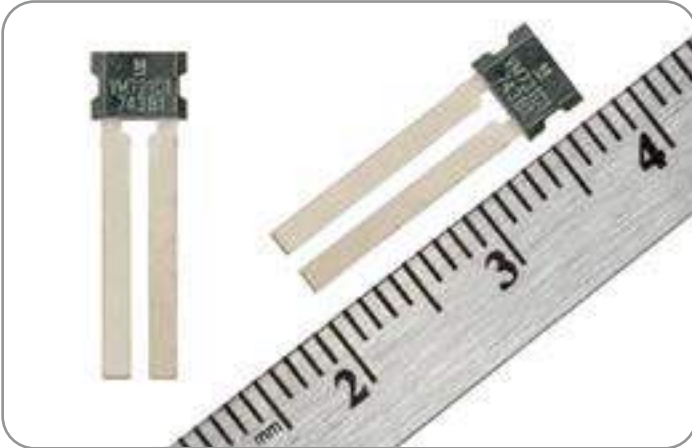


## AMR 2-Pin PWM Speed and Direction Sensor Integrated Circuit

VM721D1

**32336290**  
Issue E

Datasheet



### DESCRIPTION

Honeywell's Anisotropic Magnetoresistive (AMR) 2-Pin Pulse Width Modulated (PWM) Speed and Direction Sensor Integrated Circuit (IC) is 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 target, and the rotational direction is encoded by modulating the pulse width of the supply current. The sensor IC works over a wide range of speeds, temperatures and air gaps.

### VALUE TO CUSTOMERS

The VM721D1 sensor IC has a higher sensitivity AMR bridge array that operates with a larger airgap than Hall-effect sensor ICs, which allows for enhanced design flexibility and assembly tolerances. The sensor IC has been optimized to provide an output that is not affected by target runout or sudden air gap changes. It is insensitive to magnet pole size, allowing one sensor to be paired with different ring magnets. The VM721D1 sensor IC contains an integral capacitor for EMC protection, eliminating the need for an external capacitor in most applications. The wide leads are designed for a welded assembly, making the part easier to mount in customer applications.

*\*Patent Pending*

### FEATURES

- Integrated speed and direction sensor IC
- Pole size independent operation
- 2-pin Pulse Width Modulated (PWM) current interface
- -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
- ESD protected
- ISO-26262 conforming
- AECQ100-H qualified

### DIFFERENTIATION

Honeywell's unique solution utilizes the AMR bridge in saturation, which provides a more stable output response when the system has vibration, sudden air gap changes, or target runout without requiring complex magnitude compensation algorithms. The AMR signal has greater sensitivity than Hall-effect sensor ICs, and does not require automatic gain control or chopper stabilization that can lead to increased jitter over the operating range.

### POTENTIAL TRANSPORTATION APPLICATIONS

- Transmission speed and direction sensing
- Direction for Anti-lock Brake Systems (ABS) and auto parking (For ISO26262 Function Safety applications a Safety Manual is available upon request.)

### PORTFOLIO

The Honeywell VM721D1 2-Pin PWM Speed and Direction Sensor IC joins the following related products:

- VM721V1 AMR 2-Pin Speed Sensor IC
- VM821Q1 AMR 4-Pin Quadrature Sensor IC

# AMR 2-Pin PWM Speed and Direction Sensor IC

## VM721D1

**Table 1. Operating Characteristics (Over entire supply voltage range at  $-40^{\circ}\text{C} \leq T_A \leq 150^{\circ}\text{C}$ , unless otherwise specified)**

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage	$V_S$	$-40^{\circ}\text{C}$ to $110^{\circ}\text{C}$ $150^{\circ}\text{C}$	4.0 4.0	— —	24 9.0	V
Supply current: high	$I_{Sh}$	digital high state	12	14	16	mA
low	$I_{Sl}$	digital low state	5.9	6.95	8.0	
Current ratio	—	—	1.9	—	—	—
Pulse length: forward	$t_{on}$	—	38	45	52	$\mu\text{s}$
reverse	$t_{rev}$	—	76	90	104	
Output switching time: rise time	$t_r$	metering resistor, no bypass capacitor	—	—	8	$\mu\text{s}$
fall time	$t_f$	metering resistor, no bypass capacitor	—	—	8	
Switching frequency: forward	$f_{fwd}$	limited by length of forward pulse	—	—	14	kHz
reverse	$f_{rev}$	limited by length of reverse pulse	—	—	8	

**Table 2. Output Configuration**

Characteristic	Condition	Configuration
Number of pulses per pole	—	1
Forward definition	rotation from pin 2 to pin 1 as shown in Figure 5	ring magnet rotating from pin 2 to pin 1 (CCW)

**Table 3. Application Requirements (At  $4.0\text{ V} \leq V_S \leq 24\text{ V}$ ,  $-40^{\circ}\text{C} \leq T_A \leq 150^{\circ}\text{C}$ )**

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Magnetic flux	B	$D_{max}$ , max. air gap, max. temp.	$\pm 30$	—	—	Gauss
Magnetic flux with valid direction indication, increased jitter	B	$D_{max}$ , max. air gap, max. temp.	$\pm 10$	—	—	Gauss
Metering resistor	R	—	10	100 to 300	—	Ohm

**Table 4. Absolute Maximum Ratings**

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating temperature	$T_a$	—	$-40$ [ $-40$ ]	—	150 [302]	$^{\circ}\text{C}$ [ $^{\circ}\text{F}$ ]
Junction temperature	$T_j$	—	$-40$ [ $-40$ ]	—	165 [329]	$^{\circ}\text{C}$ [ $^{\circ}\text{F}$ ]
Storage temperature	$T_s$	—	$-40$ [ $-40$ ]	—	150 [302]	$^{\circ}\text{C}$ [ $^{\circ}\text{F}$ ]
Thermal resistance	$R_{\theta JA}$	—	—	—	—	$^{\circ}\text{C}/\text{W}$
Supply voltage	$V_S$	—	-26.5	—	26.5	V
Soldering temperature	—	3 s max.	—	—	260 [500]	$^{\circ}\text{C}$ [ $^{\circ}\text{F}$ ]
ESD (HBM)	$V_{ESD}$	JEDEC JS-002-2014	—	—	$\pm 6$	kV

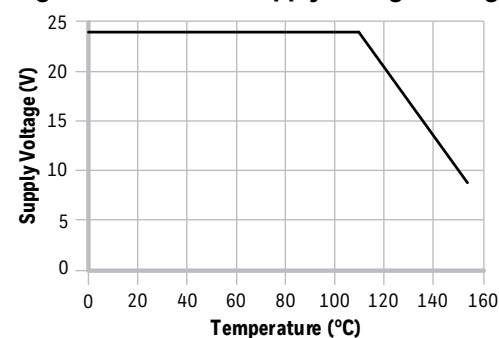
### NOTICE

Absolute maximum ratings are the extreme limits the device will momentarily withstand without damage to the device. Electrical and mechanical characteristics are not guaranteed if the rated voltage and/or currents are exceeded, nor will the device necessarily operate at absolute maximum ratings.

### NOTICE

Large, stray magnetic fields in the vicinity of the sensor may adversely affect sensor performance.

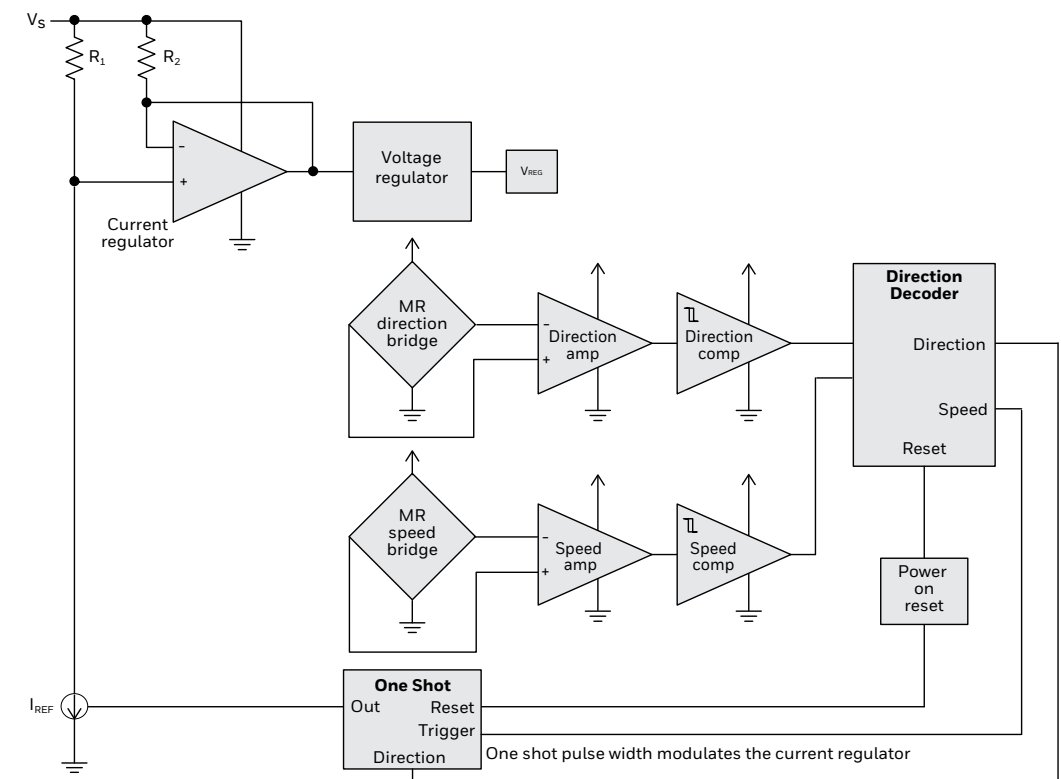
**Figure 1. Maximum Supply Voltage Rating**



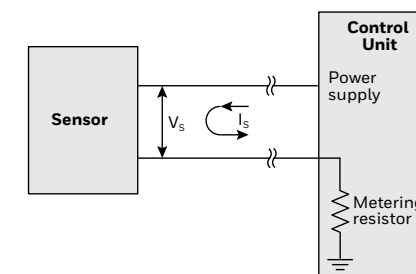
# AMR 2-Pin PWM Speed and Direction Sensor IC

## VM721D1

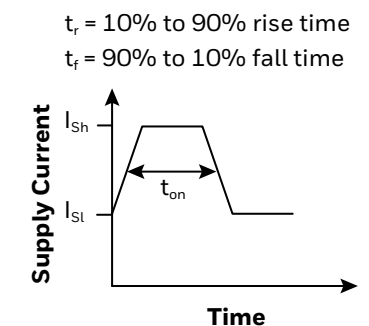
**Figure 2. Block Diagram**



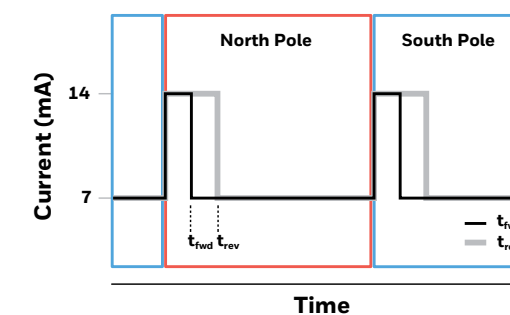
**Figure 3. Basic Application Circuit**



**Figure 4. Rise and Fall Time Definition**



**Figure 5. Transfer Characteristics**



# AMR 2-Pin PWM Speed and Direction Sensor IC VM721D1

Figure 6. Sensor IC Mounting Orientation

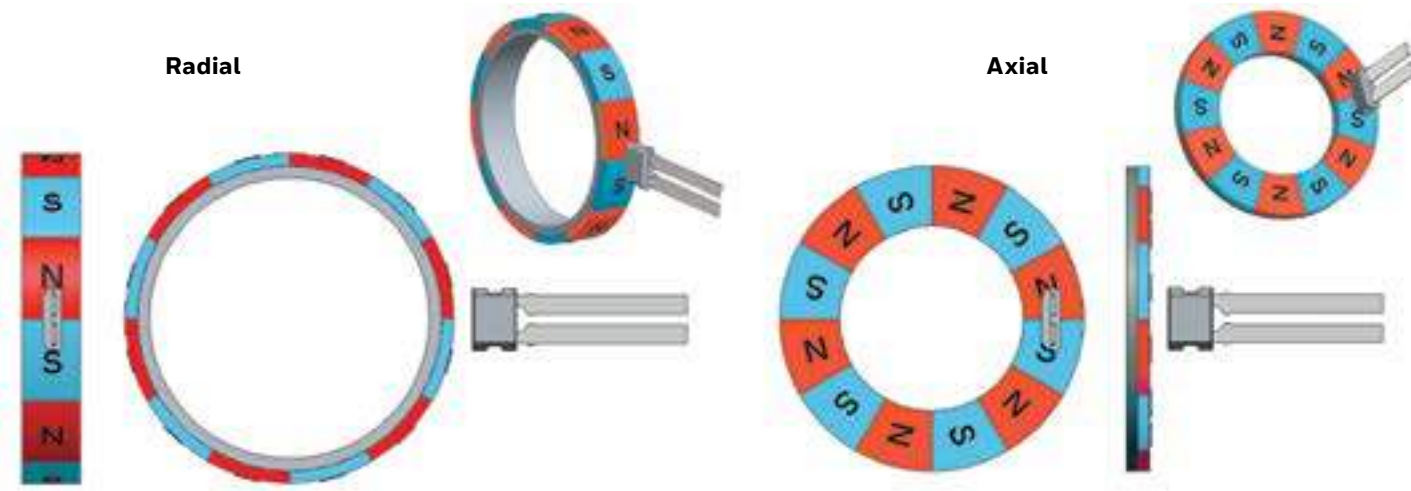


Figure 7. Dimensions and Product Marking (For reference only mm/[in])

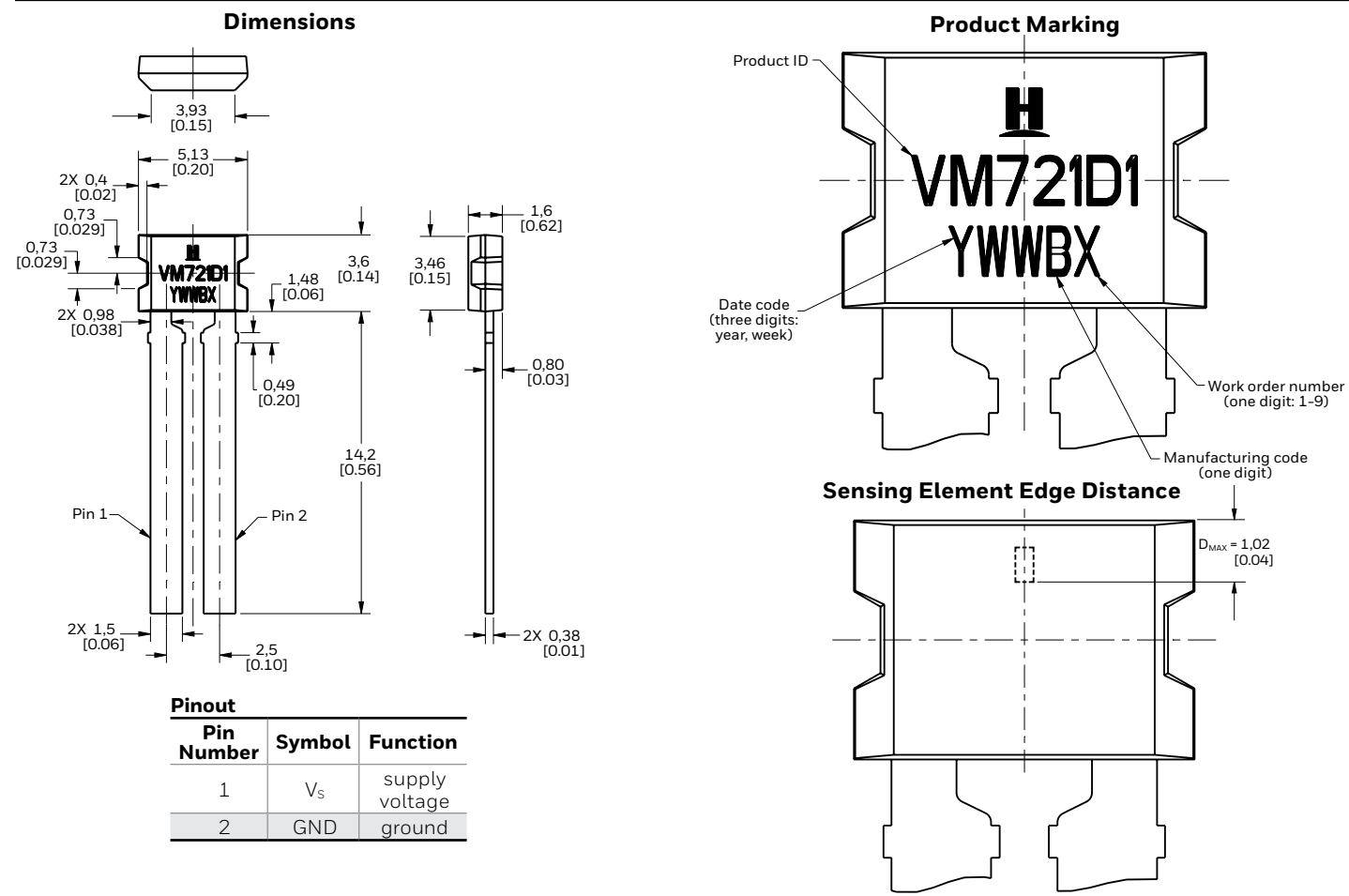


Table 5. Order Guide

Catalog Listing	Description
VM721D1	Anisotropic Magnetoresistive (AMR) 2-Pin Pulse Width Modulated (PWM) Speed and Direction Sensor Integrated Circuit, 2-pin SIP, bulk pack, 500 units/bag

## ADDITIONAL INFORMATION

The following associated literature is available on the Honeywell web site at [sensing.honeywell.com](http://sensing.honeywell.com):

- Installation instructions
- Application notes
- Technical notes
- CAD models
- Evaluation samples available from your local Honeywell contact
- Function Safety Manual is available upon request. Contact [info.sc@honeywell.com](mailto:info.sc@honeywell.com)

## ⚠ WARNING RISK TO LIFE OR PROPERTY

Never use this product for an application involving serious risk to life or property without ensuring that the system as a whole has been designed to address the risks, and that this product is properly rated and installed for the intended use within the overall system.

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

## ⚠ WARNING MISUSE OF DOCUMENTATION

- The information presented in this datasheet 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.**

## 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.**

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## For more information

Honeywell Advanced Sensing Technologies services its customers through a worldwide network of sales offices and distributors. For application assistance, current specifications, pricing or the nearest Authorized Distributor, visit [sps.honeywell.com/ast](http://sps.honeywell.com/ast) or call:

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