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

PPXV5025G SERIES

INTEGRATED PRESSURE SENSOR 0 to 25 kPa (0 to 3.6 psi) 0.2 to 4.7 Volts Output

Motorola's PPXV5025G series sensor integrates on–chip, bipolar op amp circuitry and thin film resistor networks to provide a high output signal and temperature compensation. The small form factor and high reliability of on–chip integration make the Motorola pressure sensor a logical and economical choice for the system designer.

The PPXV5025G series piezoresistive transducer is a state–of–the–art, monolithic, signal conditioned, silicon pressure sensor. This sensor 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 a pressure sensor chip.

Features

- 2.5% Maximum Error over 0° to 85°C
- Ideally suited for Microprocessor or Microcontroller–Based Systems
- Temperature Compensated from –40° to +125°C
- Durable Thermoplastic (PPS) Surface Mount Package

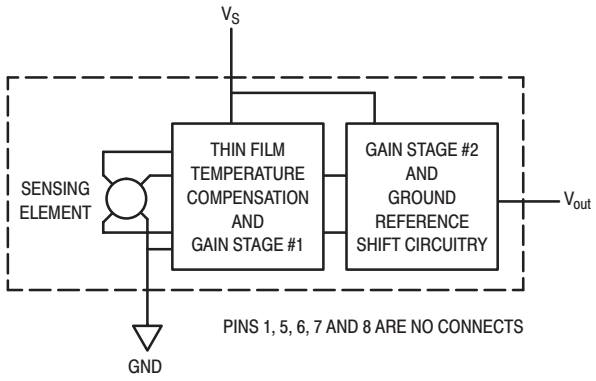
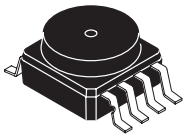
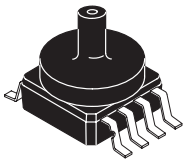


Figure 1. Fully Integrated Pressure Sensor Schematic

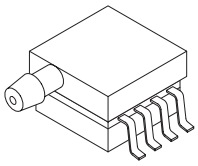
SMALL OUTLINE PACKAGE SURFACE MOUNT



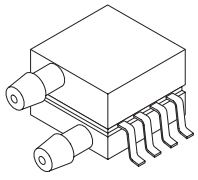
PPXV5025G6U CASE 482



PPXV5025GC6U CASE 482A

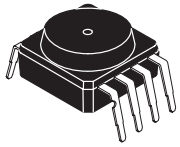


PPXV5025GP CASE 1369

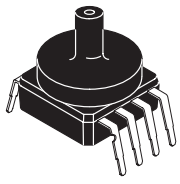


PPXV5025DP CASE 1351

SMALL OUTLINE PACKAGE DIP LEAD FORM



PPXV5025G7U CASE 482B



PPXV5025GC7U CASE 482C

PIN NUMBER							
1	N/C	3	Gnd	5	N/C	7	N/C
2	V_S	4	V_{out}	6	N/C	8	N/C

NOTE: Pins 1, 5, 6, 7, and 8 are internal device connections. Do not connect to external circuitry or ground. Pin 1 is denoted by the notch in the lead.

REV 0

MAXIMUM RATINGS(1)

Parametrics	Symbol	Value	Units
Maximum Pressure (P1 > P2)	P_{max}	100	kPa
Storage Temperature	T_{stg}	–40° to +125°	°C
Operating Temperature	T_A	–40° to +125°	°C
Output Source Current @ Full Scale Output(2)	I_o+	0.5	mAdc
Output Sink Current @ Minimum Pressure Offset(2)	I_o–	–0.5	mAdc

NOTES:
1. Exposure beyond the specified limits may cause permanent damage or degradation to the device.
2. Maximum Output Current is controlled by effective impedance from V_{out} to Gnd or V_{out} to V_S in the application circuit.

OPERATING CHARACTERISTICS (V_S = 5.0 Vdc, T_A = 25°C unless otherwise noted, P1 > P2.)

Characteristic		Symbol	Min	Typ	Max	Unit
Pressure Range		P_{OP}	0	—	25	kPa
Supply Voltage(1)		V_S	4.75	5.0	5.25	Vdc
Supply Current		I_o	—	6.0	10	mAdc
Full Scale Output(2) @ V_S = 5.0 Volts	(0 to 85°C) (P_{diff} = 0 kPa)	V_{FSO}	4.588	4.7	4.813	Vdc
Full Scale Span(3) @ V_S = 5.0 Volts	(0 to 85°C)	V_{FSS}	—	4.5	—	Vdc
Accuracy(4)	(0 to 85°C)	—	—	—	±2.5	%V_{FSS}
Sensitivity		V/P	—	0.18	—	V/kPa
Response Time(5)		t_R	—	1.0	—	ms
Warm–Up Time(6)		—	—	20	—	ms
Offset Stability(7)		—	—	±0.5	—	%V_{FSS}

NOTES:
1. Device is ratiometric within this specified excitation range.
2. Full Scale Output (V_{FSO}) is defined as the output voltage at the maximum or full rated pressure.
3. 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.
4. Accuracy is the deviation in actual output from nominal output over the entire pressure range and temperature range as a percent of span at 25°C due to all sources of error including 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 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 pressure applied, over the temperature range of 0° to 85°C, relative to 25°C.
5. 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.
6. Warm–up Time is defined as the time required for the product to meet the specified output voltage after the pressure has been stabilized.
7. Offset Stability is the product's output deviation when subjected to 1000 cycles of Pulsed Pressure, Temperature Cycling with Bias Test.

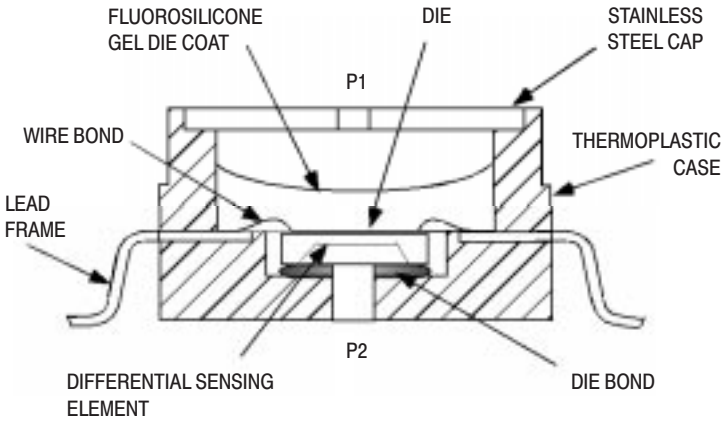


Figure 2. Cross Sectional Diagram SOP (Not to Scale)

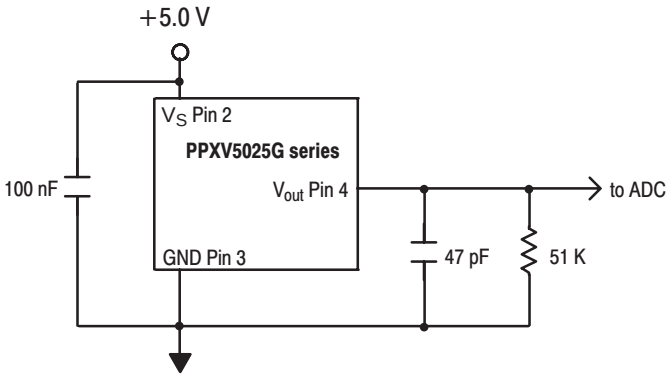


Figure 3. Typical Application Circuit (Output Source Current Operation)

Figure 2 illustrates the absolute sensing chip in the basic Small Outline chip carrier (Case 482).

Figure 3 shows a typical application circuit (output source current operation).

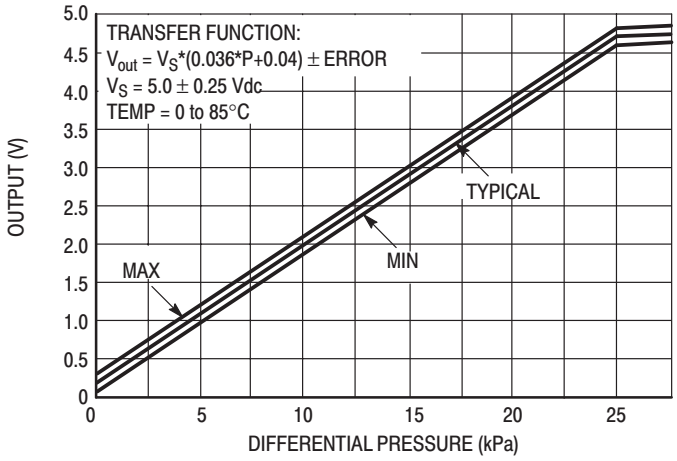


Figure 4. Output versus Pressure Differential

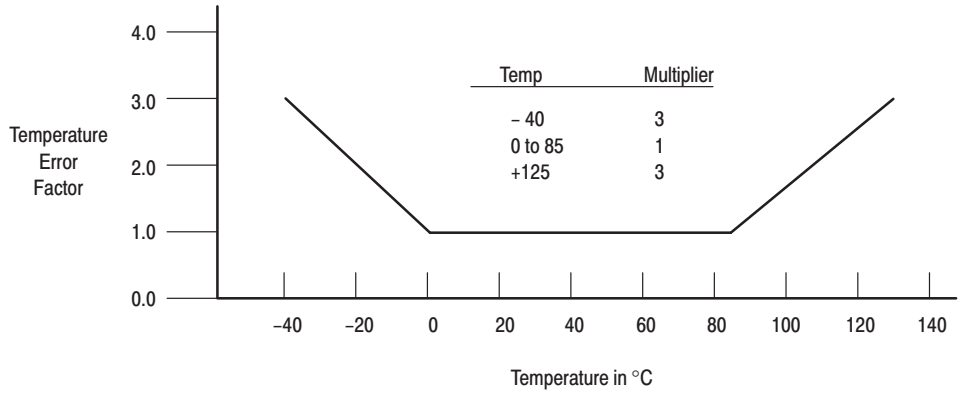
Figure 4 shows the sensor output signal relative to pressure input. Typical minimum and maximum output curves are shown for operation over 0 to 85°C temperature range. The output will saturate outside of the rated pressure range.

A fluorosilicone gel isolates the die surface and wire bonds from the environment, while allowing the pressure signal to be transmitted to the silicon diaphragm. The PPXV5025G series pressure sensor operating characteristics, 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.

Transfer Function

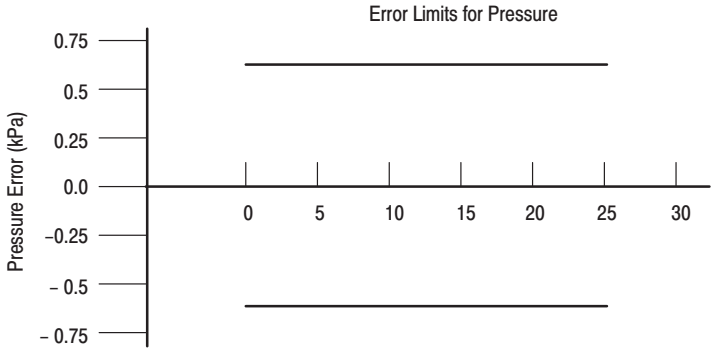
Nominal Transfer Value: $V_{out} = V_S$ (P x 0.036 + 0.04)
+/– (Pressure Error x Temp. Factor x 0.036 x V_S)
V_S = 5.0 V ± 0.25 Vdc

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



Pressure	Error (Max)
0 to 25 kPa	± 0.625 kPa

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 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
PPXV5025GC6U/T1	482A	Side with Port Attached
PPXV5025G6U/T1	482	Stainless Steel Cap
PPXV5025GC7U	482C	Side with Port Attached
PPXV5025G7U	482B	Stainless Steel Cap
PPXV5025GP	1369	Side with Port Attached
PPXV5025DP	1351	Side with Port Marking

ORDERING INFORMATION

PPXV5025G series pressure sensors are available in the basic element package or with pressure ports. Two packing options are offered for Case 482 and 482A configurations.

Device Type / Order No.	Case No.	Packing Options	Device Marking
PPXV5025G6U	482	Rails	PPXV5025G
PPXV5025G6T1	482	Tape and Reel	PPXV5025G
PPXV5025GC6U	482A	Rails	PPXV5025G
PPXV5025GC6T1	482A	Tape and Reel	PPXV5025G
PPXV5025GC7U	482C	Rails	PPXV5025G
PPXV5025G7U	482B	Rails	PPXV5025G
PPXV5025GP	1369	Trays	PPXV5025G
PPXV5025DP	1351	Trays	PPXV5025G

INFORMATION FOR USING THE SMALL OUTLINE PACKAGES

MINIMUM RECOMMENDED FOOTPRINT FOR SURFACE MOUNTED APPLICATIONS

Surface mount board layout is a critical portion of the total design. The footprint for the surface mount packages must be the correct size to ensure proper solder connection interface between the board and the package. With the correct fottprint, the packages will self align when subjected to a solder reflow process. It is always recommended to design boards with a solder mask layer to avoid bridging and shorting between solder pads.

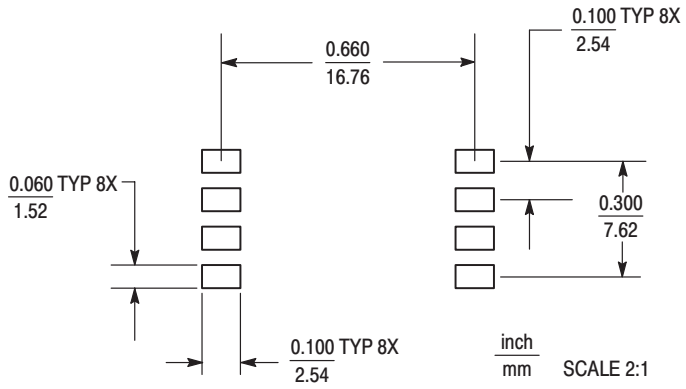
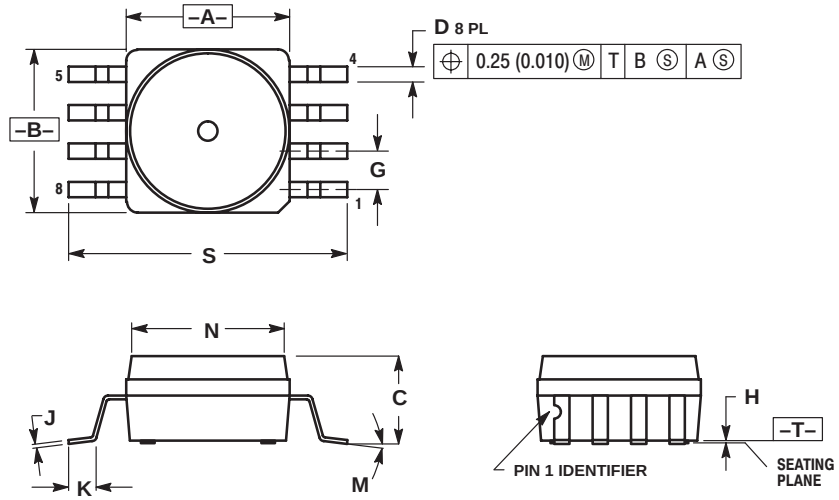


Figure 5. SOP Footprint

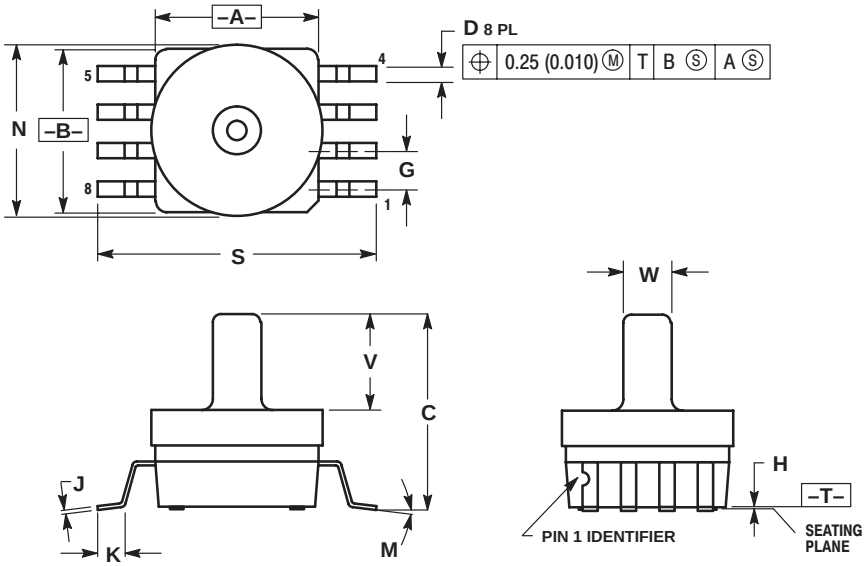
SMALL OUTLINE PACKAGE DIMENSIONS



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006).
5. ALL VERTICAL SURFACES 5° TYPICAL DRAFT.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.415	0.425	10.54	10.79
B	0.415	0.425	10.54	10.79
C	0.212	0.230	5.38	5.84
D	0.038	0.042	0.96	1.07
G	0.100 BSC		2.54 BSC	
H	0.002	0.010	0.05	0.25
J	0.009	0.011	0.23	0.28
K	0.061	0.071	1.55	1.80
M	0°	7°	0°	7°
N	0.405	0.415	10.29	10.54
S	0.709	0.725	18.01	18.41

CASE 482–01
ISSUE O



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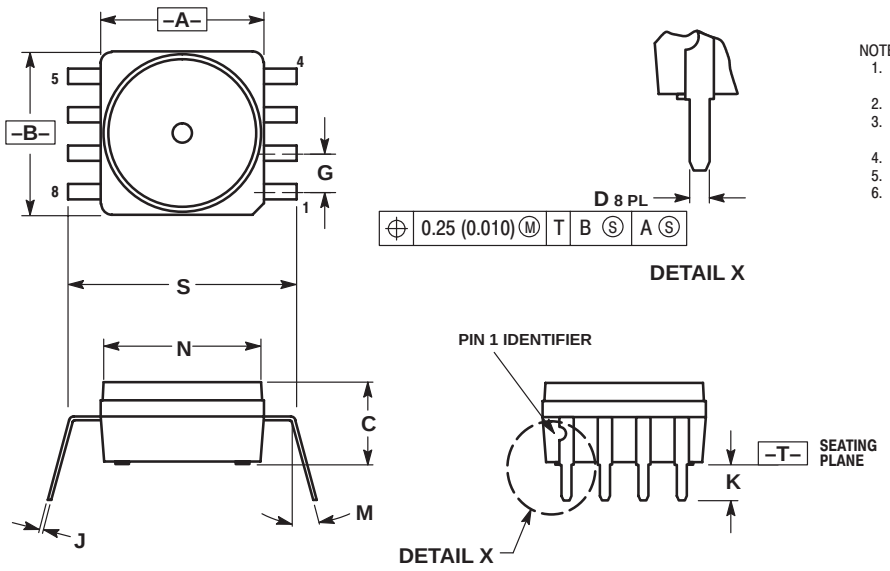
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006).
5. ALL VERTICAL SURFACES 5° TYPICAL DRAFT.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.415	0.425	10.54	10.79
B	0.415	0.425	10.54	10.79
C	0.500	0.520	12.70	13.21
D	0.038	0.042	0.96	1.07
G	0.100 BSC		2.54 BSC	
H	0.002	0.010	0.05	0.25
J	0.009	0.011	0.23	0.28
K	0.061	0.071	1.55	1.80
M	0°	7°	0°	7°
N	0.444	0.448	11.28	11.38
S	0.709	0.725	18.01	18.41
V	0.245	0.255	6.22	6.48
W	0.115	0.125	2.92	3.17

CASE 482A–01
ISSUE A

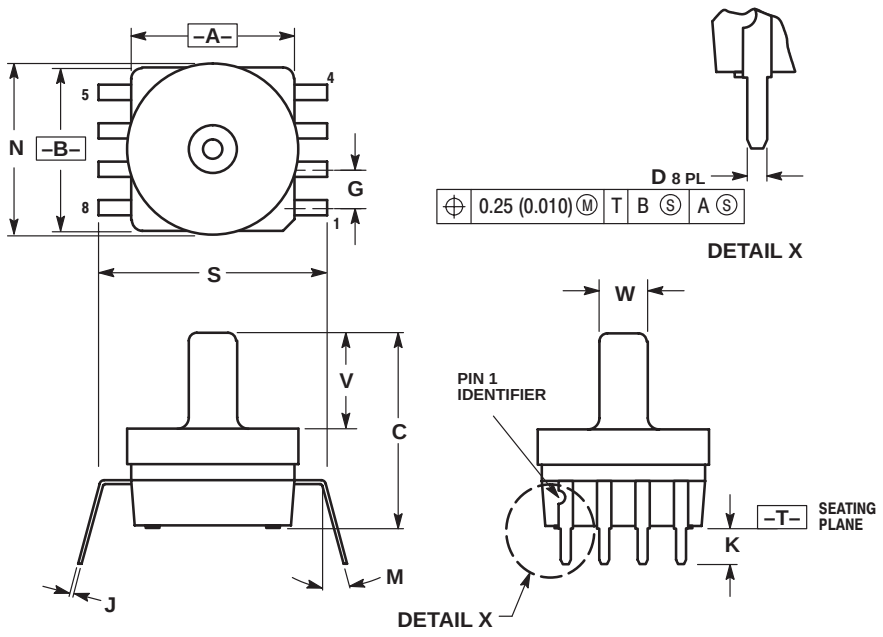
SMALL OUTLINE PACKAGE DIMENSIONS



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006).
5. ALL VERTICAL SURFACES 5° TYPICAL DRAFT.
6. DIMENSION S TO CENTER OF LEAD WHEN FORMED PARALLEL.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.415	0.425	10.54	10.79
B	0.415	0.425	10.54	10.79
C	0.210	0.220	5.33	5.59
D	0.026	0.034	0.66	0.864
G	0.100 BSC		2.54 BSC	
J	0.009	0.011	0.23	0.28
K	0.100	0.120	2.54	3.05
M	0°	15°	0°	15°
N	0.405	0.415	10.29	10.54
S	0.540	0.560	13.72	14.22

CASE 482B–03
ISSUE B

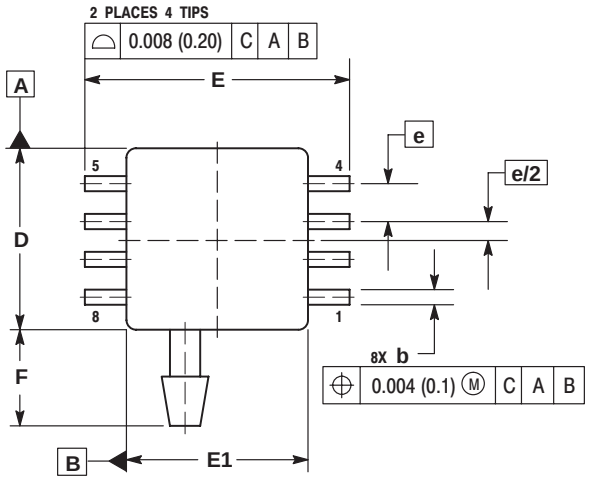


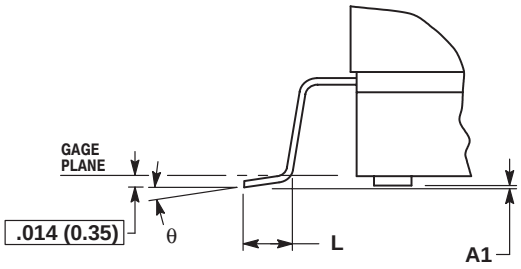
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006).
5. ALL VERTICAL SURFACES 5° TYPICAL DRAFT.
6. DIMENSION S TO CENTER OF LEAD WHEN FORMED PARALLEL.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.415	0.425	10.54	10.79
B	0.415	0.425	10.54	10.79
C	0.500	0.520	12.70	13.21
D	0.026	0.034	0.66	0.864
G	0.100 BSC		2.54 BSC	
J	0.009	0.011	0.23	0.28
K	0.100	0.120	2.54	3.05
M	0°	15°	0°	15°
N	0.444	0.448	11.28	11.38
S	0.540	0.560	13.72	14.22
V	0.245	0.255	6.22	6.48
W	0.115	0.125	2.92	3.17

CASE 482C–03
ISSUE B

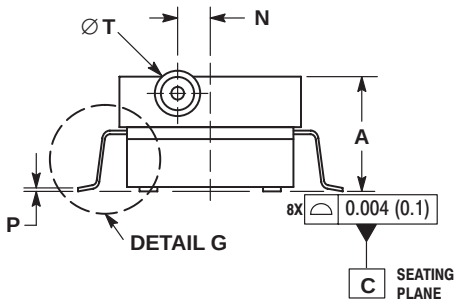
SMALL OUTLINE PACKAGE DIMENSIONS

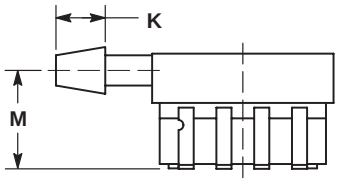




DETAIL G

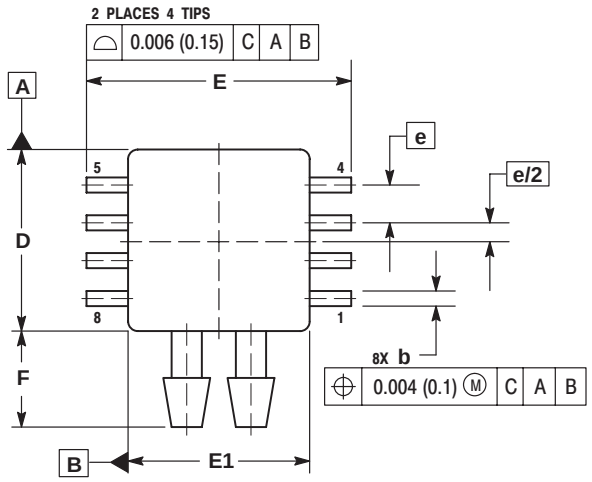
NOTES:
1. CONTROLLING DIMENSION: INCH.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M–1994.
3. DIMENSIONS "D" AND "E1" DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.006 (0.152) PER SIDE.
4. DIMENSION "b" DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.008 (0.203) MAXIMUM.

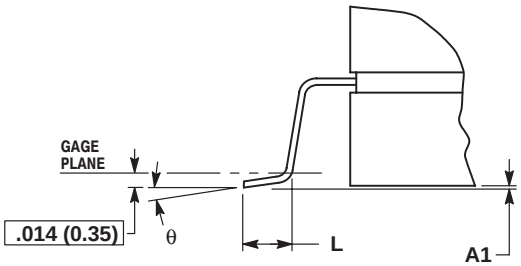




DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.300	0.330	7.11	7.62
A1	0.002	0.010	0.05	0.25
b	0.038	0.042	0.96	1.07
D	0.465	0.485	11.81	12.32
E	0.717 BSC		18.21 BSC	
E1	0.465	0.485	11.81	12.32
e	0.100 BSC		2.54 BSC	
F	0.245	0.255	6.22	6.47
K	0.120	0.130	3.05	3.30
L	0.061	0.071	1.55	1.80
M	0.270	0.290	6.86	7.36
N	0.080	0.090	2.03	2.28
P	0.009	0.011	0.23	0.28
T	0.115	0.125	2.92	3.17
θ	0°	7°	0°	7°

CASE 1369–01
ISSUE O



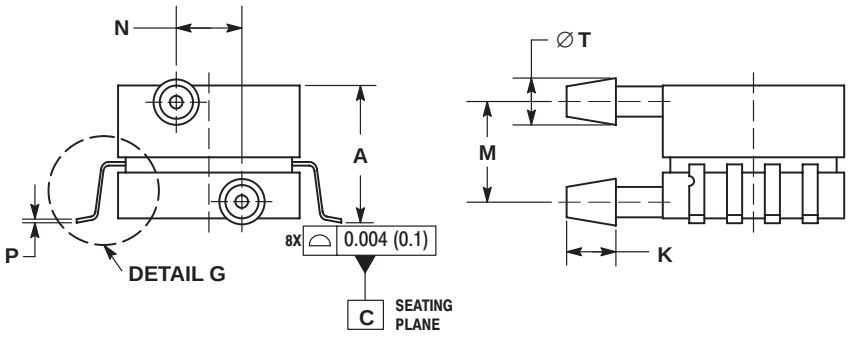


DETAIL G

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

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

NOTES:
1. CONTROLLING DIMENSION: INCH.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M–1994.
3. DIMENSIONS "D" AND "E1" DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.006 (0.152) PER SIDE.
4. DIMENSION "b" DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.008 (0.203) MAXIMUM.



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.370	0.390	9.39	9.91
A1	0.002	0.010	0.05	0.25
b	0.038	0.042	0.96	1.07
D	0.465	0.485	11.81	12.32
E	0.680	0.700	17.27	17.78
E1	0.465	0.485	11.81	12.32
e	0.100 BSC		2.54 BSC	
F	0.240	0.260	6.10	6.60
K	0.115	0.135	2.92	3.43
L	0.040	0.060	1.02	1.52
M	0.270	0.290	6.86	7.37
N	0.160	0.180	4.06	4.57
P	0.009	0.011	0.23	0.28
T	0.110	0.130	2.79	3.30
θ	0 °	7 °	0 °	7 °

CASE 1351–01
ISSUE O

NOTES

NOTES

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

JAPAN: Motorola Japan Ltd.; SPS, Technical Information Center, 3–20–1, Minami–Azabu. Minato–ku, Tokyo 106–8573 Japan. 81–3–3440–3569

ASIA/PACIFIC: Motorola Semiconductors H.K. Ltd.; Silicon Harbour Centre, 2 Dai King Street, Tai Po Industrial Estate, Tai Po, N.T., Hong Kong. 852–26668334

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