AA/AB-Series Analog Magnetic Sensors

Equivalent Circuit

V+ (Supply) → OUT+ → OUT- → V- (GND)

Features
- Magnetometer and gradiometer configurations
- Field ranges from <<1 Oe to >4000 Oe
- Ultrasensitive, high-field, and low-hysteresis versions
- Wheatstone bridge analog outputs
- Operation to near-zero voltage
- Up to 1 MHz
- Up to 150°C operating temperature
- ULLGA4, TDFN6, MSOP8, and SOIC8 packages

Applications
- Motion, speed, and position control
- Low-field sensing
- Motor commutator sensors
- Noncontact current sensing

Description
NVE’s analog GMR sensors have high sensitivity, excellent temperature stability, and small size. Their versatility and wide sensing range makes them an excellent choice for a variety of analog sensing applications including industrial and automotive position, speed, and current sensors.

The sensors are configured as inherently temperature-compensating Wheatstone bridges.

AA-Series sensors are magnetometers, which detect absolute magnetic field. AB-Series sensors are differential gradiometers, which detect field gradients.

Three magnetometer subtypes are available: the standard AA-Series; the ultrasensitive “H” subtype; the high-field, kiloersted range “K” subtype, and the low-hysteresis “L” subtype.

Packages are as small as an ultraminiature 1.1 x 1.1 mm ULLGA4.
## Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>$V_{cc}$</td>
<td>24</td>
<td></td>
<td>Volts</td>
</tr>
<tr>
<td>Manual</td>
<td>$V_{cc}$</td>
<td>12</td>
<td></td>
<td>Volts</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>$T_{op}$</td>
<td>-50</td>
<td>125</td>
<td>°C</td>
</tr>
<tr>
<td>Manual</td>
<td>$T_{op}$</td>
<td>150</td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>$T_{st}$</td>
<td>-65</td>
<td>135</td>
<td>°C</td>
</tr>
<tr>
<td>Manual</td>
<td>$T_{st}$</td>
<td>150</td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td>ESD (Human Body Model)</td>
<td></td>
<td></td>
<td>400</td>
<td>Volts</td>
</tr>
<tr>
<td>Applied magnetic field</td>
<td>$H$</td>
<td>Unlimited</td>
<td></td>
<td>Oe</td>
</tr>
</tbody>
</table>
## Operating Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Test Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>V&lt;sub&gt;CC&lt;/sub&gt;</td>
<td>&lt;1</td>
<td>12</td>
<td></td>
<td>Volts</td>
<td>Maximum limited by power dissipation</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>T&lt;sub&gt;MIN&lt;/sub&gt;; T&lt;sub&gt;MAX&lt;/sub&gt;</td>
<td>−40</td>
<td>−50</td>
<td>85</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Electrical offset</td>
<td>V&lt;sub&gt;O&lt;/sub&gt;</td>
<td>−4</td>
<td>+4</td>
<td>+5</td>
<td>mV/V</td>
<td></td>
</tr>
<tr>
<td>Output at maximum field</td>
<td>V&lt;sub&gt;OUT-MAX&lt;/sub&gt;</td>
<td>60</td>
<td>40</td>
<td>45</td>
<td>mV/V</td>
<td></td>
</tr>
<tr>
<td>Non-linearity</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td>%</td>
<td>Unipolar field sweep</td>
</tr>
<tr>
<td>Hysteresis</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Resistance tolerance</td>
<td></td>
<td>−20</td>
<td>+20</td>
<td></td>
<td>%</td>
<td>25°C</td>
</tr>
<tr>
<td>Resistance vs. temperature</td>
<td>TC&lt;sub&gt;R&lt;/sub&gt;</td>
<td>+0.14</td>
<td></td>
<td></td>
<td>%/°C</td>
<td>No applied field</td>
</tr>
<tr>
<td>Output temperature coefficient</td>
<td>TC&lt;sub&gt;O.1&lt;/sub&gt;</td>
<td>+0.03</td>
<td></td>
<td>+0.1</td>
<td>%/°C</td>
<td>Constant-current supply</td>
</tr>
<tr>
<td></td>
<td>TC&lt;sub&gt;O.V&lt;/sub&gt;</td>
<td></td>
<td>−0.1</td>
<td></td>
<td>%/°C</td>
<td>Constant-voltage supply</td>
</tr>
<tr>
<td></td>
<td>TC&lt;sub&gt;HSAT&lt;/sub&gt;</td>
<td></td>
<td>−0.19</td>
<td></td>
<td>%/°C</td>
<td></td>
</tr>
<tr>
<td>Operating frequency</td>
<td>f&lt;sub&gt;MAX&lt;/sub&gt;</td>
<td>50</td>
<td></td>
<td></td>
<td>kHz</td>
<td></td>
</tr>
<tr>
<td>Junction–Ambient thermal resistance</td>
<td>ULLGA4 (-14 suffix)</td>
<td>500</td>
<td></td>
<td></td>
<td>°C/W</td>
<td>Soldered to double-sided board; free air</td>
</tr>
<tr>
<td></td>
<td>TDFN6 (-10 suffix)</td>
<td>320</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MSOP8 (-00 suffix)</td>
<td>240</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Dissipation</td>
<td>P&lt;sub&gt;D&lt;/sub&gt;</td>
<td>100</td>
<td></td>
<td></td>
<td>mW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Operation

Sensor Subtypes
There are four AA/AB-Series subtypes, as summarized in the table below. “H” subtypes are designed for very high sensitivity, and “K” types have low sensitivity and high saturation for high-field sensing. “L” types offer low hysteresis. AAH-Series parts also have a 150°C maximum temperature specification.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>AAxxx/ABxxx</th>
<th>AAHxxx/ABHxxx</th>
<th>AAKxxx</th>
<th>AALxxx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Sensitivity</td>
<td>High</td>
<td>Very High</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Operating Field Range</td>
<td>High</td>
<td>Low</td>
<td>Very High</td>
<td>Medium</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>Medium</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Max. Temperature</td>
<td>High</td>
<td>Very High</td>
<td>Commercial</td>
<td>High</td>
</tr>
</tbody>
</table>

Magnetometer Operation
AA-Series sensors are magnetometers, which detect the absolute magnetic field.

Direction of Sensitivity
Unlike Hall effect or other sensors, the direction of sensitivity of GMR sensors is in the plane of the package, which more convenient for many applications. Two permanent magnet orientations that will activate the sensor are shown in Figure 1:

![Figure 1. Planar magnetic sensitivity.](image)

Omnipolar
AA-Series sensors are “omnipolar,” meaning the output is equally sensitive to either magnetic field polarity and the output is always a positive voltage:

![Figure 2. The omnipolar response of AA-Series sensors.](image)

Standard and Cross-Axis Axis Directional Sensitivity
The standard axis of sensitivity is along the part axis, but there are some parts available with cross-axis sensitivity, and AAKxxx sensors are not directionally sensitive in the IC plane, and are therefore sensitive in both standard and cross-axis axis directions.
Gradiometer Operation

AB-Series sensors are differential gradiometers that reject common mode magnetic fields, making them ideal for high magnetic noise environments such as near electric motors or current-carrying wires. The devices are sensitive to a field gradient along the part axis.

The figure below shows a typical gradiometer response:
Typical Performance Graphs

Figures 5–7 show the response of three types of high-sensitivity models. The standard version, the AA002, has excellent temperature stability, especially with constant-current drive. The AAH002 has very high sensitivity but more temperature dependence, and the AAL002 offers low hysteresis at the expense of more temperature dependence:

**Figure 5a.** Typical AA002 output with 1 mA constant-current drive.

**Figure 5b.** Typical AA002 output with a 5V supply.

**Figure 6a.** Typical AAH002 output with 2.28 mA constant-current drive.

**Figure 6b.** Typical AAH002 output with a 5V supply.

**Figure 7a.** Typical AAL002 output with 1 mA constant-current drive.

**Figure 7b.** Typical AAL002 output with a 5V supply.
Figure 8 shows the typical output of an AAK001 high-field sensor. The sensor responds from zero field to 4 kOe, and is highly linear from 400 Oe to 2.5 kOe. The saturation field is dependent on temperature, but sensitivity is quite stable with temperature.

![Figure 8. AAK001 high-field sensor output.](image-url)
Illustrative Applications

**Traditional Differential Amplifier**

Traditional differential amplifiers use low-cost op-amps to provide a single-ended analog output. The circuit below has a gain of 20, which provides a full-scale output at slightly less than the sensor’s saturation. A low-cost, low bias current op amp allows large resistors to avoid loading the sensor bridge. The 250 Ω input resistors are 100 times the 2.5 Ω sensor output impedance to avoid loading.

![Figure 9. Traditional op-amp differential amplifier.](image)

**Sensor Instrumentation Amplifier**

Instrumentation amplifiers such as the INA826 are popular bridge sensor preamplifiers because they have a low component count and have excellent common-mode rejection ratios without needing to match resistors. These amplifiers can run on single or dual supplies. AC coupling can be used for small, dynamic signals.

The circuit below has a gain of 20. The general equation for the output voltage is:

\[ V_{OUT} = (1 + \frac{49.4K}{R_G})V_{IN} + V_{REF} ; \; V_{IN} = V_{OUT+} - V_{OUT-} \]

![Figure 10. Single-ended analog sensor instrumentation amplifier.](image)

Note that the instrumentation amplifier has a minimum output of 0.1V, so to detect very low fields on a single supply, an offset can be provided by using a non-zero \( V_{REF} \).
Constant-Current Sensor Drive
Using a constant current rather than conventional constant voltage sensor supply can significantly improve temperature stability of AAxxx/ABxxx sensors. AA00x sensors, for example, have an output temperature coefficient (TCO-I) of 0.03%/°C with constant current, versus −0.1%/°C with constant voltage (TCO-V).

A simple constant-current supply is illustrated below:

![Constant-current supply diagram]

The supply current for the circuit above is \( V_{cc}/2R_{cc} \). \( R_{cc} \) can be set to the maximum sensor bridge resistance (e.g., 6 KΩ for many sensors) to provide the highest possible output without saturating the op-amp. The sensor will be driven with 1 mA for a 12 V supply in the circuit above. Similar op-amp or instrumentation amplifiers can be used for constant-current or constant-voltage supplies.

Variable Threshold Magnetic Switch
NVE offers AD-Series factory-set GMR Switches, but AA-Series analog sensors can be used for special thresholds or hysteresis, or for variable thresholds. In this circuit, the threshold is varied by changing \( R_G \), which sets the gain of the differential amplifier. The 1 MΩ resistor sets the threshold hysteresis:

![Variable threshold magnetic switch diagram]
**LED Field-Strength Indicator**

The op-amp circuit in Figure 13 below can be used to change the brightness of an LED to indicate magnetic field strength at a glance:

![LED Field-Strength Indicator](image)

The LED current is proportional to the sensor output:

\[ I_{\text{LED}} = \frac{(V_{\text{OUT}+} - V_{\text{OUT}-})}{R_{\text{LED}}} \]

The maximum LED current can be set to the maximum sensor output. For example, for an AAK001, typical \( V_{\text{OUT-MAX}} \) is 25 mV/V, so for a three-volt supply the maximum is approximately 75 mV. For a high-efficiency with a forward current of 2 mA, \( R_{\text{LED}} = 75 \text{ mV} / 2 \text{ mA} = 38 \Omega \).

The 50 KΩ potentiometer is optional, to correct for sensor offset or to set the minimum field to turn on the LED.

The 16-volt maximum supply voltage noted in Figure 13 is limited by the op-amp selected, but note that some sensors have a 12-volt maximum supply rating. The three-volt minimum supply is to provide enough voltage to turn on the LED; the sensors can operate on lower voltages.

**Noncontact Current Sensing**

AA-Series sensors are often used to measure the current over a circuit board trace. The sensor measures the current by detecting the magnetic field generated by the current through the trace this application, and other AA-Series sensors can be used depending on required sensitivity and hysteresis.

The AAL024 is ideal for this application because its cross-axis sensitivity provides sensitivity to a current trace directly under the part, and its low hysteresis provides repeatability. The AA003-02 is popular for overcurrent protection where hysteresis is needed and extreme accuracy is not required.

Typical current sensing configurations are shown below:

- **Figure 14a. 0.09” (2.3 mm) trace**
  (0 – 10 A with AA003 sensor)

- **Figure 14b. 0.05” (1.3 mm) trace**
  (0 – 5 A with AAL024 sensor)

- **Figure 14c. Five turns of 0.0055” (0.14 mm) trace**
  (0 – 1 A with AAL024 sensor)
For the geometry shown in Figure 15 and narrow traces with, the magnetic field generate can be approximated by Ampere’s law:

\[
H = \frac{2I}{d} \quad \text{[“H” in oersteds, “I” in amps, and “d” in millimeters]}
\]

The trace can also be run on the top side of the PCB for more current sensitivity.

More precise calculations can be made by breaking the trace into a finite element array of thin traces, and calculating the field from each array element. We have a free, Web-based application with a finite-element model to estimate magnetic fields and sensor outputs in this application:

Part Numbering

**AA** H 002-02E

**Base Part**
- **AA** = Analog Magnetometer Sensors
- **AB** = Analog Gradiometers

**Subtype**
- **Blank** = Standard
- **H** = High sensitivity
- **K** = High field
- **L** = Low hysteresis

**Sensitivity Direction**
- **00** = Standard
- **02** = Cross-Axis

**Sensitivity Code**
- **00** = MSOP8
- **02** = SOIC8
- **10** = TDFN6
- **14** = ULLGA4
- **E** = RoHS

**Direction of Sensitivity**

AA-Series (magnetometers)

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Standard (AAX00x-xx)</th>
<th>Cross-Axis (AAX02x-xx)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSOP8/SOIC8</td>
<td>TDFN6</td>
<td>ULLGA4</td>
</tr>
</tbody>
</table>

Pinouts

**AA-Series Pinout**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>V&lt;sub&gt;OUT&lt;/sub&gt;-</td>
<td>Negative bridge output (decreases with increasing field).</td>
</tr>
<tr>
<td>2</td>
<td>V&lt;sub&gt;OUT&lt;/sub&gt;-</td>
<td>No internal connection.</td>
</tr>
<tr>
<td>3</td>
<td>V&lt;sub&gt;OUT&lt;/sub&gt;-</td>
<td>Negative supply or ground.</td>
</tr>
<tr>
<td>4</td>
<td>V&lt;sub&gt;OUT&lt;/sub&gt;-</td>
<td>Positive bridge output (increases with field).</td>
</tr>
<tr>
<td>5</td>
<td>V&lt;sub&gt;OUT&lt;/sub&gt;-</td>
<td>No internal connection.</td>
</tr>
<tr>
<td>6</td>
<td>V&lt;sub&gt;OUT&lt;/sub&gt;-</td>
<td>Positive supply voltage.</td>
</tr>
</tbody>
</table>

**AB-Series Pinout**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>V&lt;sub&gt;OUT&lt;/sub&gt;-</td>
<td>Negative bridge output (decreases with gradient).</td>
</tr>
<tr>
<td>2</td>
<td>NC</td>
<td>No internal connection.</td>
</tr>
<tr>
<td>3</td>
<td>V&lt;sub&gt;OUT&lt;/sub&gt;-</td>
<td>Negative supply or ground.</td>
</tr>
<tr>
<td>4</td>
<td>V&lt;sub&gt;OUT&lt;/sub&gt;-</td>
<td>Positive bridge output (increases with gradient).</td>
</tr>
<tr>
<td>5</td>
<td>NC</td>
<td>No internal connection.</td>
</tr>
<tr>
<td>6</td>
<td>V&lt;sub&gt;OUT&lt;/sub&gt;-</td>
<td>Positive supply.</td>
</tr>
</tbody>
</table>
## AA-Series Sensor Selector Chart

### Available Parts

#### Magnetometers (AA-Series)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AA002-02</td>
<td>1.5</td>
<td>10.5</td>
<td>15</td>
<td>3</td>
<td>4.2</td>
<td>2%</td>
<td>4%</td>
<td>125°C</td>
<td>5 kΩ</td>
</tr>
<tr>
<td>AA003-02</td>
<td>2</td>
<td>14</td>
<td>20</td>
<td>2</td>
<td>3.2</td>
<td>2%</td>
<td>4%</td>
<td>125°C</td>
<td>5 kΩ</td>
</tr>
<tr>
<td>AA004-00</td>
<td>5</td>
<td>35</td>
<td>50</td>
<td>0.9</td>
<td>1.3</td>
<td>2%</td>
<td>4%</td>
<td>125°C</td>
<td>5 kΩ</td>
</tr>
<tr>
<td>AA005-00</td>
<td>5</td>
<td>35</td>
<td>50</td>
<td>0.9</td>
<td>1.3</td>
<td>2%</td>
<td>4%</td>
<td>125°C</td>
<td>5 kΩ</td>
</tr>
<tr>
<td>AA006-00</td>
<td>5</td>
<td>35</td>
<td>50</td>
<td>0.9</td>
<td>1.3</td>
<td>2%</td>
<td>4%</td>
<td>125°C</td>
<td>30 kΩ</td>
</tr>
<tr>
<td>AA007-00</td>
<td>50</td>
<td>450</td>
<td>500</td>
<td>0.08</td>
<td>0.12</td>
<td>2%</td>
<td>4%</td>
<td>125°C</td>
<td>5 kΩ</td>
</tr>
<tr>
<td>AAH002-02</td>
<td>0.6</td>
<td>3</td>
<td>6</td>
<td>11</td>
<td>18</td>
<td>4%</td>
<td>15%</td>
<td>150°C</td>
<td>2 kΩ</td>
</tr>
<tr>
<td>AAH004-00</td>
<td>1.5</td>
<td>7.5</td>
<td>15</td>
<td>3.2</td>
<td>4.8</td>
<td>4%</td>
<td>15%</td>
<td>150°C</td>
<td>2 kΩ</td>
</tr>
<tr>
<td>AAL002-02</td>
<td>1.5</td>
<td>10.5</td>
<td>15</td>
<td>3</td>
<td>4.2</td>
<td>2%</td>
<td>2%</td>
<td>125°C</td>
<td>5.5 kΩ</td>
</tr>
<tr>
<td>AAL004-10</td>
<td>1.5</td>
<td>10.5</td>
<td>15</td>
<td>3</td>
<td>4.2</td>
<td>2%</td>
<td>2%</td>
<td>125°C</td>
<td>2.2 kΩ</td>
</tr>
<tr>
<td>AAL024-10</td>
<td>1.5</td>
<td>10.5</td>
<td>15</td>
<td>3</td>
<td>4.2</td>
<td>2%</td>
<td>2%</td>
<td>125°C</td>
<td>2.2 kΩ</td>
</tr>
<tr>
<td>AAK001-14</td>
<td>400</td>
<td>2500</td>
<td>4000</td>
<td>0.0025</td>
<td>0.004</td>
<td>2%</td>
<td>4%</td>
<td>85°C</td>
<td>3.5 kΩ</td>
</tr>
</tbody>
</table>

#### Gradiometers (AB-Series)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AB001-02</td>
<td>10</td>
<td>175</td>
<td>250</td>
<td>0.02</td>
<td>0.03</td>
<td>2%</td>
<td>4%</td>
<td>125°C</td>
<td>2.5 kΩ</td>
</tr>
<tr>
<td>AB001-00</td>
<td>10</td>
<td>175</td>
<td>250</td>
<td>0.02</td>
<td>0.03</td>
<td>2%</td>
<td>4%</td>
<td>125°C</td>
<td>2.5 kΩ</td>
</tr>
<tr>
<td>ABH001-00</td>
<td>5</td>
<td>40</td>
<td>70</td>
<td>0.06</td>
<td>0.12</td>
<td>4%</td>
<td>15%</td>
<td>150°C</td>
<td>1.2 kΩ</td>
</tr>
</tbody>
</table>
Evaluation Kits

Four inexpensive evaluation kits including AA- or AB-Series analog sensors are available:

**AG001-01: Analog Sensor Evaluation Kit**
This kit features several types of NVE’s AA and AB series parts, a selection of permanent magnets for activation or bias purposes, and circuit boards to mount the parts for testing.

**AG003-01: AA003 Current Sensor Evaluation Kit**
This kit features a circuit board with different trace configurations running under four AA003-02E analog sensors to evaluate the sensor as non-contact current sensors. The board supports current ranges of 0–9 amps, 0–6 amps, and 0–250 milliamps. Boards measure 2 by 1.85 inches (51 mm by 47 mm), and include four sensors.

**AG903-01: AA003 Current Sensor Evaluation Kit**
This board includes four ADL024-10E TDFN current sensors on a PCB with four different current-trace configurations, and include four sensors. The boards measure 2 by 2 inches (50 mm x 50 mm) and include screw connections for current to be measured.

**AG940-07E: Digital/Analog/Omnipolar/Bipolar Sensor Demo Board**
The kit includes a demo board with our most popular digital, analog, omnipolar, and bipolar sensors, including an AA006-00E analog sensor. Each sensor drives an indicator LED. A bar magnet is included so you can see for yourself how the sensors work. The evaluation boards are 3.75 by 5 inches (95 mm by 127 mm), and are powered by two coin cells (included).
Bare Circuit Boards for Sensors

NVE offers several bare circuit boards specially designed for easy connections to surface-mount sensors. Popular PCBs are shown below (images are actual size):

**AG004-06**: 3” x 0.3” (75 x 8 mm) SOIC8 circuit board

**AG005-06**: 0.5” x 0.5” (13 mm x 13 mm) SOIC8

**AG915-06**: 0.25” (6 mm) octagonal MSOP8

**AG918-06** (standard) / **AG919-06** (cross-axis): 2” x 0.25” (50 mm x 6 mm) MSOP8

**AG035-06**: 1.57” x 0.25” (40 mm x 6 mm) TDFN6

**AG904-06**: 1.2” x 0.25” (30 mm x 6 mm) ULLGA
AA/AB-Series Analog Magnetic Sensors

Package Drawings

ULLGA4 (-14E suffix)

Top View

Side View

Bottom View

Package Marking: “1”

Dimensions in mm; ±0.10 mm unless otherwise noted.

RoHS COMPLIANT

TDFN6 (-10 suffix)

RoHS COMPLIANT
MSOP8 (-00 suffix)

- 0.114 (2.90)
- 0.122 (3.10)
- 0.189 (4.80)
- 0.197 (5.00)
- 0.010 (0.25)
- 0.016 (0.40)
- 0.016 (0.40)
- 0.027 (0.70)
- 0.016 (0.40)
- 0.024 (0.60)
- 0.005 (0.13)
- 0.009 (0.23)

NOTE: Pin spacing is a BASIC dimension; tolerances do not accumulate

SOIC8 (-02 suffix)

- 0.188 (4.77)
- 0.197 (5.00)
- 0.228 (5.8)
- 0.244 (6.2)
- 0.150 (3.8)
- 0.157 (4.0)
- 0.013 (0.3)
- 0.020 (0.5)
- 0.070 (1.83)
- 0.054 (1.37)
- 0.052 (1.32)
- 0.062 (1.57)
- 0.004 (0.1)
- 0.012 (0.3)

NOTE: Pin spacing is a BASIC dimension; tolerances do not accumulate

Soldering profiles per JEDEC J-STD-020C, MSL 1.
## Revision History

<table>
<thead>
<tr>
<th>Revision</th>
<th>Change</th>
<th>Notes</th>
</tr>
</thead>
</table>
| SB-00-059-D | **Change** | Added AAK001 ultrahigh-field model.  
Added LED field-strength indicator and current-sensing applications (p. 10).  
Added AA selector chart (p. 13).  
Added Evaluation Kits (p. 14) and bare circuit boards (p. 15).  
Misc. cosmetic changes and additional illustrations. |
| October 2017 |        |       |
| SB-00-059-C | **Change** | Added AA007-00E high-field model. |
| September 2017 |        |       |
| SB-00-059-B | **Change** | Added AA024-10E and AAL024-10E cross-axis versions. |
| August 2017 |        |       |
| SB-00-059-A | **Change** | Initial datasheet release superseding catalog. |
| April 2017 |        |       |
Datos del hoja de datos

La información y los datos proporcionados en los datos del producto definen la especificación del producto como acordado entre NVE y su cliente, a menos que NVE y el cliente hayan acordado de manera expresa lo contrario por escrito. Todas las especificaciones están basadas en los protocolos de prueba de NVE. En ningún caso, sin embargo, se mantendrá una acordado se considerará válido en el que el producto NVE se considera que ofrece funciones y calidad superior a las descritas en los datos del producto.

Limites de garantía y responsabilidad

La información en este documento debe ser precisa y confiable. Sin embargo, NVE no proporciona ninguna representación o garantía, explicita o implícita, concerniente a la exactitud o exhaustividad de tal información y no se hará responsable de las consecuencias de uso de tal información.

En ningún caso NVE será responsable por daños indirectos, consecuentes, punitivos, especiales o resultantes (incluyendo, sin limitación, pérdidas de beneficios, pérdidas de ganancias, daños debidos a la interrupción del negocio, costos relacionados con la eliminación o reemplazo de cualquier producto o gastos de retraso) ya sean o no estas daños se basen en hipótesis de tort, negligencia, garantía, incumplimiento del contrato o cualquier otra teoría legal.

Derecho a hacer cambios

NVE se reserva el derecho de hacer cambios a la información publicada en este documento, incluyendo, sin limitación, especificaciones y descripciones de producto.

Derechos de autor, patentes e inventos industriales

NVE no otorgará ninguna licencia de derechos de autor, patentes o derechos industriales en virtud de cualquier patente de derecho de autor, patente o cualquier otro invento industrial o intelectual en el presente documento.

Ningún párrafo de esta página puede ser interpretado o interpretado como una oferta de venta abierta o la concesión o inferencia de cualquier licencia de derechos de autor, patentes o otros derechos industriales o intelectuales.

En el caso de que el cliente use el producto para el diseño e implementación en aplicaciones y productos de uso en la vida crítica, vida crítica o vida crítica dispositivos o equipos. NVE no acepta ninguna responsabilidad por la inclusión o uso de productos NVE en tales aplicaciones y tal inclusión o uso está en el riesgo del cliente. Debería haber uso de productos NVE para tal aplicación que sea autorizada por NVE o no, el cliente se indemnizará y quedará indemne de NVE contra todas las reclamaciones y daños.