



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

The MPX5700 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
- Available in Differential and Gauge Configurations
- Patented Silicon Shear Stress Strain Gauge
- Durable Epoxy Unibody Element

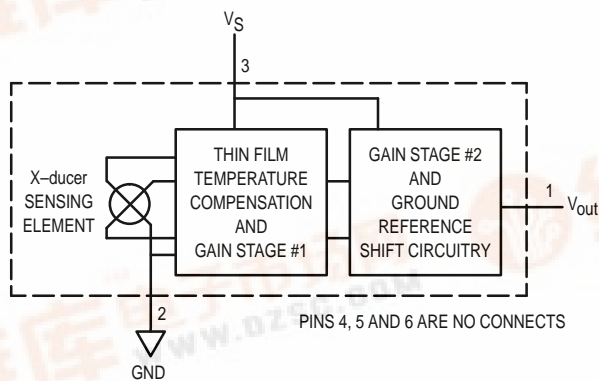


Figure 1. Fully Integrated Pressure Sensor Schematic

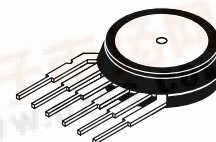
### MAXIMUM RATINGS(1)

Parametrics	Symbol	Value	Unit
Overpressure ( $P_2 \leq 1$ Atmosphere)	$P_{1max}$	2800	kPa
Burst Pressure ( $P_2 \leq 1$ Atmosphere)	$P_{1burst}$	5000	kPa
Storage Temperature	$T_{stg}$	-40 to +125	°C
Operating Temperature	$T_A$	-40 to +125	°C

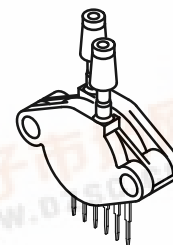
1.  $T_C = 25^\circ\text{C}$  unless otherwise noted. Maximum Ratings apply to Case 867-08 only.
2. Extended exposure at the specified limits may cause permanent damage or degradation to the device.
3. This sensor is designed for applications where  $P_1$  is always greater than, or equal to  $P_2$ .

## MPX5700 SERIES

INTEGRATED  
PRESSURE SENSOR  
0 to 700 kPa (0 to 101.5 psi)  
0.2 to 4.7 V OUTPUT



BASIC CHIP  
CARRIER ELEMENT  
CASE 867-08, STYLE 1



DIFFERENTIAL  
PORT OPTION  
CASE 867C-05, STYLE 1

### PIN NUMBER

Pin	Function	Pin	Function
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.

## MPX5700 SERIES

### OPERATING CHARACTERISTICS ( $V_S = 5.0$ Vdc, $T_A = 25^\circ\text{C}$ unless otherwise noted, $P_1 > P_2$ )

Characteristic	Symbol	Min	Typ	Max	Unit
Pressure Range <sup>(1)</sup>	$P_{OP}$	0	—	700	kPa
Supply Voltage <sup>(2)</sup>	$V_S$	4.75	5.0	5.25	Vdc
Supply Current	$I_o$	—	7.0	10	mAdc
Zero Pressure Offset <sup>(3)</sup> (0 to 85°C)	$V_{off}$	0.088	0.2	0.313	Vdc
Full Scale Output <sup>(4)</sup> (0 to 85°C)	$V_{FSO}$	4.587	4.7	4.813	Vdc
Full Scale Span <sup>(5)</sup> (0 to 85°C)	$V_{FSS}$	—	4.5	—	Vdc
Accuracy <sup>(6)</sup> (0 to 85°C)	—	—	—	$\pm 2.5$	$\%V_{FSS}$
Sensitivity	$V/P$	—	6.4	—	mV/kPa
Response Time <sup>(7)</sup>	$t_R$	—	1.0	—	ms
Output Source Current at Full Scale Output	$I_{O+}$	—	0.1	—	mAdc
Warm-Up Time <sup>(8)</sup>	—	—	20	—	ms

Decoupling circuit shown in Figure 4 required to meet electrical specifications.

### MECHANICAL CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
Weight, Basic Element (Case 867)	—	—	4.0	—	Grams
Cavity Volume	—	—	—	0.01	$\text{IN}^3$
Volumetric Displacement	—	—	—	0.001	$\text{IN}^3$

#### 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 device to meet the specified output voltage after the pressure has been stabilized.
- $P_2$  max is 500 kPa.

## MPX5700 SERIES

### ON-CHIP TEMPERATURE COMPENSATION, CALIBRATION AND SIGNAL CONDITIONING

Figure 3 illustrates both the Differential/Gauge and the Absolute 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. (For use of the MPX5700D in a high pressure, cyclic application, consult the factory.)

The MPX5700 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 4 shows a typical decoupling circuit for interfacing the sensor to the A/D input of a microprocessor. Proper decoupling of the power supply is recommended.

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 below. (The output will saturate outside of the specified pressure range.)

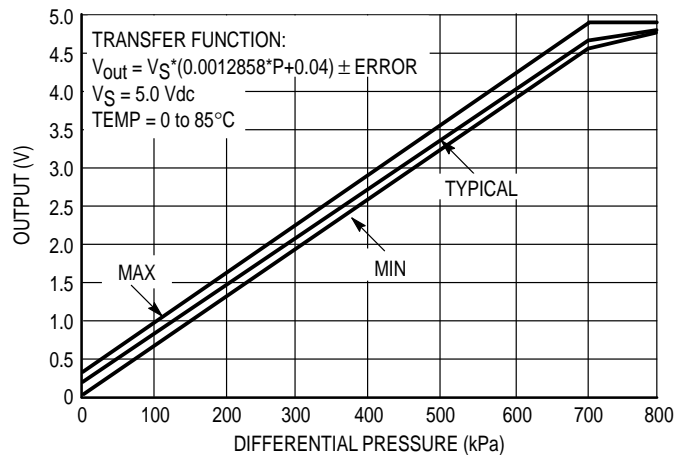


Figure 2. Output versus Pressure Differential

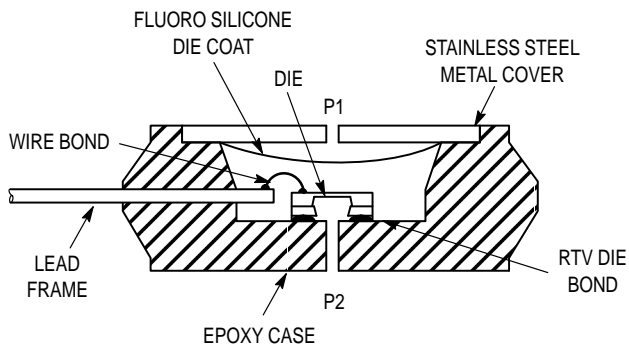


Figure 3. Cross-Sectional Diagram (Not to Scale)

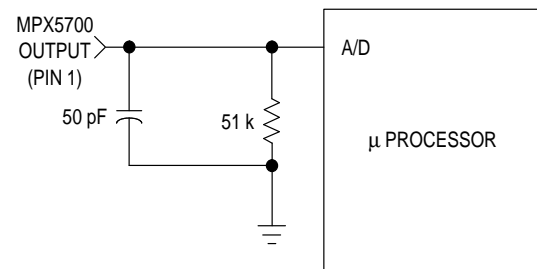


Figure 4. Typical Decoupling Filter for Sensor to Microprocessor Interface

## MPX5700 SERIES

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

Motorola 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 fluoro silicone gel which protects the die from harsh media. The Motorola MPX

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
MPX5700D	867-08	Stainless Steel Cap
MPX5700DP	867C-05	Side with Part Marking
MPX5700GP	867B-04	Side with Port Attached
MPX5700GS	867E-03	Side with Port Attached
MPX5700GSX	867F-03	Side with Port Attached

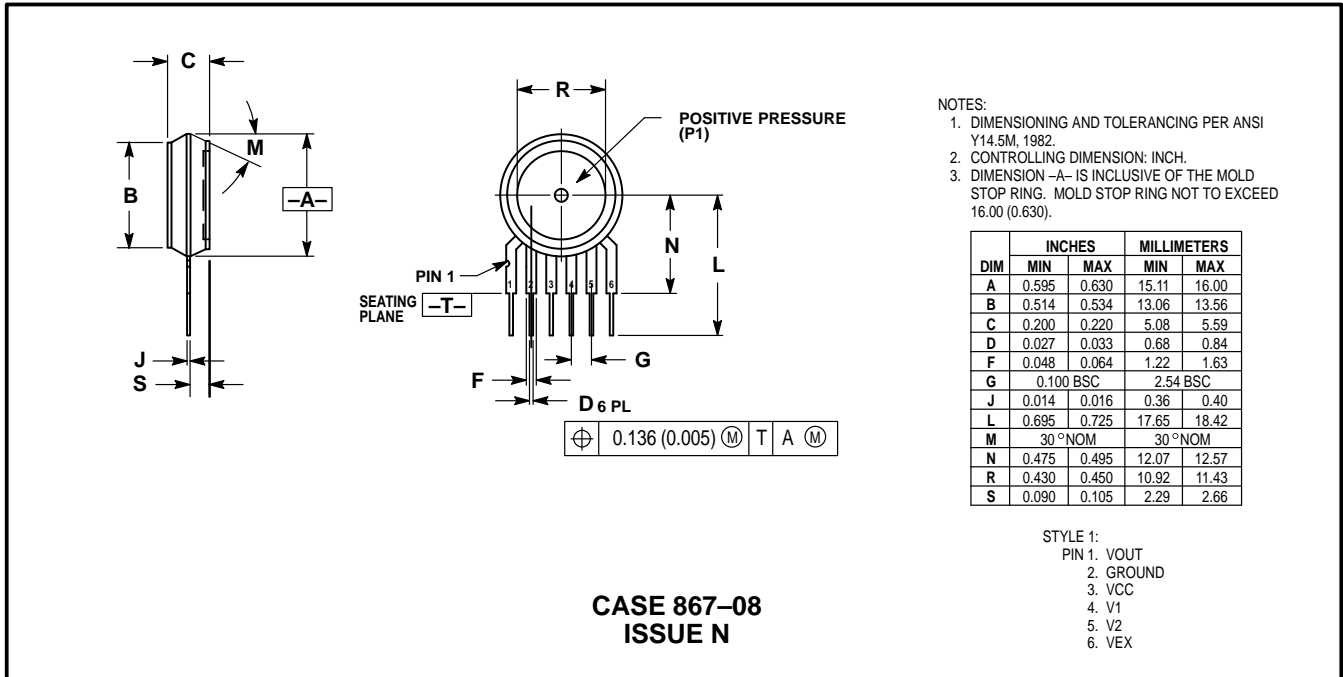
### ORDERING INFORMATION

The MPX5700 pressure sensor is available in differential and gauge configurations. Devices are available in the basic element package or with pressure port fittings that provide printed circuit board mounting ease and barbed hose pressure connections.

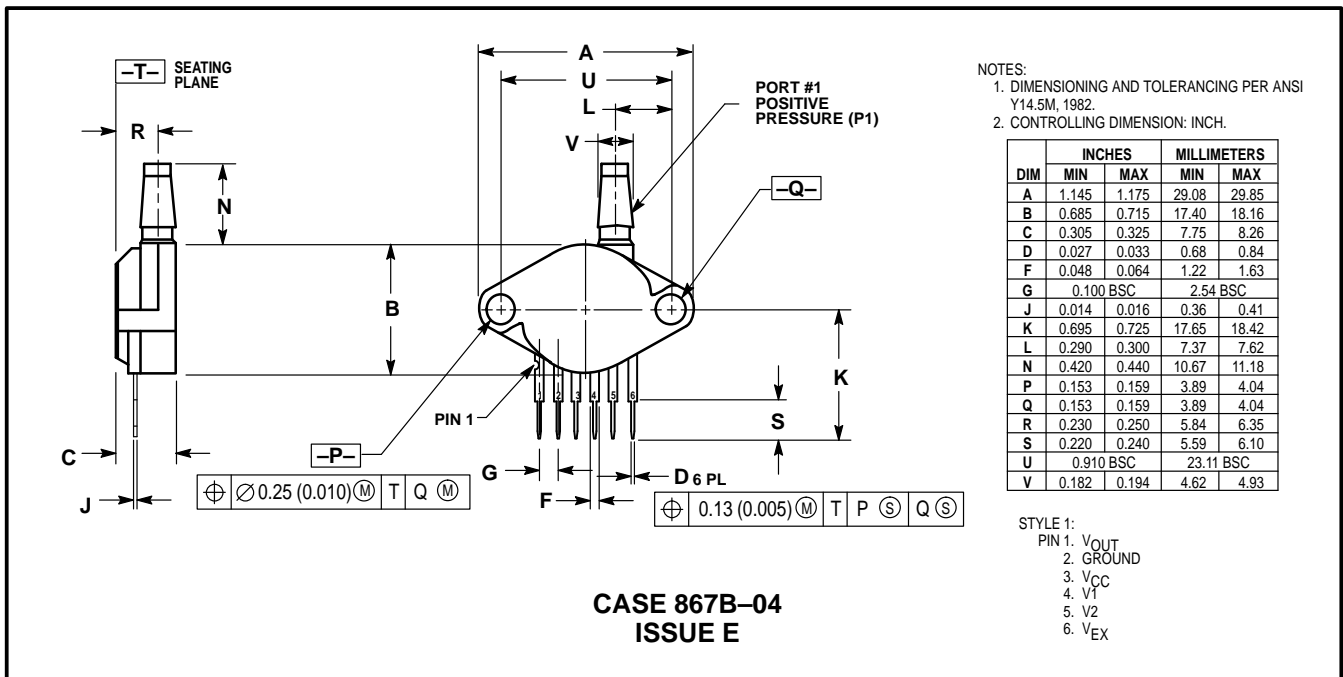
Device Type	Options	Case Type	MPX Series	
			Order Number	Device Marking
Basic Element	Differential	867-08	MPX5700D	MPX5700D
Ported Elements	Differential Dual Ports	867C-05	MPX5700DP	MPX5700DP
	Gauge	867B-04	MPX5700GP	MPX5700GP
	Gauge, Axial	867E-03	MPX5700GS	MPX5700D
	Gauge, Axial PC Mount	867F-03	MPX5700GSX	MPX5700D

# MPX5700 SERIES

## PACKAGE DIMENSIONS



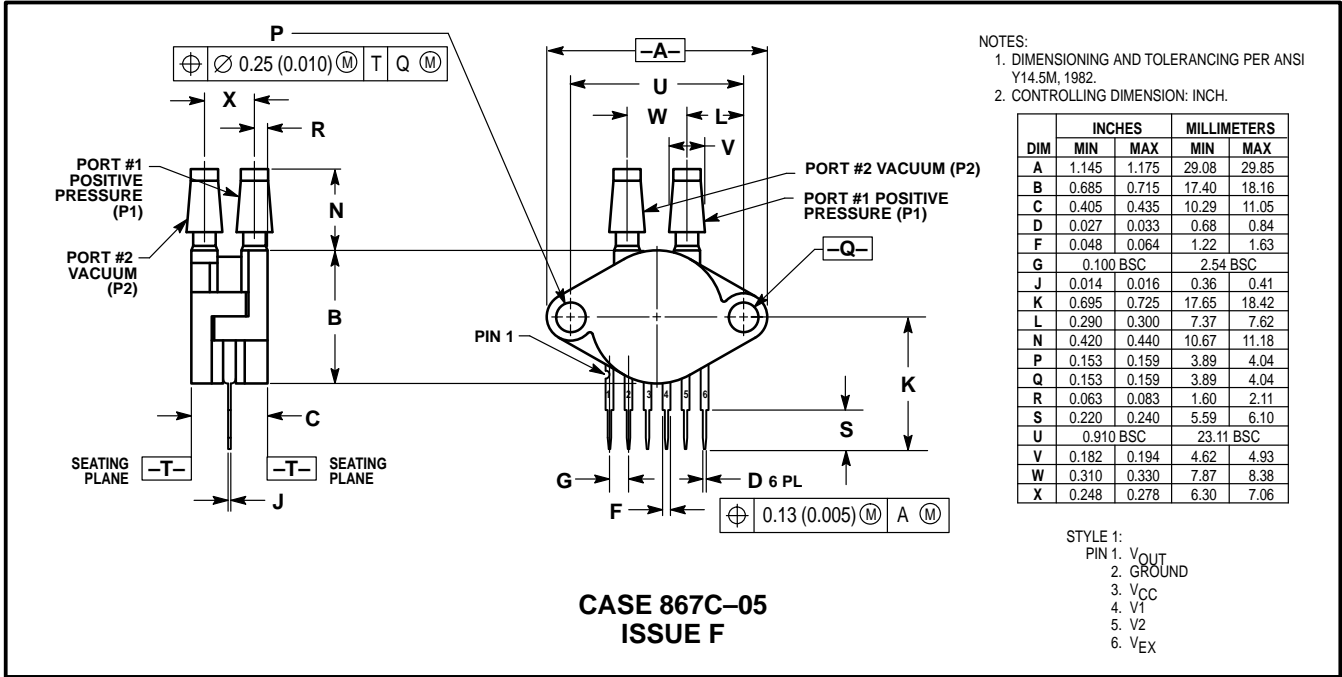
BASIC ELEMENT (A, D)



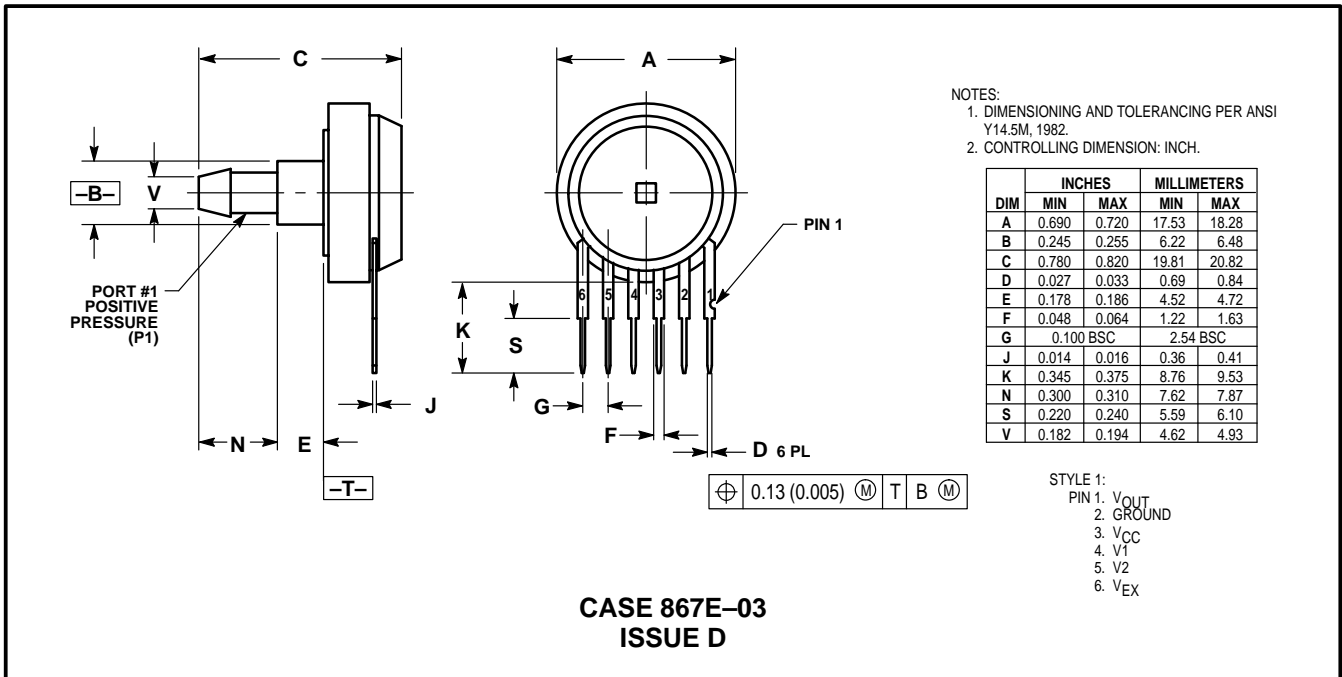
PRESSURE SIDE PORTED (AP, GP)

**MPX5700 SERIES**

**PACKAGE DIMENSIONS—CONTINUED**



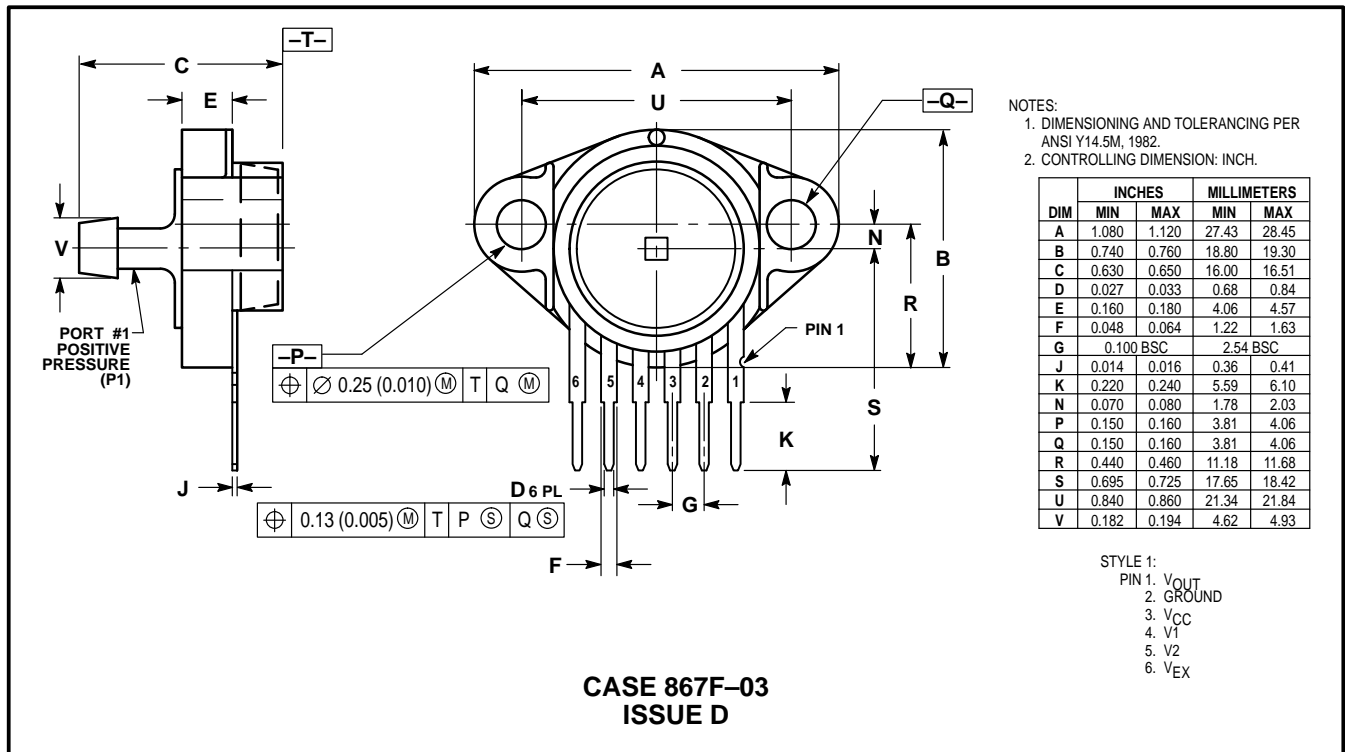
**PRESSURE AND VACUUM SIDES PORTED (DP)**



**PRESSURE SIDE PORTED (AS, GS)**

# MPX5700 SERIES

## PACKAGE DIMENSIONS—CONTINUED



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


DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.080	1.120	27.43	28.45
B	0.740	0.760	18.80	19.30
C	0.630	0.650	16.00	16.51
D	0.027	0.033	0.68	0.84
E	0.160	0.180	4.06	4.57
F	0.048	0.064	1.22	1.63
G	0.100 BSC		2.54 BSC	
J	0.014	0.016	0.36	0.41
K	0.220	0.240	5.59	6.10
N	0.070	0.080	1.78	2.03
P	0.150	0.160	3.81	4.06
Q	0.150	0.160	3.81	4.06
R	0.440	0.460	11.18	11.68
S	0.695	0.725	17.65	18.42
U	0.840	0.860	21.34	21.84
V	0.182	0.194	4.62	4.93

- STYLE 1:
1. V<sub>OUT</sub>
  2. GROUND
  3. V<sub>CC</sub>
  4. V<sub>1</sub>
  5. V<sub>2</sub>
  6. V<sub>EX</sub>

CASE 867F-03  
ISSUE D

PRESSURE SIDE PORTED (ASX, GSX)

## MPX5700 SERIES

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