

## VF401

### 2-Wire MR Fine-Pitch Ring Magnet Sensor



#### DESCRIPTION

The VF401 is a high performance, digital, 2-wire, MR (magnetoresistive) sensor in a miniature, flat, TO-92-style, plastic package with a current output, designed for sensing fine pitch ring magnets.

The unique VF401 bridge array (patent number 6,297,628) has been optimized to allow a greater air gap between the target and the sensor with reduced loss in sensor signal or accuracy.

#### FEATURES AND BENEFITS

- Robust design operating from -40 °C to 150 °C [-40 °F to 302 °F] can withstand short durations up to 175 °C [347 °F], allowing use in potential applications with extreme temperature requirements.
- Not damaged by reverse polarity voltages when customer-supplied sense resistor is installed, enhancing protection.
- Patented MR bridge optimized for stable sensing of 20- to 50-pole pair ring magnets with improved insensitivity to run-out, tilt and twist.
- 2-wire digital current output simplifies wiring and interfacing which can reduce total system cost
- Enhanced sensitivity,  $\pm 7$  Gauss typical, allows for larger air gaps (up to 2,5 mm [0.098 in]) and higher pole density (up to 50-pole pairs depending on ring diameter).
- One pulse per pole pair output and differential bridge operation allow compatibility with differential Hall sensors which can make it easier to upgrade existing applications.
- Wide speed capability provides application flexibility with true zero speed sensing and operation up to 3000 Hz.
- Output pattern independent of gap between target and sensor.
- RoHS-compliant materials meet Directive 2002/95/EC.

The VF401 has a reduced sensitivity to run-out (shift in sensor position relative to the inside or outside diameter of the ring magnet). It is also less sensitive to tilt tolerance (deviation from parallel positioning of the sensing elements and ring magnet), accepting up to 10°, versus only 2° to 3° for typical ring magnet sensors, as well as being less sensitive to twist (deviation of perfect angular position of the bridge runners relative to the pole transitions).

#### POTENTIAL APPLICATIONS

##### Transportation

- Speed encoding using a multipole ring magnet
- Enhanced accuracy rotational position sensing
- Wheel speed sensing
- Window lift applications
- Speed and direction sensing

##### Industrial

- Shaft speed encoding using a multipole ring magnet
- Enhanced accuracy rotational position sensing
- Precision motor speed measurement
- Speed control in machine tools
- Elevator speed sensing
- Speed control in motorized industrial equipment

##### Medical

- Shaft speed encoding using a multipole ring magnet

# VF401

**Table 1. Absolute Maximum Ratings<sup>1</sup>**

Characteristic	Min.	Typ.	Max.	Unit
Supply voltage <sup>2</sup>	-18	–	+18	V
Magnetic flux gauss	no limit			
Temperature	–	–	175 [347] for 10 min at 10 cycles	°C [°F]
Frequency	–	–	3000	Hz



**Notes:**

1. Absolute maximum ratings are the extreme limits the device will momentarily withstand without damage to the device. Electrical and magnetic characteristics are not guaranteed if the rated voltage and/or currents are exceeded nor will the device necessarily operate at absolute maximum ratings.
2. Customer-supplied sense resistor is required for negative reverse voltage.

**Table 2. Specifications (Established using a 65,00 mm [2.559 in] diameter, 48-pole pair ring magnet.)**

Characteristic	Condition	Min.	Typ.	Max.	Unit
V <sub>cc</sub> <sup>1</sup>	–	–	–	–	V
V <sub>h</sub> (V+ to V-)	–	4.5	–	16	V
I <sub>cc</sub> operate	–	11.8	14	16.80	mA
I <sub>cc</sub> released	–	5.9	7	8.40	mA
I <sub>cc</sub> ratio (op/rel)	–	1.9	2.0	2.3	–
Rise time, 10% to 90%	V <sub>cc</sub> = 12 V, R <sub>L</sub> = 150 Ohm, C <sub>L</sub> = 1000 pF, 25 °C [77 °F]	–	1.5	–	µs
Fall time, 10% to 90%	V <sub>cc</sub> = 12 V, R <sub>L</sub> = 150 Ohm, C <sub>L</sub> = 1000 pF, 25 °C [77 °F]	–	1.5	–	µs
Operating temperature	–	-40 [-40]	–	150 [302]	°C [°F]
Differential magnetic field over entire MR bridge area: operate release	–	–	+7 -7	–	Gauss
Air gap <sup>2</sup>	–	0.75 [0.030]	–	2.5 [0.098]	mm [in]
Duty cycle	–	30	50	70	%

**Notes:**

1. V<sub>cc</sub> is limited by V<sub>h</sub> and the value chosen for the sense resistor.
2. Sensor operation at limits for air gap is dependent on ring magnet.

**Table 3. ESD and EMC Performance**

Test	Specification	Condition	Results
ESD (Electrostatic Discharge)	GMW3100GS	–	Class 3 (low sensitivity)
Electrical Transient Transmission	ISO 7637-3	electrical capacitance and inductive coupling	Class B <sup>1</sup>
Radiated Immunity	ISO 11452-3	0.1 MHz to 12 GHz, 80% AM at 1 kHz	Class A <sup>2</sup> at 100 V/m

**Notes:**

1. Class B: One or more functions may be out of specification during disturbance, but will automatically return to normal after exposure is removed.
2. Class A: All functions remain within specification during and after exposure to disturbance.

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Figure 1. Electrical Specification Test Condition

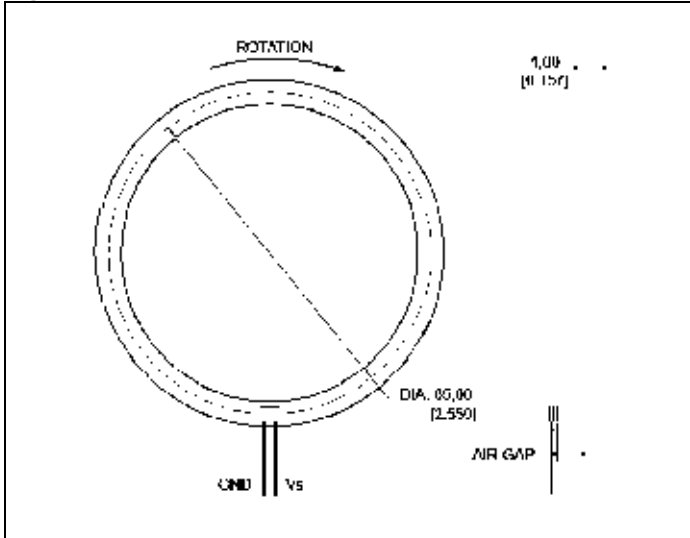


Figure 2. Sensor Output

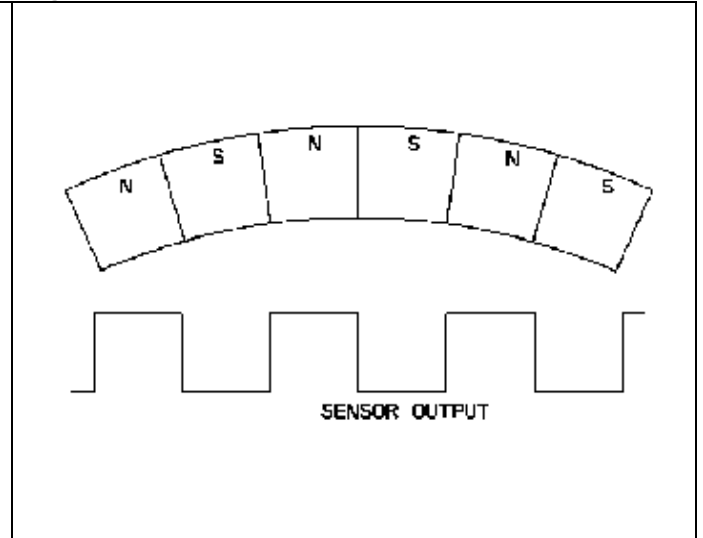


Figure 3. Block Diagram

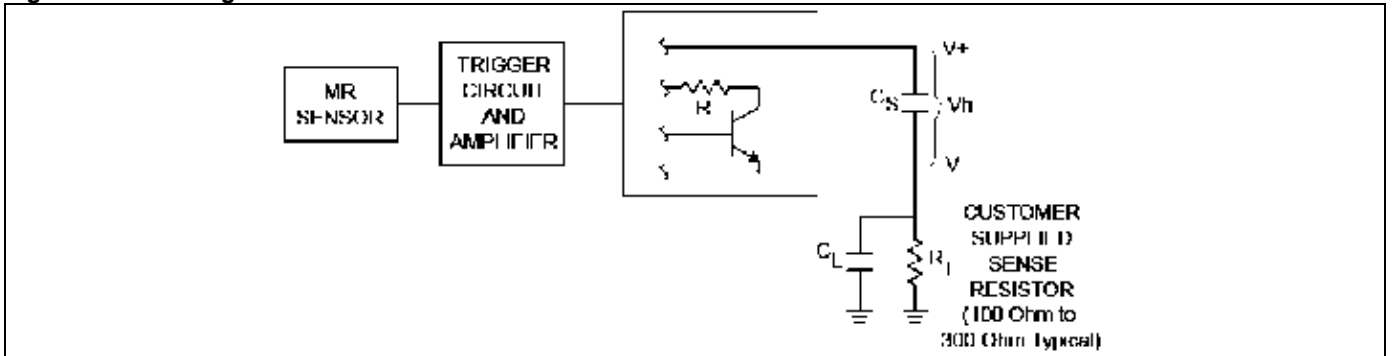
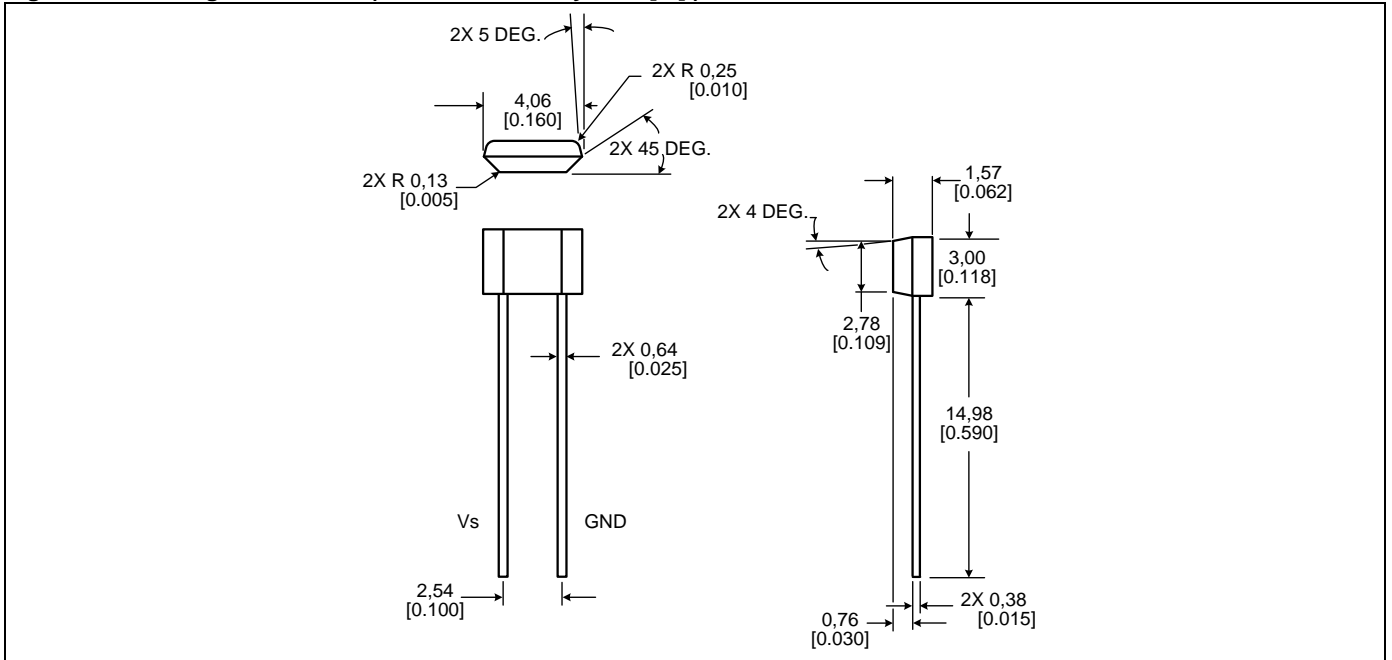


Figure 4. Mounting Dimensions (For reference only. mm/[in.] )



## Order Guide

Catalog Listing	Description
VF401	2-wire MR fine pitch ring magnet sensor, standard bulk pack, 500 units per bag

**Note:** Bulk packaging process may affect lead straightness on some units.

### **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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