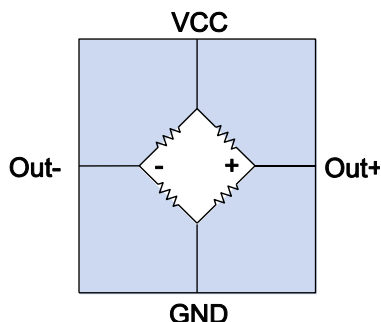
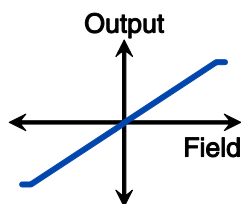


BLT022-02E Linear, High-Sensitivity Magnetometer

Equivalent Circuit



Idealized Transfer Function



Features

- Tunneling Magnetoresistive (TMR) technology
- Large signals (1000 mV/V/mT typ.)
- ± 0.1 mT (± 1 Oe) linear range
- Ultra-low temperature coefficient of output (± 0.1 %/ $^{\circ}\text{C}$)
- Up to 350 kHz frequency bandwidth
- 15 k Ω typ. device resistance
- Sub 900 μW power consumption (3V, continuous duty)
- Operation to near-zero voltage
- Up to 125 $^{\circ}\text{C}$ operating temperature
- Non-magnetic SOIC8 package

Applications

- Geospatial navigation
- Electromagnetic navigation
- Proximity detection
- Precision motion control
- Metal detection
- Non-destructive analysis

Description

The BLT022 sensor is a single-axis Tunneling Magnetoresistance (TMR) analog bridge sensor with an extraordinary amount of sensitivity, designed for low power geospatial applications.

The differential bridge output is bipolar, meaning it is positive for a positive field polarity and negative for an opposite field polarity.

The Wheatstone bridge configuration allows the sensors to be purely ratiometric devices. They will operate properly at extremely low supply voltages or harvested power, and the output signal will be proportional to the supply voltage.

The bridge signals are stable over a temperature range of -40 to 125 $^{\circ}\text{C}$.

The sensor is available in a convenient, non-magnetic SOIC8 package.

Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Units
Supply voltage	V_{CC}			24	Volts
Operating temperature	T_{min}, T_{max}	-40		125	°C
Storage temperature		-65		150	°C
ESD (Human Body Model) ¹				2000	Volts
Applied magnetic field ²	H			Unlimited	Tesla

Operating Specifications

Parameter	Symbol	Min.	Typical	Max.	Units
Operating temperature	T	-40		125	°C
Supply voltage	V_{CC}	0		10	Volts
Offset voltage	V_{offset}	-20		20	mV/V
Device resistance	R	10	15	20	kΩ
Frequency bandwidth ³	f	DC		350	kHz
Operating field range ²	H	-0.1		0.1	mT
Saturation field (90% max output) ²	H_{sat}	0.3	0.4	0.5	mT
Sensitivity ²	S_{en}	800	1000	1300	mV/V/mT
Field Detectivity ²					
1 Hz	H_{min}		350	700	pT/√Hz
100 Hz			30		
Hysteresis, 25 °C	H_c	15	30	40	μT
Linearity ⁴	Lin		4	5	%F.S.
±0.1 mT, 25 °C					
Output at maximum field	V_{max}	260	330	400	mV/V
Off-axis characteristic ⁶			Cos(β)		

Temperature Coefficients ⁵	Symbol	Min.	Typical	Max.	Units
Output sensitivity	TC_O	-0.1	0	0.1	%/°C
Device resistance	TC_R		-0.03		%/°C
Hysteresis	TC_H		1		%/°C

Package Parameters	Symbol	Min.	Typical	Max.	Units
Junction-ambient thermal resistance ⁷	θ_{JA}		320		°C/W
Power dissipation	P_D		500		mW

Notes:

- Human Body Model (HBM) per JESD22-A114
- 1 millitesla (mT) = 10⁶ nanotesla (nT) = 10 Gauss (G) = 10 Oersted (Oe) in air
- Specified for amplitude reduction of -3 dB.
- Maximum deviation from linear fit relative to output maximum over operating field. Excludes contributions from hysteresis.
- Temperature coefficients given relative to parameter value at 25 °C. TC_R is the device resistance change with temperature in constant applied field. TC_O is the sensitivity change with temperature using a constant voltage source to power the sensor. TC_H is the relative change in hysteresis at zero-field.
- Beta (β) is any angle from the sensitive axis.
- Measured per JESD51 with ground pad not connected to circuit board.

Typical Performance Graphs

Figure 1(a,b) shows the typical magnetic field response of the BLT022 at 25 °C and over the operating temperature range. Figure 2(a-f) shows typical temperature dependence of specified parameters over $\pm 200^{\circ}\text{C}$.

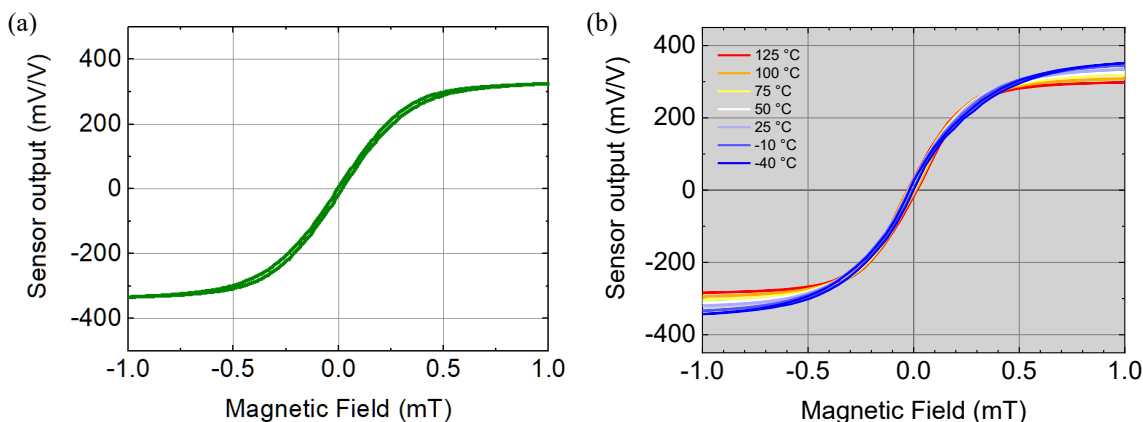


Figure 1. (a) Typical BLT022 output at 25 °C. (b) Typical temperature variation of output.

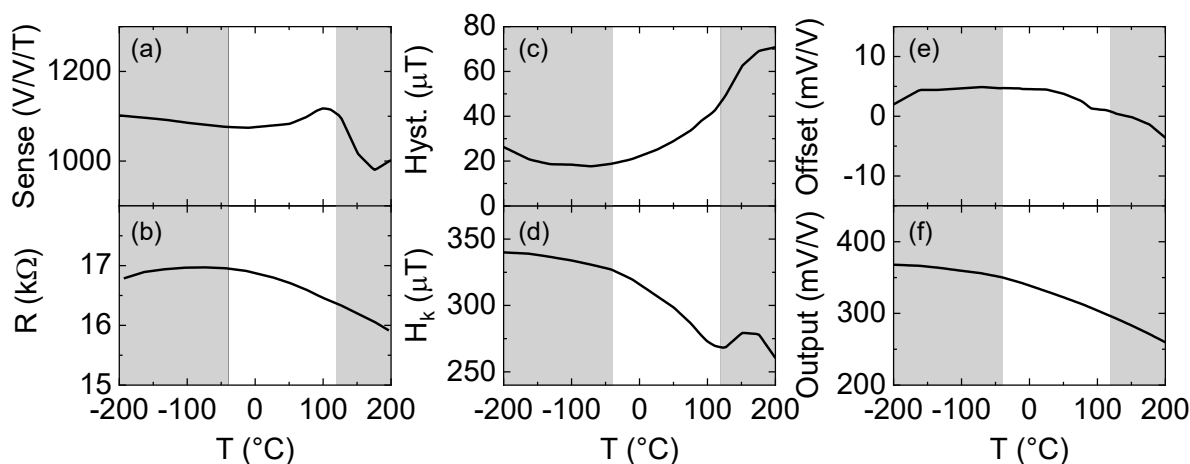


Figure 2. Typical BLT022 temperature dependence over $\pm 200^{\circ}\text{C}$ for (a) Sensitivity, (b) Device Resistance, (c) Hysteresis, (d) Field range H_k , (e) Offset voltage and (f) Output at maximum field. The operating temperature range is highlighted in white.

Cross-Axis, In-Plane Directional Sensitivity

The BLT022 has cross-axis sensitivity to magnetic fields. Cross-axis sensitivity corresponds to fields oriented from pin 1 to pin 8. The direction of sensitivity of the BLT022 is in the plane of the package. Unlike hall-effect sensors, the BLT022 does not detect magnetic fields perpendicular to the plane of the package.

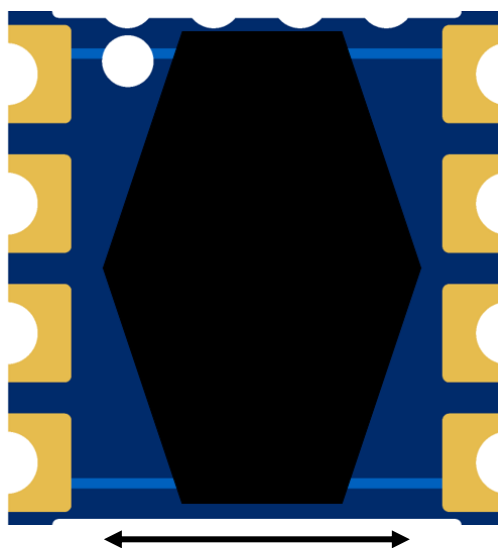


Figure 3. Cross-axis, in-plane sensitivity for BLT022-02E sensors.

Minimum Magnetic Field Detectivity

Figure 4 shows the typical (top) magnetic field noise and (bottom) voltage noise for the BLT022. These parameters define the minimum detectable field for the sensor. See NVE's application note on TMR magnetometers, SB-00-101, for more information on sensor noise.

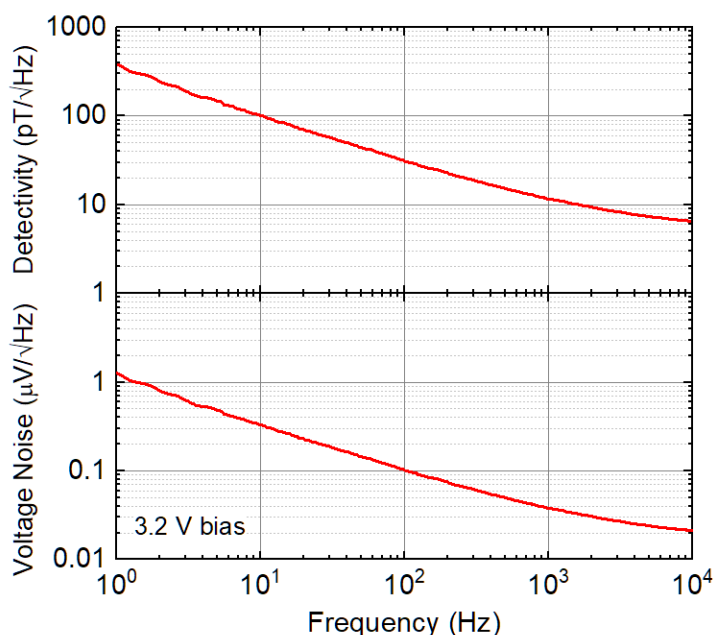


Figure 4. Typical (top) magnetic field noise or detectivity and (bottom) voltage noise for the BLT022.

Magnetic Field Frequency Bandwidth

Figure 5 shows the typical voltage output as a function of magnetic field frequency for a monochromatic sine wave stimulus.

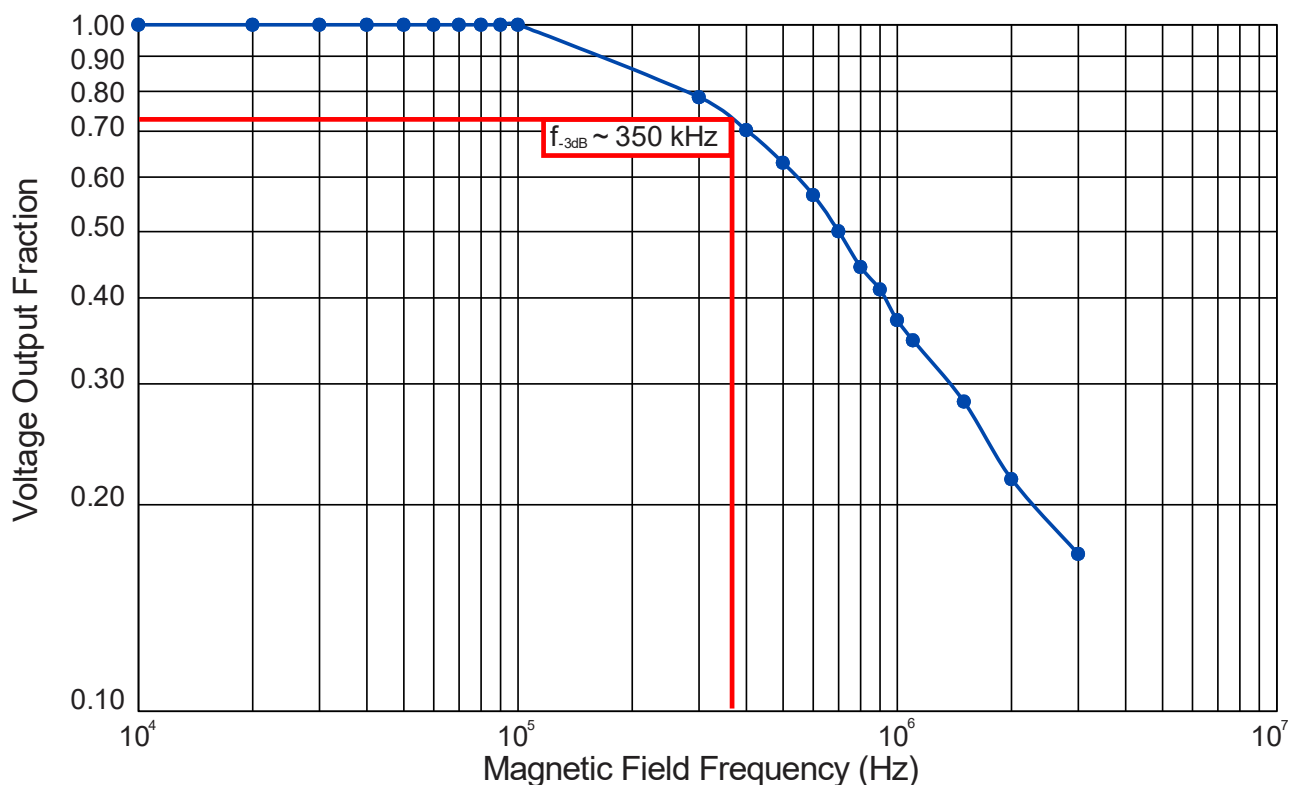
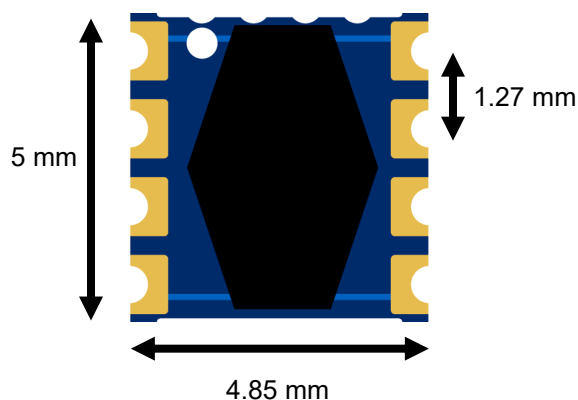


Figure 5: Magnetic field frequency bandwidth.

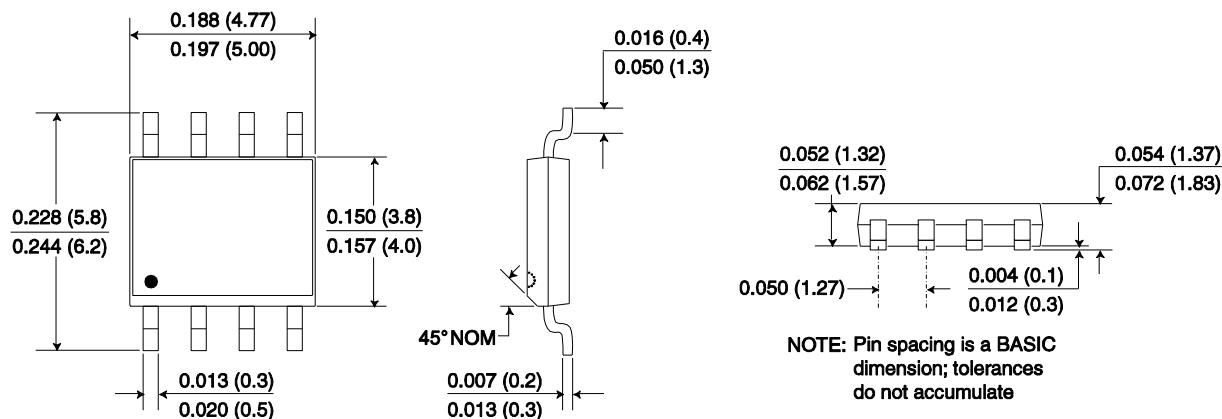
Package Drawings

Preliminary: castellated-hole chip-on-board assembly based on SOIC8 footprint. Surface mount compatible, but should be soldered carefully with minimum temperature stress applied to the protective epoxy cap.



Reflow soldering the chip-on-board package is not recommended due to thermal expansion stress.

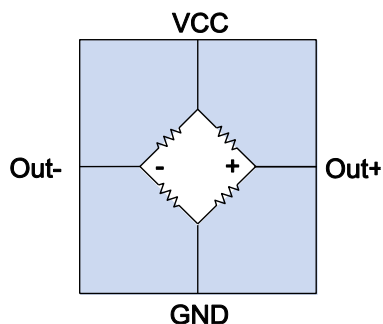
Coming Soon: SOIC8 (-02 suffix)



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

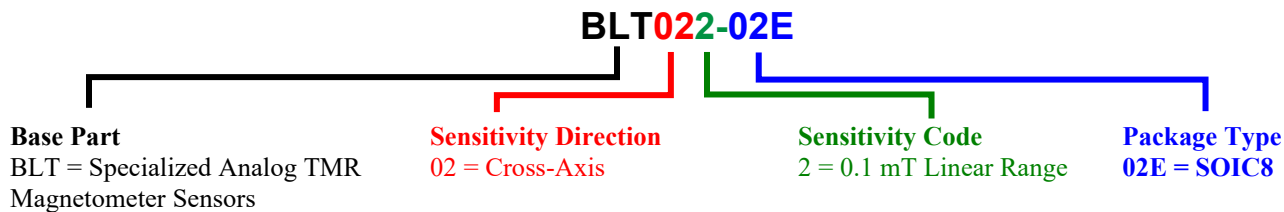
RoHS
COMPLIANT

BLT022 Functional Diagram and Pinout



Pin	Symbol	Description
2,3,6,7	NC	No internal connection
1	OUT+	Positive bridge output (increases with field).
4	GND	Negative bridge supply or ground.
5	OUT-	Negative bridge output (decreases with field).
8	V _{cc}	Positive bridge supply.

Part Numbering



Ultrasensitive Evaluation Board with Amplifier

We offer a small board with an amplifier for rapid proof of concept with the BLT022-02E sensor:



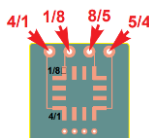
Part number BLT022-02E-EVB02 top and bottom
(0.93" x 0.48" / 23.5 mm x 12.2 mm; actual size).

Bare Circuit Boards

NVE offers bare circuit boards for easy connections to SOIC8 sensors such as the BLT022:



AG004-06: DFN4 connection board for -02E suffix sensors.
(3" x 0.3" / 75 mm x 8 mm; actual size).



AG005-06: DFN6 connection board for -02E suffix sensors.
(0.5" x 0.5" / 13 mm x 13 mm; actual size).

Revision History

SB-00-154 –Preliminary

October 2026

Change

- Preliminary release for sampling BLT022-02E COB. Actual SOIC8-package-version part number BLT022-02E not available yet

Datasheet Limitations

The information and data provided in datasheets shall define the specification of the product as agreed between NVE and its customer, unless NVE and customer have explicitly agreed otherwise in writing. All specifications are based on NVE test protocols. In no event however, shall an agreement be valid in which the NVE product is deemed to offer functions and qualities beyond those described in the datasheet.

Limited Warranty and Liability

Information in this document is believed to be accurate and reliable. However, NVE does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information.

In no event shall NVE be liable for any indirect, incidental, punitive, special or consequential damages (including, without limitation, lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Right to Make Changes

NVE reserves the right to make changes to information published in this document including, without limitation, specifications and product descriptions at any time and without notice. This document supersedes and replaces all information supplied prior to its publication.

Use in Life-Critical or Safety-Critical Applications

Unless NVE and a customer explicitly agree otherwise in writing, NVE products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical devices or equipment. NVE accepts no liability for inclusion or use of NVE products in such applications and such inclusion or use is at the customer's own risk. Should the customer use NVE products for such application whether authorized by NVE or not, the customer shall indemnify and hold NVE harmless against all claims and damages.

Applications

Applications described in this datasheet are illustrative only. NVE makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using NVE products, and NVE accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NVE product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customers. Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NVE does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customers. The customer is responsible for all necessary testing for the customer's applications and products using NVE products in order to avoid a default of the applications and the products or of the application or use by customer's third party customers. NVE accepts no liability in this respect.

Limiting Values

Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and operation of the device at these or any other conditions above those given in the recommended operating conditions of the datasheet is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and Conditions of Sale

In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. NVE hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of NVE products by customer.

No Offer to Sell or License

Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Export Control

This document as well as the items described herein may be subject to export control regulations. Export might require a prior authorization from national authorities.

Automotive Qualified Products

Unless the datasheet expressly states that a specific NVE product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. NVE accepts no liability for inclusion or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without NVE's warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond NVE's specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies NVE for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond NVE's standard warranty and NVE's product specifications.

An ISO 9001 Certified Company

NVE Corporation
11409 Valley View Road
Eden Prairie, MN 55344-3617 USA
Telephone: (952) 829-9217
www.nve.com
www.youtube.com/NveCorporation

e-mail: sensor-info@nve.com

©NVE Corporation

All rights are reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner.

SB-00-154

October 2026