AMR2501

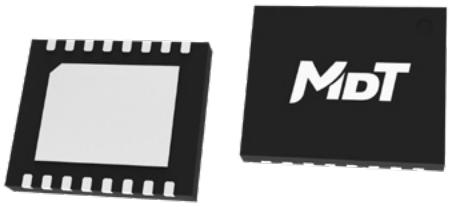
High Accuracy, Low Noise Linear Magnetic Sensor

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/√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/√Hz	DFN16L	Tape & Reel
AMR2501D-B	±1 Gs	2.5 mV/V/Gs	2 Ω	40 Ω	100 pT/√Hz	DFN16L	Tape & Reel

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1. Functional Block Diagram

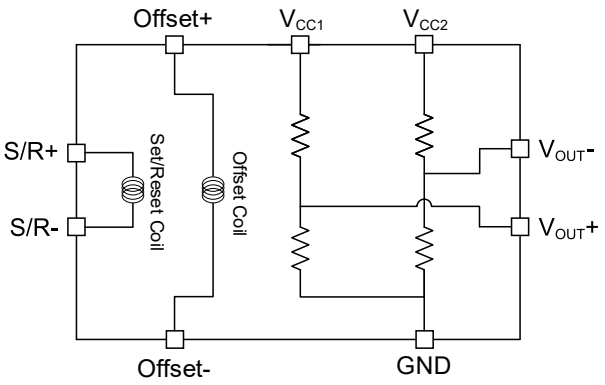

Figure 1. Block Diagram

2. Operating Principle

The AMR2501 sensing axis is as indicated by the arrow, being parallel to the printed surface and perpendicular to the horizontal Bx direction; the sensing direction is defined from the N pole toward the S pole, as indicated by the arrow in the figure below.

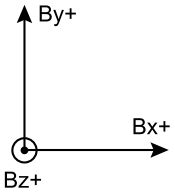

Figure 2-1. Definition of axis

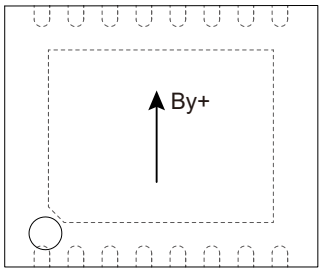

Figure 2-2. Axial diagram (DFN16L top view)

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

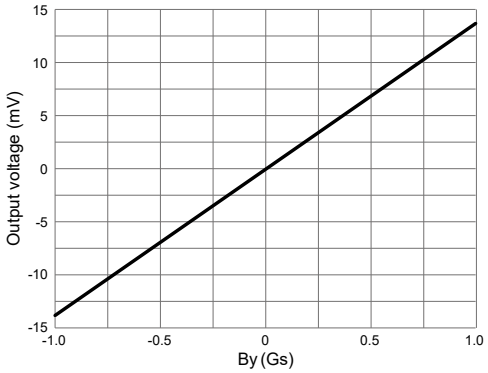

Figure 3. AMR2501 output curve

3. Pin Configuration

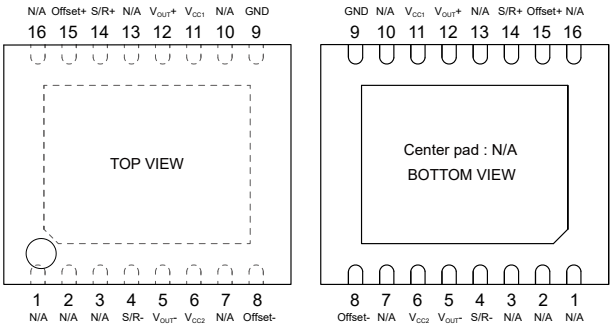

Figure 4. Pin configuration

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/√Hz
Magnetic Noise Density	B_{noise}	At 1 Hz		-	100	-	pT/√Hz
Resolution	RES	Bandwidth = 10 Hz		-	20	-	μGs
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 μs 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).

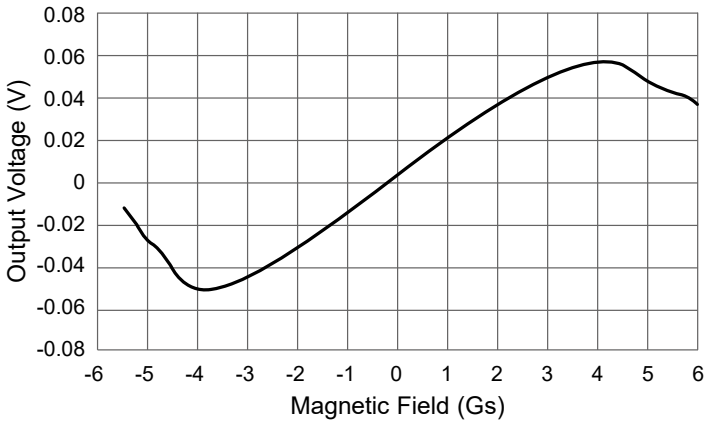

Figure 5. AMR2501 output vs. applied field

Typical voltage noise density

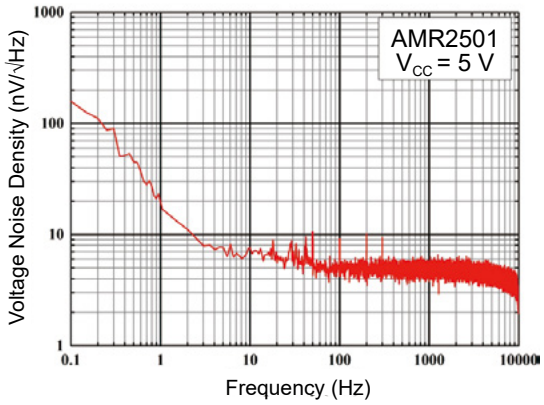

Figure 6. AMR2501 voltage noise density vs. frequency

Typical magnetic noise density

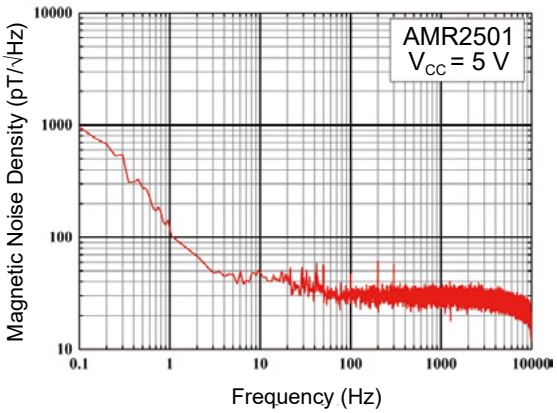

Figure 7. AMR2501 magnetic noise density vs. frequency

7. Application Information

A voltage pulse of 5 V for 2 μs 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.

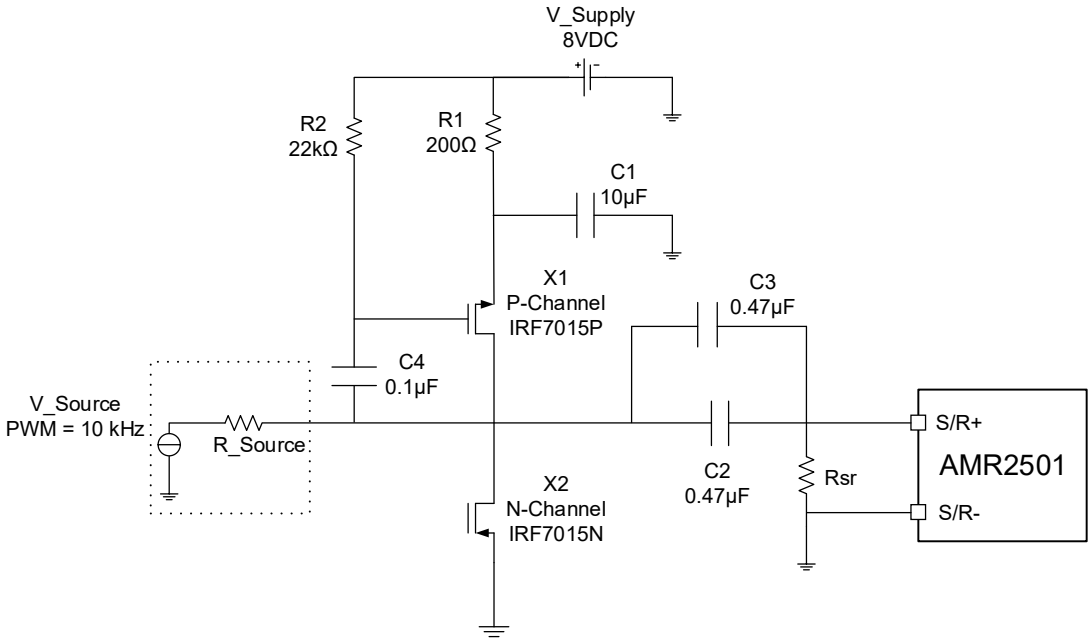

Figure 8. Set/reset drive circuit of AMR2501

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

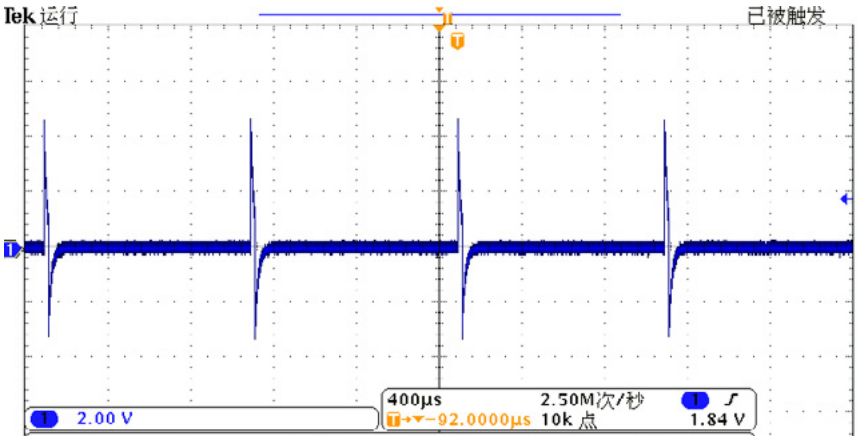

Figure 9. Set/reset voltage pulses waveform

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

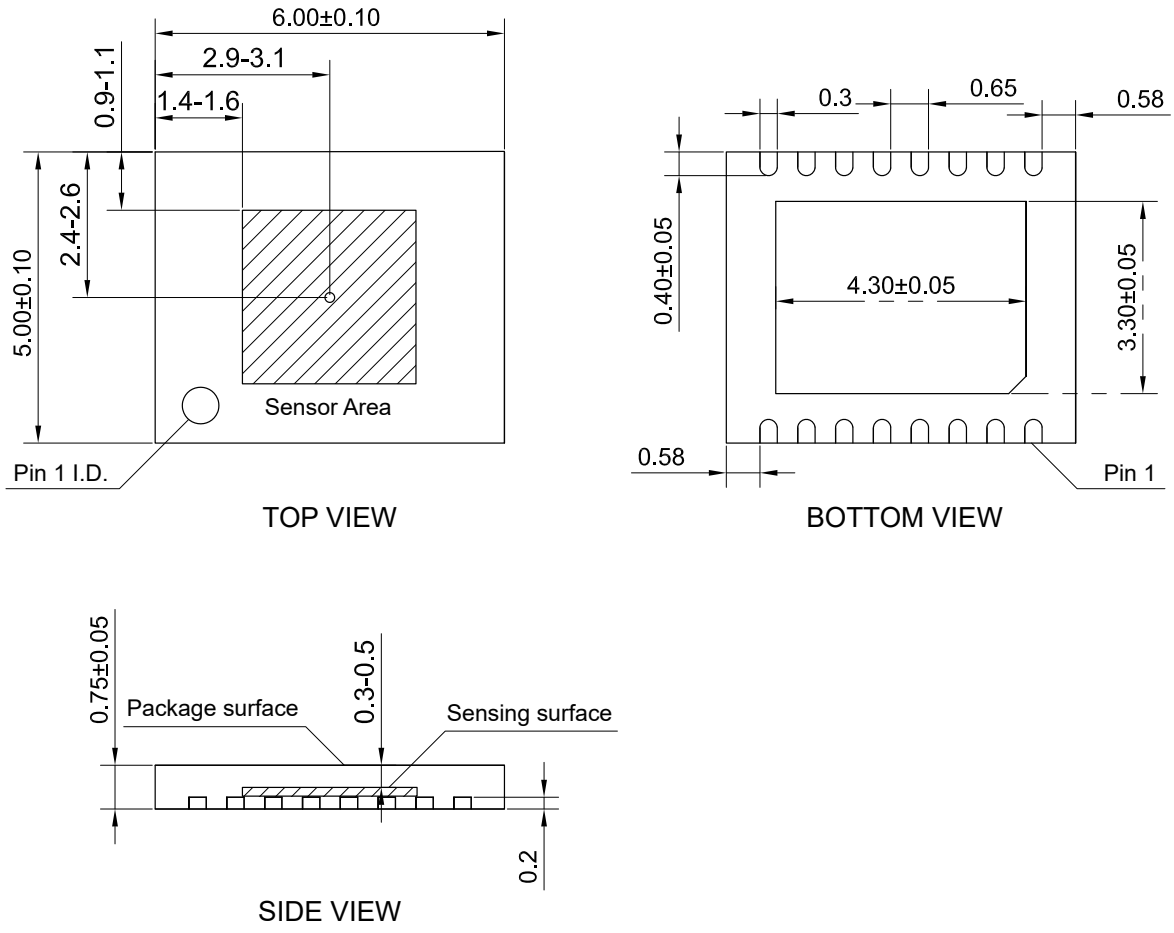

Figure 10. Package outline of DFN16L (unit: mm)

Recycling

The product(s) in this document should be disposed of at the end of the product(s) life using a qualified waste management company for recycling in accordance with local regulations.

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