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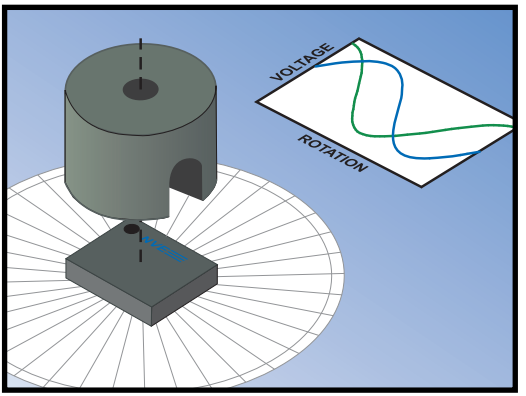
NVE CORPORATION

AG931-07E
AAT003 40 KΩ Angle Sensor Evaluation Kit



SN12447

NVE Corporation (800) 467-7141 sensor-apps@nve.com www.nve.com

Kit Overview

Evaluation Kit Features

- AAT003-10E Angle Sensor
- Part # 12426 Split-Pole Alnico 5 Round Horseshoe Magnet
- Unity-Gain Buffer Amplifier
- 1.5 V to 5.5 V Power Supply
- Magnet Locating Fixture

AAT003-10E Features

- Tunneling Magnetoresistance (TMR) Technology
- Very High Output Signal Without Amplification
- Wide Airgap Tolerance
- 40 KΩ Nominal Bridge Resistance for Low Power
- Sine and Cosine Outputs for Direction Detection
- Ultraminiature TDFN6 Package

AAT-Series Sensor Applications

- Rotary Encoders
- Motor Shaft Position Sensors
- Battery-Powered Angle Sensors (AAT001-10E low-power version)

AAT003-10E Angle Sensor Description

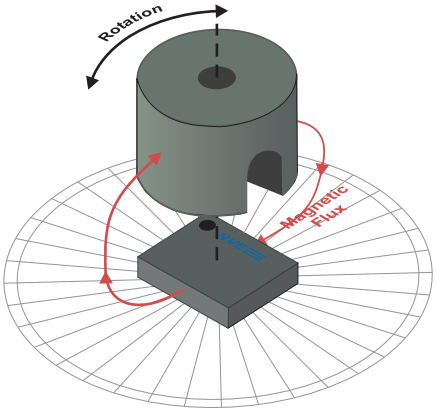
The AAT003-10E angle sensor is a low power, high output magnetic sensor element for position measurements when a rotating magnetic field is applied. Sine and cosine signals are available for a quadrature output.

The sensor element has a resistance of approximately 40 KΩ, allowing a low-noise interface to signal-processing circuitry while still maintaining low power. Outputs are proportional to the supply voltage and peak-to-peak output voltages are much larger than conventional sensor technologies.

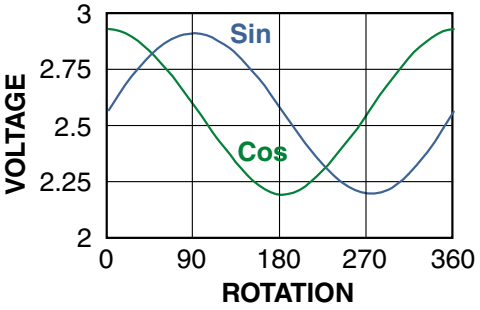
The part is packaged in NVE's 2.5 mm x 2.5 mm x 0.8 mm TDFN6 surface-mount package

Quick Start

⇒ Connect V_{CC1} and V_{CC2} to a 5 V power supply.
⇒ Connect the “SIN” and “COS” screw terminals to an oscilloscope or to meters.
⇒ Place the split-pole magnet in the Plexiglas pocket SLOT DOWN.
⇒ Rotate the magnet.

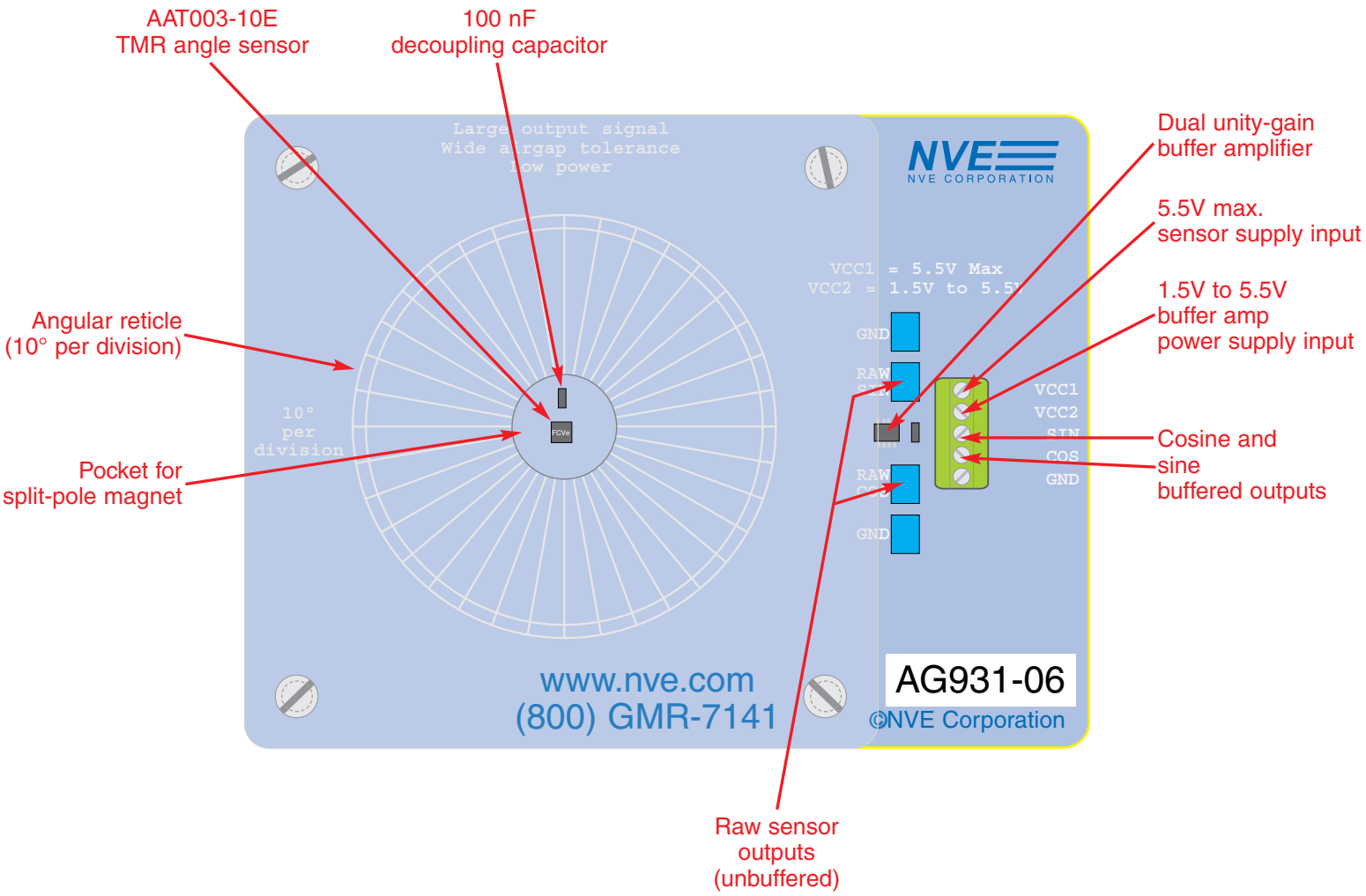


⇒ The outputs should be similar to the following graph:



The output is insensitive to magnet spacing over a wide range. Signal is lost if the magnet is too far away; if the magnet is too close the outputs will be non-sinusoidal. A relatively large magnet-sensor airgap is possible with the magnet provided with the kit, although smaller magnets will require a smaller gap.

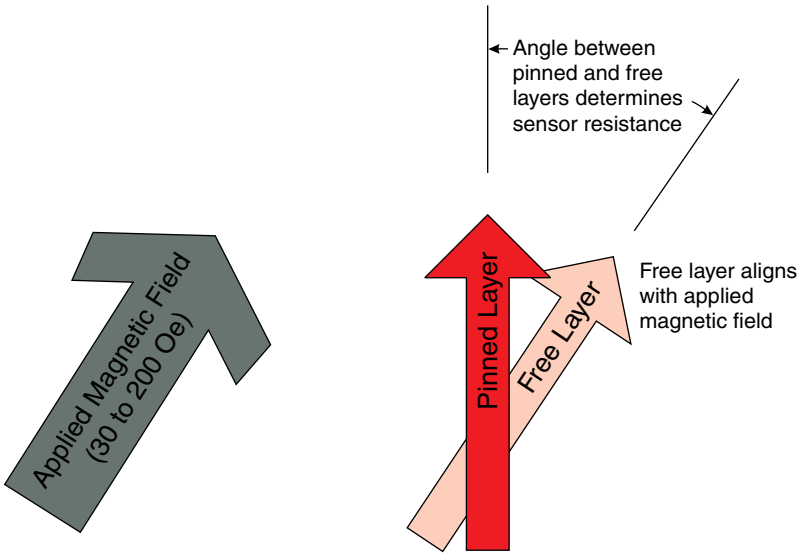
Evaluation Board Layout



Principles of Operation

Each of the four sensor elements contains two magnetic layers: a “pinned,” or fixed direction layer; and a movable-direction, or “free” layer. Internal sensor pairs are 90° out of phase to provide quadrature outputs.

The diagram below illustrates the configuration, using arrows to represent the magnetic orientation of the layers:



The sensor element free layers will align with the external field. As the applied field changes direction, the angle between the free layer and the pinned layer changes, changing the resistance of spintronic Tunneling Magnetoresistance (TMR) elements, which changes the device output voltages.

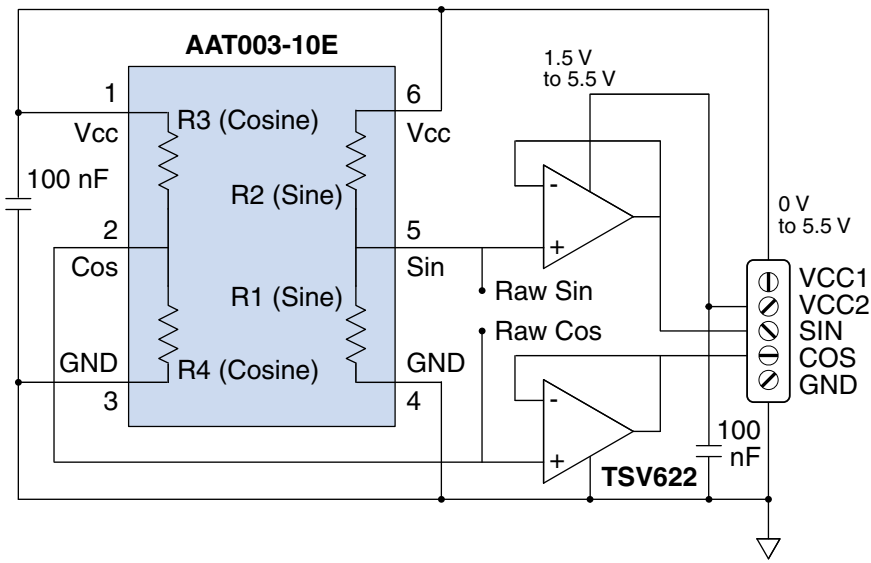
In the typical configuration, an external magnet provides a saturating magnetic field (30 to 200 Oe) in the plane of the sensor, as demonstrated in this kit.

Depending on the application, a bar magnet can also be used instead of a split-pole magnet.

PCB Assembly

Raw output signals from the AAT003 are available as test points on the board. The PCB assembly also includes a unity-gain buffer that provides low-impedance outputs and buffers the sensor bridge from loading by downstream electronics.

Ouput buffering may not be necessary in the end application depending on the impedance of the connections to the outputs of the board.



AG931-07E Evaluation Kit schematic.

Separate power supply connections for the sensor and op amp (V_{CC1} and V_{CC2}) allow monitoring the current requirements of the sensor only. The minimum op amp supply voltage is 1.5 V, while the AAT003 sensor has no minimum. Sensitivity increases proportionately to the sensor supply voltage, as does current consumption.

V_{CC1} and V_{CC2} can be connected together if desired.

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