

Speed and Direction Sensing in Transmission Applications Using Multipole Ring Magnet Encoder Targets

An Application Note

Background

Heavy duty and automotive vehicle transmission design engineers are looking for larger air gap solutions that are not susceptible to run out and sudden air gap changes. These engineers also need a speed and direction sensing solution that has low jitter (repeatability over many rotations).

Solution

Product: Honeywell's VM721D1 AMR (Anisotropic Magnetoresistive) 2-Pin PWM (Pulse Width Modulated) Speed and Direction Sensor IC and VM721V1 AMR 2-Pin Speed Sensor IC are designed for use with ring magnet encoder targets in transmissions (see Figure 1).

Function in application: The VM721D1 and VM721V1 AMR sensor ICs are designed to operate relative to the angle of the magnetic field. The design has been optimized for multipole ring magnet applications. The sensor ICs are inherently insensitive to variation in magnetic field strength. As these

AMR sensor ICs are omnipolar, the base circuit provides one output per pole and two outputs per pole pair.

The VM721D1 and VM721V1 AMR sensor ICs can be paired with a radially or axially magnetized ring magnet (see Figure 2). Each sensor IC operates with an end-facing magnetic field, and each has two leads designed for welding.

The sensor IC should be packaged into an environmentally-sealed housing with appropriate mounting and termination features for the end application (see Figure 2).

Figure 1. AMR Sensor ICs (shown in probe-style housing) in a Ring Magnet Encoder Transmission Application

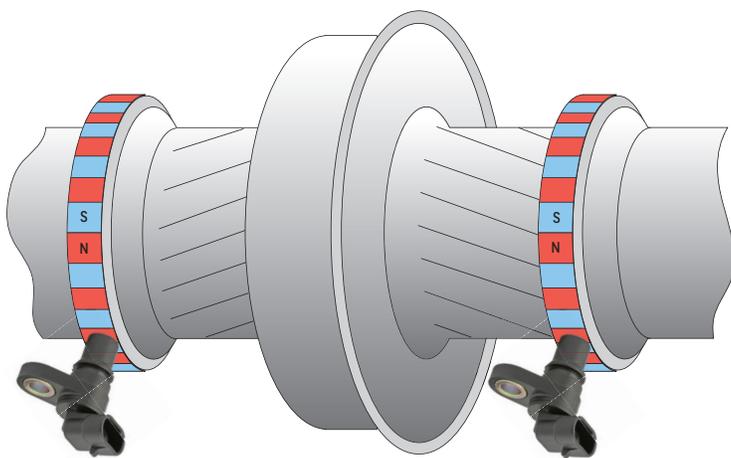


Figure 2. AMR Sensor IC (shown in probe-style housing) Mounting Orientation



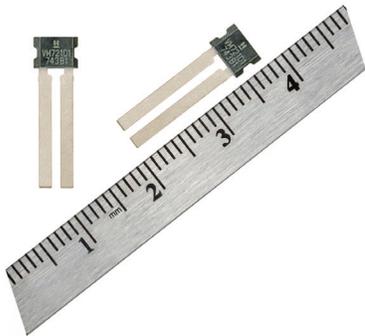
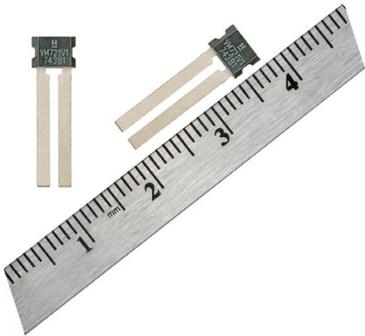
Customer Benefits

- Unique* AMR bridge design operates in saturation, allowing the sensor to work at larger air gaps and it is not affected by run out or sudden air gap changes.
- Dither rejection functionality blocks output pulsing due to vibration when the target is stopped.

*Patent Pending

- Insensitivity to magnet pole size allows one sensor to be paired with different ring magnet applications.
- Integrated EMC capacitor eliminates the need for additional external components in most applications.

Table 1: VM721D1 and VM721V1 AMR Sensor ICs

	VM721D1 AMR 2-PIN PWM SPEED AND DIRECTION SENSOR IC	VM721V1 AMR 2-PIN SPEED SENSOR IC
		
GENERAL DESCRIPTION	Designed to detect the speed and direction of a ring magnet encoder target using a unique bridge design. The frequency of the digital supply current is proportional to the rotational speed of the wheel. The sensor IC works over a wide range of speeds, temperatures and air gaps.	
SPECIFIC DESCRIPTION	The target rotational direction is encoded by modulating the pulse width of the supply current.	—
GENERAL FEATURES	<ul style="list-style-type: none"> • -40°C to 150°C operating temperature range • Zero speed operation • No calibration required • Insensitive to mechanical vibration • Protection against reverse polarity • Integral capacitor for EMC protection • Vibration rejection • ESD protected • ISO-26262 compliant • AECQ100-H qualified and compliant 	
SPECIFIC FEATURES	<ul style="list-style-type: none"> • Integrated speed and direction sensor IC • 2-pin Pulse Width Modulated (PWM) current interface 	<ul style="list-style-type: none"> • Integrated speed sensor IC • 2-pin current interface

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