

AMR2501

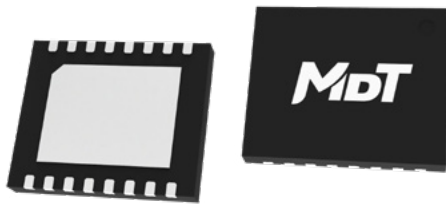
High Accuracy, Low Noise Linear Magnetic Sensor

Description

The AMR2501 linear sensor utilizes a push-pull Wheatstone bridge composed of four highly sensitive AMR sensor elements. The Wheatstone bridge effectively compensates the sensor's temperature drift to achieve outstanding temperature stability with minimal noise. AMR2501 is available in the DFN16L (5 mm × 6 mm × 0.75 mm) package.

Features and Benefits

- Anisotropic magnetoresistance (AMR) technology
- Low noise density: 100 pT/ $\sqrt{\text{Hz}}$ @1 Hz
- Wide range supply voltages
- Low saturation field
- Excellent temperature stability
- Low hysteresis
- RoHS & REACH compliant



DFN16L

Applications

- Weak magnetic field sensing
- Current sensor
- Position sensor
- Magnetometer

Selection Guide

| Part Number | Linear Range | Sensitivity | Set/reset Coil Resistance | Offset Coil Resistance | Noise Density | Package | Packing Form |
|-------------|--------------|-------------|---------------------------|------------------------|----------------------------|---------|--------------|
| AMR2501D-A | ± 1 Gs | 2.5 mV/V/Gs | 2 Ω | 3 Ω | 100 pT/ $\sqrt{\text{Hz}}$ | DFN16L | Tape & Reel |
| AMR2501D-B | ± 1 Gs | 2.5 mV/V/Gs | 2 Ω | 40 Ω | 100 pT/ $\sqrt{\text{Hz}}$ | DFN16L | Tape & Reel |

Catalogue

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1. Functional Block Diagram

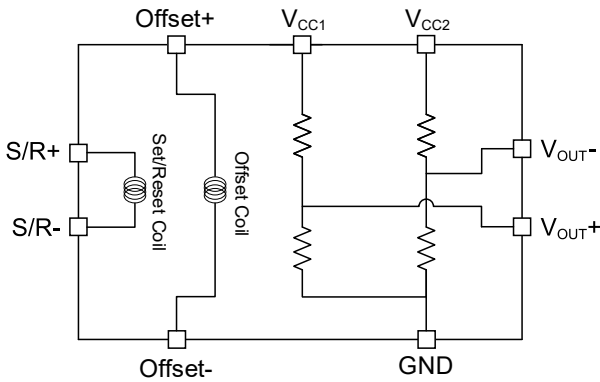


Figure 1. Block Diagram

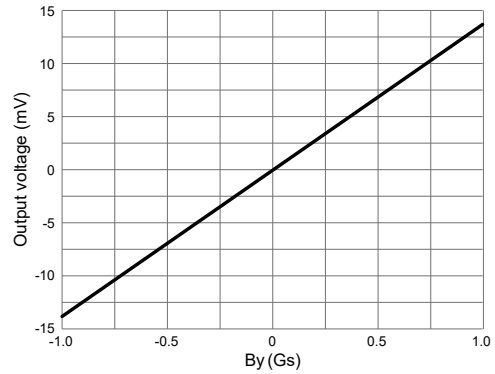


Figure 3. AMR2501 output curve

2. Operating Principle

The AMR2501 sensing axis is perpendicular to the package top-marking surface; the sensing axis is defined from the N pole toward the S pole, as indicated by the arrow in the figure below.

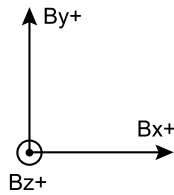


Figure 2-1. Definition of axis

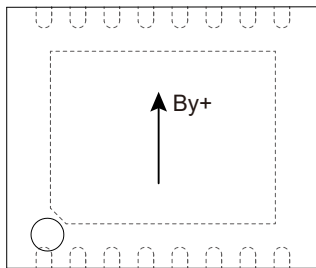


Figure 2-2. Axial diagram (DFN16L top view)

The AMR2501 output voltage varies linearly with the magnetic field along the sensing axis.

3. Pin Configuration

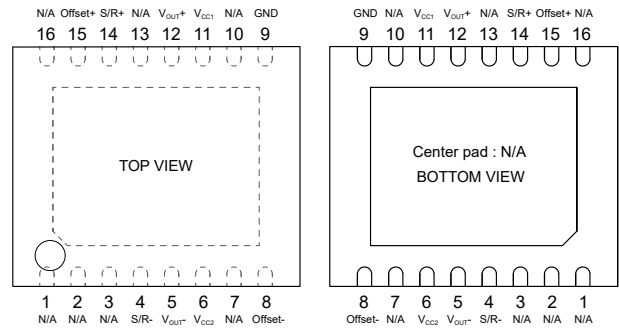


Figure 4. Pin configuration

| Pin Number | Name | Function |
|------------|-------------------|-------------------|
| 1 | N/A | Not connected |
| 2 | N/A | Not connected |
| 3 | N/A | Not connected |
| 4 | S/R- | Set/reset input - |
| 5 | V _{OUT-} | Output - |
| 6 | V _{CC2} | Supply voltage |
| 7 | N/A | Not connected |
| 8 | Offset- | Offset voltage - |
| 9 | GND | Ground |
| 10 | N/A | Not connected |
| 11 | V _{CC1} | Supply voltage |
| 12 | V _{OUT+} | Output + |
| 13 | N/A | Not connected |
| 14 | S/R+ | Set/reset input + |
| 15 | Offset+ | Offset voltage + |
| 16 | N/A | Not connected |

4. Absolute Maximum Ratings

| Parameters | Symbol | Min. | Max. | Unit |
|-------------------------------|-----------|------|-------|------|
| Supply Voltage | V_{CC} | - | 12 | V |
| ESD Performance (HBM) | V_{ESD} | - | 4 | kV |
| Operating Ambient Temperature | T_A | -55 | 150 | °C |
| Storage Ambient Temperature | T_{STG} | -55 | 175 | °C |
| Soldering Temperature | T_I | - | 260 | °C |
| Magnetic Field | B | - | 10000 | Gs |

5. Electrical Specifications

$V_{CC} = 5.0$ V, $T_A = 25$ °C, $I_{S/R} = 2.5$ A, differential output unless otherwise specified

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit | |
|--|---------------|---|------------|-----------|------|-----------------|----------|
| Supply Voltage | V_{CC} | Bridge voltage, referenced to ground | 1.8 | 5 | 12 | V | |
| Bridge Resistance | R_B | $I = 10$ mA | 500 | 700 | 1100 | Ω | |
| Field Range | B_{SAT} | Full scale (FS) | -2 | - | 2 | Gs | |
| Linearity Error | NONL | Fit in: ± 1 Gs | - | 0.2 | 0.5 | %FS | |
| | | Fit in: ± 2 Gs | - | 1.2 | 2 | | |
| Hysteresis Error | HYS | 2 sweeps, across ± 2 Gs | - | 0.02 | 0.1 | %FS | |
| Repeatability Error | B_{repeat} | 2 sweeps, across ± 2 Gs | - | 0.05 | 0.1 | %FS | |
| Bridge Offset | V_{OFFSET} | $V_{OFFSET} = (V_{OUT+}) - (V_{OUT-})$, B = 0 Gs, after set pulse | -10 | ± 2 | +10 | mV/V | |
| Sensitivity | SEN | - | 1.8 | 2.5 | 3.5 | mV/V/Gs | |
| Voltage Noise Density | V_{noise} | At 1 Hz | - | 20 | - | nV/ \sqrt{Hz} | |
| Magnetic Noise Density | B_{noise} | At 1 Hz | - | 100 | - | pT/ \sqrt{Hz} | |
| Resolution | RES | Bandwidth = 10 Hz | - | 20 | - | μ Gs | |
| Bandwidth | BW | Magnetic signal (lower limit = DC) | - | 5 | - | MHz | |
| Offset Coil Resistance | $R_{OFFCOIL}$ | Measured from OFFSET+ to OFFSET- | AMR2501D-A | - | 3 | - | Ω |
| | | | AMR2501D-B | - | 40 | - | |
| Offset Field | $B_{OFFCOIL}$ | Field applied in sensitive direction | AMR2501D-A | 45 | 51 | 60 | mA/Gs |
| | | | AMR2501D-B | 9 | 10 | 12 | |
| Set/Reset Coil Resistance | $R_{S/R}$ | Measured between S/R+ and S/R- | 1.5 | 2 | 2.5 | Ω | |
| Set/Reset Current | $I_{S/R}$ | 2 μ s current pulse | 1 | 2.5 | 3.5 | A | |
| Disturbing Field | $B_{disturb}$ | Sensitivity starts to degrade, restore by S/R pulse | - | 3 | - | Gs | |
| Sensitivity Temperature Coefficient | TCS | $T_A = -40$ °C to 125 °C | - | -3000 | - | PPM/°C | |
| Bridge Offset Temperature Coefficient | TCO | $T_A = -40$ °C to 125 °C, w/o set/reset | - | 300 | - | PPM/°C | |
| | | $T_A = -40$ °C to 125 °C, w/ set/reset | - | 10 | - | | |
| Resistance Temperature Coefficient | TCR_B | $T_A = -40$ °C to 125 °C | - | 2500 | - | PPM/°C | |
| Cross-Axis Effect | X_B | Cross field = 1 Gs | - | ± 0.5 | - | %FS | |

6. Typical Output Characteristics

Figure 5 shows the response of the AMR2501 to an applied magnetic field. (Applied field = ± 6 Gs, analysis field = ± 2 Gs, and $V_{CC} = 5$ V).

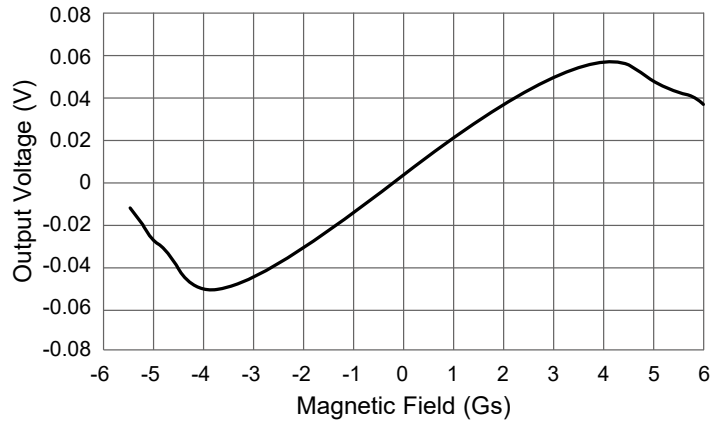


Figure 5. AMR2501 output vs. applied field

Typical voltage noise density

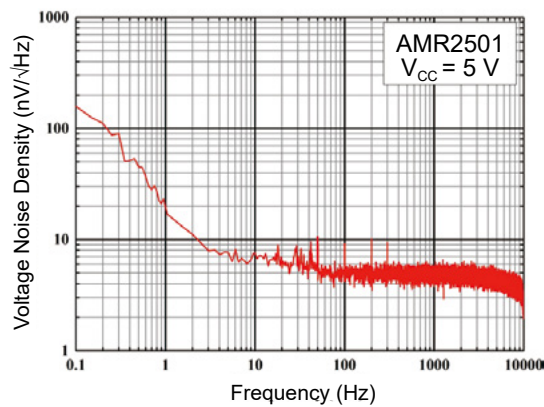


Figure 6. AMR2501 voltage noise density vs. frequency

Typical magnetic noise density

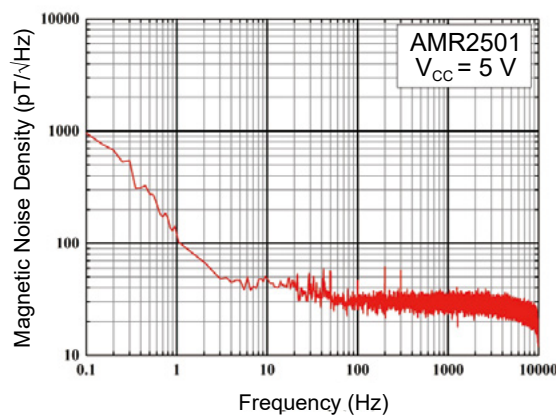


Figure 7. AMR2501 magnetic noise density vs. frequency

7. Application Information

A voltage pulse of 5 V for 2 μ s in 10 kHz can be select as the set/reset signal. The pulse voltage, pulse width and duty cycle can be adjusted in a certain range. A typical drive circuit is shown in Figure 8.

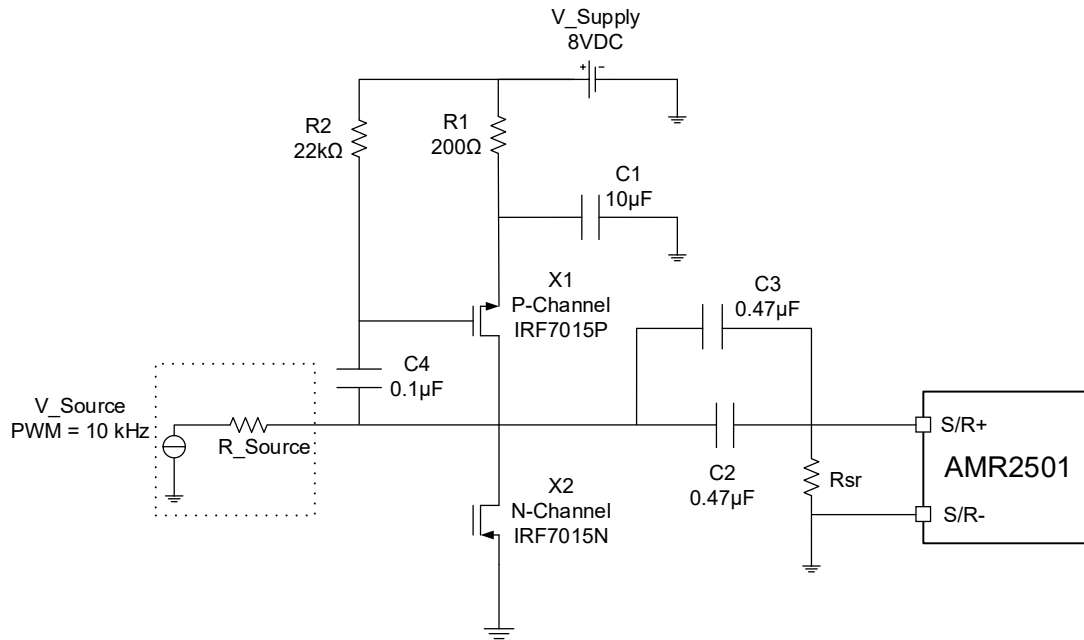


Figure 8. Set/reset drive circuit of AMR2501

The circuit will generate 5 V set/reset pulses, as illustrated in figure 9.

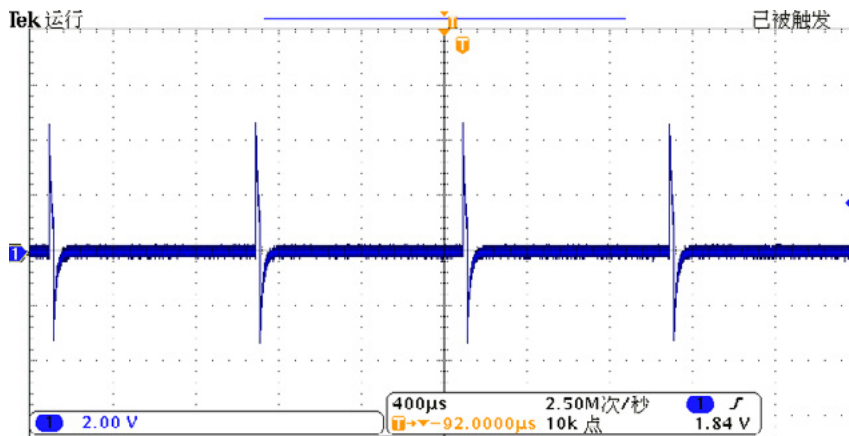


Figure 9. Set/reset voltage pulses waveform

When set-only or reset-only pulse is applied, the set- and reset- pulse is switchable by reversing the set/reset input.

8. Dimensions

DFN16L Package

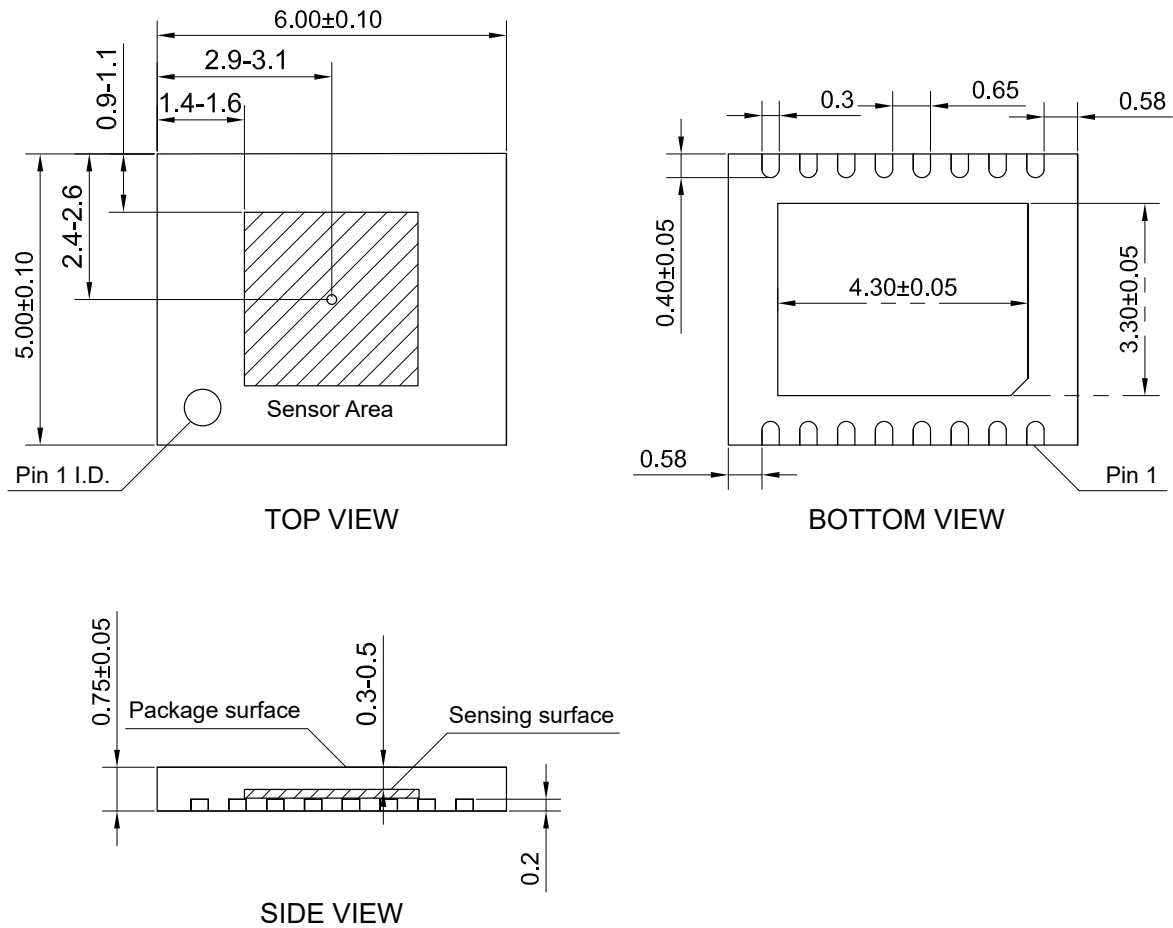


Figure 10. Package outline of DFN16L (unit: mm)

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