------|------|
| Overpressure ⁽²⁾ (P1 > P2) | P _{max} | 400 | kPa |
| Burst Pressure ⁽²⁾ (P1 > P2) | P _{burst} | 1000 | kPa |
| Storage Temperature | T _{stg} | -40° to +125° | °C |
| Operating Temperature | T _A | -40° to +125° | °C |

1. T_C = 25°C unless otherwise noted.

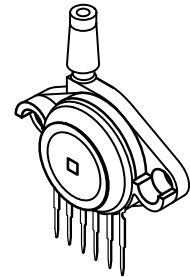
2. Exposure beyond the specified limits may cause permanent damage or degradation to the device.

MPX4250D SERIES

OPERATING OVERVIEW
INTEGRATED
PRESSURE SENSOR
0 to 250 kPa (0 to 36.3 psi)
0.2 to 4.91 Volts Output



BASIC CHIP
CARRIER ELEMENT
CASE 867-08, STYLE 1



PORT OPTION
CASE 867B-04, STYLE 1

PIN NUMBER

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

NOTE: Pins 4, 5, and 6 are internal device connections. Do not connect to external circuitry or ground. Pin 1 is noted by the notch in the Lead.

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REV 1

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OPERATING CHARACTERISTICS ($V_S = 5.1$ Vdc, $T_A = 25^\circ\text{C}$ unless otherwise noted, $P_1 > P_2$)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---------------------|-------|-----------|-----------|-------------|
| Pressure Range ⁽¹⁾ | P_{OP} | 0 | — | 250 | kPa |
| Supply Voltage ⁽²⁾ | V_S | 4.85 | 5.1 | 5.35 | Vdc |
| Supply Current | I_o | — | 7.0 | 10 | mAdc |
| Minimum Pressure Offset ⁽³⁾ @ $V_S = 5.1$ Volts | V_{OFF} | 0.139 | 0.204 | 0.269 | Vdc |
| Full Scale Output ⁽⁴⁾ @ $V_S = 5.1$ Volts | V_{FSO} | 4.844 | 4.909 | 4.974 | Vdc |
| Full Scale Span ⁽⁵⁾ @ $V_S = 5.1$ Volts | V_{FSS} | — | 4.705 | — | Vdc |
| Accuracy ⁽⁶⁾ | — | — | — | ± 1.4 | % V_{FSS} |
| Sensitivity | $\Delta V/\Delta P$ | — | 18.8 | — | 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 | — | mSec |
| Offset Stability ⁽⁹⁾ | — | — | ± 0.5 | — | % V_{FSS} |

MECHANICAL CHARACTERISTICS

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|--------|-----|-----|-----|-------|
| Weight, Basic Element (Case 867) | — | — | 4.0 | — | Grams |
| Common Mode Line Pressure ⁽¹⁰⁾ | — | — | — | 690 | kPa |

NOTES:

- 1.0 kPa (kiloPascal) equals 0.145 psi.
- Device is ratiometric within this specified excitation range.
- Offset (V_{off}) is defined as the output voltage at the minimum rated pressure.
- Full Scale Output (V_{FSO}) is defined as the output voltage at the maximum or full rated pressure.
- 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.
- 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 .
- 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.
- Warm-up is defined as the time required for the product to meet the specified output voltage after the Pressure has been stabilized.
- Offset stability is the product's output deviation when subjected to 1000 hours of Pulsed Pressure, Temperature Cycling with Bias Test.
- Common mode pressures beyond what is specified may result in leakage at the case-to-lead interface.

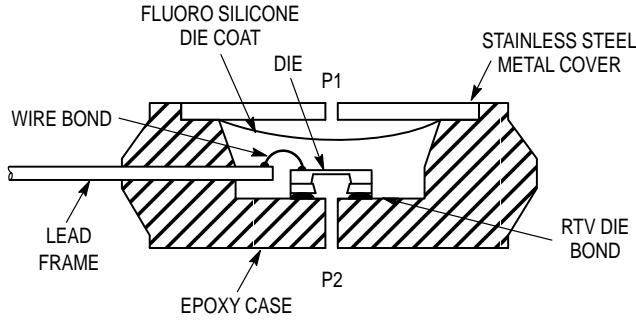


Figure 2. Cross-Sectional Diagram (Not to Scale)

Figure 2 illustrates the Differential/Gauge Pressure Sensing Chip in the basic chip carrier (Case 867). 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 MPX4250D 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

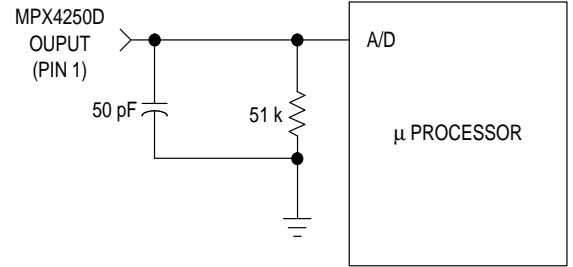


Figure 3. Typical Decoupling Filter for Sensor to Microprocessor Interface

regarding media compatibility in your application.

Figure 3 shows a typical decoupling circuit for interfacing the integrated sensor to the A/D input of a microprocessor. 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° to 85°C using the decoupling circuit below. (The output will saturate outside of the specified pressure range.)

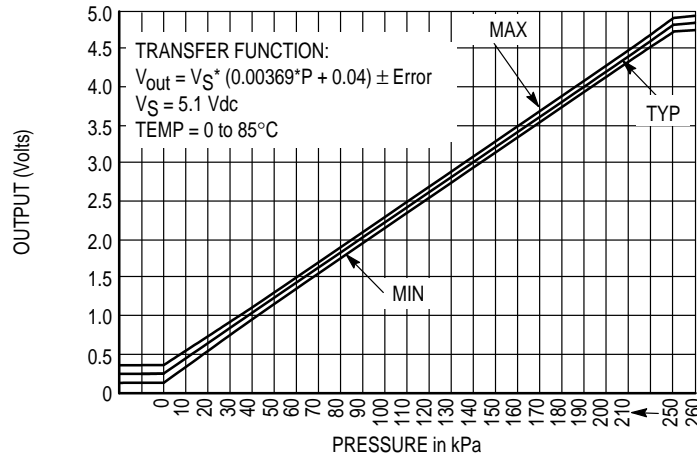


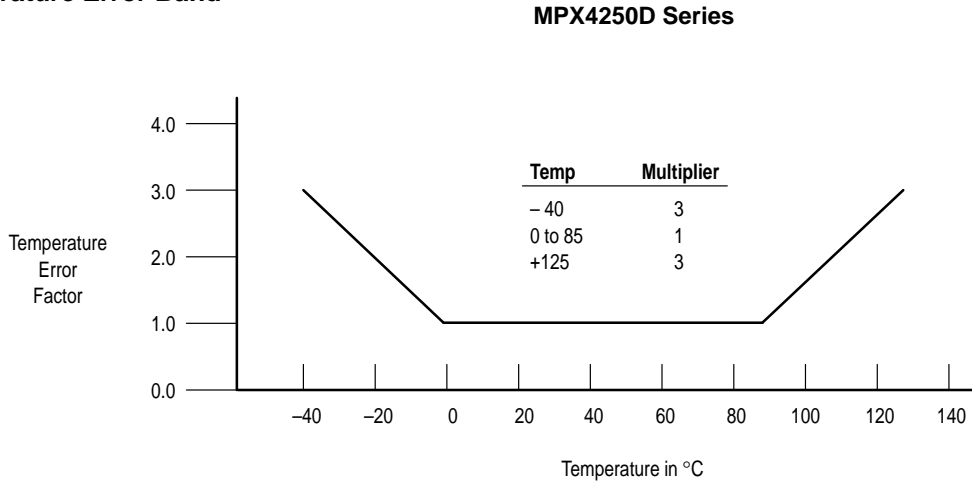
Figure 4. Output versus Differential Pressure

MPX4250D SERIES

Transfer Function (MPX4250D)

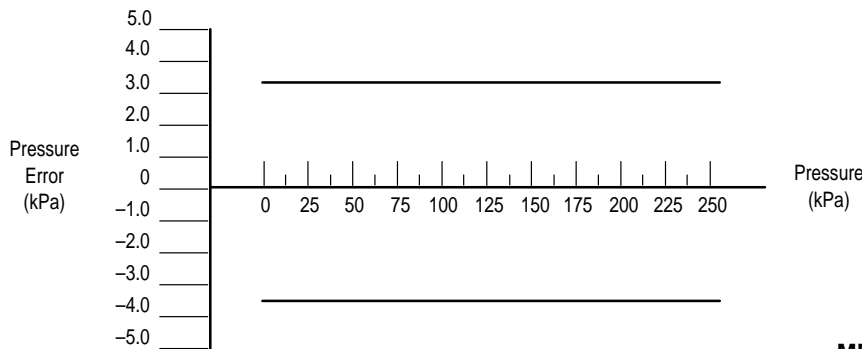
Nominal Transfer Value: $V_{out} = V_S \times (0.00369 \times P + 0.04)$
 $\pm (\text{Pressure Error} \times \text{Temp. Factor} \times 0.00369 \times V_S)$
 $V_S = 5.1 \pm 0.25 \text{ Vdc}$

Temperature Error Band



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

Pressure Error Band



MPX4250D Series

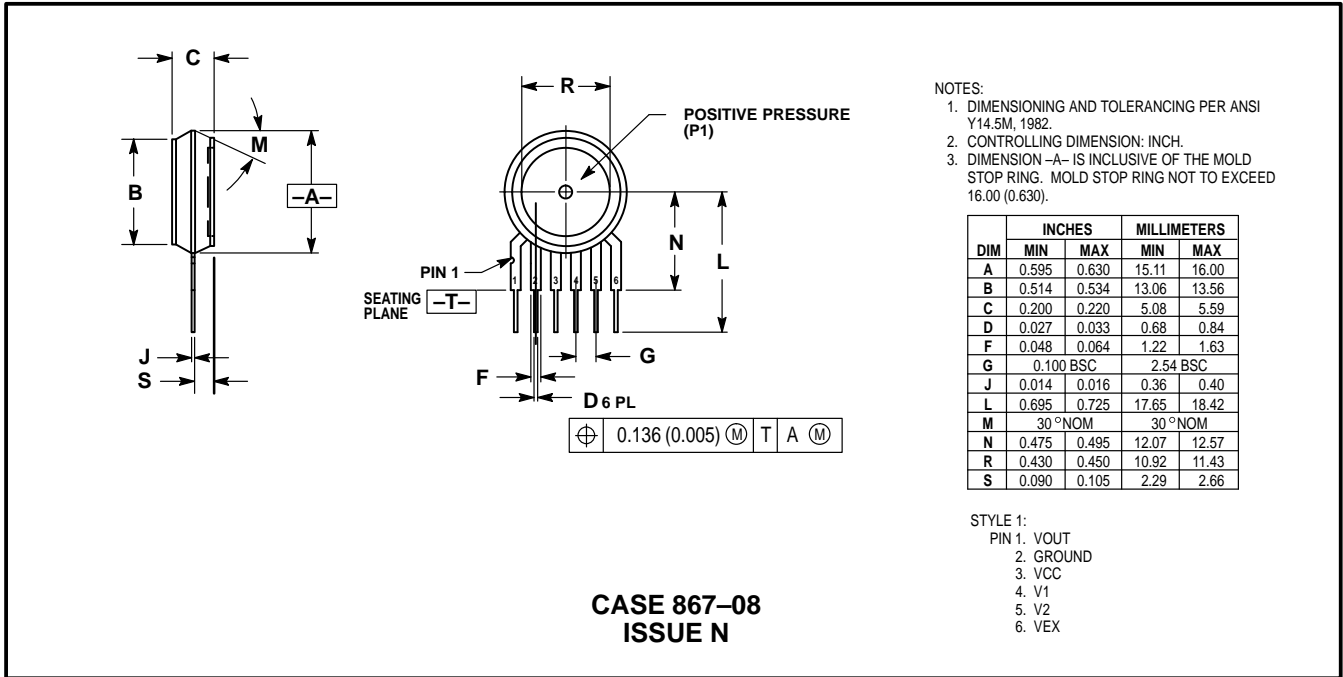
| Pressure | Error (max) |
|--------------|------------------------|
| 0 to 250 kPa | $\pm 3.45 \text{ kPa}$ |

ORDERING INFORMATION

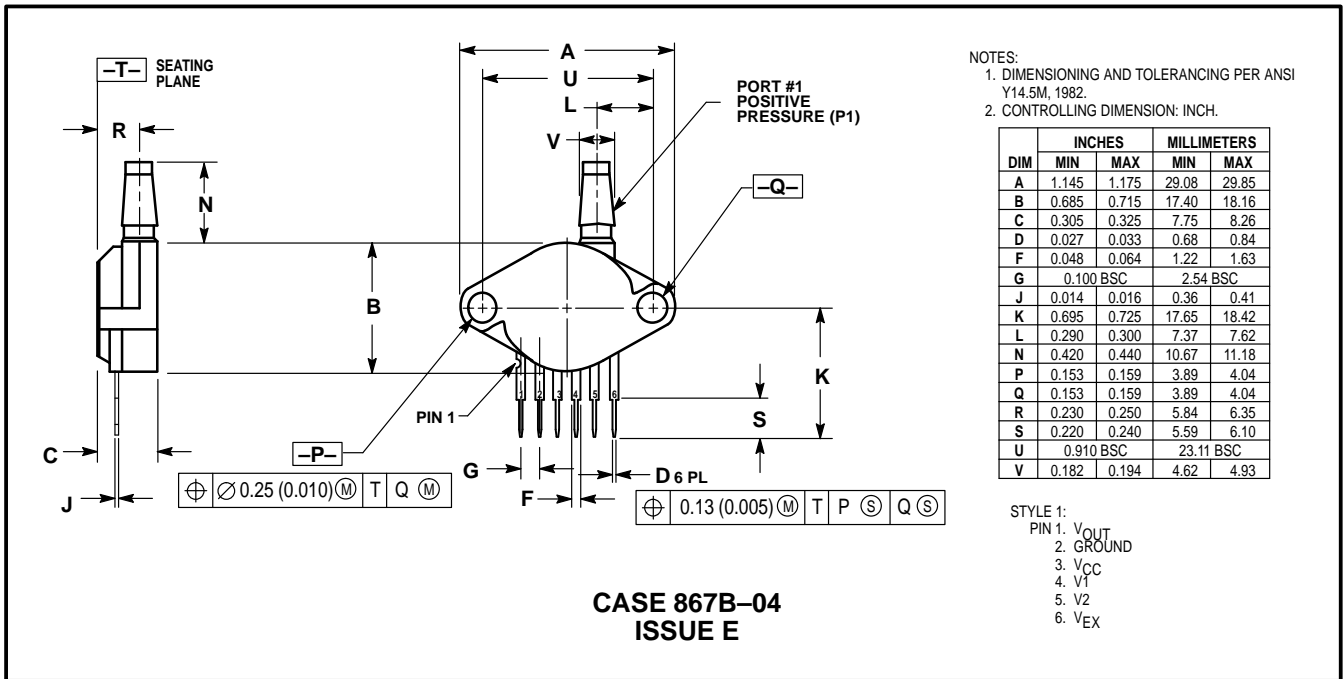
The MPX4250D series silicon pressure sensors are available in the basic element package or with pressure port fittings that provide mounting ease and barbed hose connections.

| Device Type | Options | Case No. | MPX Series Order No. | Marking |
|-----------------|-------------------------------------|--------------|----------------------|-----------|
| Basic Element | Differential/Gauge, Element | Case 867-08 | MPX4250D | MPX4250D |
| Ported Elements | Differential/Gauge, Ported | Case 867B-04 | MPX4250DP | MPX4250DP |
| | Differential/Gauge, Stove Pipe Port | Case 867E-03 | MPX4250GS | MPX4250D |
| | Differential/Gauge, Axial Port | Case 867F-03 | MPX4250GSX | MPX4250D |

PACKAGE DIMENSIONS

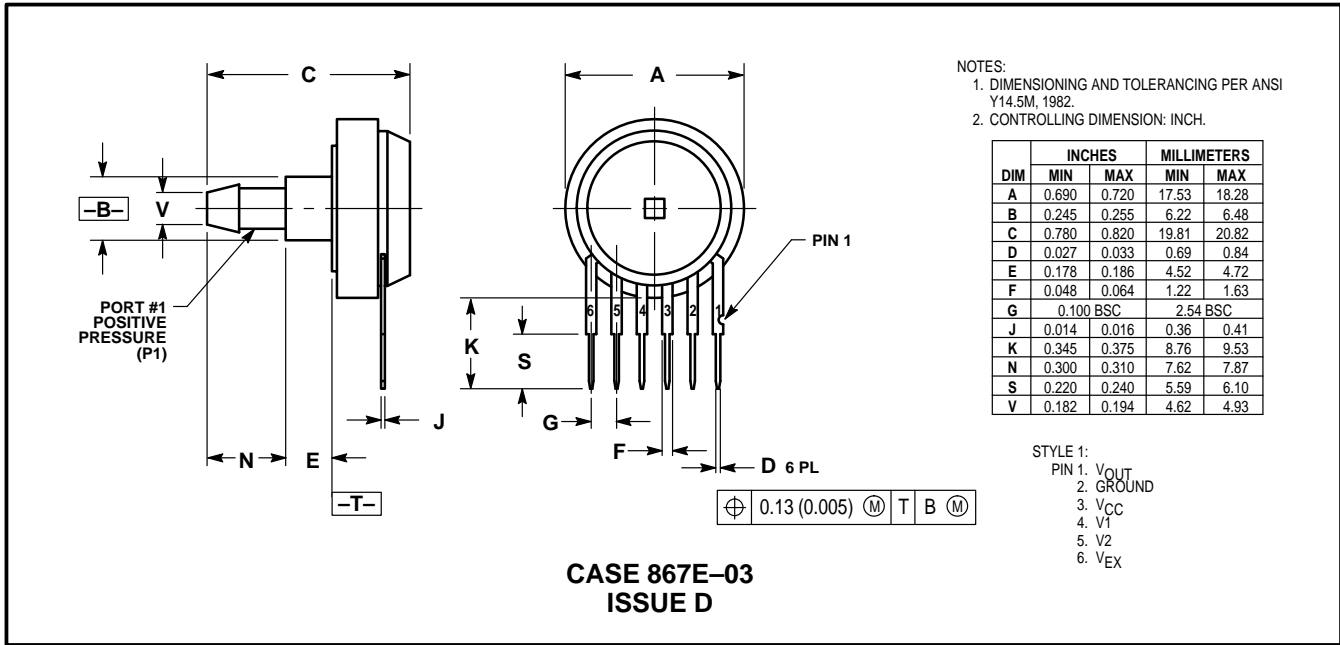


BASIC ELEMENT (D)

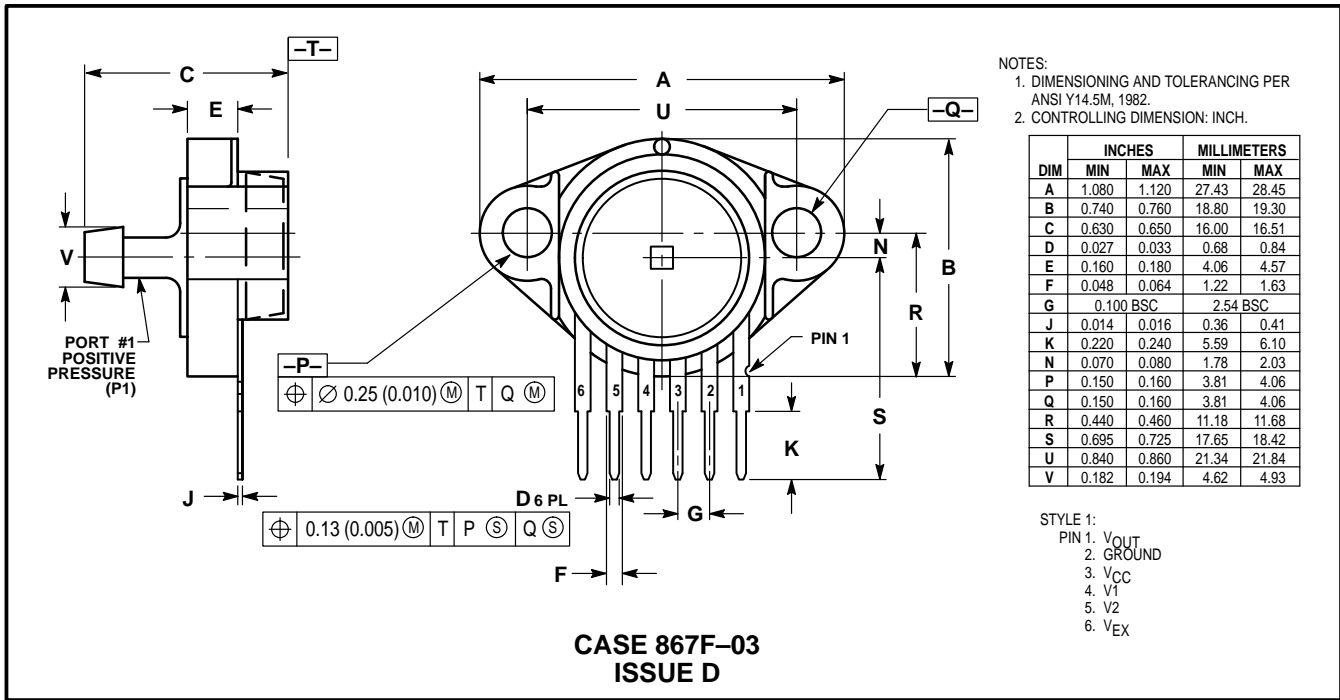


PRESSURE SIDE PORTED (AP)


PACKAGE DIMENSIONS – CONTINUED



PRESSURE SIDE PORTED (AS)



PRESSURE SIDE PORTED (ASX)

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