

# AA747

## MagnetoResistive Angle Sensor

The AA747 is an angular sensor based on the AnisotropicMagnetoResistive (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  $\alpha$  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.

### Product Overview

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

### Quick Reference Guide (per bridge)

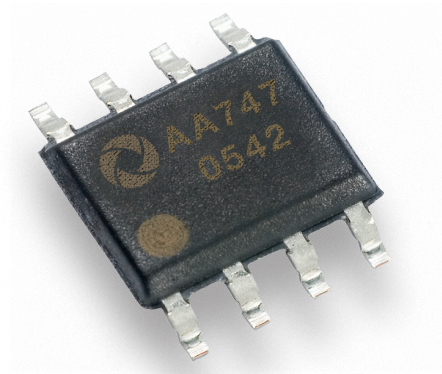
Symbol	Parameter	Min.	Typ.	Max.	Unit
$V_{CC}$	Supply voltage	-	5	9	V
S	Sensitivity ( $\alpha_1 = 0^\circ$ ; $\alpha_2 = 135^\circ$ )	2.1	2.35	2.6	mV/deg
$V_{off}$	Offset voltage per $V_{CC}$	-2	-	+2	mV/V
$V_{peak}$	Signal amplitude per $V_{CC}$	12	13	14	mV/V
$R_B$	Bridge resistance	2.7	3.2	3.7	k $\Omega$

### 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 AnisotropicMagnetoResistive (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)



## Magnetic Data

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$H_{\text{ext}}$	Magnetic field strength <sup>1)</sup>		-	25	-	kA/m

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

## Electrical Data

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
<b>Per bridge</b>						
$V_{\text{CC}}$	Supply voltage		-	5	9	V
S	Sensitivity <sup>2)</sup>	$\alpha_1 = 0^\circ$ ; $\alpha_2 = 135^\circ$	2.1	2.35	2.6	mV/deg
$TC_S$	Temperature coefficient of sensitivity <sup>3)</sup>	$T_{\text{amb}} = (-40...+150)^\circ\text{C}$	-0.31	-0.35	-0.39	%/K
$V_{\text{off}}$	Offset voltage per $V_{\text{CC}}$	See Fig.1	-2	-	+2	mV/V
$TC_{V_{\text{off}}}$	Temperature coefficient of $V_{\text{off}}$ <sup>4)</sup>	$T_{\text{amb}} = (-40...+150)^\circ\text{C}$	-2	-	+2	( $\mu\text{V/V}$ )/K
$V_{\text{peak}}$	Signal amplitude per $V_{\text{CC}}$ <sup>5)</sup>	See Fig.1	12	13	14	mV/V
$TC_{V_{\text{peak}}}$	Temperature coefficient of $V_{\text{peak}}$ <sup>6)</sup>	$T_{\text{amb}} = (-40...+150)^\circ\text{C}$	-0.31	-0.35	-0.39	%/K
$R_B$	Bridge resistance <sup>7)</sup>		2.7	3.2	3.7	k $\Omega$
$TC_{R_B}$	Temperature coefficient of $R_B$ <sup>8)</sup>	$T_{\text{amb}} = (-40...+150)^\circ\text{C}$	0.38	0.42	0.46	%/K

<sup>2)</sup> Sensitivity changes with angle due to sinusoidal output.

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

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

<sup>5)</sup> Maximal output voltage without offset influences. Periodicity of  $V_{\text{peak}}$  is  $\sin(2\alpha)$  and  $\cos(2\alpha)$ .

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

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

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

## Accuracy

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$\Delta\alpha$	Angular error <sup>9)</sup>		0	0.05	0.1	deg
k	Amplitude synchronism <sup>10)</sup>		-0.5	0	+0.5	% of $V_{\text{peak}}$

<sup>9)</sup>  $\Delta\alpha = |x_{\text{real}} - x_{\text{measured}}|$  without offset influences due to deviations from ideal sinusoidal characteristics.

$$\supset k = 100 - 100 \cdot \frac{V_{\text{peak1}}}{V_{\text{peak2}}}.$$

## Dynamic Data

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

## General Data

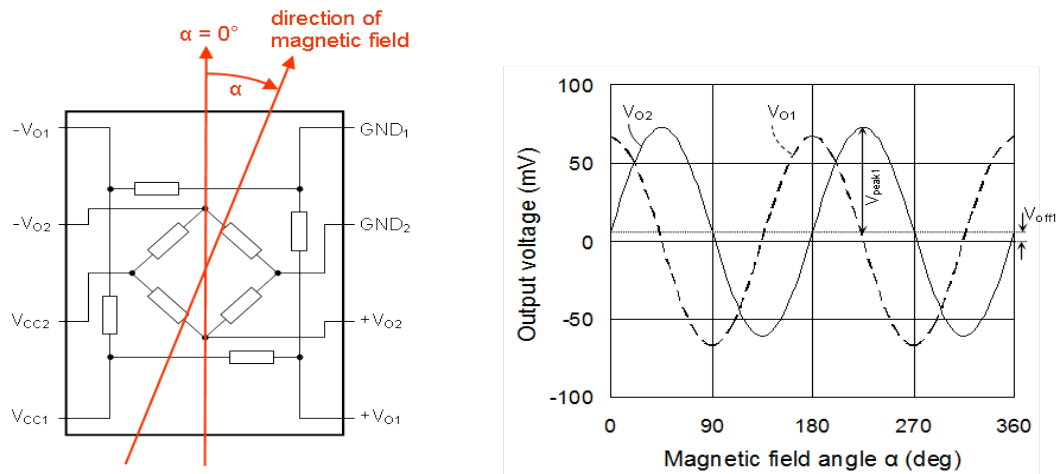


Fig. 1: *left*: Simplified circuit diagram with schematic of applied magnetic field.  
*right*: Output signals as a function of the magnetic field angle  $\alpha$ .



## General Information

### Product Status

Article	Status
AA747AHA-LB	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 <a href="http://www.sensitec.com">www.sensitec.com</a> .

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## General Information

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## Changelist

Version	Description of the Change	Date
AA747.DSE.10	New Figure 3 on page 4	06/2023
AA747.DSE.09	Disclaimer supplement	06/2022
AA747.DSE.08	Change of corporate design (pp. 1-6)	01/2022
AA747.DSE.00	Original (pp. 1-6)	10/2007

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