

# AMR1320

## 360°, Ultra-Low Power, Omnipolar Switch Sensor

### Description

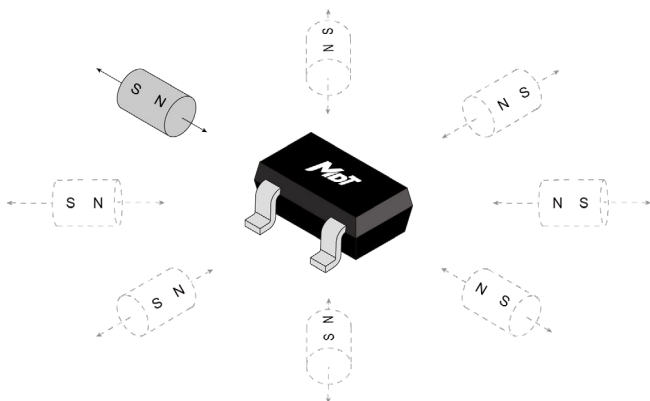
The AMR1320 is an omnipolar magnetic switch integrated with anisotropic magnetoresistance (AMR) magnetic sensor and CMOS circuitry, which is able to detect the change of magnetic field and output high and low voltage signals for high accuracy position detection.

The AMR1320 can detect magnetic fields from all directions in the plane, enabling 360° sensing. It provides 30 Hz sampling frequency, 1  $\mu$ A power consumption, and a wide range of operating voltages from 1.8 V to 5.5 V. It has excellent thermal stability and immunity to stray field interference.

The AMR1320 available in the compact SOT23-3 package.



SOT23-3

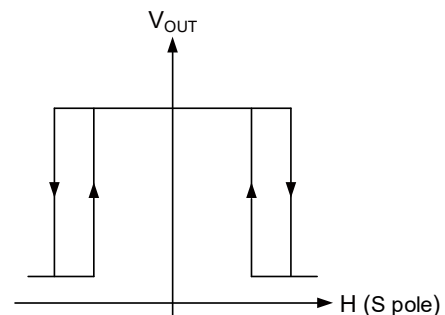


### Features and Benefits

- Anisotropic magnetoresistance (AMR) technology
- Low power consumption at 1  $\mu$ A
- Fast internal switching frequency at 30 Hz
- Omnipolar operation
- High sensitivity
- Wide range supply voltages: 1.8 V to 5.5V
- CMOS output
- Excellent temperature stability
- High tolerance to external magnetic field interference
- RoHS & REACH compliant

### Applications

- Utility meters: water, gas, and heat meters
- Proximity switches
- Speed sensing
- Linear and rotary position sensing
- Wake up switches



## Selection Guide

Part Number	Supply Current	Switching Frequency	Operating Ambient Temperature	Operating Point	Release Point	Package	Packing Form
AMR1320S	1 $\mu$ A	30 Hz	-40 °C to 125 °C	$\pm$ 25 Gs	$\pm$ 20 Gs	SOT23-3	Tape & Reel
Note: Please contact MultiDimension Technology local sales for customizing operating and release points.							

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## 1. Functional Block Diagram

The AMR1320 switch is composed of AMR sensors and signal processing circuits. The AMR sensor detects external magnetic field, generates an analog voltage signal, and outputs a logical switch level after processing by the circuit as shown in Figure 1.

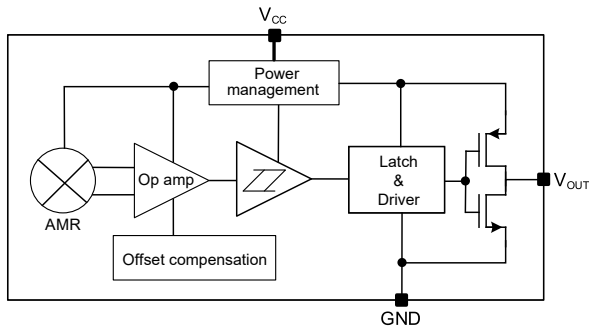


Figure 1. Block diagram

## 2. Switching Characteristics

Figure 2 shows the sensing direction is parallel to the laser mark surface of the package as shown by the arrows in the X-Y plane.

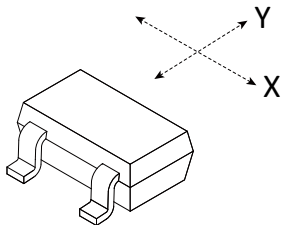


Figure 2. Sensing direction

The output is “High”, when power is on at zero magnetic field.  $B$  is the external magnetic field along the sensing direction,  $B_{OPS}$  ( $B_{OPN}$ ) is the operating point,  $B_{RPS}$  ( $B_{RPN}$ ) is the release point, and hysteresis  $B_H$  is define as the difference between  $B_{OPS}$  and  $B_{RPS}$  ( $B_{OPN}$  and  $B_{RPN}$ ).

The sensor outputs a high level, when the magnetic field along the sensing axis exceed the operating point  $B_{OPS}$  ( $B_{OPN}$ ), and the device outputs a low level, when the magnetic field is reduced below the release point  $B_{RPS}$  ( $B_{RPN}$ ) as shown in Figure 3.

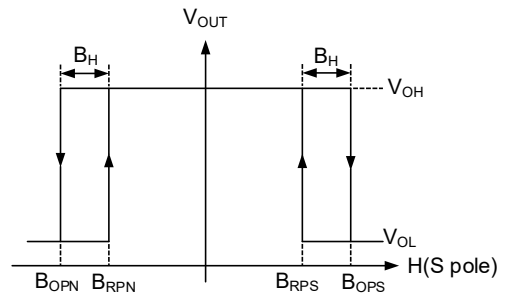


Figure 3. Switching characteristics

## 3. Pin Configuration

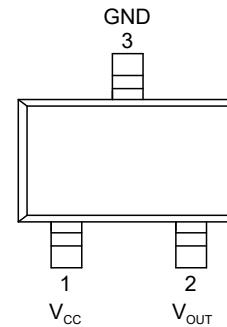


Figure 4. Pin configuration (SOT23-3)

Pin Number	Name	Function
1	$V_{CC}$	Power supply
2	$V_{OUT}$	Output
3	GND	Ground

## 4. Absolute Maximum Ratings

Parameters	Symbol	Min.	Max.	Unit
Supply voltage	$V_{CC}$	-0.3	7	V
Output current	$I_{SINK}, I_{SOURCE}^{1)}$	-	9	mA
Magnetic flux density	B	-	4000	Gs
ESD performance (HBM)	$V_{ESD}$	-	4	kV
Operating ambient temperature	$T_A$	-40	125	°C
Storage ambient temperature	$T_{STG}$	-50	150	°C

1)  $I_{SINK}$  is the current flowing through the pin of switch, when the output is turned on.  $I_{SOURCE}$  is the current flowing through the pin of the switch, when the output is turned off.

## 5. Electrical Specifications

$V_{CC} = 3\text{ V}$ ,  $T_A = 25\text{ °C}$ , a 0.1  $\mu\text{F}$  capacitor is connected between  $V_{CC}$  and GND unless specified otherwise

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage	$V_{CC}$	Operating	1.8	3.0	5.5	V
Output high voltage	$V_{OH}$	RP	$V_{CC} - 0.3$	-	$V_{CC}$	V
Output low voltage	$V_{OL}$	OP	0	-	0.2	V
Supply current	$I_{CC}$	OP/RP	0.1	1.0	2.0	$\mu\text{A}$
Switching frequency	F	-	-	30	-	Hz

## 6. Magnetic Specifications

$V_{CC} = 3\text{ V}$ ,  $T_A = 25\text{ °C}$ , a 0.1  $\mu\text{F}$  capacitor is connected between  $V_{CC}$  and GND unless specified otherwise

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operate point	$B_{OPS}$	14	25	40	Gs
	$B_{OPN}$	-40	-25	-14	Gs
Release point	$B_{RPS}$	9	20	35	Gs
	$B_{RPN}$	-35	-20	-9	Gs
Hysteresis	$B_H$	-	5	-	Gs

## 7. Typical Supply Voltage Characteristics

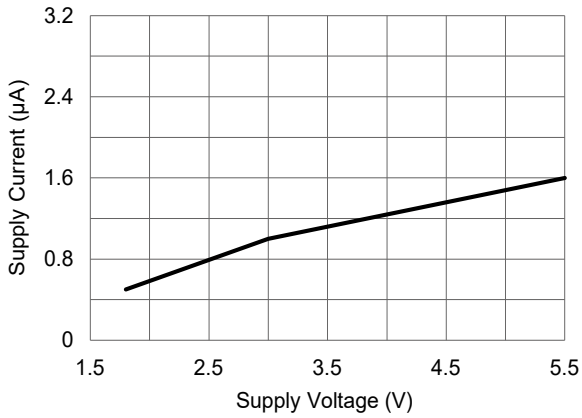


Figure 5. Supply current versus supply voltage ( $T_A=25^\circ\text{C}$ )

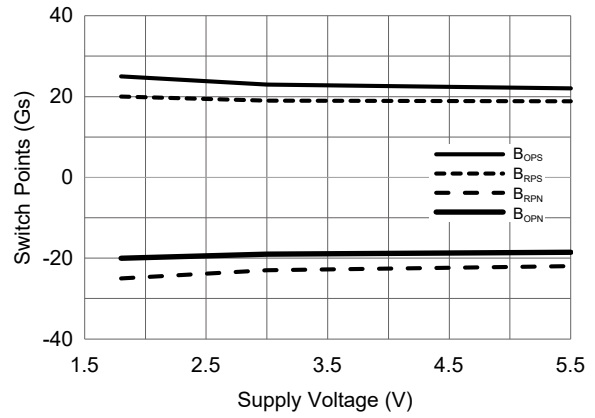


Figure 6. Switch points versus supply voltage ( $T_A=25^\circ\text{C}$ )

## 8. Typical Temperature Characteristics

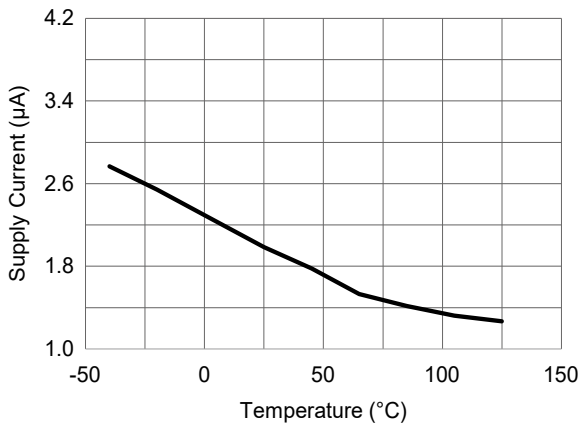


Figure 7. Supply current versus temperature ( $V_{CC} = 3\text{ V}$ )

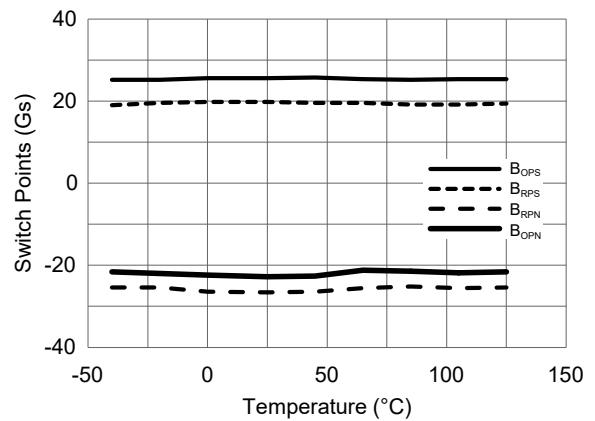


Figure 8. Switch points versus temperature ( $V_{CC} = 3\text{ V}$ )

## 9. Application Information

It is recommended to add a filter capacitor with the typical value of  $0.1\ \mu\text{F}$  between the switch power supply and ground (close to the sensor) to reduce external noise as shown in Figure 9.

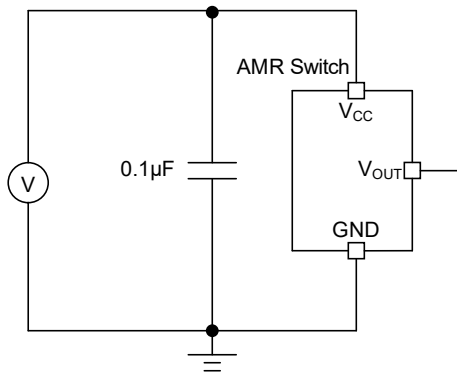


Figure 9. Application circuit diagram

The AMR1320 is not suitable for driving power loads. Figure 10 illustrates the general method of improving the drive capability is utilizing the output voltage of  $V_{\text{OUT}}$  pin as a signal to input the MCU or drive a triode or MOS.

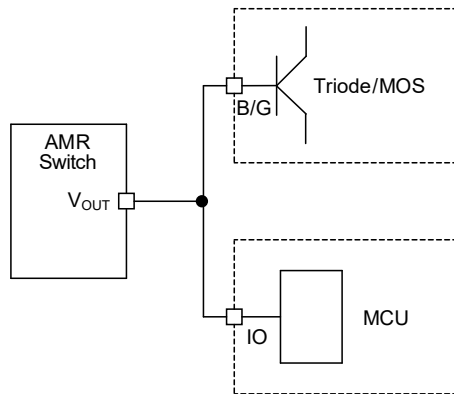


Figure 10. Application diagram for driving power load

Common failure conditions:

- The supply voltage exceeds the limit of absolute maximum ratings
- Absence of matching filter capacitor to power supply when the power supply is unstable, which can cause the product to restart repeatedly
- Using switch output  $V_{\text{OUT}}$  to control high-power relays, etc., and cause  $I_{\text{SINK}}$ ,  $I_{\text{SOURCE}}$  exceeding the limit of absolute maximum ratings
- The external magnetic field exceeds the limit of absolute maximum ratings
- Operating in a humid environment for a long time, causing vapor penetration and increased power consumption
- Overheating when soldering
- Over bending of pins

## 10. Dimensions

### SOT23-3 Package

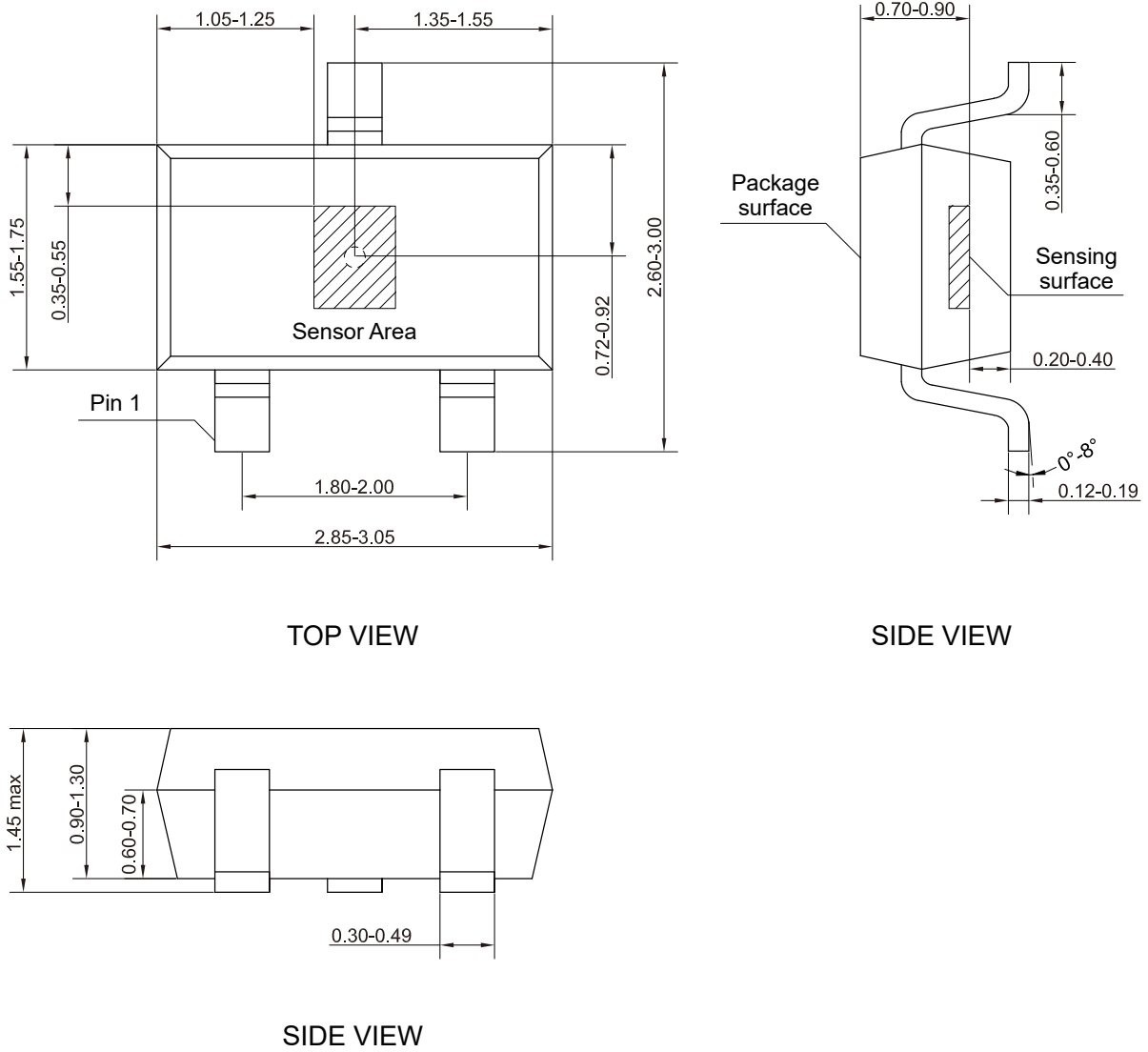


Figure 11. Package outline of SOT23-3 (unit: mm)

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