

## Speed and Direction Sensing in Wheel Speed Applications Using Multipole Ring Magnet/ Encoder Targets

### An Application Note

#### Background

Vehicle design engineers for wheel speed applications are looking for larger air gap solutions that are not susceptible to run out and sudden air gap changes. These engineers also need a sensing solution that is not affected by jitter (repeatability over many rotations) at zero/low speed which typically causes start/stop issues. Vehicle wheel speed applications include Anti-lock Disk Brakes (ABS), self park, electronic stability control, and traction control systems

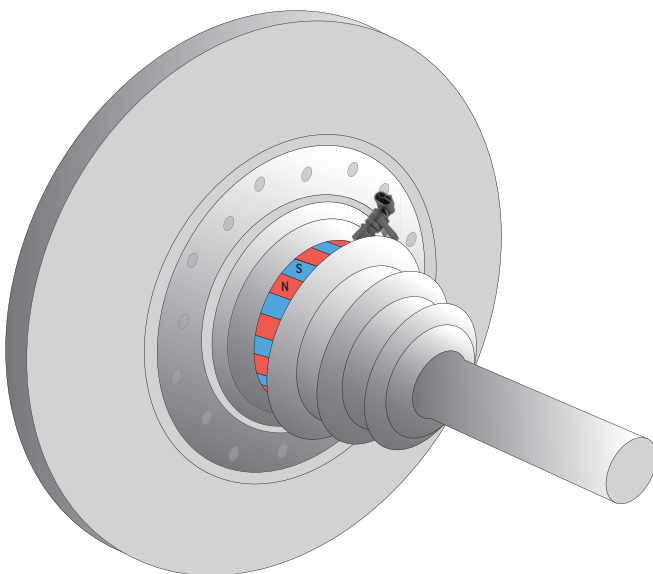
#### Solution

Product: Honeywell's VM721D1 AMR (Anisotropic Magneto-resistive) 2-Pin PWM (Pulse Width Modulated) Speed and Direction Sensor IC and VM721V1 AMR 2-Wire Speed Sensor IC are designed for use with ring magnet encoder targets in wheel speed applications (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.

**Figure 1. AMR Sensor IC (in probe-style housing) in a Ring Magnet Encoder Wheel Speed Application**



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



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

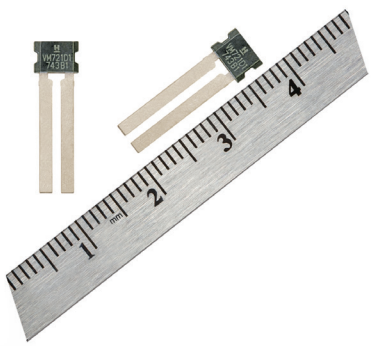
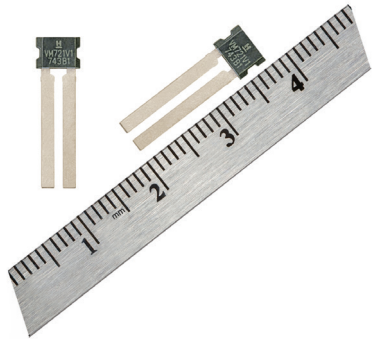
- Insensitivity to magnet pole size allows one sensor to be paired with different ring magnet applications.
- Integrated EMC capacitor eliminates the need for additional external components in most applications.

### 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

**Table 1: VM721D1 and VM721V1**

	VM721D1 AMR 2-PIN PWM SPEED AND DIRECTION SENSOR IC	VM721V1 AMR 2-PIN SPEED SENSOR IC
		
<b>GENERAL DESCRIPTION</b>	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.	
<b>SPECIFIC DESCRIPTION</b>	The target rotational direction is encoded by modulating the pulse width of the supply current.	—
<b>GENERAL FEATURES</b>	<ul style="list-style-type: none"> <li>• -40°C to 150°C operating temperature range</li> <li>• Zero speed operation</li> <li>• No calibration required</li> <li>• Insensitive to mechanical vibration</li> <li>• Protection against reverse polarity</li> <li>• Integral capacitor for EMC protection</li> <li>• Vibration rejection</li> <li>• ESD protected</li> <li>• ISO-26262 compliant</li> <li>• AECQ100-H qualified and compliant</li> </ul>	
<b>SPECIFIC FEATURES</b>	<ul style="list-style-type: none"> <li>• Integrated speed and direction sensor IC</li> <li>• 2-pin Pulse Width Modulated (PWM) current interface</li> </ul>	<ul style="list-style-type: none"> <li>• Integrated speed sensor IC</li> <li>• 2-pin current interface</li> </ul>

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