

ABP SERIES

32305128

Issue J

Basic Board Mount Pressure Sensors

High Accuracy, Compensated/Amplified
60 mbar to 10 bar | 6 kPa to 1 MPa | 1 psi to 150 psi
Digital or Analog Output, Liquid Media Capable

DESCRIPTION

The ABP Series are piezoresistive silicon pressure sensors offering a ratiometric analog or digital output for reading pressure over the specified full scale pressure span and temperature range. They are calibrated and temperature compensated for sensor offset, sensitivity, temperature effects and accuracy errors (which include non-linearity, repeatability and hysteresis) using an on-board Application Specific Integrated Circuit (ASIC). Calibrated output values for pressure are updated at approximately 1 kHz for analog and 2 kHz for digital. All products are designed and manufactured according to ISO 9001 standards.

- Dry gases option: The input port is limited to non-corrosive, non-ionic media (e.g., dry air, gases) and should not be exposed to condensation. The gases are limited to media compatible with high temperature polyamide, silicone, alumina ceramic, silicon, gold, and glass.
- Liquid media option: Includes an additional silicone-based gel coating to protect the electronics under port P1, which enables use with non-corrosive liquids (e.g. water and saline) and in applications where condensation can occur. Since port P2 is designed for use with non-corrosive liquids, this option is often suitable for wet-wet differential sensing.

DIFFERENTIATION

- Enhanced accuracy helps the design engineer fully understand the error in measurement.
- Wide supply voltage range offers design flexibility.
- Power consumption when utilizing sleep mode option allows for use in battery-powered applications.

VALUE TO CUSTOMERS

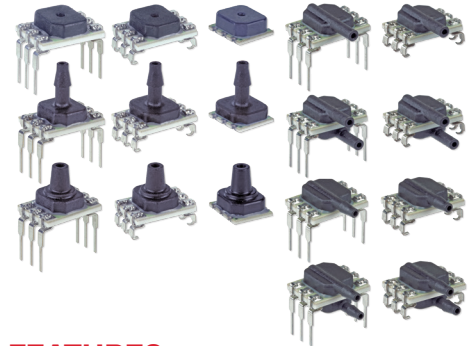
- Simplifies design-in: Small size saves room on the PC board (PCB), or simplifies design in smaller and lower power devices. Meets Moisture Sensitivity Level 1 requirements, which allows for unlimited shelf life when stored at <30 °C/85 %RH and, under most storage conditions, allows for PCB soldering without any material concern about solder joint quality due

to aging of the sensor terminals, which minimizes the concern about aging of the terminals prior PCB assembly. Pressure choices allow engineers to select range required for their application. Leadless SMT, SMT, and DIP package options.

- Cost-effective: Small size helps engineers reduce design and manufacturing costs while maintaining enhanced performance and reliability of the systems they design.
- Accurate: Total Error Band (TEB) and wide pressure range enable engineers to optimize system performance by improving resolution and system accuracy. Optional internal diagnostics validate that the sensor readings are correct.
- Flexible: Supply voltage range, variety of pressure units, types, and ranges, output options, and wide operating temperature range simplify use in the application.
- Versatile: Wet-media compatibility, sleep mode, and temperature output options make the sensor a versatile choice for Internet of Things applications.
- Honeywell Brand: Utilize proprietary Honeywell technology, and are protected by multiple global patents.
- Food Safety Certification for North America, Europe and Asia.

POTENTIAL APPLICATIONS

- **Medical:** CPAP, blood analysis, blood pressure monitoring, breast pumps, drug dosing, hospital beds, massage machines, oxygen concentrators, patient monitoring, sleep apnea equipment, urine analyzers, ventilators/portable ventilators, and wound therapy
- **Industrial:** Air brakes, HVAC/transmitters, life sciences, material handling, pneumatic control and regulation, process gas monitoring, and valve positioning/positioners
- **Commercial:** Air beds, coffee makers, and washing machines



FEATURES

- Measures gage and differential pressures
- Total Error Band (see Figure 1): $\pm 1.5\%$ FSS
- Liquid media option: Allows for wet/wet operation on dual ported devices
- Industry-leading long-term stability: $\pm 0.25\%$ FSS
- Industry-leading accuracy: $\pm 0.25\%$ FSS BFLS
- Wide pressure range: 60 mbar to 10 bar | 6 kPa to 1 MPa | 1 psi to 150 psi
- As small as 8 mm x 7 mm
- High burst pressures (see Table 7)
- Calibrated over temperature range of 0°C to 50°C [32°F to 122°F]
- Operates from a single power supply of either 3.3 Vdc or 5.0 Vdc
- Output: Ratiometric analog or I²C- or SPI-compatible 12-bit digital
- Power consumption: 2 μ A typical when utilizing sleep mode option
- Meets IPC/JEDEC J-STD-020D.1 Moisture Sensitivity Level 1 requirements
- REACH and RoHS compliant
- Options: Internal diagnostic function, liquid media, sleep mode, temperature output
- Sensor materials have been tested and certified for these food safety standards:
 - NSF-169
 - BPA Free
 - LFGB



PORTFOLIO

Honeywell offers a variety of board mount pressure sensors for potential use in medical and industrial applications. To view the entire product portfolio, [click here](#).



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FIGURE 1. TOTAL ERROR BAND

Total Error Band (TEB) is a single specification that includes all possible sources of error. TEB should not be confused with accuracy, which is actually a component of TEB. TEB is the worst error that the sensor could experience. The TEB specification on a datasheet may be confusing. Honeywell uses the TEB specification in its datasheet because it is the most comprehensive measurement of a sensor's true accuracy. Honeywell also provides the accuracy specification in order to provide a common comparison with competitors' literature that does not use the TEB specification. Many competitors do not use TEB—they simply specify the accuracy of their device. Their accuracy specification, however, may exclude certain parameters. On their datasheet, the errors are listed individually. When combined, the total error (or what would be TEB) can be significant.

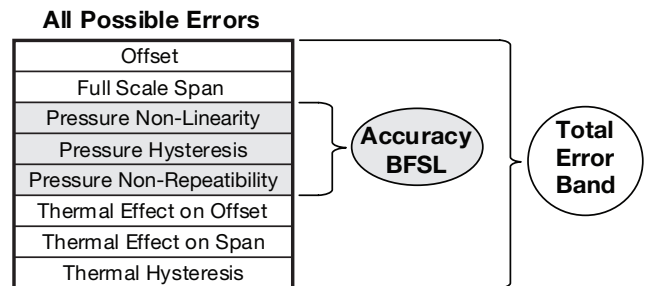


TABLE 1. ABSOLUTE MAXIMUM RATINGS¹

| CHARACTERISTIC | MIN. | MAX. | UNIT |
|---------------------------------------------|-----------|----------------------------|---------|
| Supply voltage (V_{supply}) | -0.3 | 6.0 | Vdc |
| Voltage on any pin | -0.3 | $V_{supply} + 0.3$ | V |
| Digital interface clock frequency: | | | |
| I ² C | 100 | 400 | kHz |
| SPI | 50 | 800 | |
| ESD susceptibility (human body model) | 2 | — | kV |
| Storage temperature | -40 [-40] | 85 [185] | °C [°F] |
| Soldering time and temperature: | | | |
| lead solder temperature (DIP) | | 4 s max. at 250°C [482°F] | |
| peak reflow temperature (Leadless SMT, SMT) | | 15 s max. at 250°C [482°F] | |

¹Absolute maximum ratings are the extreme limits the device will withstand without damage.

TABLE 2. ENVIRONMENTAL SPECIFICATIONS

| CHARACTERISTIC | PARAMETER |
|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Humidity: | |
| all external surfaces | 0 %RH to 95 %RH, non-condensing |
| internal surfaces of Liquid Media Option (T, V, B, C, F, G) | 0 %RH to 100 %RH, condensing |
| internal surfaces of Dry Gases Option (N, D) | 0 %RH to 95 %RH, non-condensing |
| Vibration | 15 g, 10 Hz to 2 kHz |
| Shock | 100 g, 6 ms duration |
| Life ¹ | 1 million pressure cycles minimum |
| Solder reflow | J-STD-020-D.1 Moisture Sensitivity Level 1 (unlimited shelf life when stored at $\leq 30^{\circ}\text{C}/85\% \text{RH}$) |
| Certification (silicone gel coating option: Port 1 only) | NSF-169, BPA Free, LFGB |

¹Life may vary depending on specific application in which the sensor is used.

TABLE 3. WETTED MATERIALS¹

| COMPONENT | PRESSURE PORT 1 (P1) | | PRESSURE PORT 2 (P2) |
|-----------------------|--------------------------------|---------------------|----------------------|
| | DRY GAS OPTION | LIQUID MEDIA OPTION | |
| Ports and covers | high temperature polyamide | | |
| Metal gel ring | — | 304 SST | — |
| Substrate | alumina ceramic | — | alumina ceramic |
| Adhesives | epoxy, silicone | epoxy, silicone gel | epoxy, silicone |
| Electronic components | silicon, glass, gold, aluminum | — | silicon |

¹Contact Honeywell Customer Service for detailed material information.

TABLE 4. SENSOR PRESSURE TYPES

| PRESSURE TYPE | DESCRIPTION |
|---------------|--------------------------------------------------------------------------------------------------------|
| Gage | Output is proportional to the difference between applied pressure and atmospheric (ambient) pressure. |
| Differential | Output is proportional to the difference between the pressures applied to each port (Port 1 – Port 2). |

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TABLE 5. OPERATING SPECIFICATIONS

| CHARACTERISTIC | ANALOG | | | DIGITAL | | | UNIT |
|-------------------------------------------------------------------------|-------------|-----------------|-----------------|-------------|-----------------|------------------|-------------------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. | |
| Supply voltage (V_{supply}): ^{1,2,3} 3.3 Vdc 5.0 Vdc | 3.0 4.75 | 3.3 5.0 | 3.6 5.25 | 3.0 4.75 | 3.3 5.0 | 3.6 5.25 | Vdc |
| Supply current: 3.3 Vdc 5.0 Vdc sleep mode option | — — — | 2.1 2.7 — | 2.8 3.8 — | — — — | 3.1 3.7 1 | 3.9 4.6 10 | mA mA μA |
| Operating temperature range ⁴ | -40 [-40] | — | 85 [185] | -40 [-40] | — | 85 [185] | °C [°F] |
| Compensated temperature range ⁵ | 0 [-32] | — | 50 [122] | 0 [-32] | — | 50 [122] | °C [°F] |
| Temperature output option ⁶ | — | — | — | — | ±4 | — | °C |
| Startup time (power up to data ready) | — | — | 5 | — | — | 3 | ms |
| Response time | — | 1 | — | — | 0.46 | — | ms |
| Clipping limit: upper lower | — 2.5 | — — | 97.5 — | — — | — — | — — | %Vsupply |
| I ² C/SPI voltage level: low high | — — | — — | — — | — 80 | — — | 20 — | %Vsupply |
| Pull up on SDA/MISO, SCL/SCLK, SS | — | — | — | 1 | — | — | kOhm |
| Total Error Band ⁷ | — | — | ±1.5 | — | — | ±1.5 | %FSS ⁸ |
| Accuracy ⁹ | — | — | ±0.25 | — | — | ±0.25 | %FSS BFSL |
| Long term stability (1000 hr, 25°C [77°F]) | — | — | ±0.25 | — | — | ±0.25 | %FSS |
| Output resolution | 0.03 — | — — | — — | — 12 | — — | — — | %FSS bits |

¹Sensors are either 3.3 Vdc or 5.0 Vdc based on the catalog listing selected.

²Ratiometricity of the sensor (the ability of the device output to scale to the supply voltage) is achieved within the specified operating voltage.

³The sensor is not reverse polarity protected. Incorrect application of supply voltage or ground to the wrong pin may cause electrical failure.

⁴Operating temperature range: The temperature range over which the sensor will produce an output proportional to pressure.

⁵Compensated temperature range: The temperature range over which the sensor will produce an output proportional to pressure within the specified performance limits.

⁶Temperature output option: Typical temperature output error over the compensated temperature range of 0°C to 50°C. Operation in Sleep Mode may affect temperature output error depending on duty cycle.

⁷Total Error Band: The maximum deviation from the ideal transfer function over the entire compensated temperature and pressure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability, thermal effect on offset, thermal effect on span, and thermal hysteresis.

⁸Full Scale Span (FSS): The algebraic difference between the output signal measured at the maximum (Pmax.) and minimum (Pmin.) limits of the pressure range. (See Figure 2.)

⁹Accuracy: The maximum deviation in output from a Best Fit Straight Line (BFSL) fitted to the output measured over the pressure range at 25°C [77°F]. Includes all errors due to pressure non-linearity, pressure hysteresis, and non-repeatability.

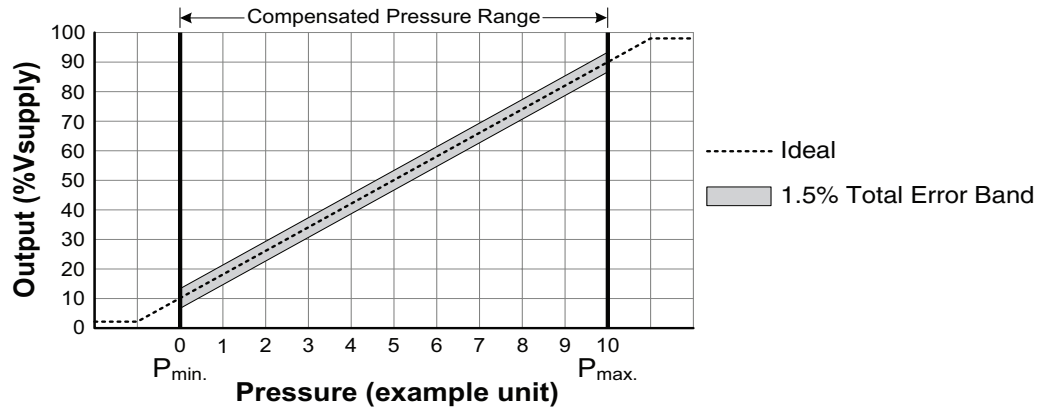
TABLE 6. SENSOR OUTPUT AT SIGNIFICANT PERCENTAGES (DIGITAL VERSIONS ONLY)

| % OUTPUT | DIGITAL COUNTS | |
|----------|----------------|--------|
| | DECIMAL | HEX |
| 0 | 0 | 0x0000 |
| 10 | 1638 | 0x0666 |
| 50 | 8192 | 0x2000 |
| 90 | 14746 | 0x399A |
| 100 | 16383 | 0x3FFF |

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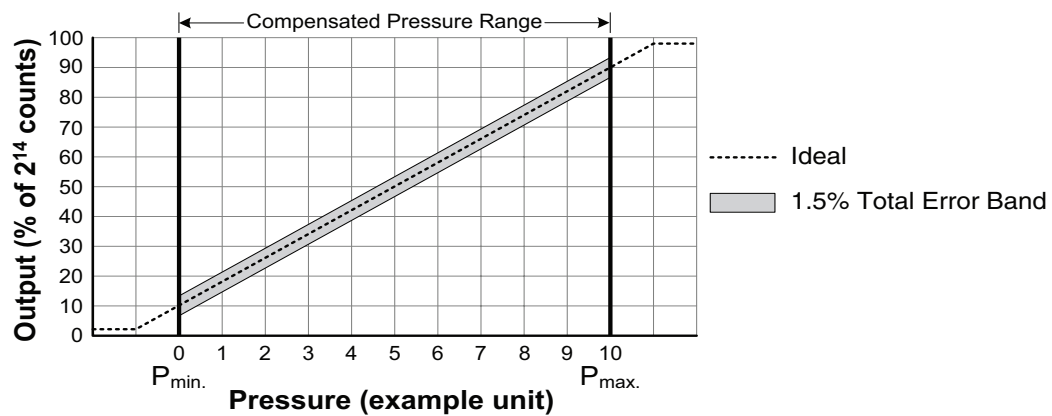
FIGURE 2. TRANSFER FUNCTION LIMITS¹

Analog Versions



$$\text{Output (V)} = \frac{0.8 \times V_{\text{supply}}}{P_{\text{max.}} - P_{\text{min.}}} \times (\text{Pressure}_{\text{applied}} - P_{\text{min.}}) + 0.10 \times V_{\text{supply}}$$

Digital Versions



$$\text{Output (\% of } 2^{14} \text{ counts)} = \frac{80\%}{P_{\text{max.}} - P_{\text{min.}}} \times (\text{Pressure}_{\text{applied}} - P_{\text{min.}}) + 10\%$$

¹Transfer Function "A" is shown. See Figure 3 for other available transfer functions.

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TABLE 7. PRESSURE RANGE SPECIFICATIONS

| PRESSURE RANGE (SEE FIGURE 3.) | PRESSURE RANGE | | UNIT | OVERPRESSURE ¹ | | BURST PRESSURE ² | | COMMON MODE PRESSURE ³ |
|-----------------------------------|----------------|-------|------|---------------------------|-------------|-----------------------------|-------------|-----------------------------------|
| | PMIN. | PMAX. | | PORT 1 (P1) | PORT 2 (P2) | PORT 1 (P1) | PORT 2 (P2) | |
| 1 psi to 150 psi | | | | | | | | |
| Differential | | | | | | | | |
| 060MD | -60 | 60 | mbar | 2000 | 850 | 3500 | 1000 | 10000 |
| 100MD | -100 | 100 | mbar | 4000 | 1400 | 7000 | 2500 | 10000 |
| 160MD | -160 | 160 | mbar | 4000 | 1400 | 7000 | 2500 | 10000 |
| 250MD | -250 | 250 | mbar | 4000 | 1400 | 7000 | 2500 | 10000 |
| 400MD | -400 | 400 | mbar | 6000 | 2000 | 19000 | 4000 | 10000 |
| 600MD | -600 | 600 | mbar | 6000 | 2000 | 19000 | 4000 | 10000 |
| 001BD | -1 | 1 | bar | 17 | 4 | 19 | 8 | 17 |
| 1.6BD | -1.6 | 1.6 | bar | 17 | 8 | 19 | 16 | 17 |
| 2.5BD | -2.5 | 2.5 | bar | 17 | 8 | 19 | 16 | 17 |
| 004BD | -4.0 | 4.0 | bar | 17 | 16 | 19 | 19 | 17 |
| Gage | | | | | | | | |
| 060MG | 0 | 60 | mbar | 2000 | — | 3500 | — | 5500 |
| 100MG | 0 | 100 | mbar | 2000 | — | 3500 | — | 10000 |
| 160MG | 0 | 160 | mbar | 2000 | — | 3500 | — | 10000 |
| 250MG | 0 | 250 | mbar | 4000 | — | 7000 | — | 10000 |
| 400MG | 0 | 400 | mbar | 6000 | — | 19000 | — | 10000 |
| 600MG | 0 | 600 | mbar | 6000 | — | 19000 | — | 10000 |
| 001BG | 0 | 1 | bar | 17 | — | 19 | — | 17 |
| 1.6BG | 0 | 1.6 | bar | 17 | — | 19 | — | 17 |
| 2.5BG | 0 | 2.5 | bar | 17 | — | 19 | — | 17 |
| 004BG | 0 | 4 | bar | 17 | — | 19 | — | 17 |
| 006BG | 0 | 6 | bar | 17 | — | 19 | — | 17 |
| 010BG | 0 | 10 | bar | 17 | — | 19 | — | 17 |
| 6 kPa to 1 MPa | | | | | | | | |
| Differential | | | | | | | | |
| 006KD | -6 | 6 | kPa | 200 | 85 | 350 | 100 | 1000 |
| 010KD | -10 | 10 | kPa | 400 | 140 | 700 | 250 | 1000 |
| 016KD | -16 | 16 | kPa | 400 | 140 | 700 | 250 | 1000 |
| 025KD | -25 | 25 | kPa | 400 | 140 | 700 | 250 | 1000 |
| 040KD | -40 | 40 | kPa | 600 | 200 | 1900 | 400 | 1000 |
| 060KD | -60 | 60 | kPa | 600 | 200 | 1900 | 400 | 1000 |
| 100KD | -100 | 100 | kPa | 1700 | 400 | 1900 | 800 | 1700 |
| 160KD | -160 | 160 | kPa | 1700 | 800 | 1900 | 1600 | 1700 |
| 250KD | -250 | 250 | kPa | 1700 | 800 | 1900 | 1600 | 1700 |
| 400KD | -400 | 400 | kPa | 1700 | 1600 | 1900 | 1900 | 1700 |
| Gage | | | | | | | | |
| 006KG | 0 | 6 | kPa | 200 | — | 350 | — | 550 |
| 010KG | 0 | 10 | kPa | 200 | — | 350 | — | 1000 |
| 016KG | 0 | 16 | kPa | 200 | — | 350 | — | 1000 |
| 025KG | 0 | 25 | kPa | 400 | — | 700 | — | 1000 |
| 040KG | 0 | 40 | kPa | 600 | — | 1900 | — | 1000 |
| 060KG | 0 | 60 | kPa | 600 | — | 1900 | — | 1000 |
| 100KG | 0 | 100 | kPa | 1700 | — | 1900 | — | 1700 |
| 160KG | 0 | 160 | kPa | 1700 | — | 1900 | — | 1700 |
| 250KG | 0 | 250 | kPa | 1700 | — | 1900 | — | 1700 |
| 400KG | 0 | 400 | kPa | 1700 | — | 1900 | — | 1700 |
| 600KG | 0 | 600 | kPa | 1700 | — | 1900 | — | 1700 |
| 001GG | 0 | 1 | MPa | 1.7 | — | 1.9 | — | 1.7 |

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TABLE 7. PRESSURE RANGE SPECIFICATIONS (CONTINUED)

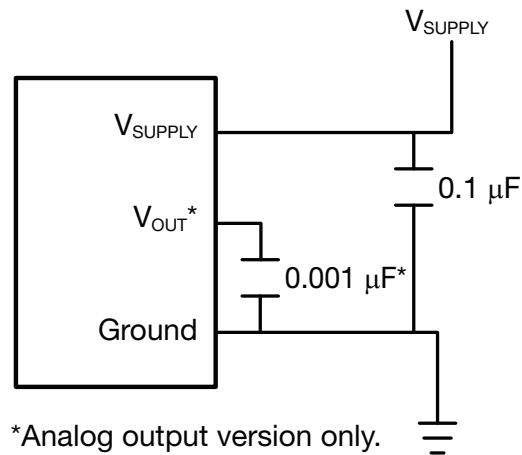
| PRESSURE RANGE (SEE FIGURE 3.) | PRESSURE RANGE | | UNIT | OVERPRESSURE ¹ | | BURST PRESSURE ² | | COMMON MODE PRESSURE ³ |
|-----------------------------------|----------------|-------|------|---------------------------|-------------|-----------------------------|-------------|-----------------------------------|
| | PMIN. | PMAX. | | Port 1 (P1) | Port 2 (P2) | Port 1 (P1) | Port 2 (P2) | |
| 1 psi to 150 psi | | | | | | | | |
| Differential | | | | | | | | |
| 001PD | -1 | 1 | psi | 30 | 10 | 50 | 15 | 150 |
| 005PD | -5 | 5 | psi | 90 | 30 | 275 | 40 | 150 |
| 015PD | -15 | 15 | psi | 250 | 60 | 275 | 120 | 250 |
| 030PD | -30 | 30 | psi | 250 | 120 | 275 | 240 | 250 |
| 060PD | -60 | 60 | psi | 250 | 250 | 275 | 275 | 250 |
| Gage | | | | | | | | |
| 001PG | 0 | 1 | psi | 30 | — | 50 | — | 150 |
| 005PG | 0 | 5 | psi | 90 | — | 275 | — | 150 |
| 015PG | 0 | 15 | psi | 250 | — | 275 | — | 250 |
| 030PG | 0 | 30 | psi | 250 | — | 275 | — | 250 |
| 060PG | 0 | 60 | psi | 250 | — | 275 | — | 250 |
| 100PG | 0 | 100 | psi | 250 | — | 275 | — | 250 |
| 150PG | 0 | 150 | psi | 250 | — | 275 | — | 250 |

¹Overpressure: The maximum pressure which may safely be applied to the product for it to remain in specification once pressure is returned to the operating pressure range. Exposure to higher pressures may cause permanent damage to the product. Unless otherwise specified this applies to all available pressure ports at any temperature with the operating temperature range.

²Burst pressure: The maximum pressure that may be applied to the specified port (P1 or P2) of the product without causing escape of pressure media. Product should not be expected to function after exposure to any pressure beyond the burst pressure.

³Common mode pressure: The maximum pressure that can be applied simultaneously to both ports of a differential pressure sensor without causing changes in specified performance.

FIGURE 4. RECOMMENDED FILTER CAP

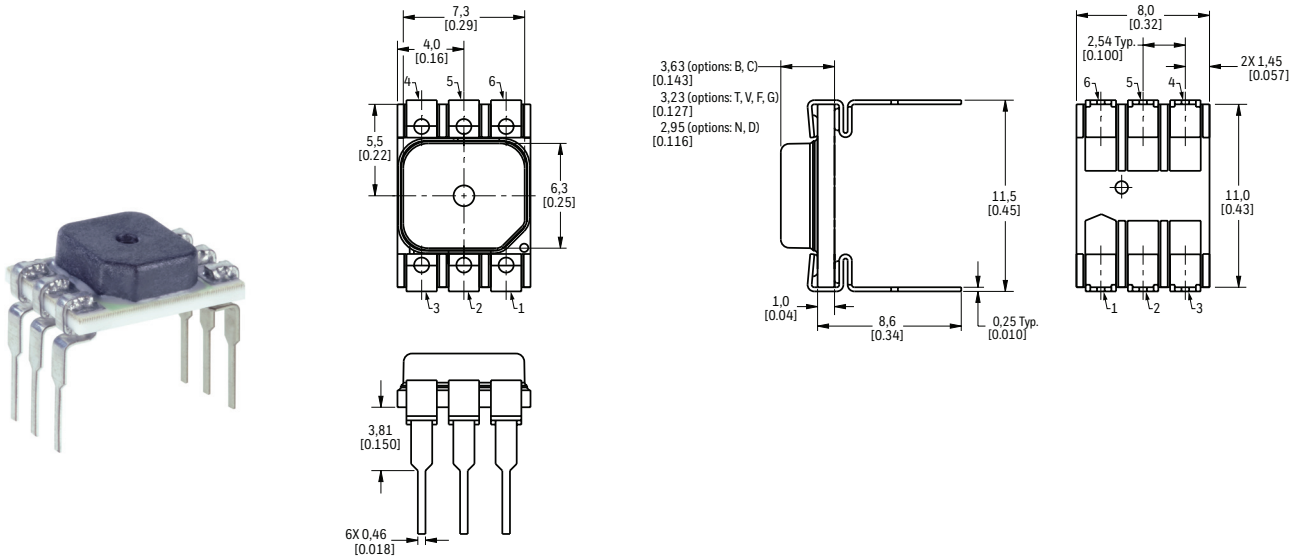


*Analog output version only.

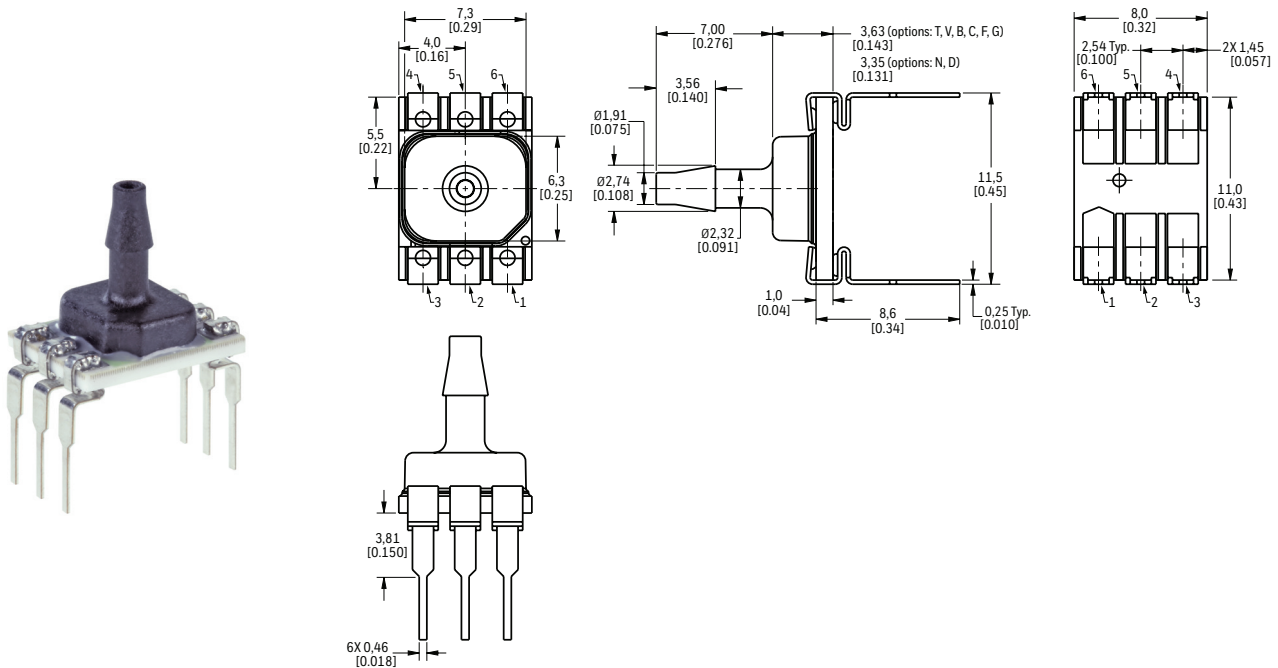
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FIGURE 5. DIP PACKAGE DIMENSIONAL DRAWINGS (FOR REFERENCE ONLY: MM [IN.])

DIP NN: No port



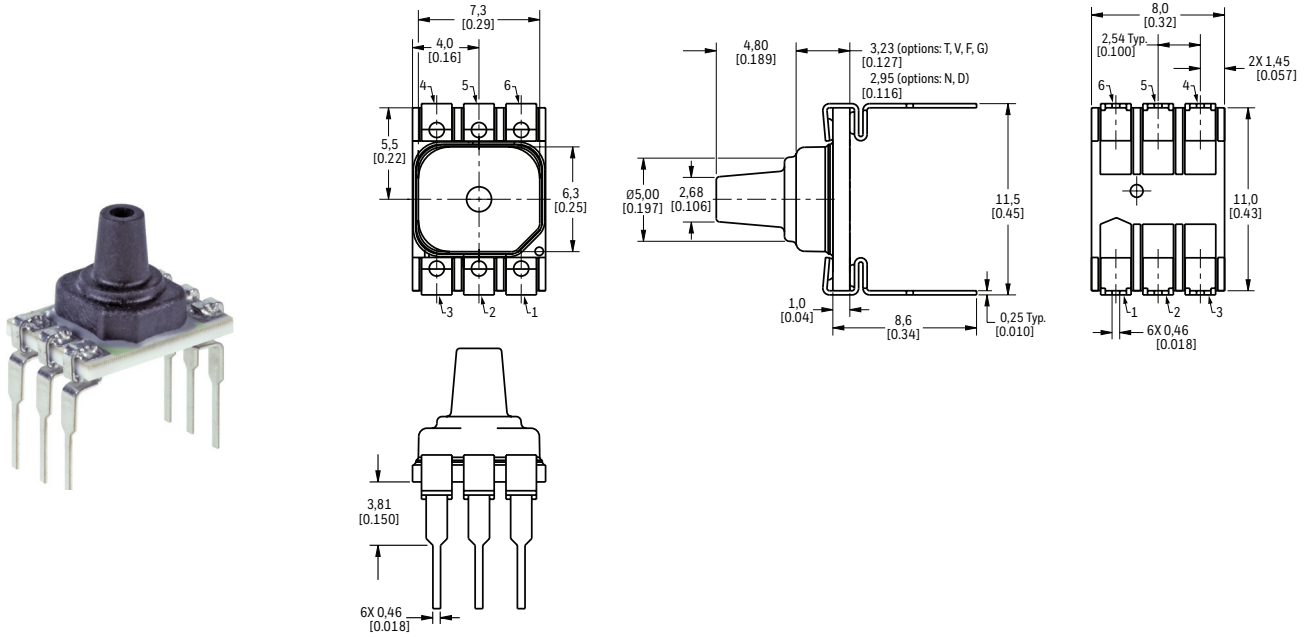
DIP AN: Single axial barbed port



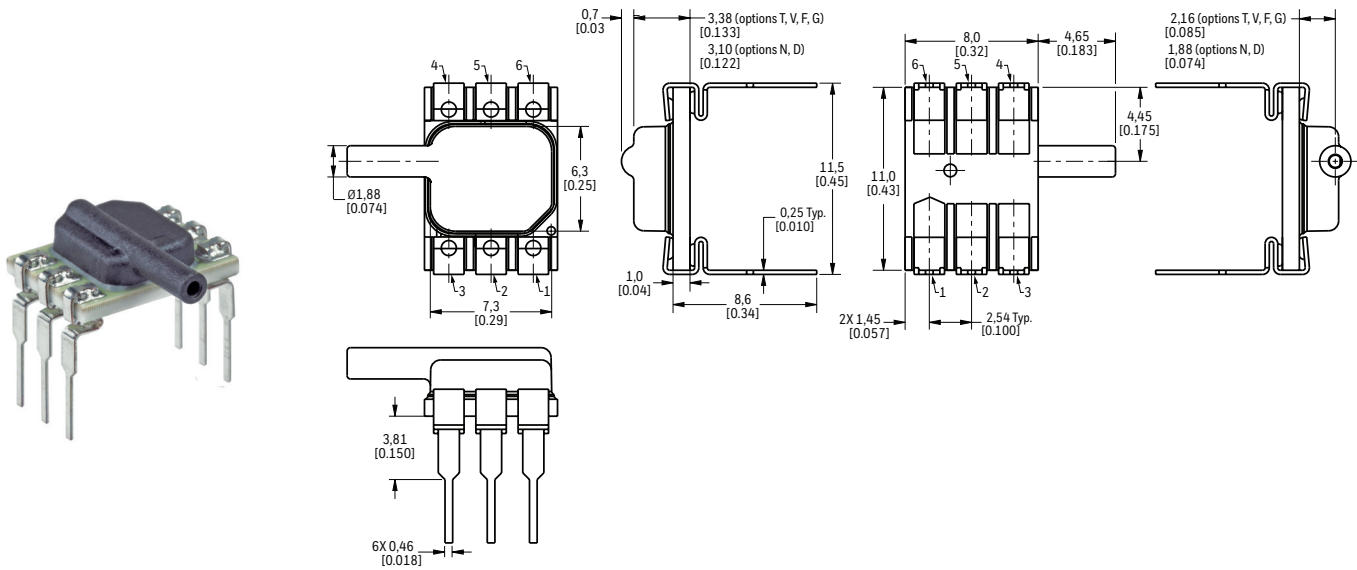
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FIGURE 5. DIP PACKAGE DIMENSIONAL DRAWINGS (CONTINUED)

DIP LN: Single axial barbless port



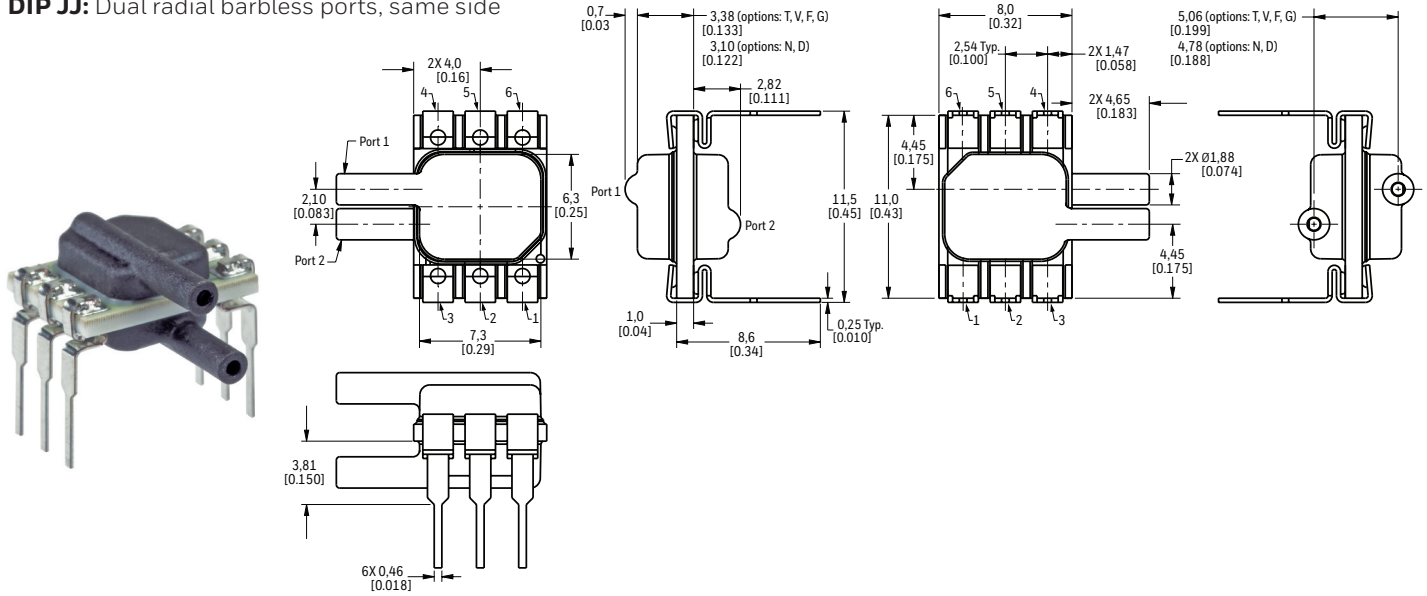
DIP JN: Single radial barbless port



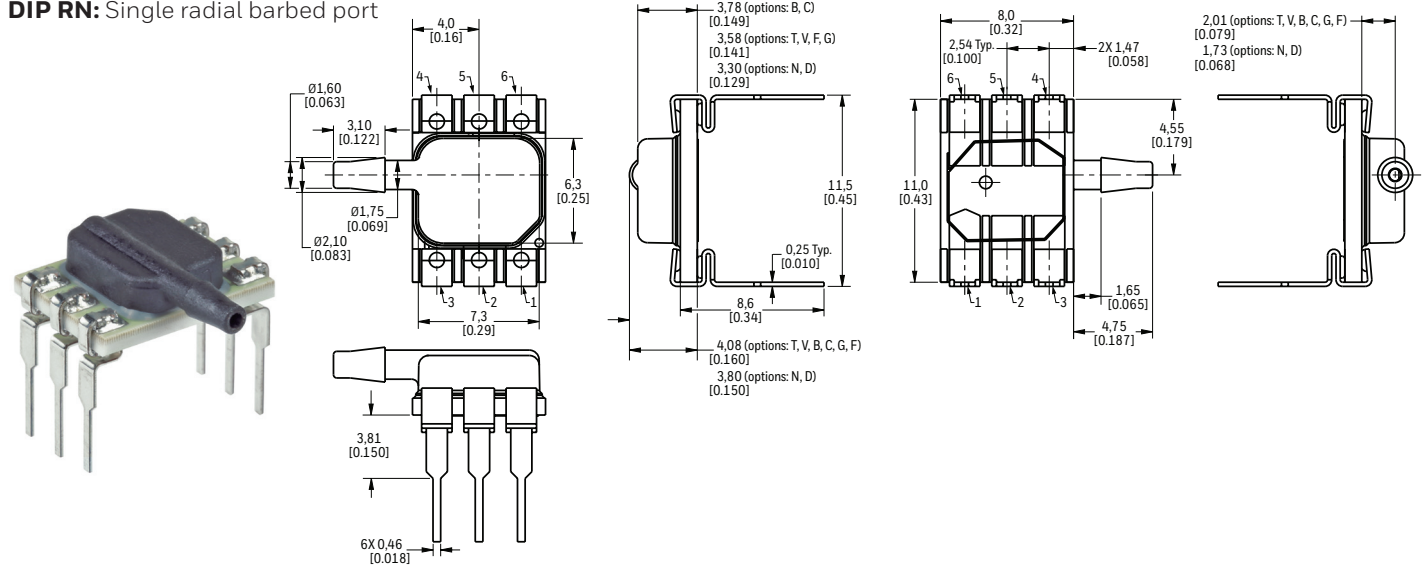
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FIGURE 5. DIP PACKAGE DIMENSIONAL DRAWINGS (CONTINUED)

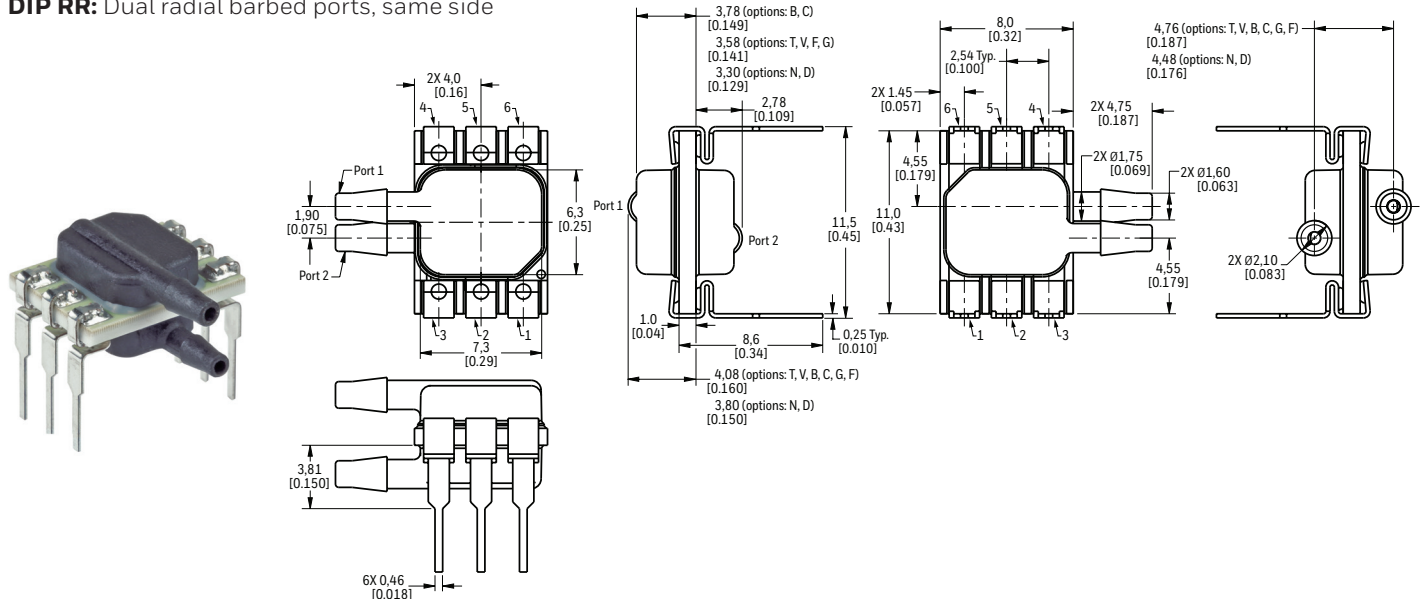
DIP JJ: Dual radial barbless ports, same side



DIP RN: Single radial barbed port



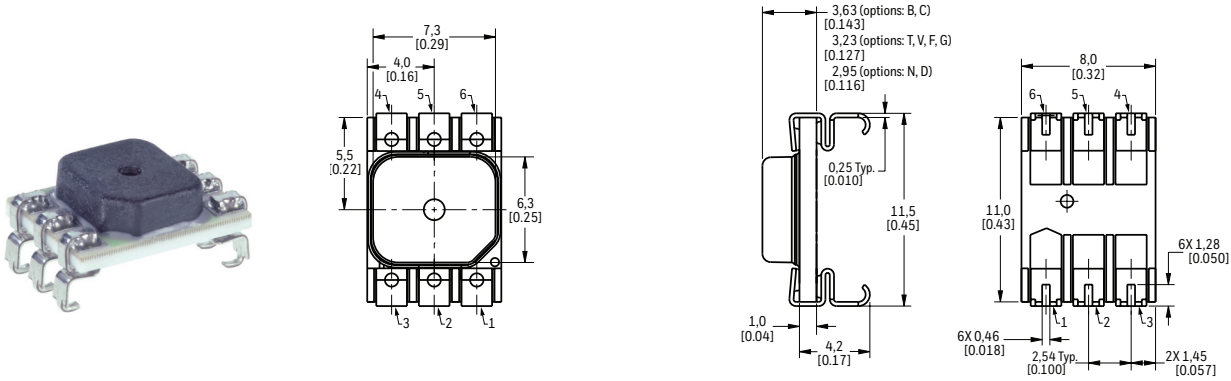
DIP RR: Dual radial barbed ports, same side



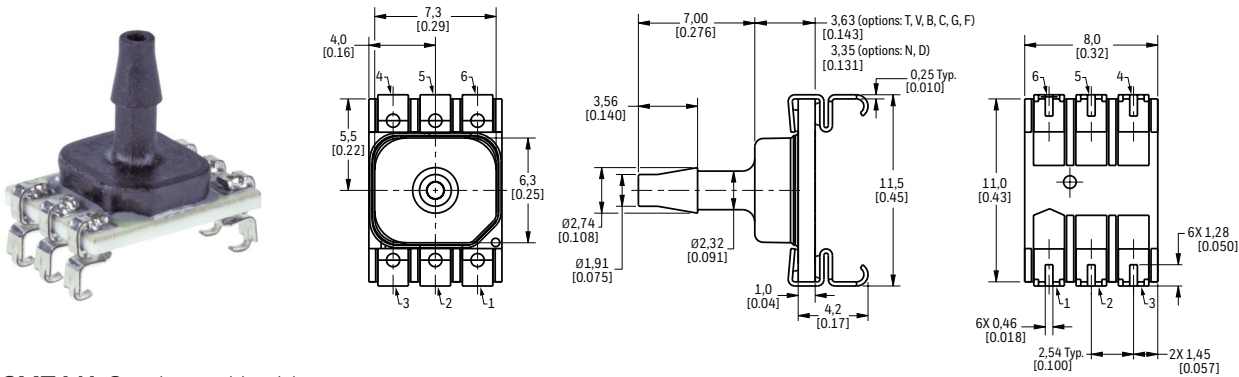
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FIGURE 6. SMT PACKAGE DIMENSIONAL DRAWINGS (FOR REFERENCE ONLY: MM [IN].)

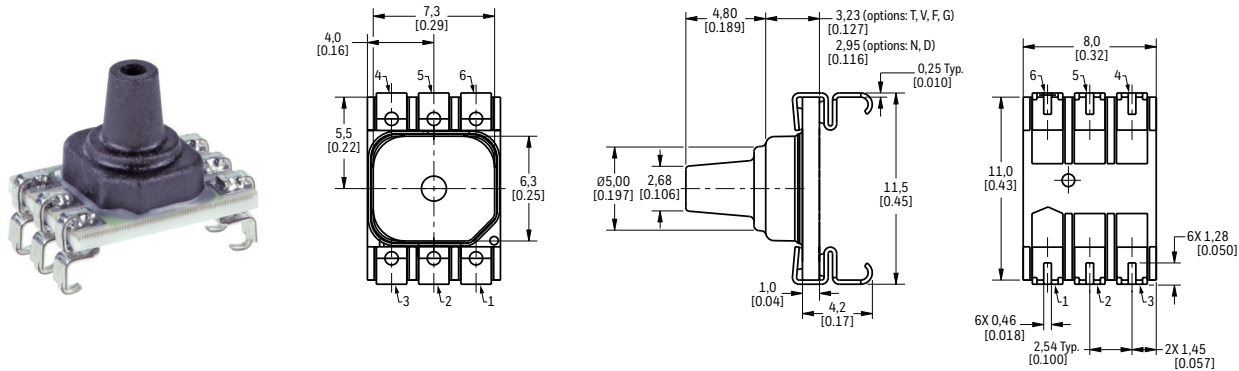
SMT NN: No port



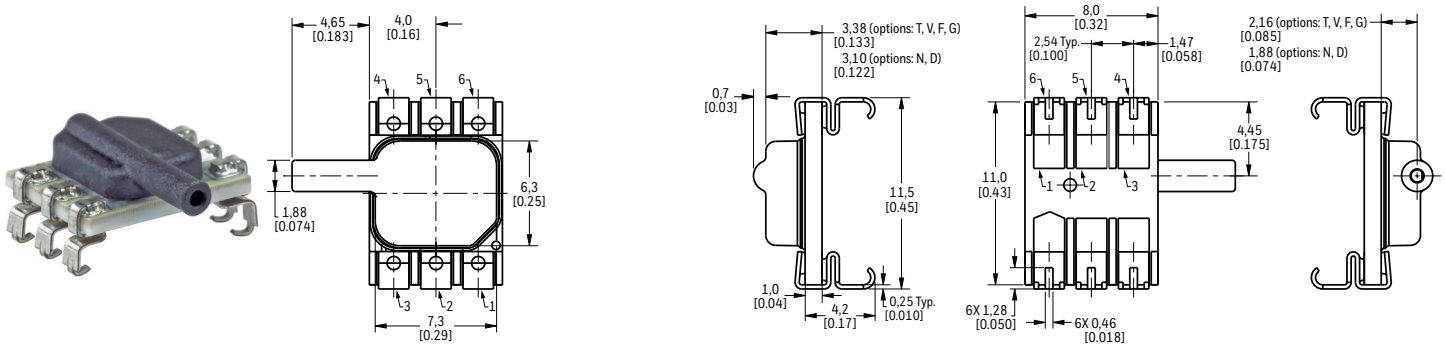
SMT AN: Single axial barbed port



SMT LN: Single axial barbless port



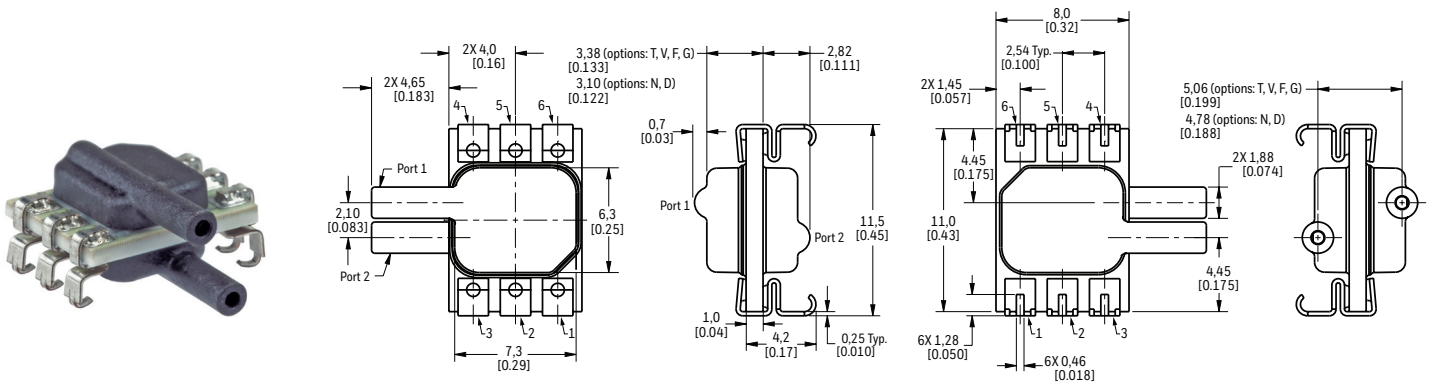
SMT JN: Single radial barbless port



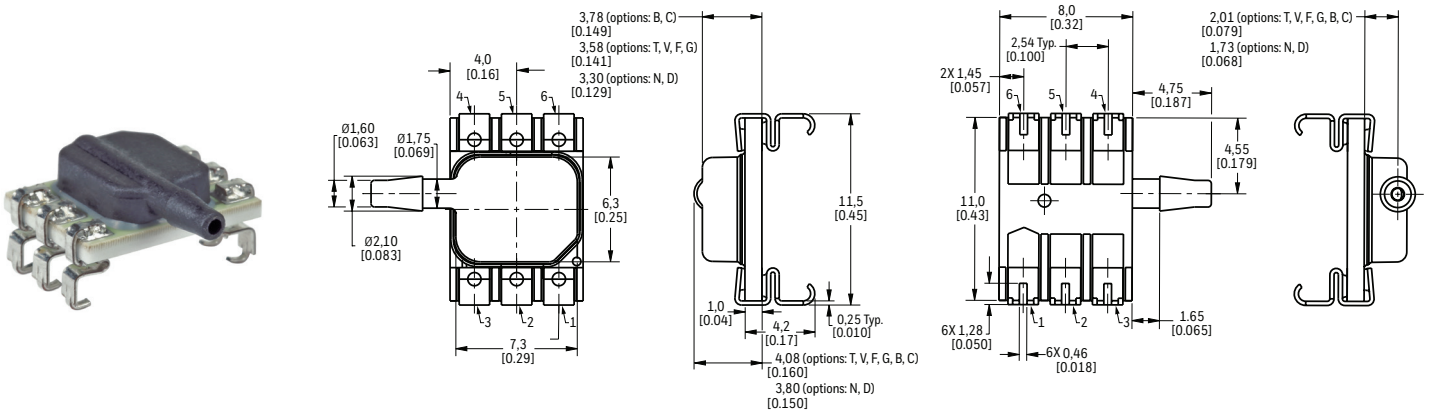
BASIC BOARD MOUNT PRESSURE SENSORS, ABP SERIES

FIGURE 6. SMT PACKAGE DIMENSIONAL DRAWINGS (CONTINUED)

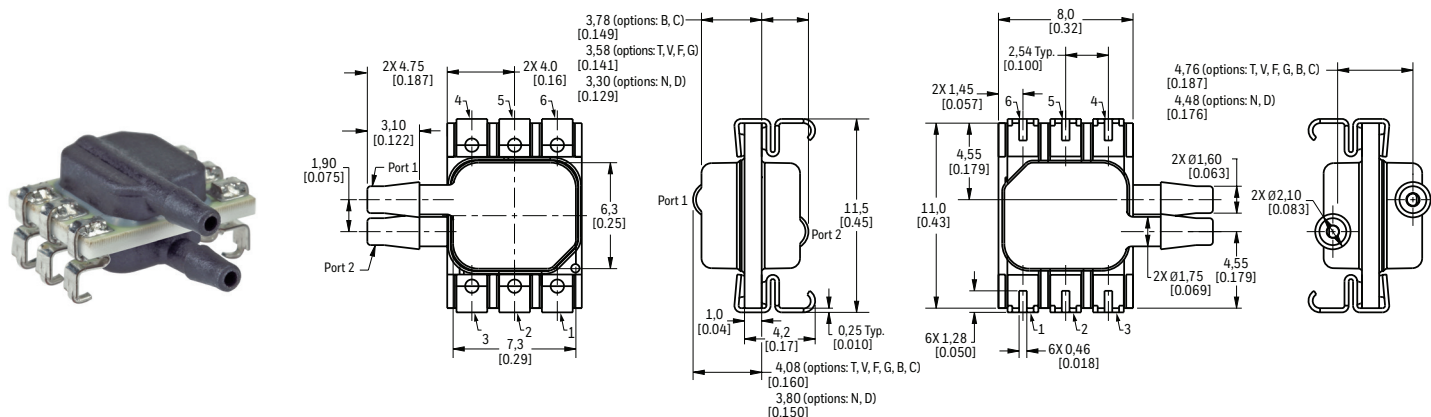
SMT JJ: Dual radial barbless ports, same side



SMT RN: Single radial barbed port



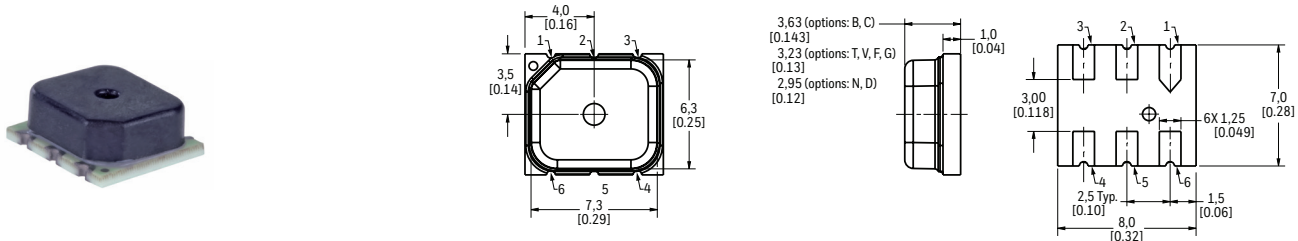
SMT RR: Dual radial barbed ports, both sides



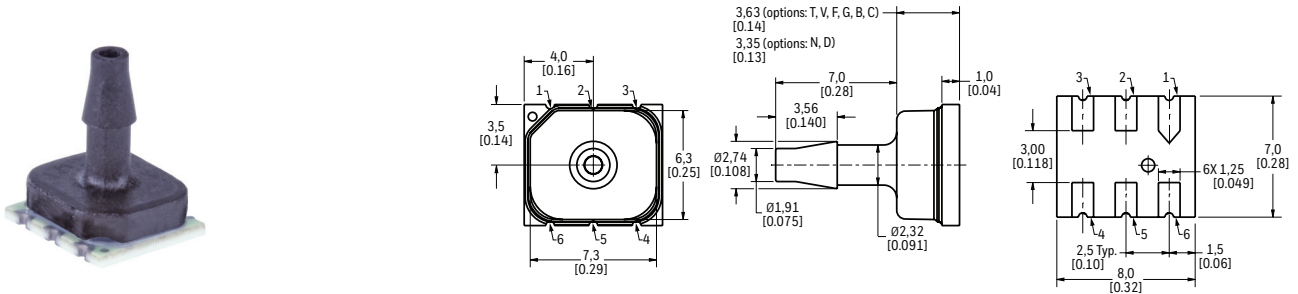
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FIGURE 7. LEADLESS SMT PACKAGE DIMENSIONAL DRAWINGS (FOR REFERENCE ONLY: MM [IN].)

Leadless SMT NN: No port



Leadless SMT AN: Single axial barbed port



Leadless SMT LN: Single axial barbless port

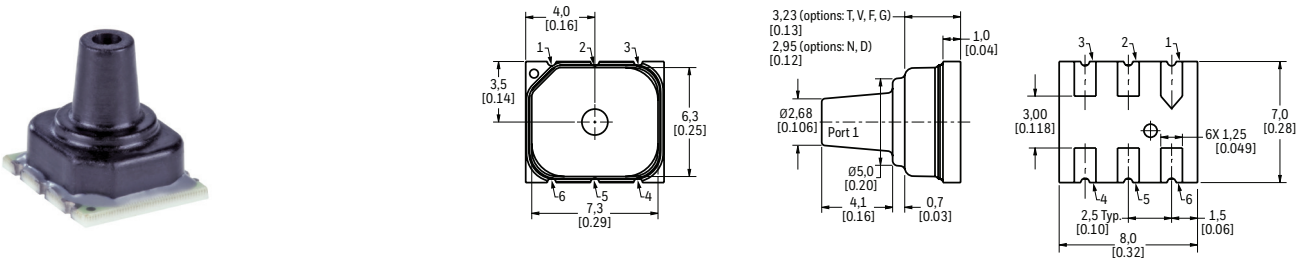


TABLE 8. PINOUTS

| OUTPUT TYPE | PIN 1 | PIN 2 | PIN 3 | PIN 4 | PIN 5 | PIN 6 |
|------------------|-------|---------------------|------------------|-------|-------|---------------------|
| I ² C | GND | V _{supply} | INT | NC | SDA | SCL |
| SPI | GND | V _{supply} | SS | NC | MISO | SCLK |
| analog | GND | NC | V _{out} | NC | NC | V _{supply} |

FIGURE 8. RECOMMENDED PCB LAYOUTS

