

0 to 700 kPa (0 to 100 PSI) On-Chip Signal Conditioned, 0.2 V to 4.7 V Output, Temperature Compensated and Calibrated, Silicon Pressure Sensors

MPX5700 SERIES

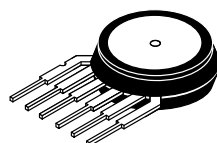
Features

- Temperature Compensated Over 0 to 85°C
- Ideally Suited for Microprocessor or Microcontroller–Based Systems
- Patented Silicon Shear Stress Strain Gauge
- Available in Differential and Gauge Configurations
- Durable Epoxy Unibody Element

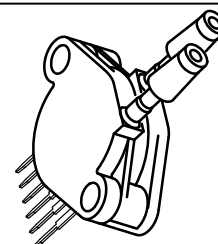
X–ducer™
SILICON
PRESSURE SENSORS

Pin Number					
1	2	3	4	5	6
V _{out}	Ground	V _S	N/C	N/C	N/C

NOTE: Pins 4, 5 and 6 are internal device connections.
Do not connect to external circuitry or ground.



BASIC CHIP
CARRIER ELEMENT
CASE 867-04
Style 1



DIFFERENTIAL
PORT OPTION
CASE 867C-03
Style 1

MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Overpressure ⁽⁷⁾ (P ₁ > P ₂)	P _{max}	2800	kPa
Burst Pressure ⁽⁷⁾ (P ₁ > P ₂)	P _{burst}	5000	kPa
Storage Temperature	T _{stg}	–50 to +125	°C
Operating Temperature	T _A	–40 to +125	°C

The MPX5700 series piezoresistive transducer is a state-of-the-art pressure sensor designed for a wide range of applications, but particularly for those employing a microcontroller or microprocessor with A/D inputs. This patented, single element X–ducer 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.

Figure 1 shows a block diagram of the internal circuitry integrated on the stand-alone sensing chip.

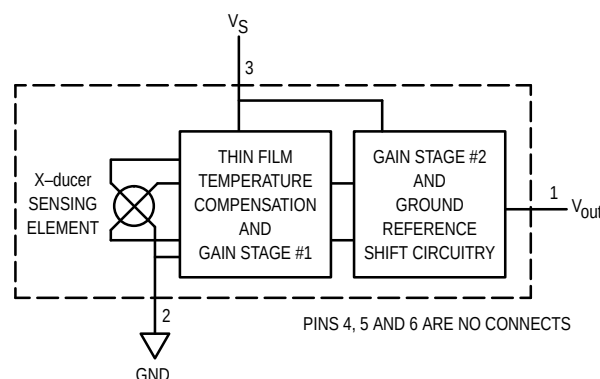


Figure 1. Fully Integrated Pressure Sensor Schematic

X–ducer is a trademark of Motorola, Inc.

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	P_{OP}	0	–	700	kPa
Supply Voltage (1)	V_S	4.75	5.0	5.25	Vdc
Supply Current	I_S	–	7.0	10	mAdc
Full Scale Span (2) (0 to 85°C)	V_{FSS}	4.388	4.5	4.613	V
Zero Pressure Offset (3) (0 to 85°C)	V_{off}	.088	0.2	0.313	V
Sensitivity	V/P	–	6.0	–	mV/kPa
Accuracy (4) (0 to 85°C)	–	–	–	± 2.50	$\%V_{FSS}$
Response Time (5)	t_R	–	1.0	–	ms
Output Source Current at Full Scale Output	I_{O+}	–	0.1	–	mA

MECHANICAL CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
Weight, Basic Element (Case 867)	–	–	4.0	–	Grams
Warm-Up	–	–	15	–	Sec
Cavity Volume	–	–	–	0.01	IN^3
Volumetric Displacement	–	–	–	0.001	IN^3
Common Mode Line Pressure (6)	–	–	–	1000	kPa

NOTES:

- Device is ratiometric within this specified excitation range.
- 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.
- 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 .
 - Offset Stability: Output deviation, after 1000 temperature cycles, -40 to 125°C , and 1.5 million pressure cycles, with minimum rated pressure applied.
 - 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.
- Common mode pressures beyond specified may result in leakage at the case-to-lead interface.
- Exposure beyond these limits may cause permanent damage or degradation to the device.

ON-CHIP TEMPERATURE COMPENSATION, CALIBRATION AND SIGNAL CONDITIONING

Figure 2 shows the sensor output signal relative to pressure input. Typical, minimum and maximum output curves are shown for operation over 0°C to 85°C. (Device output may be nonlinear outside of the rated pressure range.)

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 3 illustrates the differential or gauge configuration in the basic chip carrier (Case 867). A fluoro silicone gel isolates the die surface and wire bonds from harsh environments,

while allowing the pressure signal to be transmitted to the silicon diaphragm.

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 output of the MPX5700 to the A/D microprocessor. Proper decoupling of the power supply is recommended.

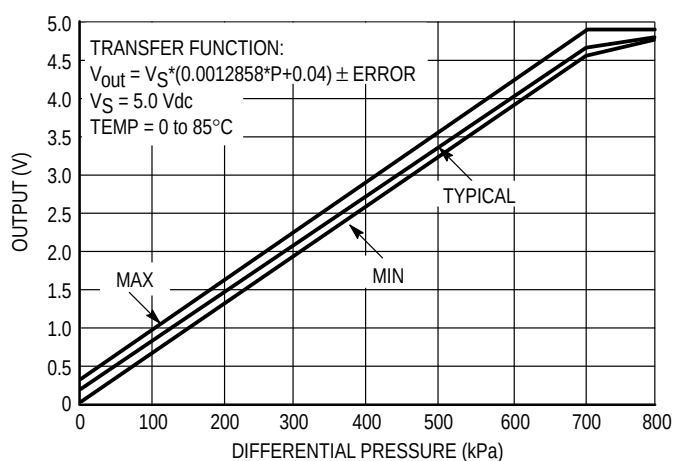


Figure 2. Output versus Pressure Differential

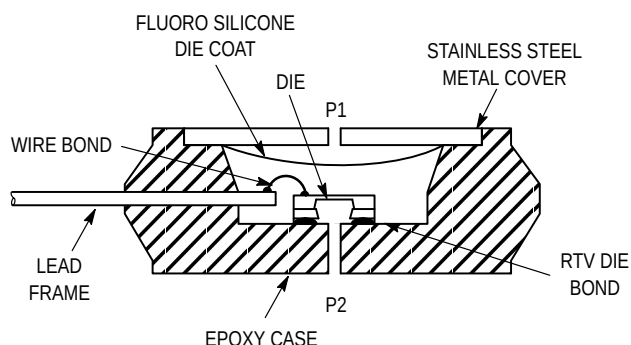


Figure 3. Cross-Sectional Diagram (Not to Scale)

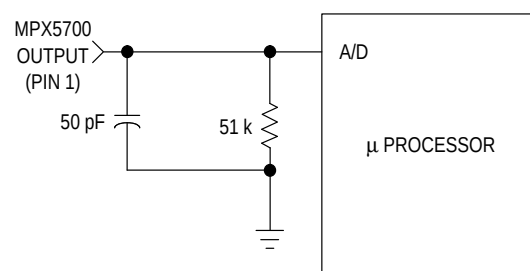


Figure 4. Typical Decoupling Filter for Sensor to Microprocessor Interface

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:

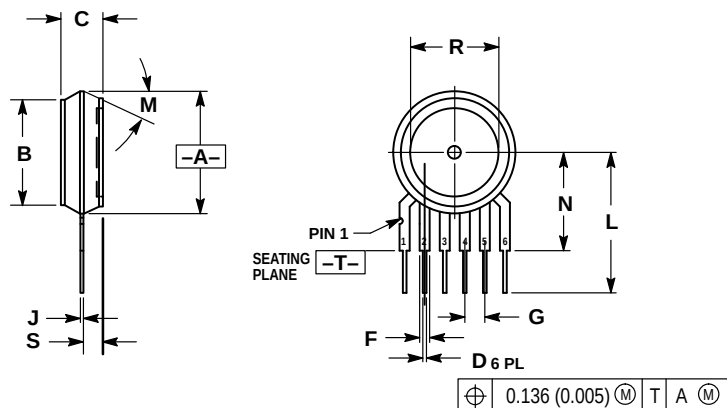
Part Number	Case Type	Pressure (P1) Side Identifier
MPX5700D	867-04	Stainless Steel Cap
MPX5700DP	867C-03	Side with Part Marking
MPX5700GP	867B-03	Side with Port Attached
MPX5700GVP	867D-03	Stainless Steel Cap
MPX5700GS	867E-02	Side with Port Attached
MPX5700GVS	867A-03	Stainless Steel Cap
MPX5700GSX	867F-02	Side with Port Attached
MPX5700GVSX	867G-02	Stainless Steel Cap

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	867-04	MPX5700D	MPX5700D
Ported Elements	Differential Dual Ports	867C-03	MPX5700DP	MPX5700DP
	Gauge	867B-03	MPX5700GP	MPX5700GP
	Gauge Vacuum Port	867D-03	MPX5700GVP	MPX5700GVP
	Gauge, Axial	867E-02	MPX5700GS	MPX5700D
	Gauge Vacuum Axial	867A-03	MPX5700GVS	MPX5700D
	Gauge, Axial PC Mount	867F-02	MPX5700GSX	MPX5700D
	Gauge Vacuum Axial PC Mount	867G-02	MPX5700GVSX	MPX5700D

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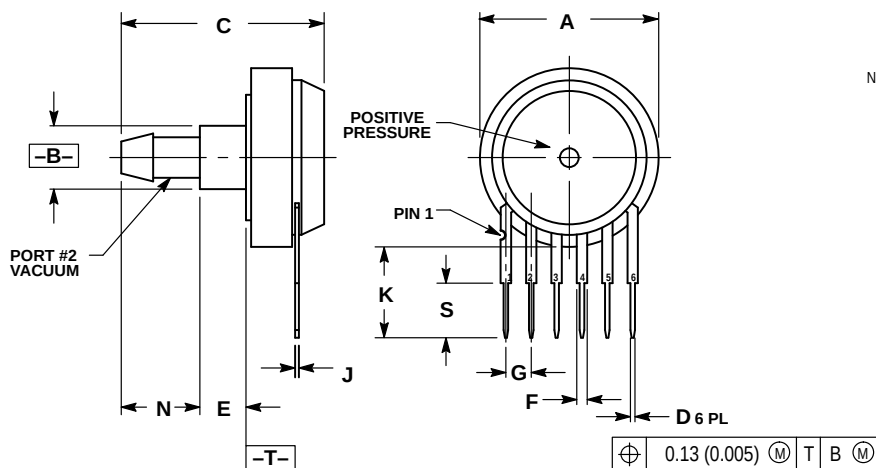
PACKAGE DIMENSIONS


- NOTES:
8. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 9. CONTROLLING DIMENSION: INCH.
 10. DIMENSION -A- DOES NOT INCLUDE MOLDED FLASH RING. MOLDED FLASH RING NOT TO EXCEED 16.00 (0.630).

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.590	0.615	14.99	15.62
B	0.505	0.525	12.83	13.34
C	0.195	0.225	4.95	5.72
D	0.027	0.033	0.68	0.84
F	0.048	0.052	1.22	1.32
G	0.100 BSC		2.54 BSC	
J	0.014	0.016	0.36	0.40
L	0.685	0.715	17.40	18.16
M	30° NOM		30° NOM	
N	0.490	0.510	12.45	12.95
R	0.420	0.450	10.67	11.43
S	0.090	0.105	2.29	2.66

- STYLE 1:
- PIN 1. V_{OUT}
 - GROUND
 - V_{CC}
 - V_1
 - V_2
 - V_{EX}

**CASE 867-04
ISSUE H**

BASIC ELEMENT (A, D)


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

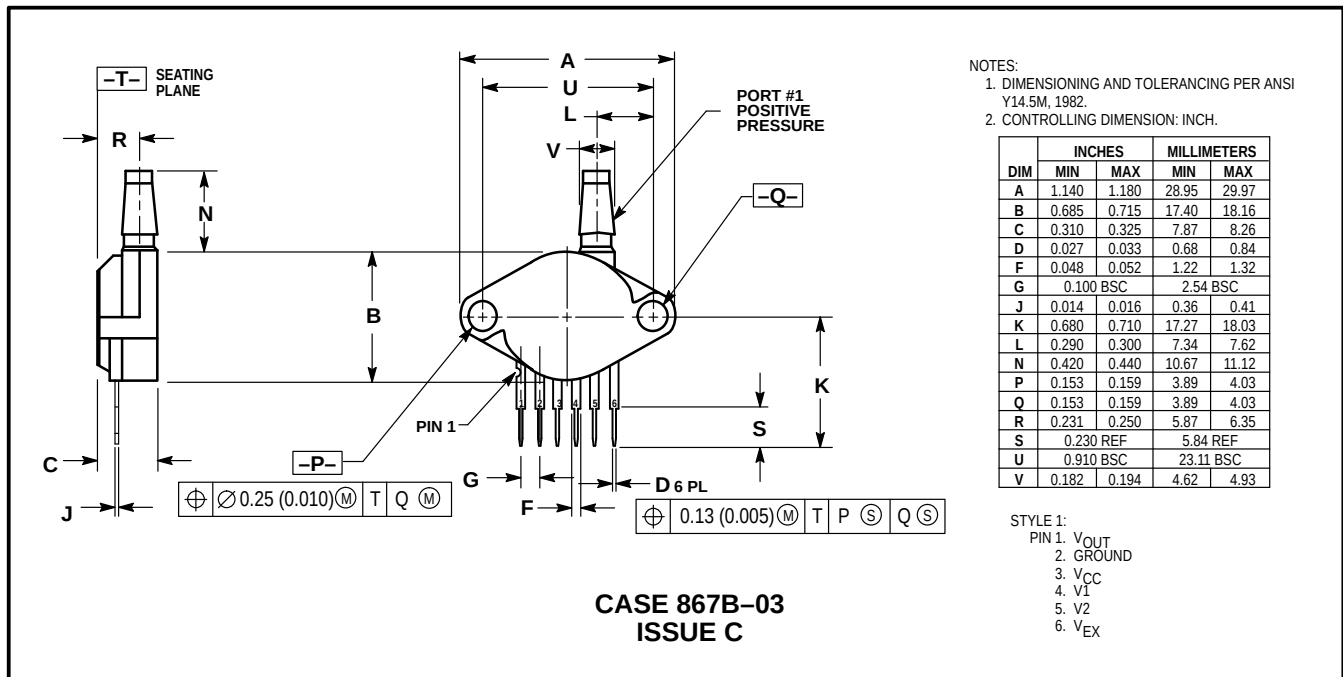
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.690	0.720	17.53	18.28
B	0.247	0.253	6.28	6.42
C	0.780	0.820	19.81	20.82
D	0.027	0.033	0.68	0.84
E	0.178	0.185	4.52	4.69
F	0.048	0.052	1.22	1.32
G	0.100 BSC		2.54 BSC	
J	0.014	0.016	0.36	0.40
K	0.335	0.360	8.51	9.14
N	0.305	0.315	7.75	8.00
S	0.220	0.240	5.59	6.10

- STYLE 1:
- PIN 1. V_{OUT}
 - GROUND
 - V_{CC}
 - V_1
 - V_2
 - V_{EX}

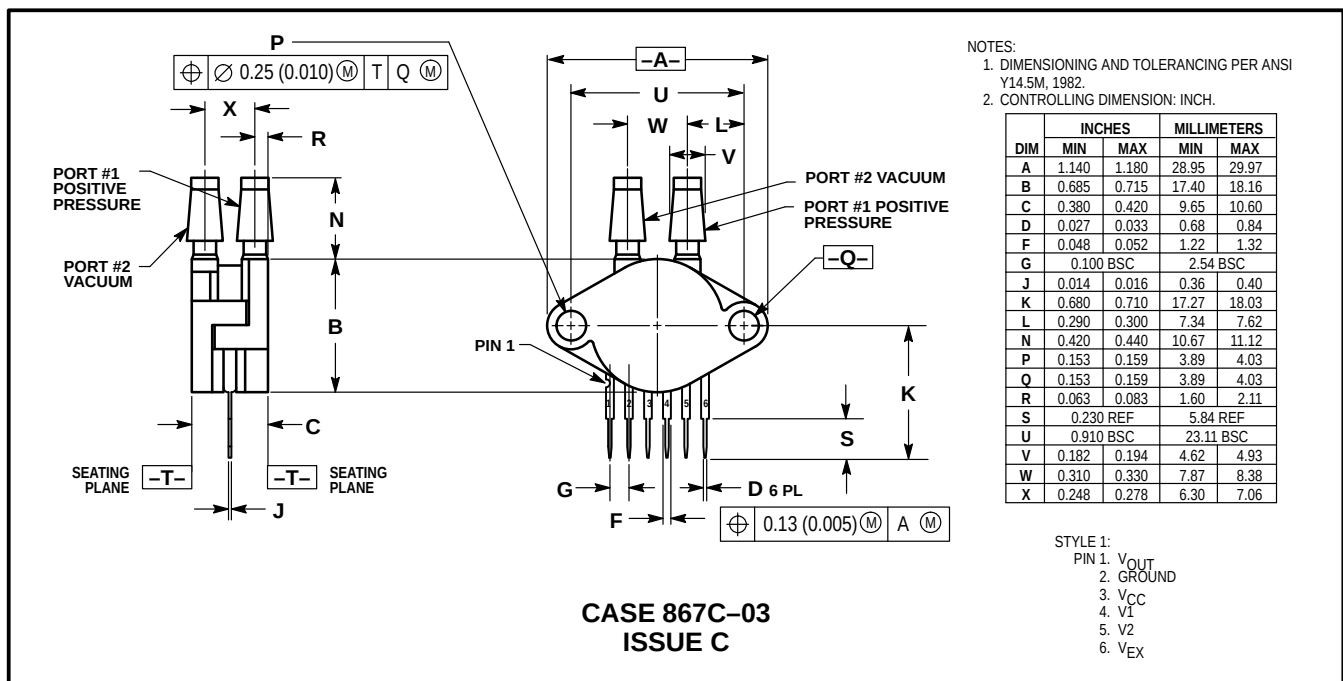
**CASE 867A-03
ISSUE C**

VACUUM SIDE PORTED (GVS)

PACKAGE DIMENSIONS—CONTINUED

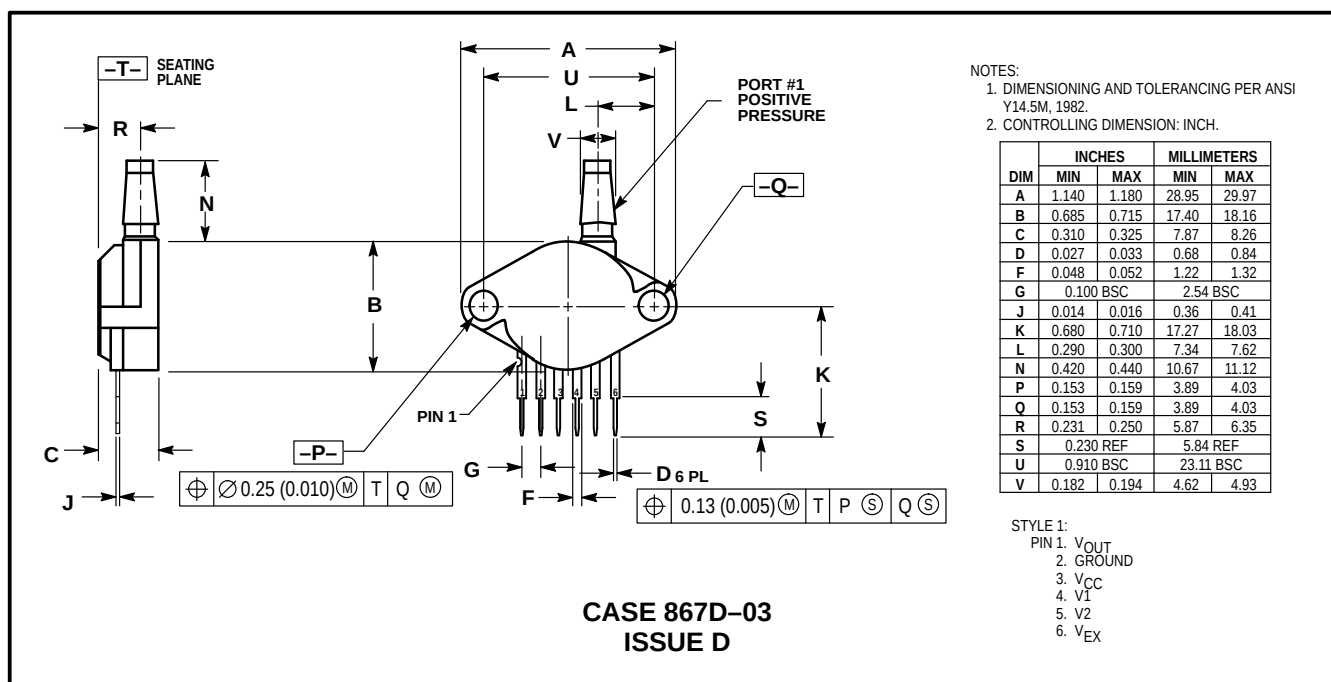


PRESSURE SIDE PORTED (AP, GP)

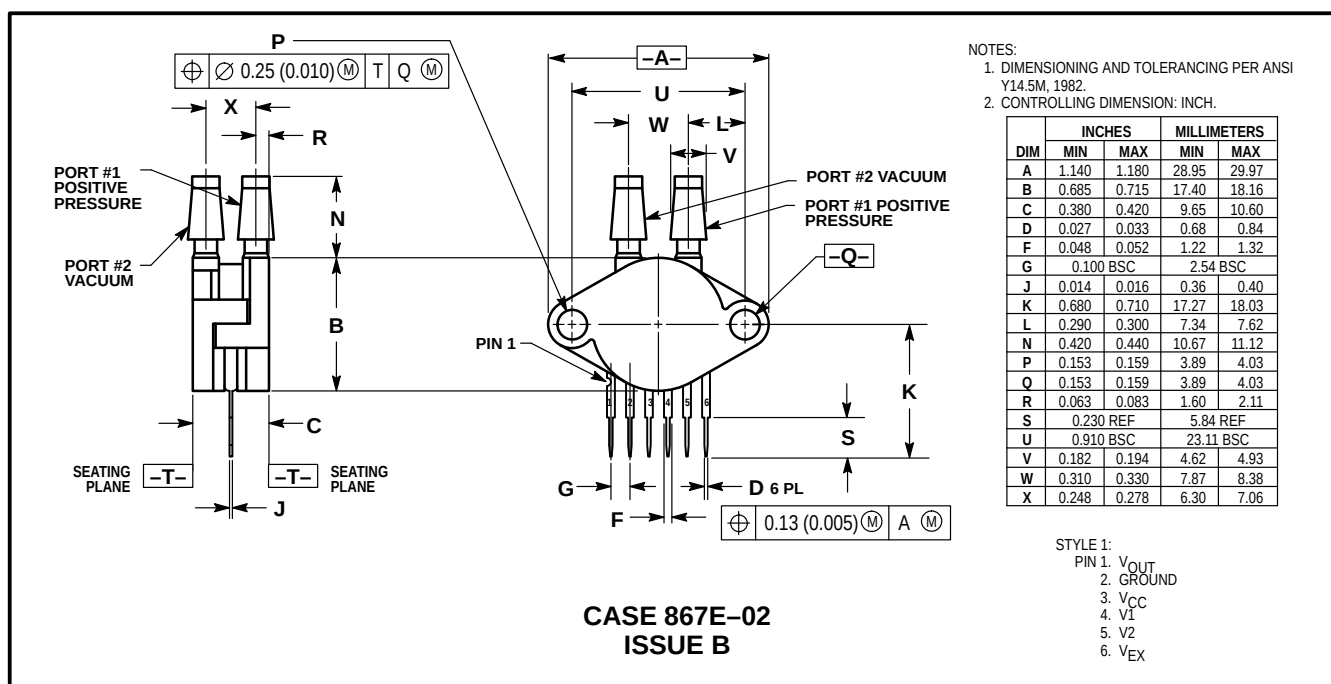


PRESSURE AND VACUUM SIDES PORTED (DP)

PACKAGE DIMENSIONS—CONTINUED

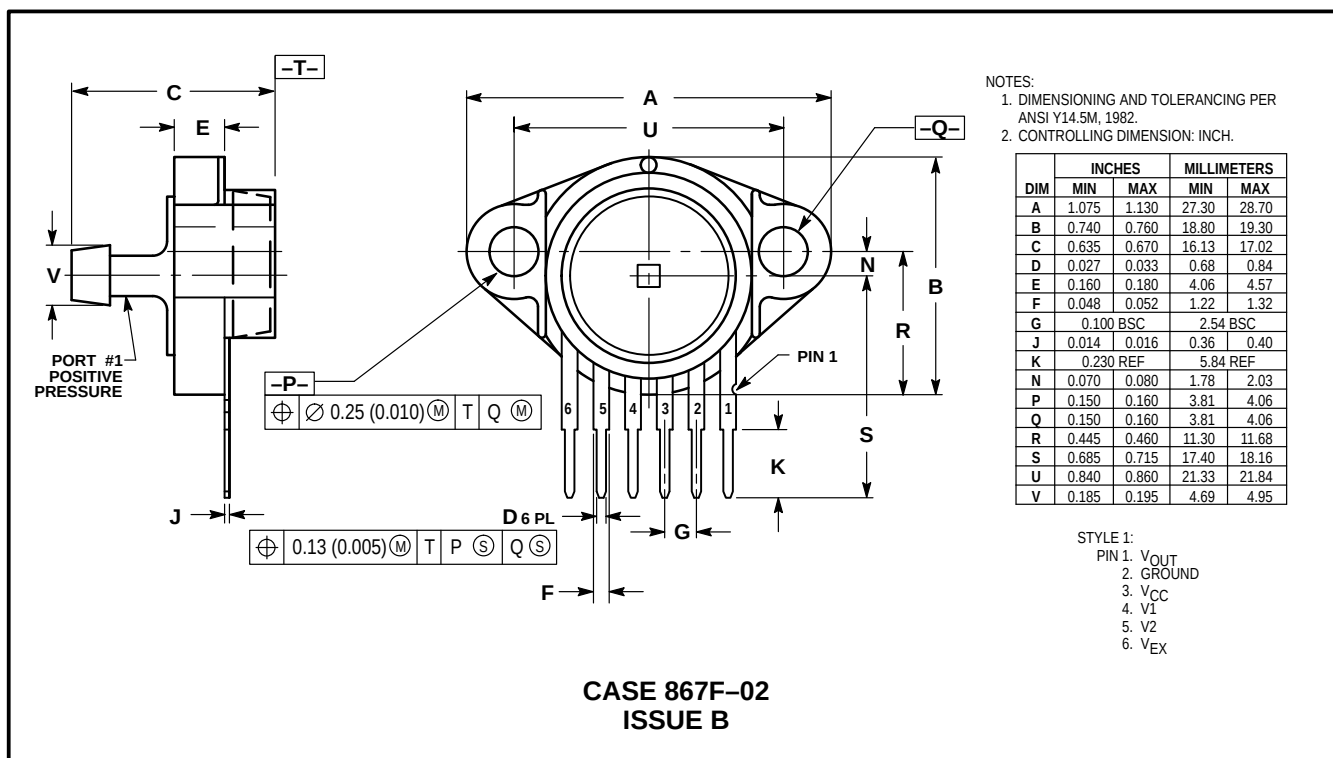


VACUUM SIDE PORTED (GVP)

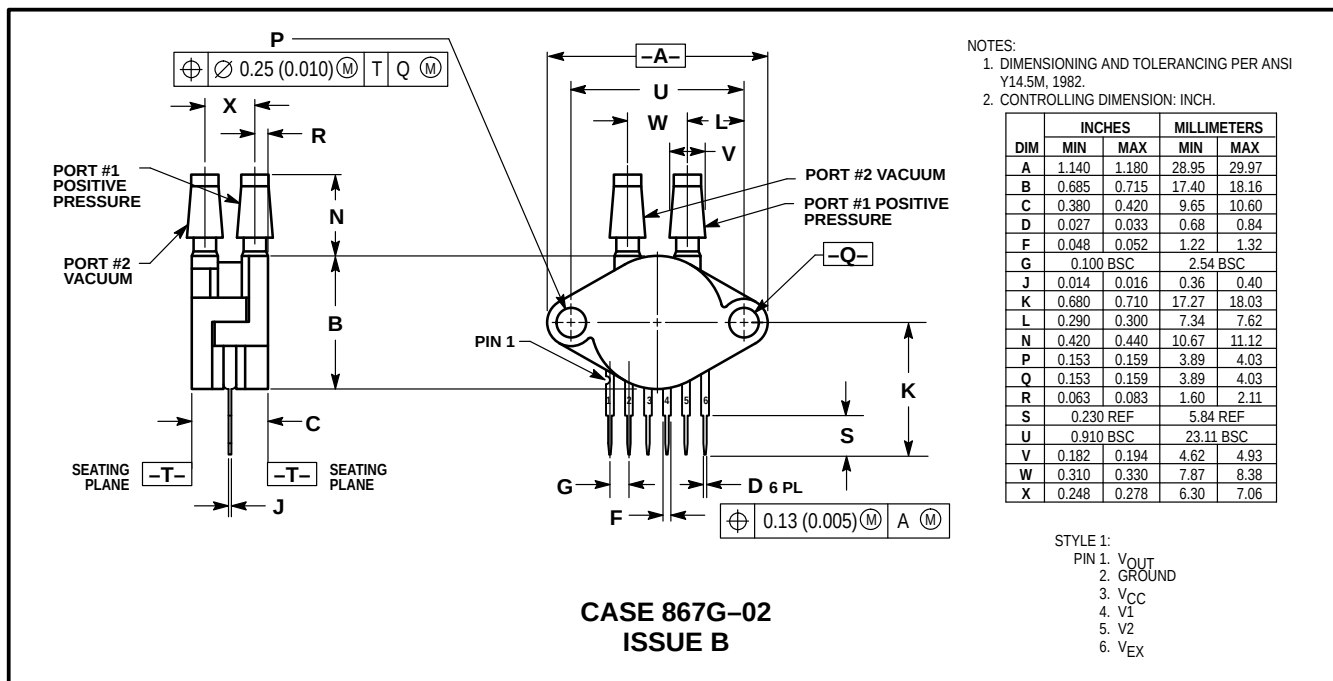


PRESSURE SIDE PORTED (AS, GS)

PACKAGE DIMENSIONS—CONTINUED



PRESSURE SIDE PORTED (ASX, GSX)



VACUUM SIDE PORTED (GV SX)

Literature Distribution Centers:

USA: Motorola Literature Distribution; P.O. Box 20912; Phoenix, Arizona 85036.

EUROPE: Motorola Ltd.; European Literature Centre; 88 Tanners Drive, Blakelands, Milton Keynes, MK14 5BP, England.

JAPAN: Nippon Motorola Ltd.; 4-32-1, Nishi-Gotanda, Shinagawa-ku, Tokyo 141, Japan.

ASIA PACIFIC: Motorola Semiconductors H.K. Ltd.; Silicon Harbour Center, No. 2 Dai King Street, Tai Po Industrial Estate, Tai Po, N.T., Hong Kong.



MOTOROLA

MPX5700/D

