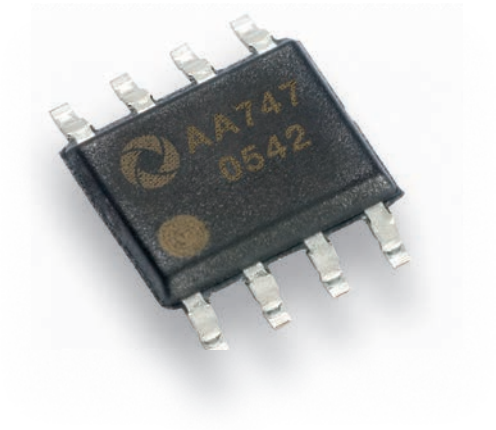
SENSITEC
KÖRBER SOLUTIONS

DATA SHEET

# 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

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| **Per bridge** | | | | | |
| $V_{CC}$ | Supply voltage | - | 5 | 9 | V |
| S | Sensitivity ($\alpha1$ = 0°; $\alpha2$ = 135°) | 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 | kΩ |

### 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 (≤30 °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)

ESD

RoHS-Compliant www.sensitec.com

## 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] | $\alpha_1$ = 0°; $\alpha_2$ = 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 |
| $TCV_{off}$ | Temperature coefficient of $V_{off}$ [4] | $T_{amb}$ = (-40...+150)°C | -2 | - | +2 | (µV/V)/K |
| $Vp_{eak}$ | Signal amplitude per $V_{CC}$ [5] | See Fig.1 | 12 | 13 | 14 | mV/V |
| $TCV_{peak}$ | 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 | ΩW |
| $TC_{RB}$ | 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] $TC_S = 100 \cdot \frac{S_{(T2)} - S_{(T1)}}{S_{(T1)} \cdot (T_2 - T_1)}$ with $T_1$ = -40 °C; $T_2$ = +150 °C.

[4] $TC_{Voff} = \frac{V_{off(T2)} - V_{off(T1)}}{(T_2 - T_1)}$ with $T_1$ = -40 °C; $T_2$ = +150 °C.

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

[6] $TC_{Vpeak} = 100 \cdot \frac{V_{peak(T2)} - V_{peak(T1)}}{V_{peak(T1)} \cdot (T_2 - T_1)}$ with $T_1$ = -40 °C; $T_2$ = +150 °C.

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

[8] $TC_{RB} = 100 \cdot \frac{R_{B(T2)} - R_{B(T1)}}{R_{B(T1)} \cdot (T_2 - T_1)}$ with $T_1$ = -40 °C; $T_2$ = +150 °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] $\Delta x = |x_{real} - x_{measured}|$ without offset influences due to deviations from ideal sinusoidal characteristics.

[10] $k = 100 - 100 \cdot \frac{V_{peak1}}{V_{peak2}}$ .

## Dynamic Data

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

## General Data

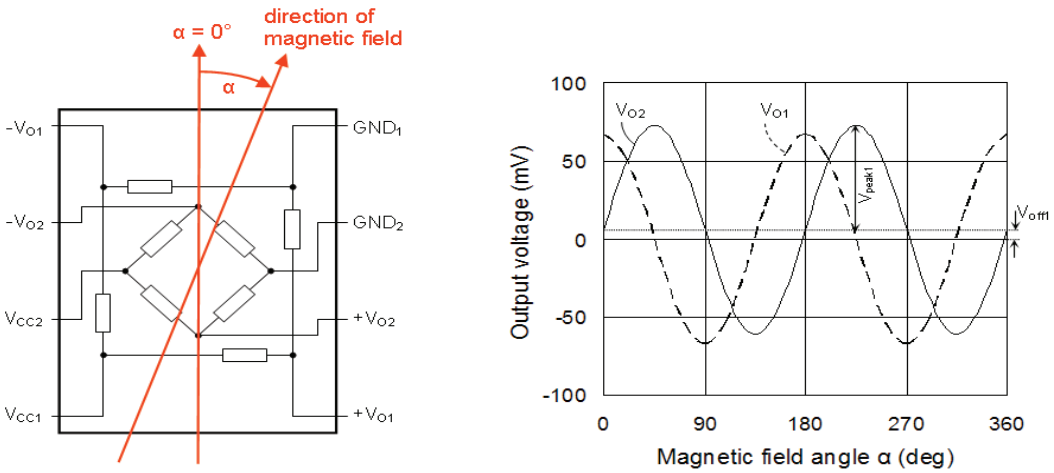



Fig. 1: *left:* Simplified circuit diagram with schematic of applied magnetic field.
*right:* Output signals as a function of the magnetic field angle α.

## AA747 in SO8-housing

### Pinning

| Symbol | Parameter | Conditions |
|---|---|---|
| 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.

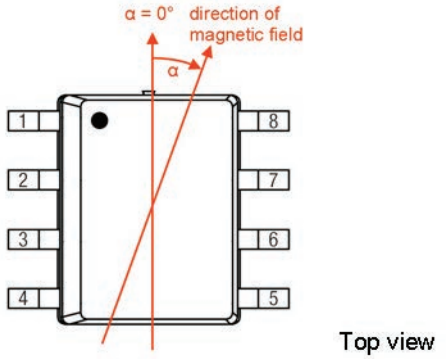



Fig.2: AA747AHA shown with magnetic field direction.

### Dimensions

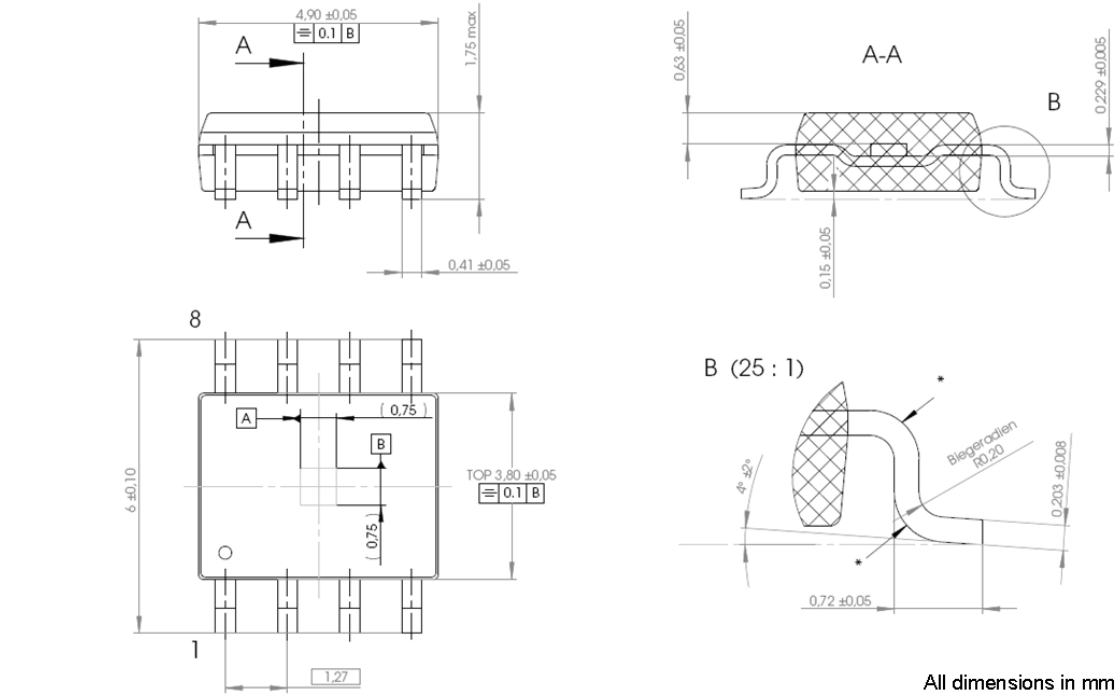



Fig.3: Package outline of SO8-housing.

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 (≤30 °C / 60% RH).

## 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 www.sensitec.com. |

### Disclaimer

Sensitec GmbH reserves the right to make changes, without notice, in the products, including software, described or contained herein in order to improve design and/or performance. Information in this document is believed to be accurate and reliable. However, Sensitec GmbH does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. Sensitec GmbH takes no responsibility for the content in this document if provided by an information source outside of Sensitec products.

In no event shall Sensitec GmbH be liable for any indirect, incidental, punitive, special or consequential damages (including but not limited to lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) irrespective the legal base the claims are based on, including but not limited to tort (including negligence), warranty, breach of contract, equity or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, Sensitec product aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the General Terms and Conditions of Sale of Sensitec GmbH. Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Unless otherwise agreed upon in an individual agreement Sensitec products sold are subject to the General Terms and Conditions of Sales as published at www.sensitec.com.

## General Information

### Application Information

Applications that are described herein for any of these products are for illustrative purposes only. Sensitec GmbH makes no representation or warranty – whether expressed or implied – that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using Sensitec products, and Sensitec GmbH accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the Sensitec product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

Sensitec GmbH does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using Sensitec products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s).

Sensitec does not accept any liability in this respect

### Life Critical Applications

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



**Sensitec GmbH**
Georg-Ohm-Str. 11 · 35633 Lahnau · Germany
Tel. +49 6441 9788-0 · Fax +49 6441 9788-17
www.sensitec.com · sensitec@sensitec.com

KÖRBER