



700 kPa High Pressure, Temperature Compensated & Calibrated Silicon Pressure Sensors

The MPX2700 series device is a silicon piezoresistive pressure sensor providing a highly accurate and linear voltage output — directly proportional to the applied pressure. The sensor is a single monolithic silicon diaphragm with the strain gauge and a thin-film resistor network integrated on-chip. The sensor is laser trimmed for precise span and offset calibration and temperature compensation.

Features

- Unique Silicon Shear Stress Strain Gauge
- ±0.5% Linearity
- Easy to Use Chip Carrier Package
- Basic Element, Single and Dual Ported Devices Available
- Available in Absolute, Differential and Gauge configurations

Application Examples

- Pump/Motor Controllers
- Pneumatic Control
- Tire Pressure Gauges
- Robotics
- Medical Diagnostics
- Pressure Switching
- Hydraulics

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

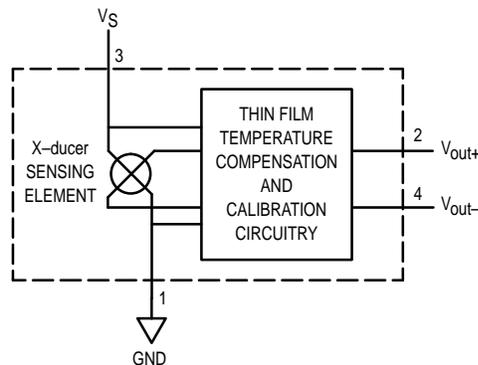


Figure 1. Temperature Compensated Pressure Sensor Schematic

VOLTAGE OUTPUT versus APPLIED DIFFERENTIAL PRESSURE

The differential voltage output of the X-ducer is directly proportional to the differential pressure applied.

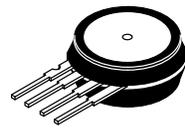
The output voltage of the differential or gauge sensor increases with increasing pressure applied to the pressure side (P1) relative to the vacuum side (P2). Similarly, output voltage increases as increasing vacuum is applied to the vacuum side (P2) relative to the pressure side (P1). This sensor is designed for applications where P1 is always greater than, or equal to P2.

Senseon and X-ducer are trademarks of Motorola, Inc.

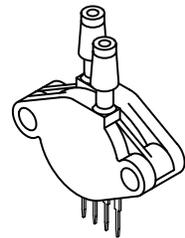
REV 2

MPX2700 SERIES

0 to 700 kPa (0 to 100 psi)
40 mV FULL SCALE SPAN
(TYPICAL)



**BASIC CHIP
CARRIER ELEMENT
CASE 344-15, STYLE 1**



**DIFFERENTIAL
PORT OPTION
CASE 344C-01, STYLE 1**

NOTE: Pin 1 is the notched pin.

PIN NUMBER			
1	Gnd	3	V _S
2	+V _{out}	4	-V _{out}

MPX2700 SERIES

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Overpressure ⁽⁸⁾ ($P_2 \leq 1$ Atmosphere)	P_{1max}	2800	kPa
Burst Pressure ⁽⁸⁾ ($P_2 \leq 1$ Atmosphere)	P_{1burst}	5000	kPa
Storage Temperature	T_{stg}	-40 to +125	°C
Operating Temperature	T_A	-40 to +125	°C

OPERATING CHARACTERISTICS ($V_{CC} = 10$ Vdc, $T_A = 25^\circ\text{C}$ unless otherwise noted. $P_1 \geq P_2$; $P_2 \leq 1$ Atmosphere.)

Characteristic	Symbol	Min	Typ	Max	Unit
Pressure Range ⁽¹⁾	P_{OP}	0	—	700	kPa
Supply Voltage ⁽²⁾	V_S	—	10	16	Vdc
Supply Current	I_o	—	6.0	—	mAdc
Full Scale Span ⁽³⁾	V_{FSS}	38.5	40	41.5	mV
Offset ⁽⁴⁾	V_{off}	-1.0	—	1.0	mV
Sensitivity	$\Delta V/\Delta P$	—	0.057	—	mV/kPa
Linearity ⁽⁵⁾	—	-0.5	—	0.5	% V_{FSS}
Pressure Hysteresis ⁽⁵⁾ (0 to 700 kPa)	—	—	± 0.1	—	% V_{FSS}
Temperature Hysteresis ⁽⁵⁾ (-40°C to +125°C)	—	—	± 0.5	—	% V_{FSS}
Temperature Effect on Full Scale Span ⁽⁵⁾	TCV_{FSS}	-1.0	—	1.0	% V_{FSS}
Temperature Effect on Offset ⁽⁵⁾	TCV_{off}	-1.0	—	1.0	mV
Input Impedance	Z_{in}	1300	—	4000	Ω
Output Impedance	Z_{out}	1400	—	3000	Ω
Response Time ⁽⁶⁾ (10% to 90%)	t_R	—	1.0	—	ms
Warm-Up ⁽⁷⁾	—	—	20	—	ms

MECHANICAL CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
Weight (Basic Element Case 344-15)	—	—	2.0	—	Grams

NOTES:

- 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.
- Accuracy (error budget) consists of the following:
 - Linearity: Output deviation from a straight line relationship with pressure, using end point method, 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 at full rated pressure 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.
- 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.
- Basic Element only, Case 344-15.
- P_2 max : 500 kPa.

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 or (2) a least squares best line fit (see Figure 3). 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. Motorola's specified pressure sensor linearities are based on the end point straight line method measured at the midrange pressure.

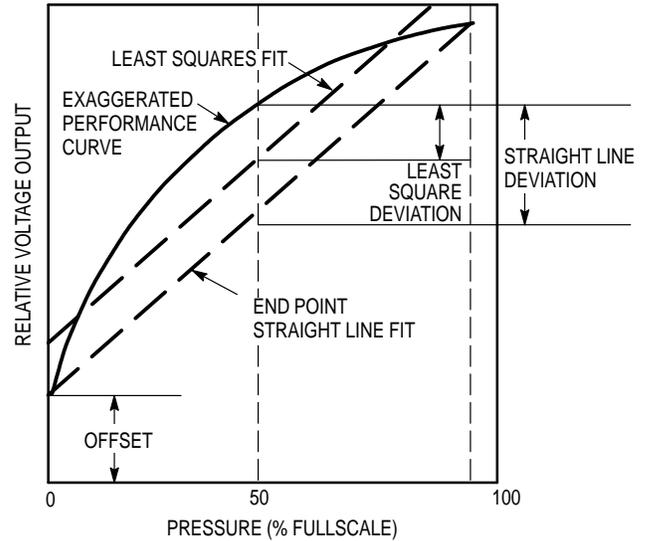


Figure 2. Linearity Specification Comparison

ON-CHIP TEMPERATURE COMPENSATION and CALIBRATION

Figure 3 shows the output characteristics of the MPX2700 series at 25°C. The output is directly proportional to the differential pressure and is essentially a straight line.

The effects of temperature on Full-Scale Span and Offset are very small and are shown under Operating Characteristics.

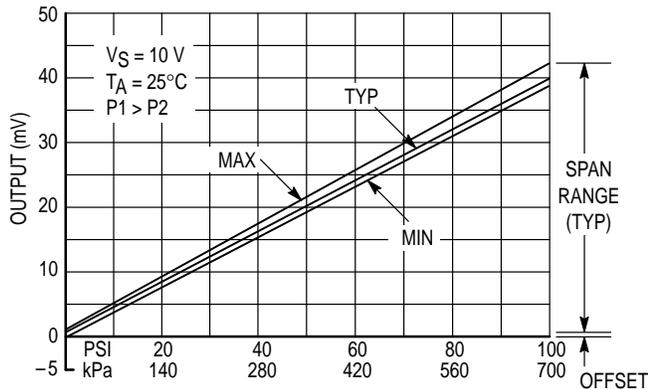


Figure 3. Output versus Pressure Differential

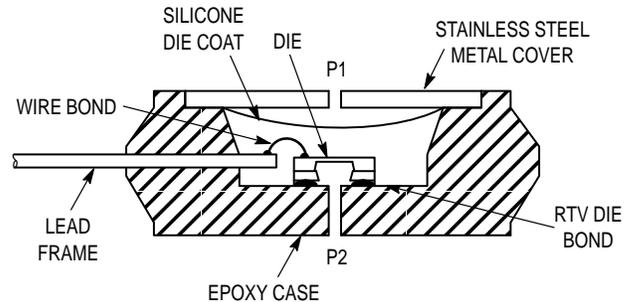


Figure 4. Cross-Section of Differential Pressure Sensor Die in Its Basic Package (Not to Scale)

Figure 4 shows the cross section of the Motorola MPX pressure sensor die in the chip carrier package. 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. MPX2700 series pressure sensor operating characteristics and internal reli-

ability 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.

MPX2700 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 silicone gel which isolates the die from the environment. 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:

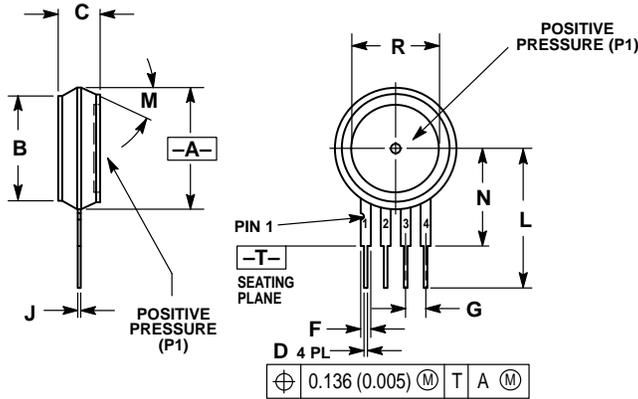
Part Number		Case Type	Pressure (P1) Side Identifier
MPX2700D	MPX2700A	344-15	Stainless Steel Cap
MPX2700DP		344C-01	Side with Part Marking
MPX2700GP	MPX2700AP	344B-01	Side with Port Attached
MPX2700GVP		344D-01	Stainless Steel Cap
MPX2700GS	MPX2700AS	344E-01	Side with Port Attached
MPX2700GVS		344A-01	Stainless Steel Cap
MPX2700GSX	MPX2700ASX	344F-01	Side with Port Attached
MPX2700GVSX		344G-01	Stainless Steel Cap

ORDERING INFORMATION

MPX2700 series pressure sensors are available in differential and gauge configurations. Devices are available in the basic element package or with pressure port fittings which 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	Case 344-15	MPX2700D	MPX2700D
Ported Elements	Differential	Case 344C-01	MPX2700DP	MPX2700DP
	Gauge	Case 344B-01	MPX2700GP	MPX2700GP
	Gauge Vacuum	Case 344D-01	MPX2700GVP	MPX2700GVP
	Gauge Stove Pipe	Case 344E-01	MPX2700GS	MPX2700D
	Gauge Vacuum Stove Pipe	Case 344A-01	MPX2700GVS	MPX2700D
	Gauge Axial	Case 344F-01	MPX2700GSX	MPX2700D
	Gauge Vacuum Axial	Case 344G-01	MPX2700GVSX	MPX2700D

PACKAGE DIMENSIONS



NOTES:

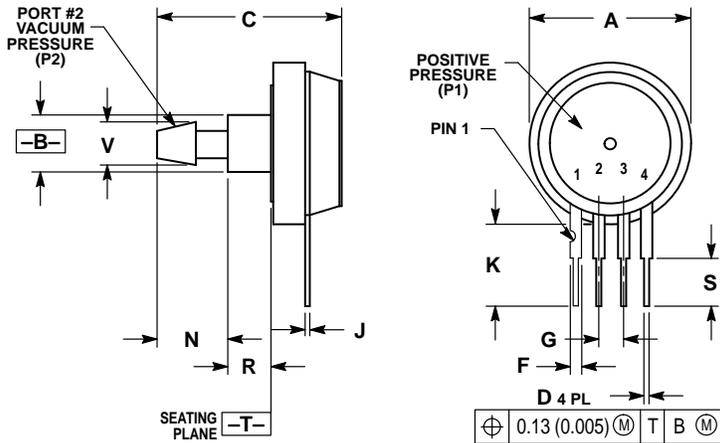
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION -A- IS INCLUSIVE OF THE MOLD STOP RING. MOLD STOP RING NOT TO EXCEED 16.00 (0.630).

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

STYLE 1:

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

CASE 344-15
ISSUE W



NOTES:

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

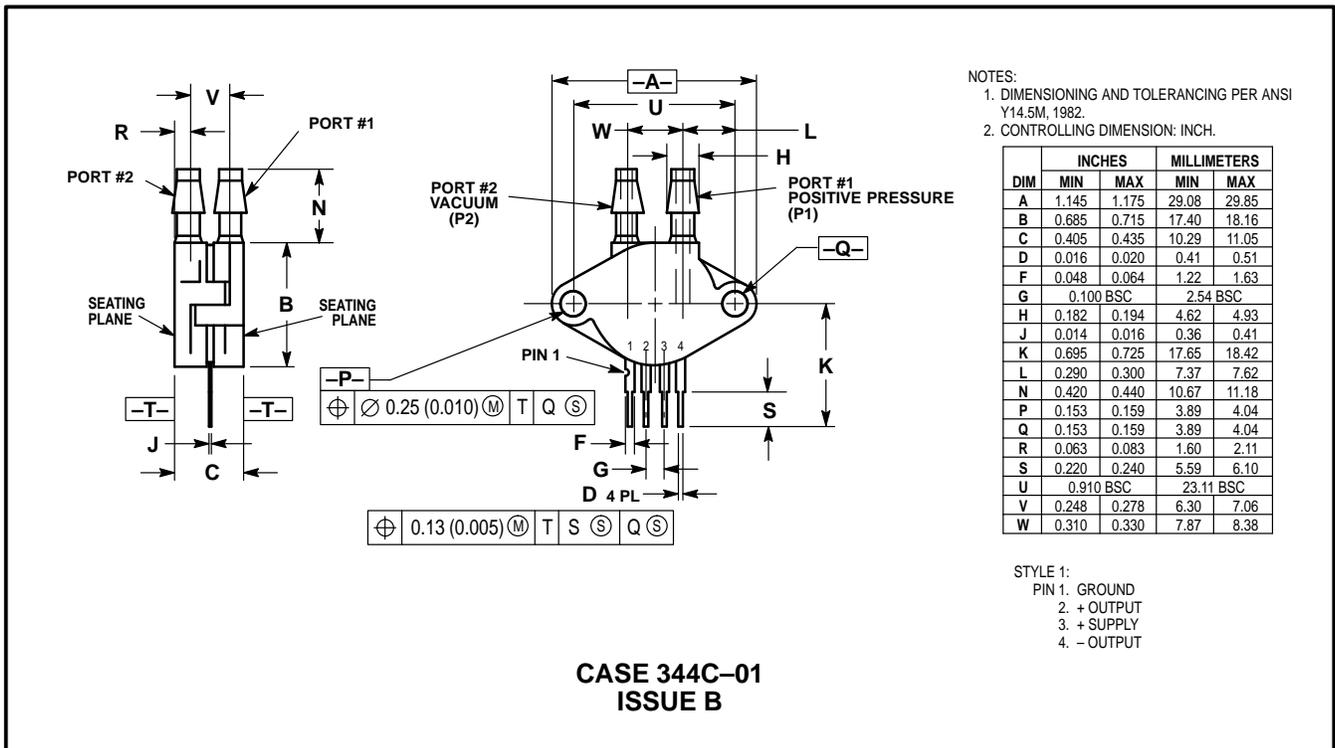
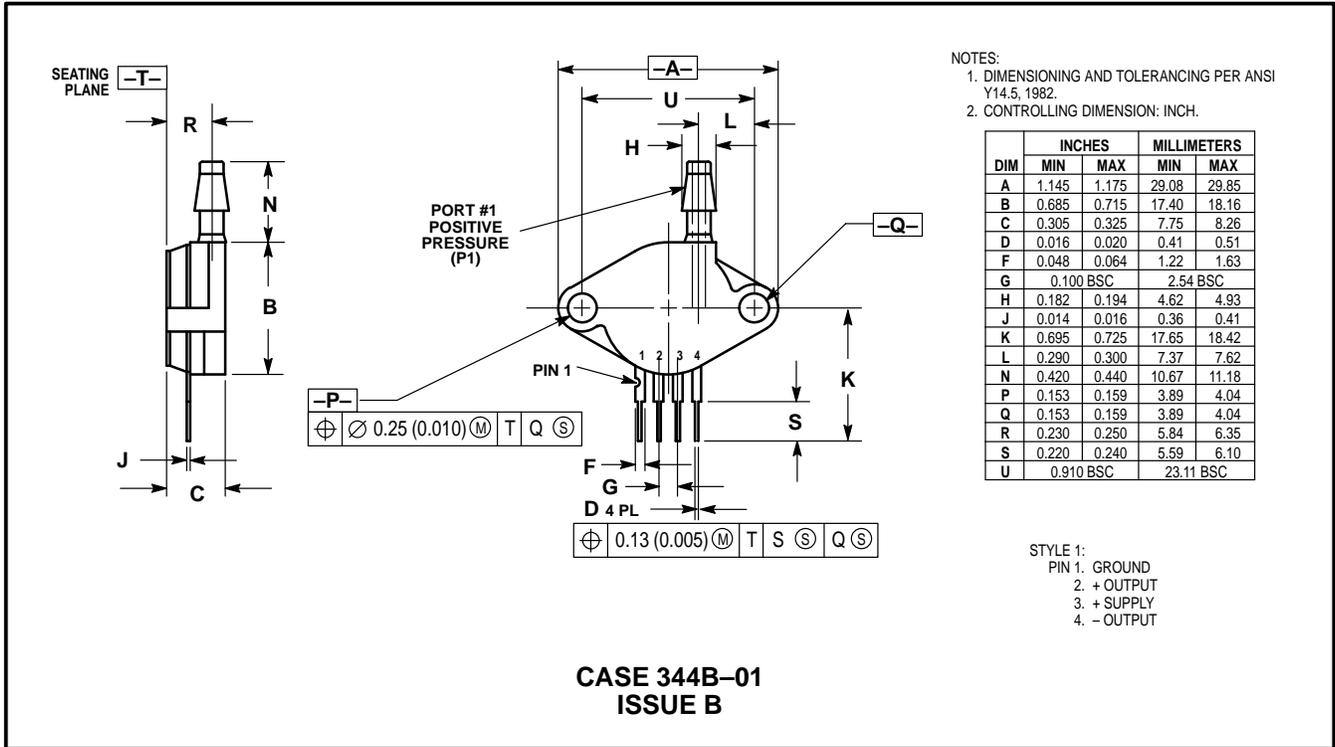
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.690	0.720	17.53	18.28
B	0.245	0.255	6.22	6.48
C	0.780	0.820	19.81	20.82
D	0.016	0.020	0.41	0.51
F	0.048	0.064	1.22	1.63
G	0.100 BSC		2.54 BSC	
J	0.014	0.016	0.36	0.41
K	0.345	0.375	8.76	9.53
N	0.300	0.310	7.62	7.87
R	0.178	0.186	4.52	4.72
S	0.220	0.240	5.59	6.10
V	0.182	0.194	4.62	4.93

STYLE 1:

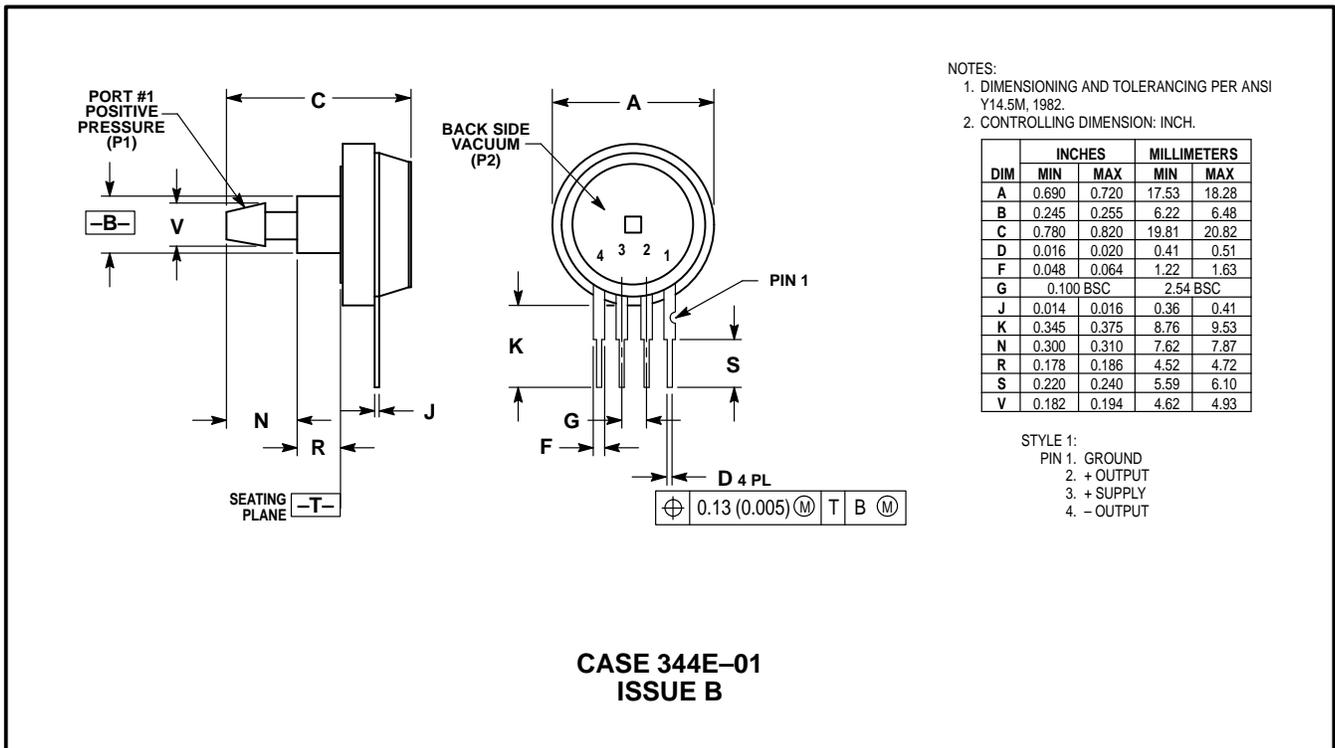
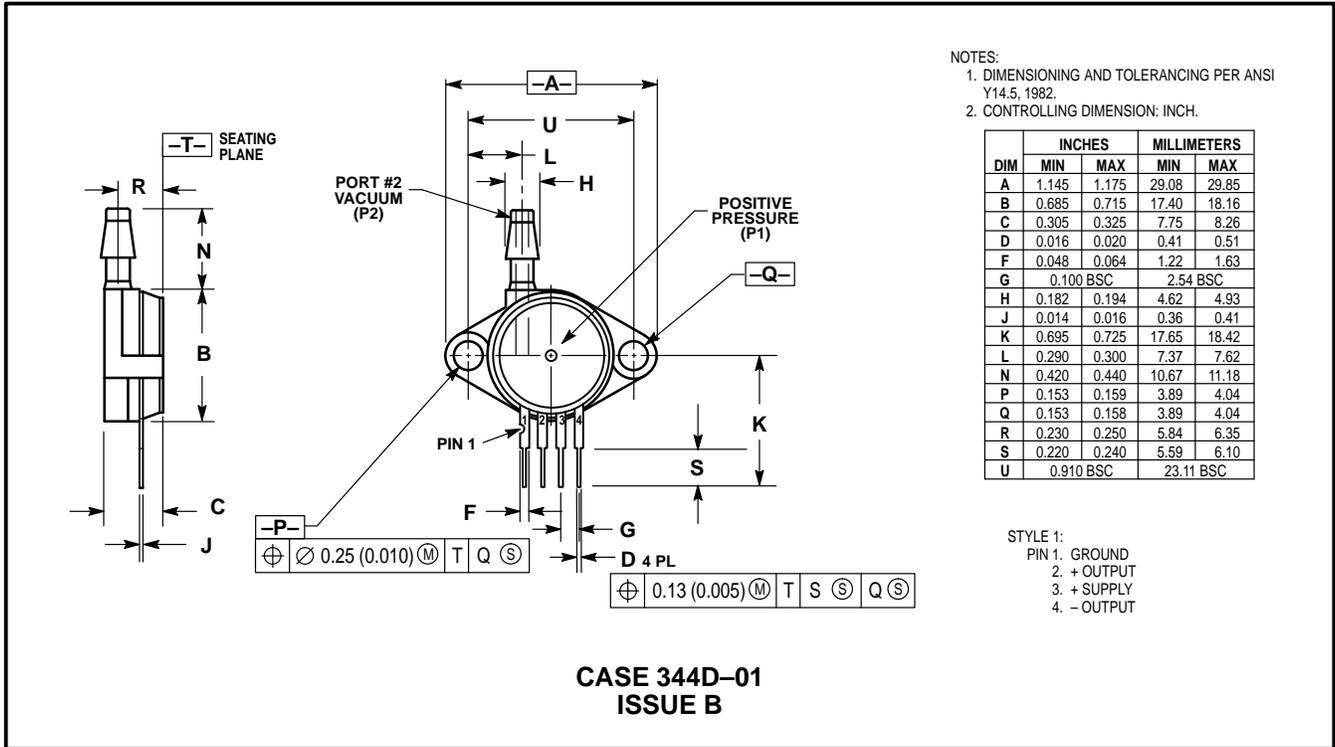
1. GROUND
2. + OUTPUT
3. + SUPPLY
4. - OUTPUT

CASE 344A-01
ISSUE B

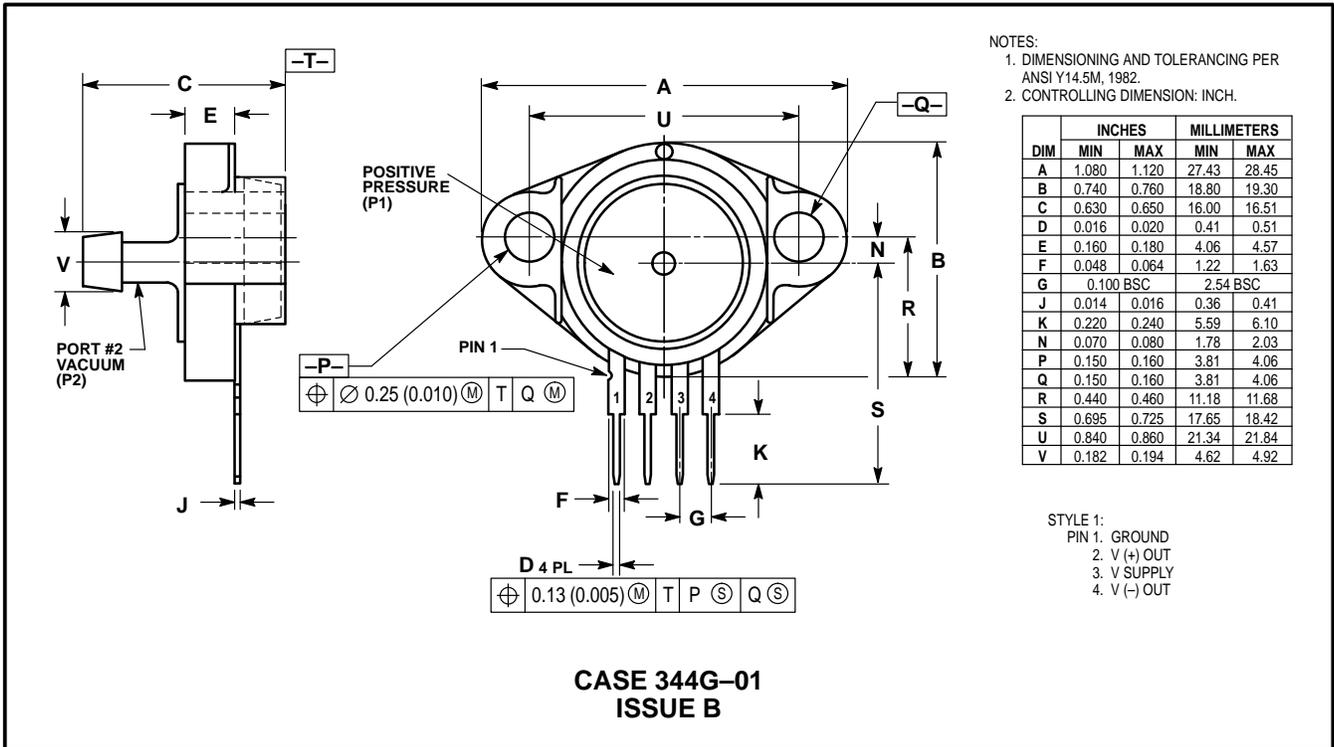
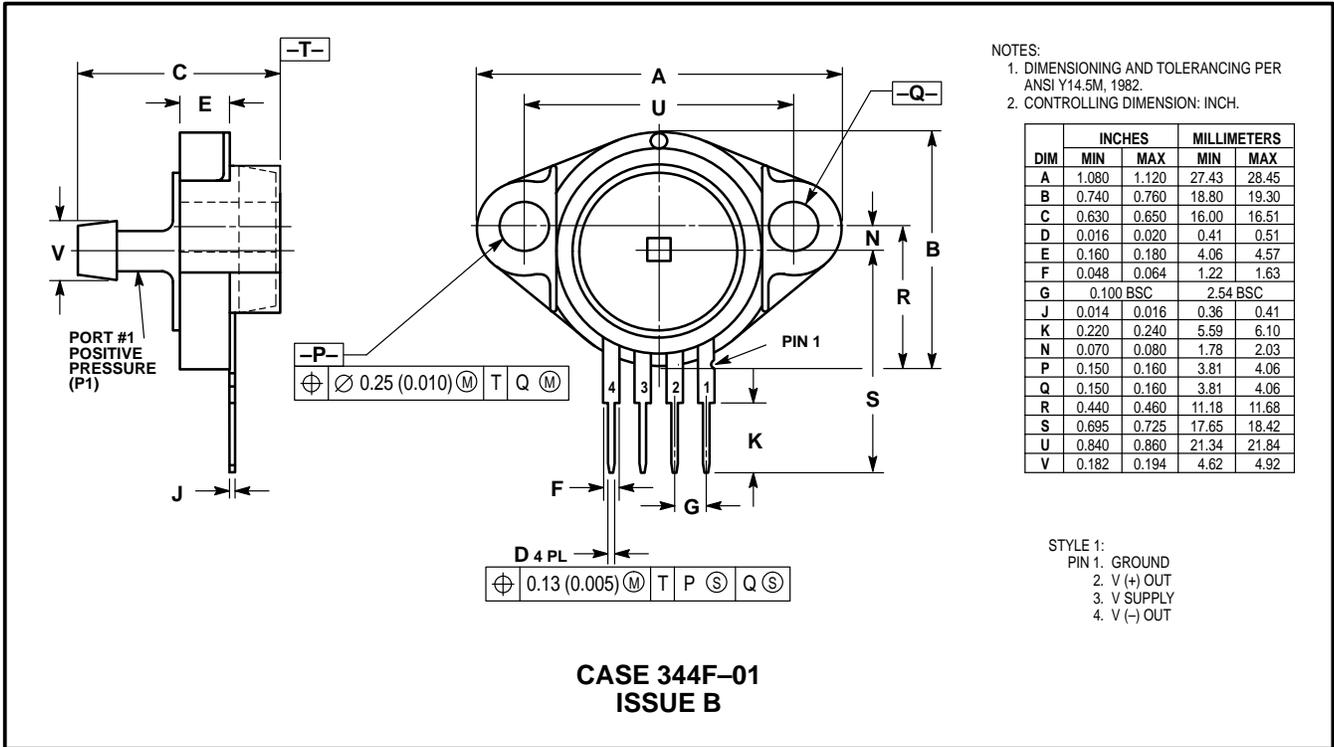
PACKAGE DIMENSIONS — CONTINUED



PACKAGE DIMENSIONS — CONTINUED



PACKAGE DIMENSIONS — CONTINUED



Motorola reserves the right to make changes without further notice to any products herein. Motorola makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Motorola assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters which may be provided in Motorola data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. Motorola does not convey any license under its patent rights nor the rights of others. Motorola products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Motorola product could create a situation where personal injury or death may occur. Should Buyer purchase or use Motorola products for any such unintended or unauthorized application, Buyer shall indemnify and hold Motorola and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Motorola was negligent regarding the design or manufacture of the part. Motorola and  are registered trademarks of Motorola, Inc. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer.

MPX2700 SERIES

Mfax is a trademark of Motorola, Inc.

How to reach us:

USA/EUROPE/Locations Not Listed: Motorola Literature Distribution;
P.O. Box 5405, Denver, Colorado 80217. 303-675-2140 or 1-800-441-2447

JAPAN: Nippon Motorola Ltd.; Tatsumi-SPD-JLDC, 6F Seibu-Butsuryu-Center,
3-14-2 Tatsumi Koto-Ku, Tokyo 135, Japan. 81-3-3521-8315

Mfax™: RMFAX0@email.sps.mot.com – TOUCHTONE 602-244-6609
– US & Canada ONLY 1-800-774-1848

ASIA/PACIFIC: Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,
51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852-26629298

INTERNET: <http://motorola.com/sps>



MOTOROLA



MPX2700/D