

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 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.

Product Overview

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

Quick Reference Guide (per bridge)

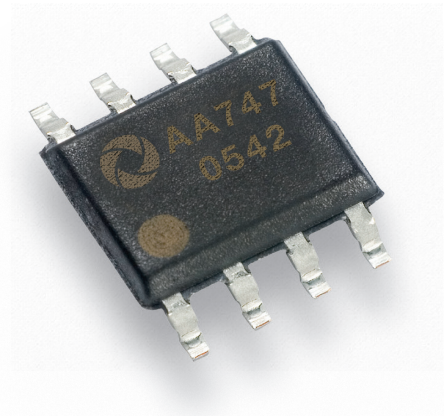
| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|------------|---|------|------|------|------------|
| V_{CC} | Supply voltage | - | 5 | 9 | V |
| S | Sensitivity ($\alpha_1 = 0^\circ$; $\alpha_2 = 135^\circ$) | 2.1 | 2.35 | 2.6 | mV/deg |
| V_{off} | Offset voltage per V_{CC} | -2 | - | +2 | mV/V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



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.

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

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

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

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

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

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

Accuracy

T_{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} |

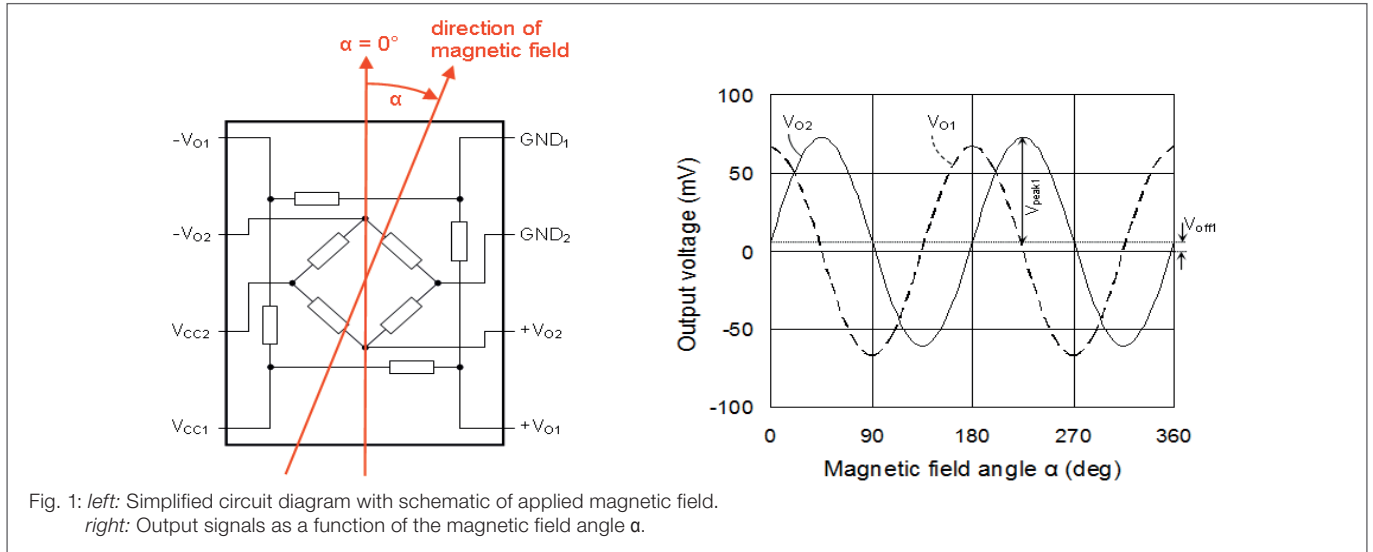
⁹⁾ ΔX = |x_{real} - x_{measured}| without offset influences due to deviations from ideal sinusoidal characteristics.

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

Dynamic Data

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

General Data

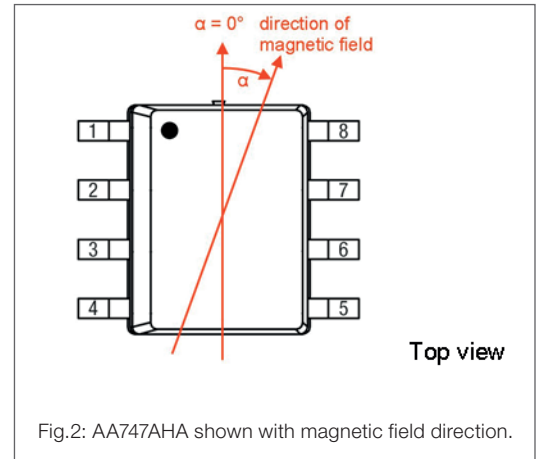


AA747 in SO8-housing

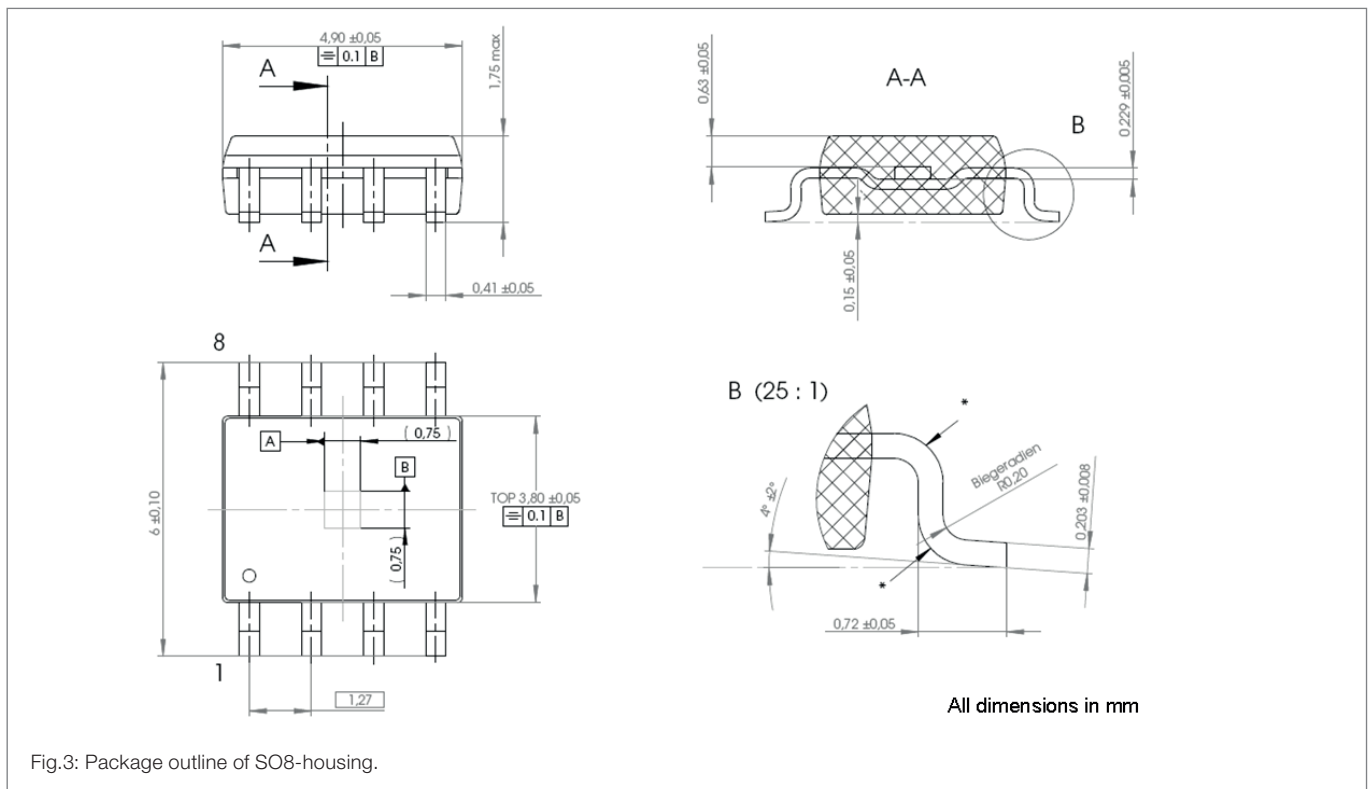
Pinning

| 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.



Dimensions



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 ($\leq 30\text{ °C} / 60\% \text{ RH}$).

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 . |

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Changelist

| Version | Description of the Change | Date |
|--------------|--------------------------------------|---------|
| 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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