

AA747

MagnetoResistive Angle Sensor

Data sheet

The AA747 is an angular sensor based on the Anisotropic Magneto Resistive (AMR) effect. The Sensor contains two galvanically separated Wheatstone bridges, at a relative angle of 45° to one another.

A rotating magnetic field in the sensor plane delivers two sinusoidal output signals with the double frequency of the angle α between sensor and magnetic field direction shown in Fig.1. The function of these signals is $+\sin(2\alpha)$ and $+\cos(2\alpha)$.

The AA747 is available as a SO8 package for SMD assembly.



AA747AHA

Product overview

Article description	Package	Delivery Type
AA747AHA-LB	SO8	Tape On Reel

Quick reference guide

Symbol	Parameter	Min.	Typ.	Max.	Unit
Per bridge					
V_{CC}	Supply voltage	-	5	9	V
S	Sensitivity ($\alpha_1 = 0^\circ$; $\alpha_2 = 135^\circ$)	2.1	2.35	2.6	mV/deg
V_{off}	Offset voltage per V_{CC}	-2	-	+2	mV/V
V_{peak}	Signal amplitude per V_{CC}	12	13	14	mV/V
R_B	Bridge resistance	2.7	3.2	3.7	k Ω

Absolute maximum ratings

In accordance with the absolute maximum rating system (IEC60134).

Symbol	Parameter	Min.	Max.	Unit
V_{CC1}	Supply voltage of bridge 1	-9	+9	V
V_{CC2}	Supply voltage of bridge 2	-9	+9	V
T_{amb}	Ambient temperature	-40	+150	°C
t_{FL}	Floor life ($\leq 30^\circ\text{C}$ / 60% RH)	-	1	years
MSL	Moisture sensitivity level	2		

Stresses beyond those listed under "Absolute maximum ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Features

- Based on the Anisotropic Magneto Resistive (AMR) effect
- Contains two independent Wheatstone bridges
- Sine and cosine output
- Temperature range from -40 °C to +150 °C

Advantages

- Non-contacting angle measurement
- Large air gap
- Excellent accuracy, even for weak magnetic field strength
- Position tolerant
- Minimal offset voltage
- Negligible hysteresis

Applications

- Incremental or absolute position measurement (linear and rotary motion)
- Motor commutation
- Rotational speed measurement
- Angle measurement (180° absolute on shaft end)



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Magnetic data

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
H _{ext}	Magnetic field strength ¹⁾		-	25	-	kA/m

1) The stimulating magnetic field in the sensor plane necessary to ensure the minimum error as specified in note 9.

Electrical data

T_{amb} = 25 °C; H_{ext} = 25 kA/m; V_{CC1} = 5 V; V_{CC2} = 5 V; unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Per bridge						
V _{CC}	Supply voltage		-	5	9	V
S	Sensitivity ²⁾	α ₁ = 0°; α ₂ = 135°	2.1	2.35	2.6	mV/deg
TC _S	Temperature coefficient of sensitivity ³⁾	T _{amb} = (-40...+150)°C	-0.31	-0.35	-0.39	%/K
V _{off}	Offset voltage per V _{CC}	See Fig.1	-2	-	+2	mV/V
TC _{Voff}	Temperature coefficient of V _{off} ⁴⁾	T _{amb} = (-40...+150)°C	-2	-	+2	(μV/V)/K
V _{peak}	Signal amplitude per V _{CC} ⁵⁾	See Fig.1	12	13	14	mV/V
TC _{Vpeak}	Temperature coefficient of V _{peak} ⁶⁾	T _{amb} = (-40...+150)°C	-0.31	-0.35	-0.39	%/K
R _B	Bridge resistance ⁷⁾		2.7	3.2	3.7	kΩ
TC _{RB}	Temperature coefficient of R _B ⁸⁾	T _{amb} = (-40...+150)°C	0.38	0.42	0.46	%/K

2) Sensitivity changes with angle due to sinusoidal output.

$$3) \quad TC_S = 100 \cdot \frac{S_{(T_2)} - S_{(T_1)}}{S_{(T_1)} \cdot (T_2 - T_1)} \quad \text{with } T_1 = -40 \text{ °C}; T_2 = +150 \text{ °C}.$$

$$4) \quad TC_{Voff} = \frac{V_{off(T_2)} - V_{off(T_1)}}{T_2 - T_1} \quad \text{with } T_1 = -40 \text{ °C}; T_2 = +150 \text{ °C}.$$

5) Maximal output voltage without offset influences. Periodicity of V_{peak} is sin(2α) and cos(2α).

$$6) \quad TC_{Vpeak} = 100 \cdot \frac{V_{peak(T_2)} - V_{peak(T_1)}}{V_{peak(T_1)} \cdot (T_2 - T_1)} \quad \text{with } T_1 = -40 \text{ °C}; T_2 = +150 \text{ °C}.$$

7) Bridge resistance between pins 8 and 4, 7 and 3, 5 and 1, and 6 and 2.

$$8) \quad TC_{RB} = 100 \cdot \frac{R_{B(T_2)} - R_{B(T_1)}}{R_{B(T_1)} \cdot (T_2 - T_1)} \quad \text{with } T_1 = -40 \text{ °C}; T_2 = +150 \text{ °C}.$$

Accuracy

T_{amb} = 25 °C; H_{ext} = 25 kA/m; V_{CC1} = 5 V; V_{CC2} = 5 V; unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Δα	Angular error ⁹⁾		0	0.05	0.1	deg
k	Amplitude synchronism ¹⁰⁾		-0.5	0	+0.5	% of V _{peak}

9) ΔX = |X_{real} - X_{measured}| without offset influences due to deviations from ideal sinusoidal characteristics.

$$10) \quad k = 100 - 100 \cdot \frac{V_{peak1}}{V_{peak2}}.$$

Dynamic data

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
ω	Angular velocity of the magnetic field		0	-	1	MHz

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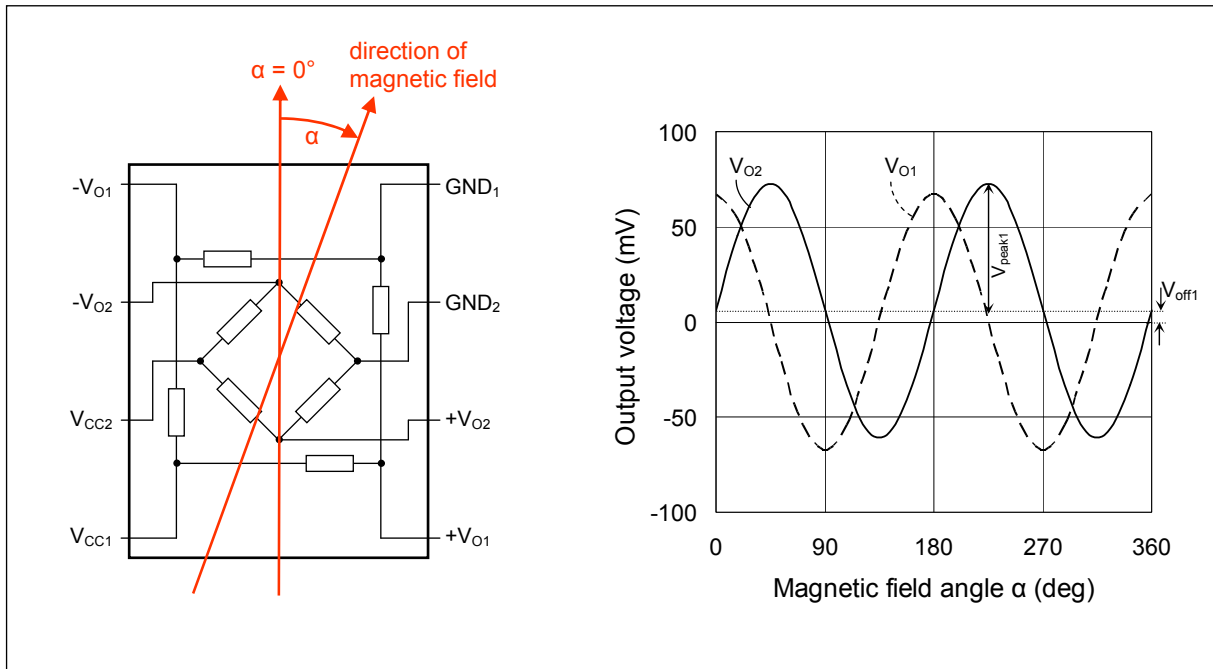


Fig.1: *left*: Simplified circuit diagram with schematic of applied magnetic field.
right: Output signals as a function of the magnetic field angle α .

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AA747 in SO8-housing

Pinning

Pin	Symbol	Parameter
1	-V _{O1}	Output voltage bridge 1
2	-V _{O2}	Output voltage bridge 2
3	V _{CC2}	Supply voltage bridge 2
4	V _{CC1}	Supply voltage bridge 1
5	+V _{O1}	Output voltage bridge 1
6	+V _{O2}	Output voltage bridge 2
7	GND ₂	Ground 2
8	GND ₁	Ground 1

Pin 1 is marked by a point on housing.

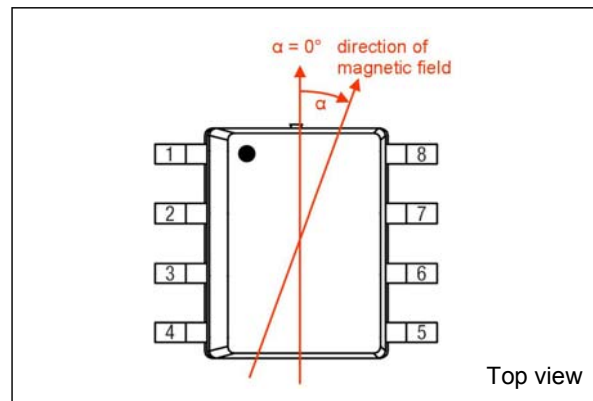


Fig.2: AA747AHA shown with magnetic field direction.

Dimensions

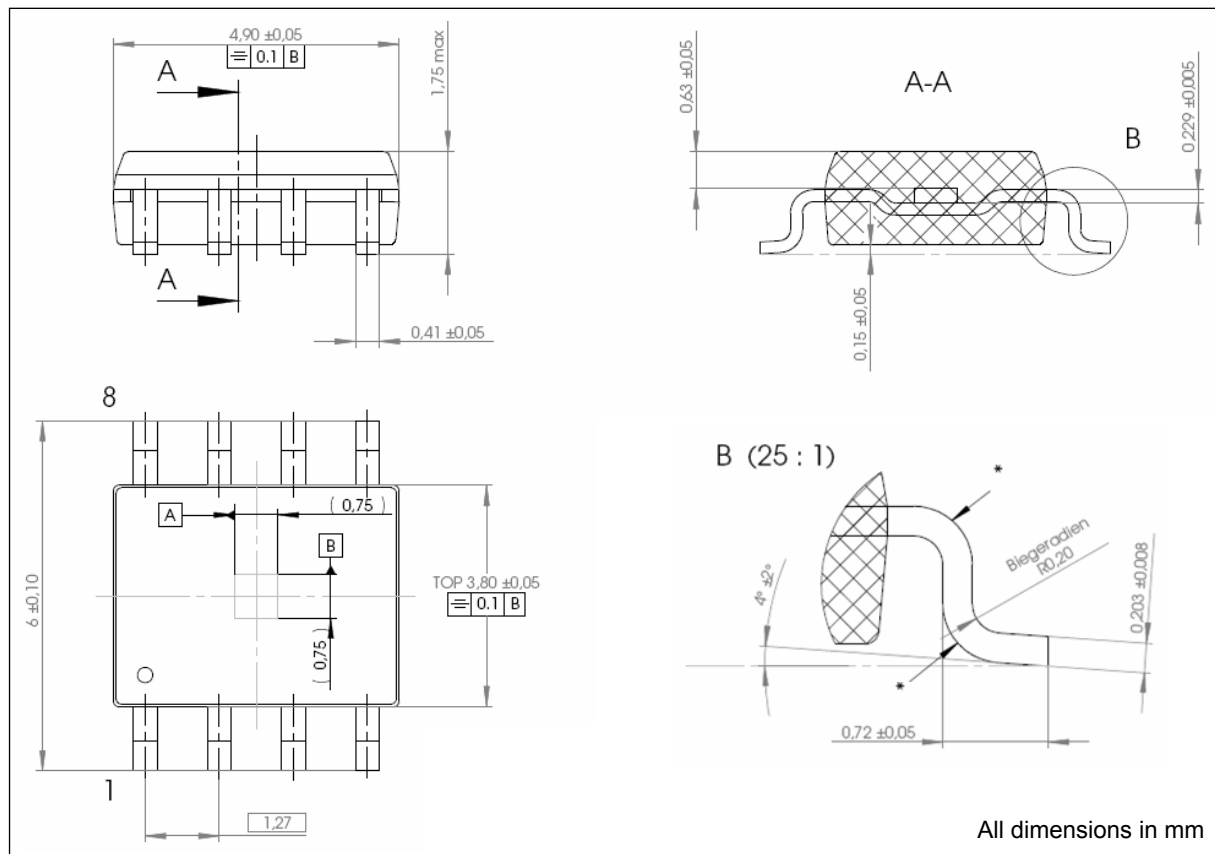


Fig.3: Package outline of SO8-housing.

The moisture sensitivity level of the package is MSL2 according to JEDEC standard J-STD-020D. The allowable time period (floor life) after removal from a moisture barrier bag, dry storage or dry bake and before the solder reflow process is 1 year ($\leq 30\text{ }^{\circ}\text{C}$ / 60% RH).

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General Information

Product Status

The product is in series production. **Note:** The status of the product may have changed since this data sheet was published. The latest information is available on the internet at www.sensitec.com.

Right to make changes

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Life critical applications

These products are not qualified for use in life support applications, aeronautical applications or devices or systems where malfunction of these products can reasonably be expected to result in personal injury.

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MagnetoResistive Sensors

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Solutions for measuring:

- Position
- Angle
- Magnetic field
- Current

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