

APS00B

High Resolution Magnetic Displacement Sensor



DESCRIPTION

Honeywell's APS00B High Resolution Magnetic Displacement Sensor is a miniature surface mount sensor for linear, angular, or rotary displacement designed for magnetic saturating field sensing.

The APS00B creates an analog output voltage that varies with the direction of the magnetic flux passing over the sensor surface. It contains dual, saturated-mode Wheatstone bridges that generate quadrature (sine and cosine) signals to provide an extended range of angular measurements up to 180°.

This sensor is a cost-effective and space-efficient solution for high-volume OEM designs. Potential applications include position sensing, rotary speed and angle detection, and non-contact precision location measurement systems.

FEATURES AND BENEFITS

- Wide, angular range allows measurements of $\pm 90^\circ$ without additional components, making this device suitable for a variety of angular sensing applications. Measurements of $\pm 180^\circ$ are possible with external components.
- Resolution capability of less than 0.05° enhances overall system accuracy.
- Absolute sensing means no indexing is required and the exact target position is known, which can simplify the system design.
- Dual Wheatstone bridges provide a passive, low-noise design, enhancing system performance.
- Small, 8-pin surface-mount package saves room on the PC board when compared to larger IC (Integrated Circuit) packages and components.
- RoHS-compliant materials meet Directive 2002/95/EC.
- Tape and reel configuration allows use with automated pick-and-place equipment, potentially reducing assembly costs (178 mm [7 in] and 330 mm [13 in] reels available).
- Typical 0 MHz to 5 MHz frequency response with 190 G minimum magnetic field applied makes this saturated mode sensor potentially suitable for high speed applications.
- Typically requires only 5 V at 4 mA to operate (20 mW), promoting energy efficiency.
- The sensors measure only field direction and are virtually unaffected by shock, vibration and magnetic-source gap variations, providing a stable, reliable output.
- Dual bridges with outputs 45° out of phase make it possible to use outputs as speed and direction signals.
- Honeywell APS00A instrumentation amplifier is available separately for additional signal processing.

APS00B sensors use Honeywell's Anisotropic Magnetoresistive (AMR) technology that provides advantages over Hall-effect-based magnetic sensors. They are designed to resolve better than a tenth of a degree or a tenth of a millimeter, to withstand large variations in magnet-to-sensor gaps, and to exhibit insensitivity to shocks and vibrations. Honeywell's magnetic sensors are among the most precise and reliable position sensors in the industry.

These surface mount devices are mounted directly on the electrical traces on a PC (Printed Circuit) board. They are attached by an automatic solder reflow operation which requires no hole, so it may help reduce the cost of the PC board.

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POTENTIAL APPLICATIONS

Transportation

- High accuracy angular position sensing
- Rotary speed and angle detection
- Non-contact precision displacement sensing
- Speed and direction sensing

Medical

- High accuracy position sensing
- Rotary speed and angle detection
- Non-contact precision displacement sensing

Industrial

- High accuracy position sensing
- Rotary speed and angle detection
- Non-contact precision displacement sensing
- Valve position
- Robotics control

Table 1. Absolute Maximum Ratings¹

Characteristic	Min.	Max.	Unit
Supply voltage	-12	+12	V
Power dissipation	–	200	mW
Operating temperature	-55 [-67]	150 [302]	°C [°F]
Magnetic flux	no limit		Gauss



Note 1: Absolute maximum ratings are the extreme limits that the device will withstand without damage to the device. However, the electrical and mechanical characteristics are not guaranteed as the maximum limits (above recommended operating conditions) are approached, nor will the device necessarily operate at absolute maximum ratings.

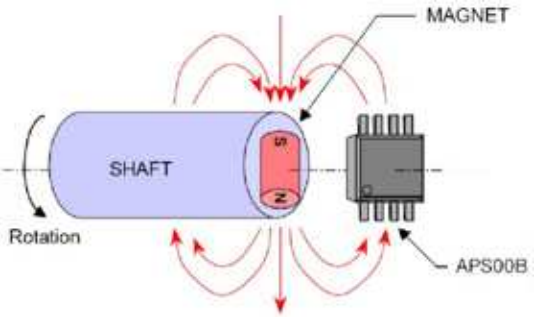
Table 2. Specifications (At Vs = 5.0 V and Ta = 25 °C [77 °F] unless otherwise noted.)¹

Characteristic	Condition	Min.	Typ.	Max.	Unit
Supply voltage	–	1	5	12	V
Operating temperature	–	-40 [-40]	–	150 [302]	°C [°F]
Bridge resistance	bridges are connected in parallel	0.9	1.25	1.6	kOhm
Supply current	–	–	4.0	7.0	mA
Sensitivity	–	–	2.1	2.3	mV/°
Angle range	B > saturation field	-90	–	+90	°
Resolution	–	–	0.05	–	°
Max output amplitude	–	47.5	57.5	67.5	mV
Min output amplitude	–	-47.5	-57.5	-67.5	mV
Output amplitude (peak to peak)	–	95	115	135	mV
Offset voltage	–	-1	–	1	mV/V
Amplitude change from 25 °C	140 °C [284 °F]	-34	–	-43	%
Amplitude change from 25 °C	-40 °C [-40 °F]	24	–	31	%
Offset shift	–	-2	–	2	mV
Synchronism	(Amp A/Amp B) * 100	97	–	103	%
Synchronism shift	–	-1	–	1	%
Saturation level	<10µV/Gauss amplitude change	60	190	–	Gauss
Bandwidth	–	–	0 to 5	–	MHz

Note 1: To test the sensor against the specified magnetic characteristics, the sensor must be placed in a uniform magnetic field.

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Figure 1. Detection of Relative Motion of a Magnet in Angular Displacement



The APS00B sensor is designed to detect the relative motion of a magnet in angular displacement.

With the stationary APS00B, the magnet can move up to $\pm 90^\circ$ and stay within a linear slope of ΔV versus θ .

Given a typical supply voltage of 5 V, each bridge will provide about 120 mV of swing (± 60 mV) on top of 2.5 V bias voltage. With +5 V applied to it, the bridge performs a rail splitter function to create two near +2.5 V sources driven apart by ΔV as created by the magnetic field and the offset error voltage. The bridge differential output voltages (ΔV) for the APS00B are:

$$\Delta V_A = -V_s S \cos(2\theta) \text{ and } \Delta V_B = V_s S \sin(2\theta), \text{ where:}$$

- V_s = Supply Voltage (V)
- S = Material Constant (12 mV/V)
- θ = Reference to Magnetic Field Angle ($^\circ$)

Please refer to the Application Note ["How to Apply Honeywell APS00B AMR Sensors"](#) for additional details.

Figure 2. Electrical Diagram

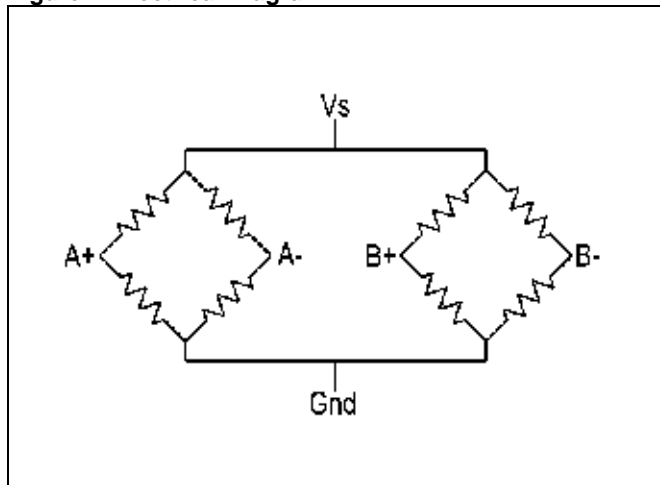


Figure 3. Pinout and Sensing Element Location

The APS00B has two sensor bridges optimized for potential rotary sensing applications. Thus, the die is centered in all three dimensions within the SOIC-8 package.

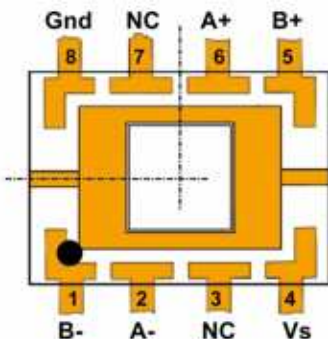
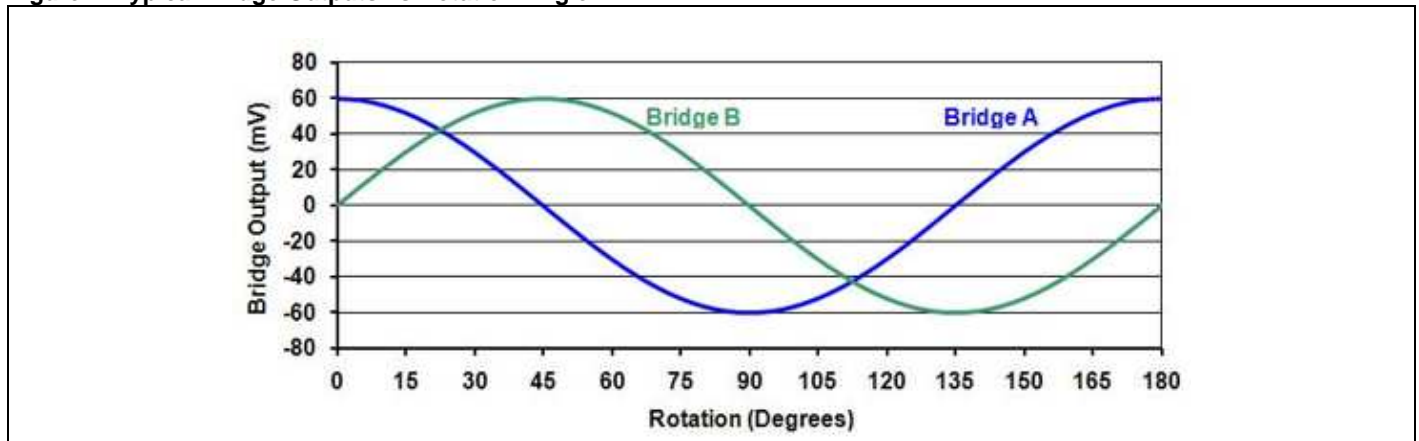


Figure 4. Typical Bridge Outputs vs Rotation Angle



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Figure 5. Common Wiring Diagrams

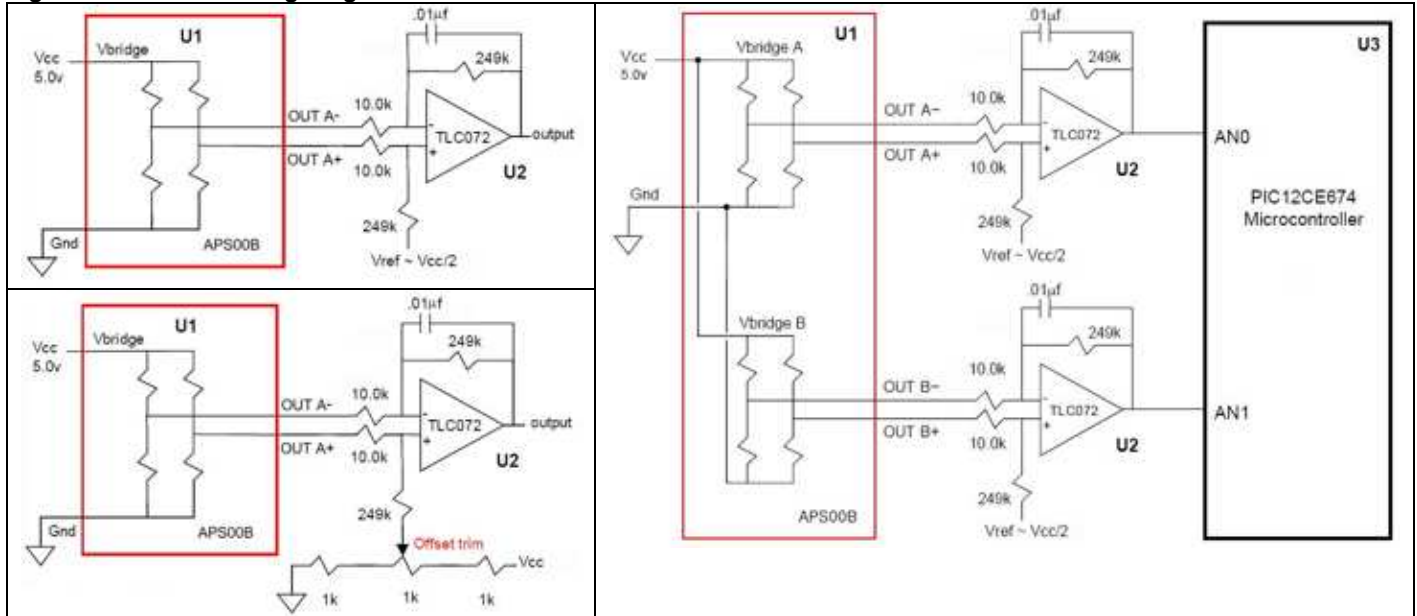
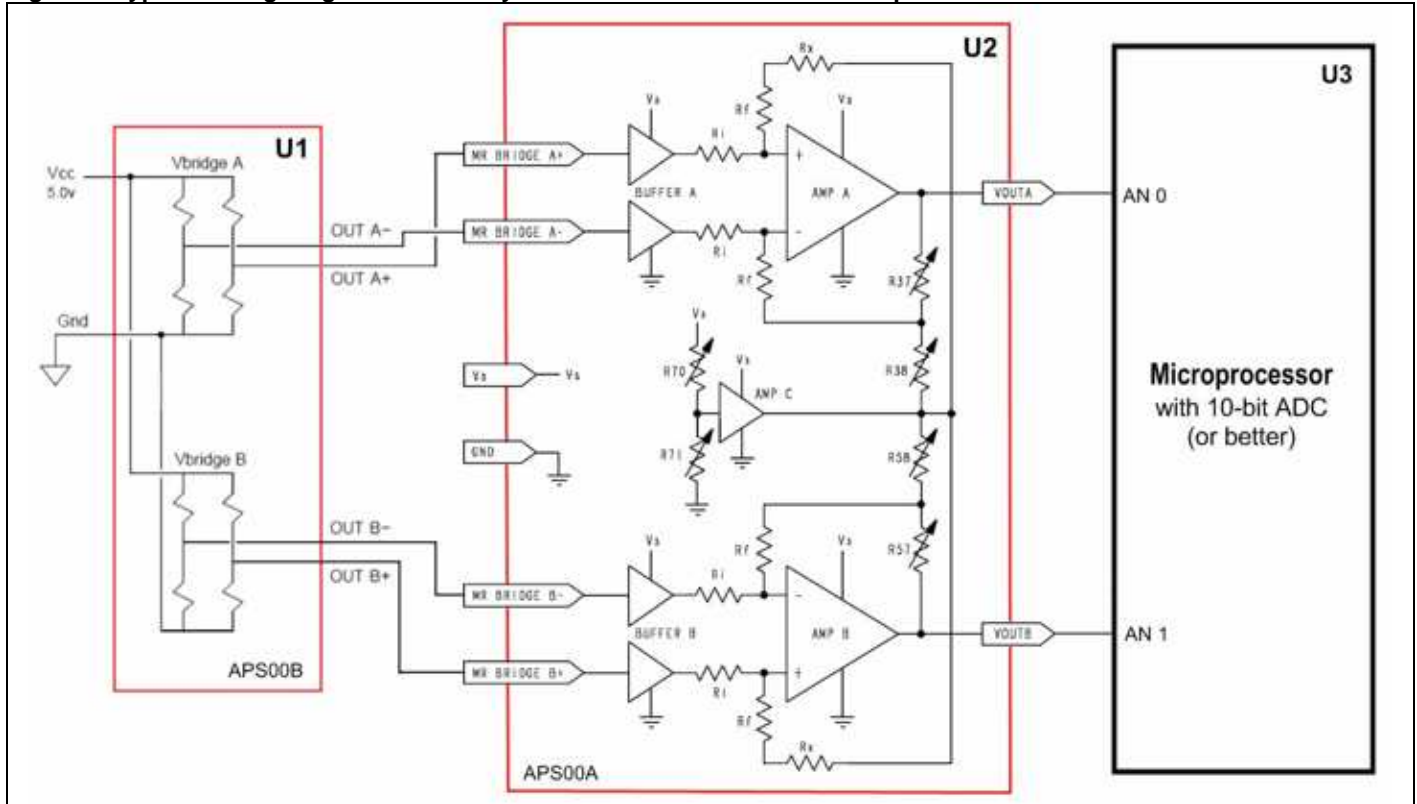
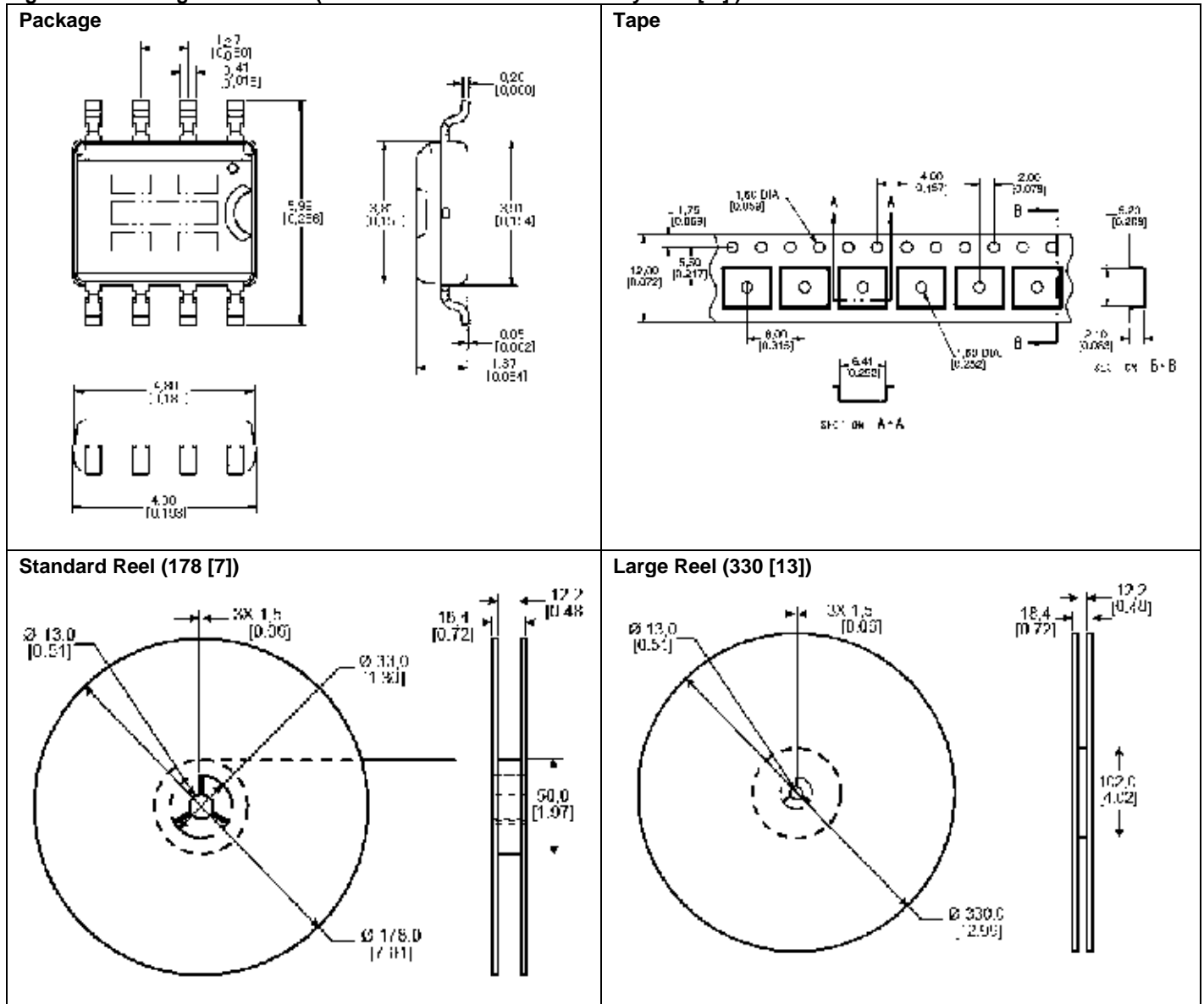


Figure 6. Typical Wiring Diagram with Honeywell APS00A Instrumentation Amplifier



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Figure 7. Mounting Dimensions (All dimensions for reference only: mm/[in.]



Order Guide

Catalog Listing	Description
APS00B	High resolution magnetic displacement sensor, SO-8 surface-mount package, on tape and reel, 1,000 pcs on 178 mm [7 in] reel
APS00B-T13	High resolution magnetic displacement sensor, SO-8 surface-mount package, on tape and reel, 4,000 pcs on 330 mm [13 in] reel
APS00A	Instrumentation amplifier



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.

WARRANTY/REMEDY

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship. Honeywell's standard product warranty applies unless agreed to otherwise by Honeywell in writing; please refer to your order acknowledgement 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 it 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 we provide application assistance personally, through our literature and the Honeywell web site, it is up to the customer 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 printing. However, we assume no responsibility for its use.



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.

SALES AND SERVICE

Honeywell serves its customers through a worldwide network of sales offices, representatives and distributors. For application assistance, current specifications, pricing or name of the nearest Authorized Distributor, contact your local sales office or:

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