

ABP SERIES

32350389
Issue A

For Use in Medical Ventilators

Basic Board Mount Pressure Sensors
High Accuracy, Compensated/Amplified
60 mbar to 1.6 bar | 1 psi to 15 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

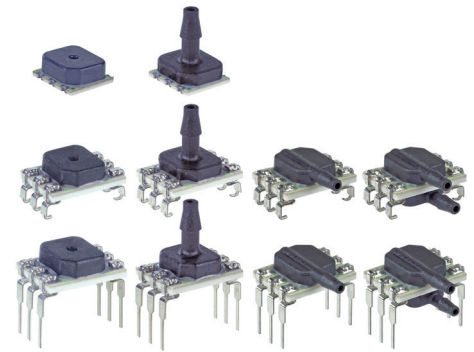
- Enhanced accuracy helps the design engineer fully understand the error in measurement.
- Wide supply voltage range offers design flexibility.
- Power consumption when utilizing sleep mode option allows for use in battery-powered applications.

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: Utilizes proprietary Honeywell technology, and is protected by multiple global patents.

POTENTIAL MEDICAL APPLICATIONS

Oxygen concentrators, patient monitoring, sleep apnea equipment, ventilators/portable ventilators.



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 BFSL
- Wide pressure range: 60 mbar to 1.6 bar | 1 psi to 15 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 3.3Vdc or 5.0Vdc
- Output: Ratiometric analog or I²C- or SPI-compatible 12-bit digital
- Power consumption: 2 uA typical when utilizing sleep mode option
- Meet 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



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](#).

BASIC BOARD MOUNT PRESSURE SENSORS, ABP SERIES FOR MEDICAL VENTILATOR APPLICATIONS

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.

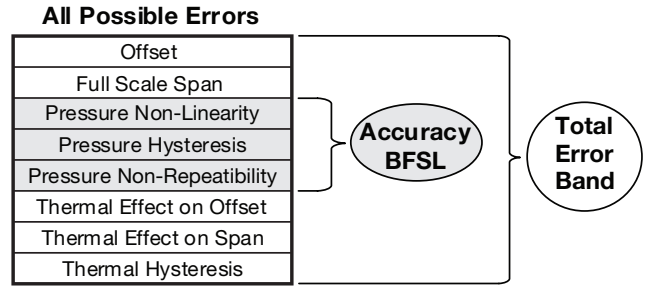


TABLE 1. ABSOLUTE MAXIMUM RATINGS¹

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, 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 $\leq 30^{\circ}\text{C}/85\% \text{RH}$)

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		
Substrate	alumina ceramic	—	alumina ceramic
Adhesives	epoxy, silicone	epoxy, silicone gel	epoxy, silicone
Electronic components	silicon, glass, solder, gold, aluminum	304 SST	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).

BASIC BOARD MOUNT PRESSURE SENSORS, ABP SERIES FOR MEDICAL VENTILATOR APPLICATIONS

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 uA
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.

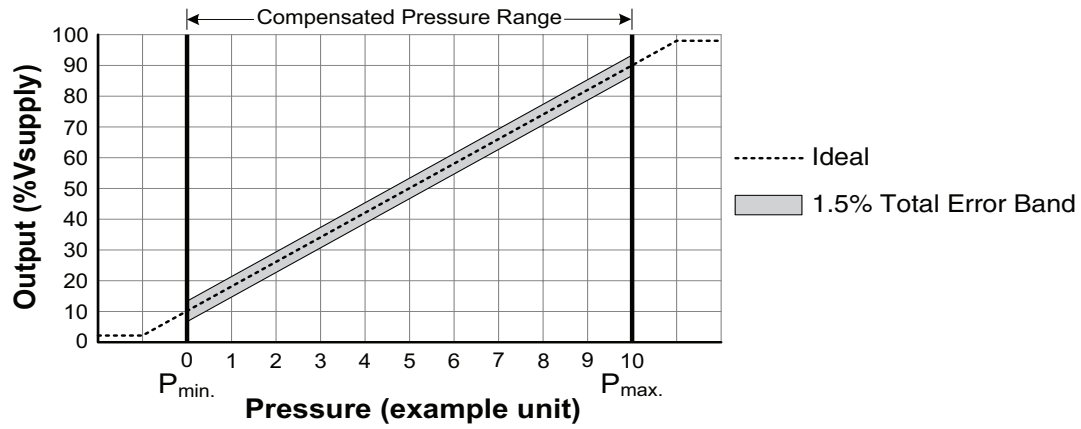
TABLE 6. SENSOR OUTPUT AT SIGNIFICANT PERCENTAGES (DIGITAL VERSIONS ONLY)

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

BASIC BOARD MOUNT PRESSURE SENSORS, ABP SERIES FOR MEDICAL VENTILATOR APPLICATIONS

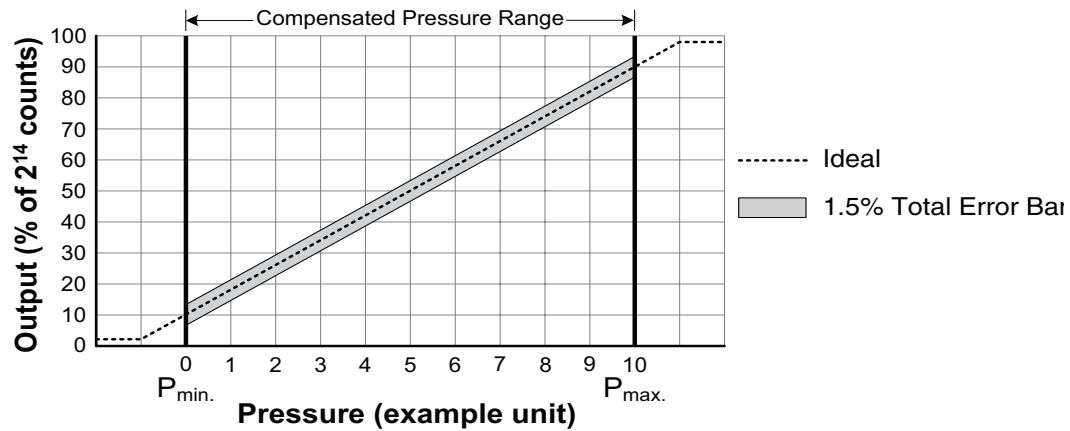
FIGURE 2. TRANSFER FUNCTION LIMITS¹

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



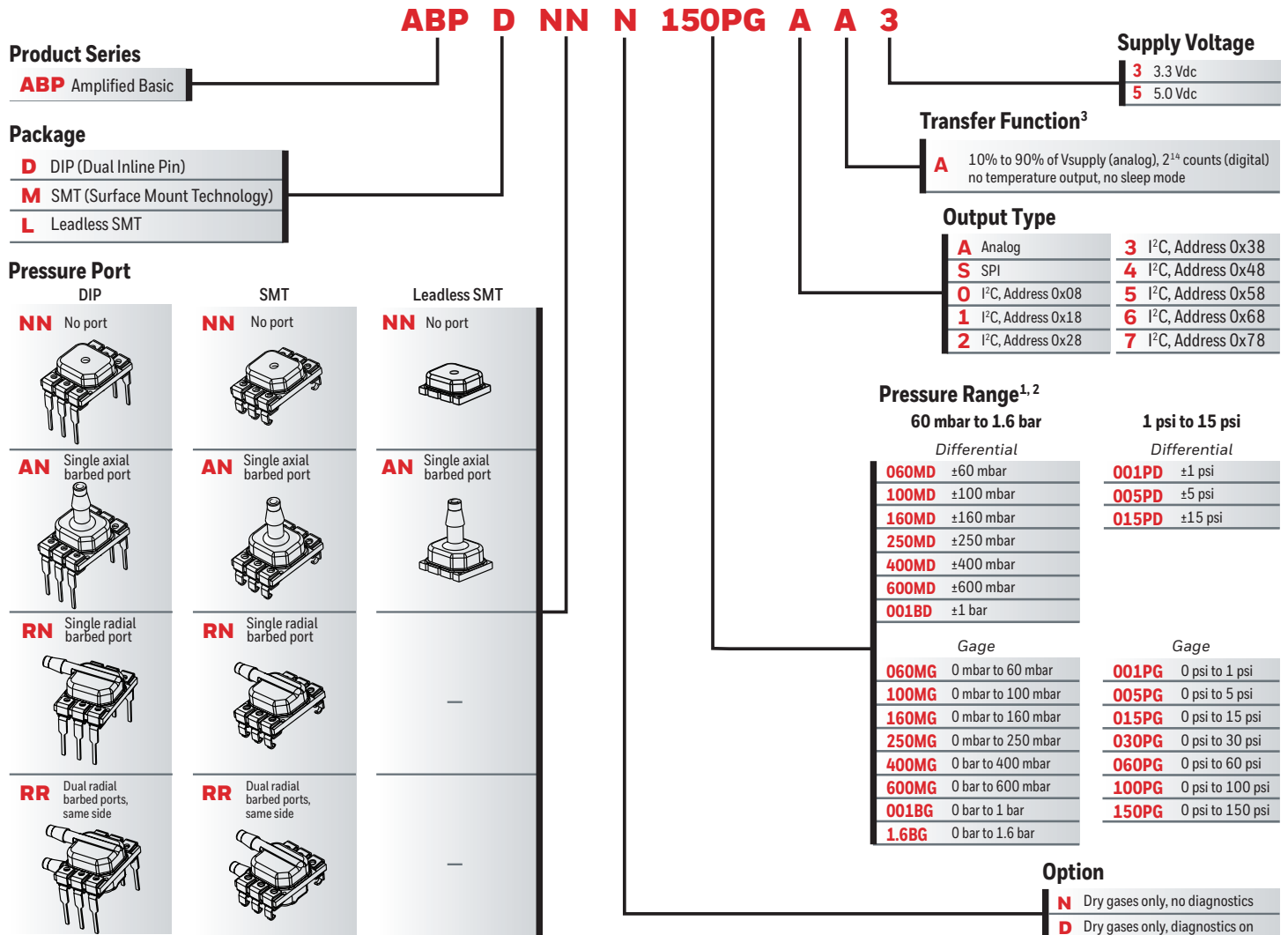
$$\text{Output (\% of } 2^{14} \text{ counts)} = \frac{80\%}{P_{\text{max.}} - P_{\text{min.}}} \times (\text{Pressure}_{\text{applied}} - P_{\text{min.}}) + 10\%$$

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

BASIC BOARD MOUNT PRESSURE SENSORS, ABP SERIES FOR MEDICAL VENTILATOR APPLICATIONS

FIGURE 3. NOMENCLATURE AND ORDER GUIDE

For example, **ABPDNNN150PGAA3** defines an ABP Series Amplified Basic Pressure Sensor, DIP package, NN pressure port, dry gases only, no diagnostics, 150 psi gage pressure range, analog output type, 10% to 90% of Vsupply (analog), transfer function, no temperature output, no sleep mode, 3.3 Vdc supply voltage.



¹ Custom pressure ranges are available. Contact Honeywell Customer Service for more information.

² See the explanation of sensor pressure types in Table 4.

³ The transfer function limits define the output of the sensor at a given pressure input. By specifying Pmin. and Pmax., the output at Pmin. and Pmax., the complete transfer function of the sensor is defined. See the graphical representations of the transfer function in Figure 3.

BASIC BOARD MOUNT PRESSURE SENSORS, ABP SERIES FOR MEDICAL VENTILATOR APPLICATIONS

TABLE 7. PRESSURE RANGE SPECIFICATIONS

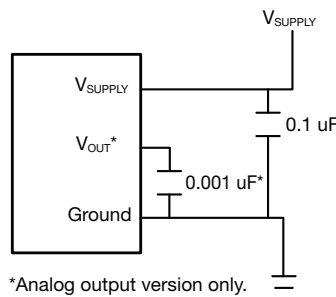
PRESSURE RANGE (SEE FIGURE 3.)	PRESSURE RANGE		UNIT	OVERPRESSURE ¹		BURST PRESSURE ²		COMMON MODE PRESSURE ³
	PMIN.	PMAX.		PORT 1 (P1)	PORT 2 (P2)	PORT 1 (P1)	PORT 2 (P2)	
60 mbar to 1.6 bar								
Differential								
060MD	-60	60	mbar	2000	850	3500	1000	10000
100MD	-100	100	mbar	4000	1400	7000	2500	10000
160MD	-160	160	mbar	4000	1400	7000	2500	10000
250MD	-250	250	mbar	10000	2000	19000	4000	10000
400MD	-400	400	mbar	10000	2000	19000	4000	10000
600MD	-600	600	mbar	17000	2000	19000	4000	10000
001BD	-1	1	bar	17	4	19	8	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	10000	—	19000	—	10000
600MG	0	600	mbar	10000	—	19000	—	10000
001BG	0	1	bar	17	—	19	—	17
1.6BG	0	1.6	bar	17	—	19	—	17
1 psi to 15 psi								
Differential								
001PD	-1	1	psi	30	10	50	15	150
005PD	-5	5	psi	150	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	150	—	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.

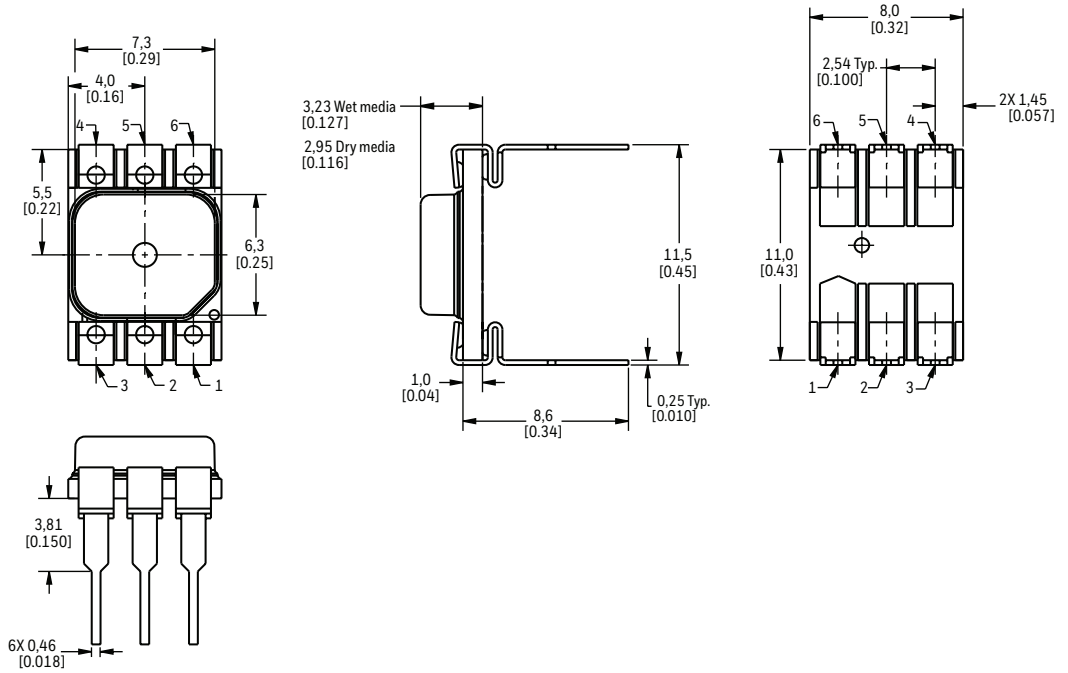
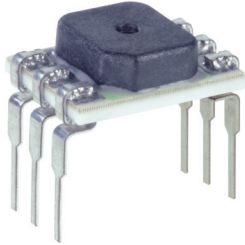
FIGURE 4. RECOMMENDED FILTER CAP



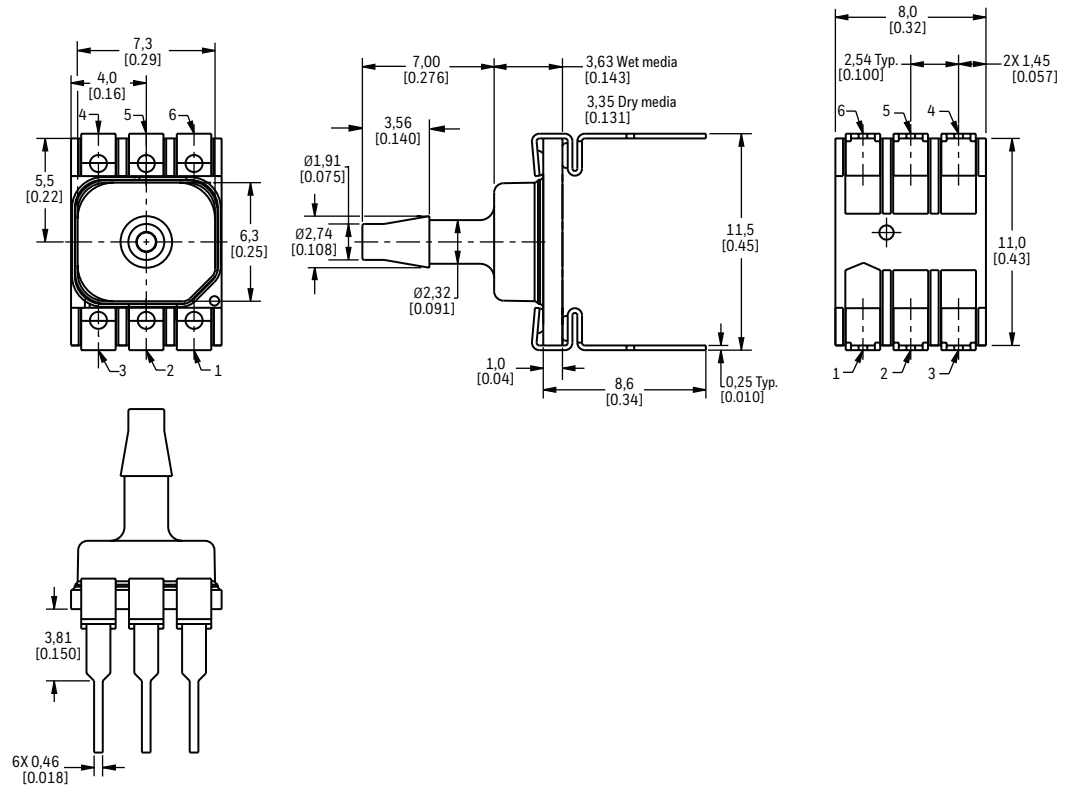
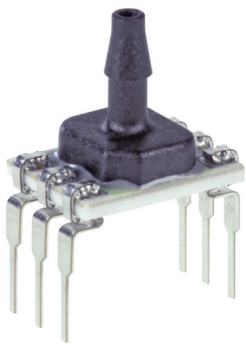
BASIC BOARD MOUNT PRESSURE SENSORS, ABP SERIES FOR MEDICAL VENTILATOR APPLICATIONS

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

DIP NN: No port



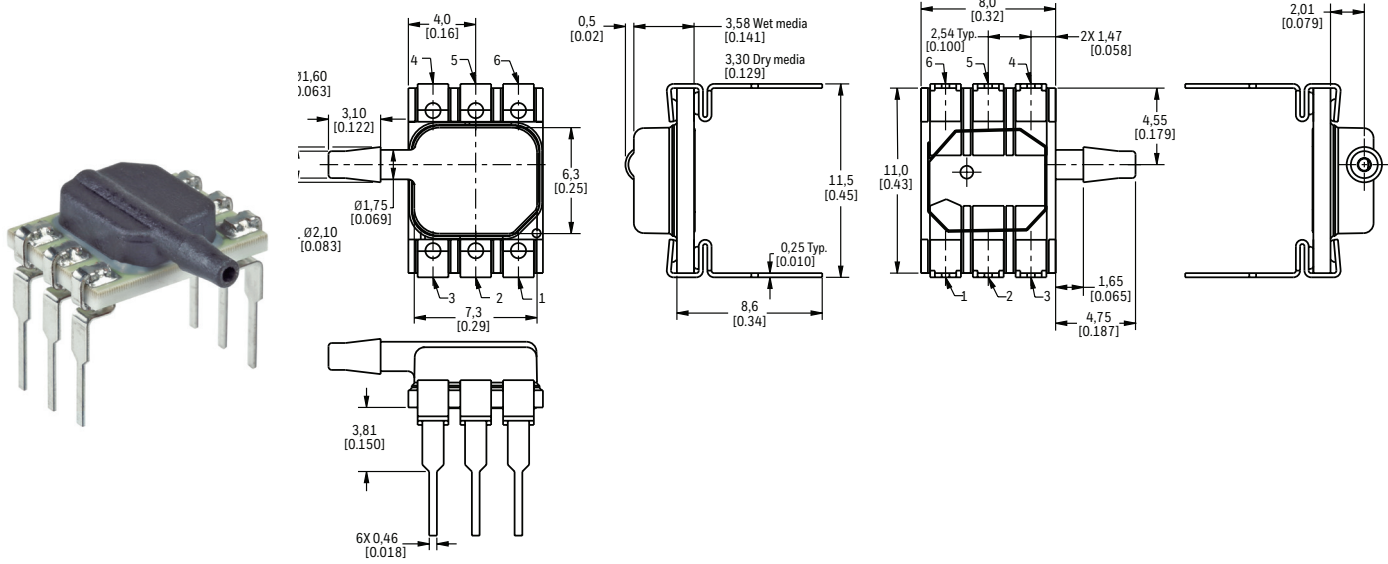
DIP AN: Single axial barbed port



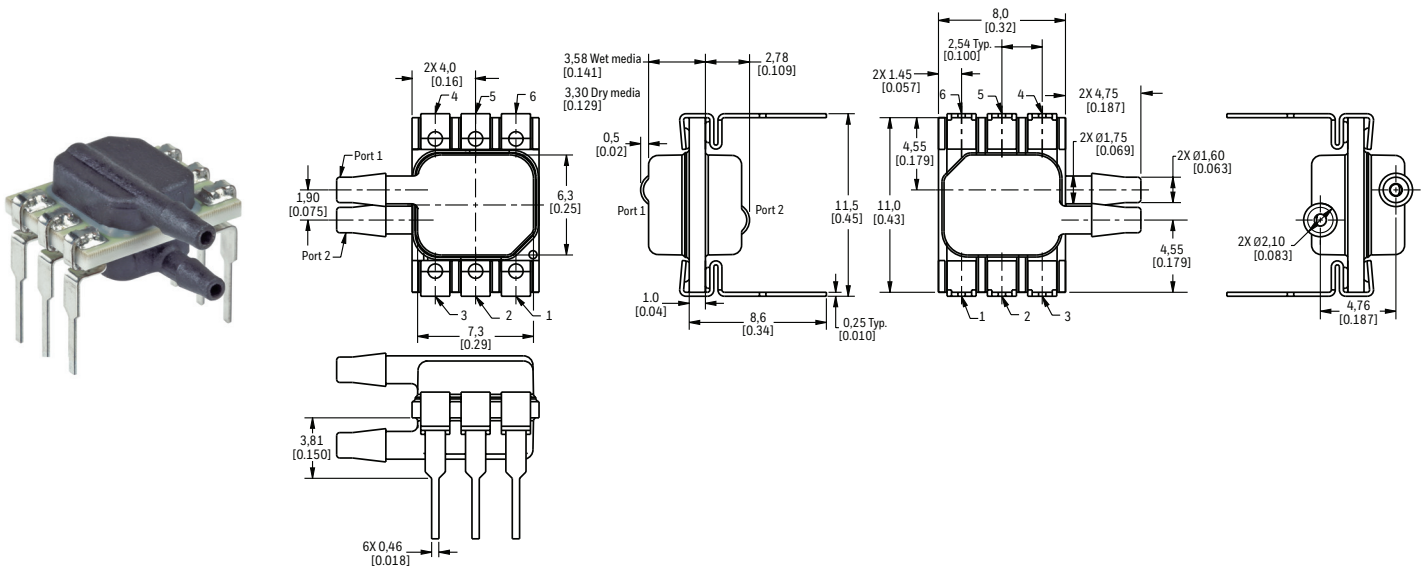
BASIC BOARD MOUNT PRESSURE SENSORS, ABP SERIES FOR MEDICAL VENTILATOR APPLICATIONS

FIGURE 5. DIP PACKAGE DIMENSIONAL DRAWINGS (CONTINUED)

DIP RN: Single radial barbed port



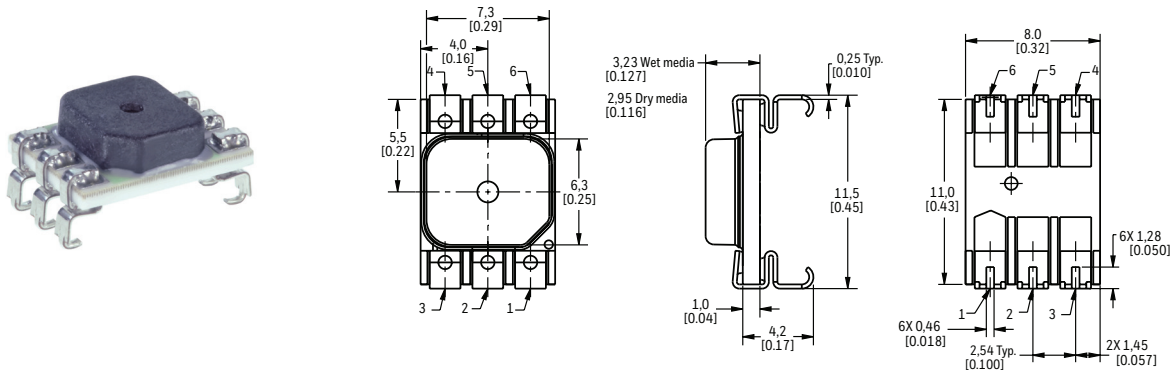
DIP RR: Dual radial barbed ports, same side



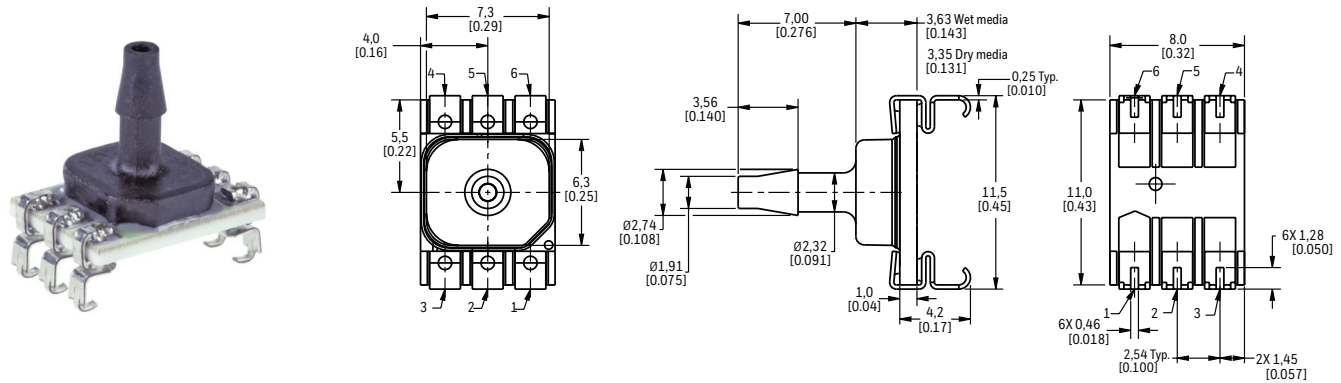
BASIC BOARD MOUNT PRESSURE SENSORS, ABP SERIES FOR MEDICAL VENTILATOR APPLICATIONS

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

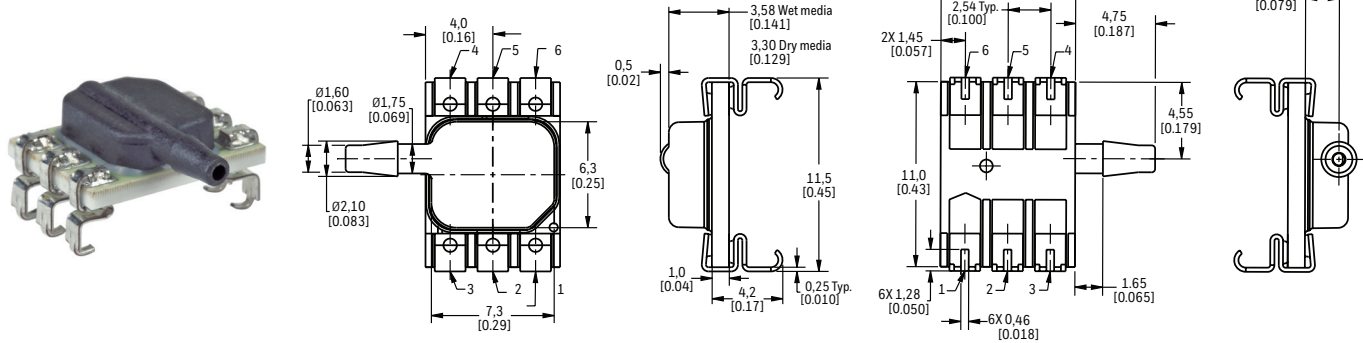
SMT NN: No port



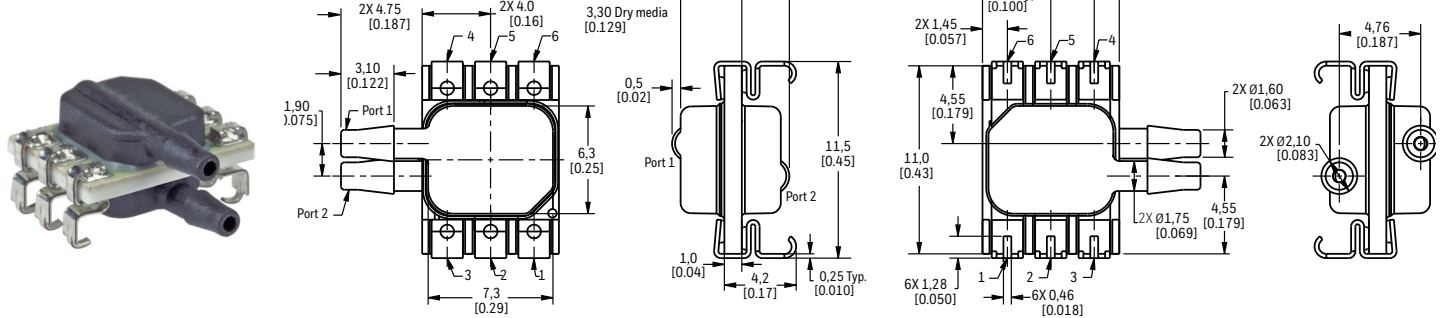
SMT AN: Single axial barbed port



SMT RN: Single radial barbed port



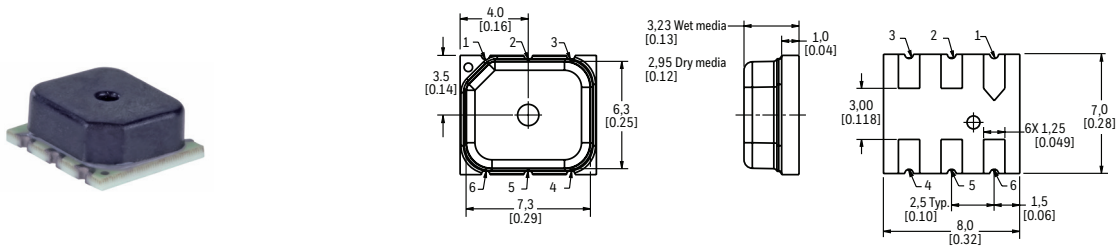
SMT RR: Dual radial barbed ports, both sides



BASIC BOARD MOUNT PRESSURE SENSORS, ABP SERIES FOR MEDICAL VENTILATOR APPLICATIONS

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

Leadless SMT NN: No port



Leadless SMT AN: Single axial barbed port

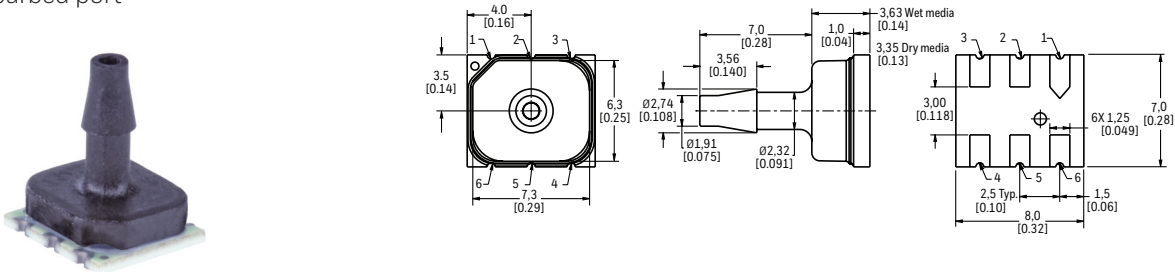
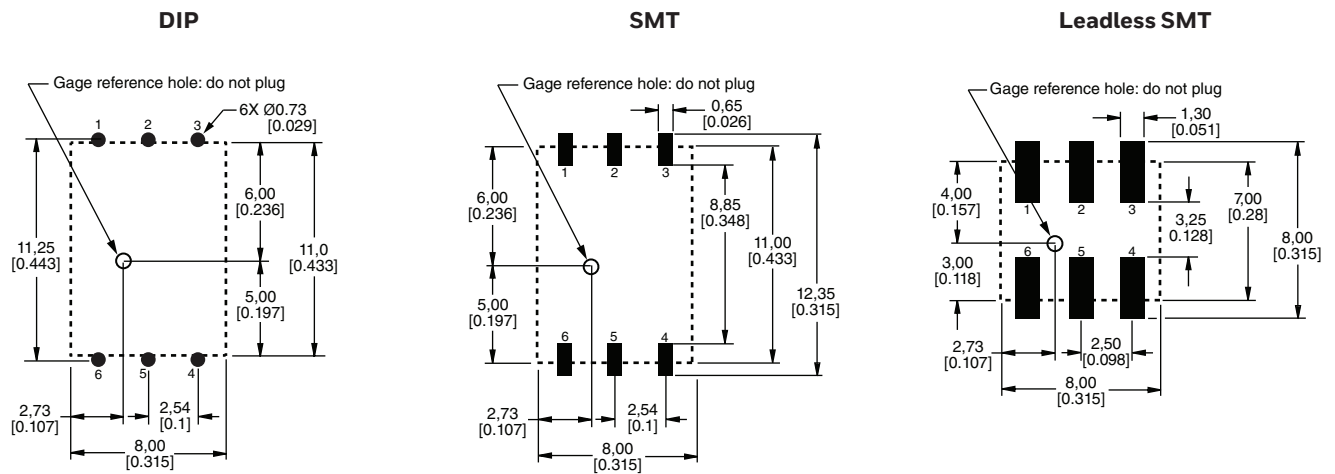


TABLE 8. PINOUTS

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



ADDITIONAL MATERIALS

The following associated literature is available at sensing.honeywell.com:

- Product range guide
- Installation instructions
- Application note

FOR MORE INFORMATION

Honeywell Sensing and Internet of Things services its customers through a worldwide network of sales offices and distributors. For application assistance, current specifications, pricing or the nearest Authorized Distributor, visit sensing.honeywell.com or call:

USA/Canada	+1 302 613 4491
Latin America	+1 305 805 8188
Europe	+44 1344 238258
Japan	+81 (0) 3-6730-7152
Singapore	+65 6355 2828
Greater China	+86 4006396841

Honeywell Sensing and Internet of Things

830 East Arapaho Road
Richardson, TX 75081
sensing.honeywell.com

WARRANTY/REMEDY

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship during the applicable warranty period. Honeywell's standard product warranty applies unless agreed to otherwise by Honeywell in writing; please refer to your order acknowledgment or consult your local sales office for specific warranty details. If warranted goods are returned to Honeywell during the period of coverage, Honeywell will repair or replace, at its option, without charge those items that Honeywell, in its sole discretion, finds defective.

The foregoing is buyer's sole remedy and is in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose. In no event shall Honeywell be liable for consequential, special, or indirect damages.

While Honeywell may provide application assistance personally, through our literature and the Honeywell web site, it is buyer's sole responsibility to determine the suitability of the product in the application.

Specifications may change without notice. The information we supply is believed to be accurate and reliable as of this writing. However, Honeywell assumes no responsibility for its use.

WARNING PERSONAL INJURY

DO NOT USE these products as safety or emergency stop devices or in any other application where failure of the product could result in personal injury.

Failure to comply with these instructions could result in death or serious injury.

WARNING MISUSE OF DOCUMENTATION

- The information presented in this product sheet is for reference only. Do not use this document as a product installation guide.
- Complete installation, operation, and maintenance information is provided in the instructions supplied with each product.

Failure to comply with these instructions could result in death or serious injury.