

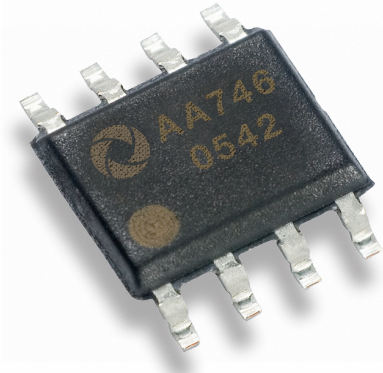
AA746B

MagnetoResistive FreePitch Sensor

The AA746 is an angle sensor based on the Anisotropic MagnetoResistive (AMR) effect. The sensor contains two Wheatstone bridges with common ground (GND) and supply pin (V_{CC}). They are shifted 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 AA746 is optimized for a low magnetic field strength down to 5 kA/m.



Product Overview

Article description	Package	Delivery Type
AA746BHA-AE	SO8	Tape and Reel (4000)

Quick Reference Guide

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{CC}	Supply voltage	-	5.0	-	V
V_{off}	Offset voltage per V_{CC}	-2.0	-	+2.0	mV/V
V_{peak}	Signal amplitude per V_{CC}	12.0	13.0	14.0	mV/V
R_s	Sensor resistance	0.45	0.60	0.75	k Ω

Absolute Maximum Ratings

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

Symbol	Parameter	Min.	Max.	Unit
V_{CC}	Supply voltage	-9.0	+9.0	V
T_{amb}	Ambient temperature	-40	+125	$^\circ\text{C}$

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 MagnetoResistive (AMR) effect
- Contains two Wheatstone bridges
- Sine and cosine output
- Temperature range from -40°C to $+125^\circ\text{C}$

Advantages

- Non-contacting angle measurement
- Large air gap
- Excellent accuracy
- 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⁾		5.0	-	-	kA/m

¹⁾ The stimulating magnetic field in the sensor plane necessary to ensure the minimum error as specified in note 8.

Electrical Data

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{CC}	Supply voltage		-	5.0	-	V
V_{off}	Offset voltage per V_{CC}	See Fig. 1	-2.0	-	+2.0	mV/V
$TC_{V_{\text{off}}}$	Temperature coefficient of V_{off} ²⁾	$T_{\text{amb}} = (-40\dots+125)\text{ °C}$	-2.0	-	+2.0	($\mu\text{V/V}$)/K
V_{peak}	Signal amplitude per V_{CC} ³⁾	See Fig. 1	12.0	13.0	14.0	mV/V
$TC_{V_{\text{peak}}}$	Temperature coefficient of V_{peak} ⁴⁾	$T_{\text{amb}} = (-40\dots+125)\text{ °C}$	-0.36	-0.42	-0.48	%/K
R_{S}	Sensor resistance ⁵⁾		0.45	0.60	0.75	k Ω
R_{B}	Bridge resistance ⁶⁾		0.9	1.2	1.5	k Ω
$TC_{R_{\text{B}}}$	Temperature coefficient of R_{B} ⁷⁾	$T_{\text{amb}} = (-40\dots+125)\text{ °C}$	0.24	0.28	0.32	%/K

$$^2) TC_{V_{\text{off}}} = \frac{V_{\text{off}(T_2)} - V_{\text{off}(T_1)}}{T_2 - T_1} \text{ with } T_1 = +25\text{ °C}; T_2 = +125\text{ °C}.$$

³⁾ Maximal output voltage without offset influences. Periodicity of V_{peak} is $\sin(2\alpha)$ and $\cos(2\alpha)$.

$$^4) TC_{V_{\text{peak}}} = 100 \cdot \frac{V_{\text{peak}(T_2)} - V_{\text{peak}(T_1)}}{V_{\text{peak}(T_1)} \cdot (T_2 - T_1)} \text{ with } T_1 = +25\text{ °C}; T_2 = +125\text{ °C}.$$

⁵⁾ Sensor resistance between pads 1 / 2, 3 / 4.

⁶⁾ Bridge resistance between pads 5 and 6, 7 and 8.

$$^7) TC_{R_{\text{B}}} = 100 \cdot \frac{R_{\text{B}(T_2)} - R_{\text{B}(T_1)}}{R_{\text{B}(T_1)} \cdot (T_2 - T_1)} \text{ with } T_1 = +25\text{ °C}; T_2 = +125\text{ °C}.$$

Accuracy

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$\Delta\alpha$	Angular error ⁸⁾		-	± 0.25	± 0.5	deg
k	Amplitude synchronism ⁹⁾		-0.5	0	+0.5	% of V_{peak}

⁸⁾ $\Delta\alpha = |x_{\text{real}} - x_{\text{measured}}|$ without offset influences due to deviations from ideal sinusoidal characteristics.

$$^9) k = 100 - 100 \cdot \frac{V_{\text{peak1}}}{V_{\text{peak2}}}.$$

Dynamic Data

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
ω	Angular velocity of the magnetic field ¹⁰⁾		1	-	-	MHz

¹⁰⁾ No significant amplitude attenuation.

General Data

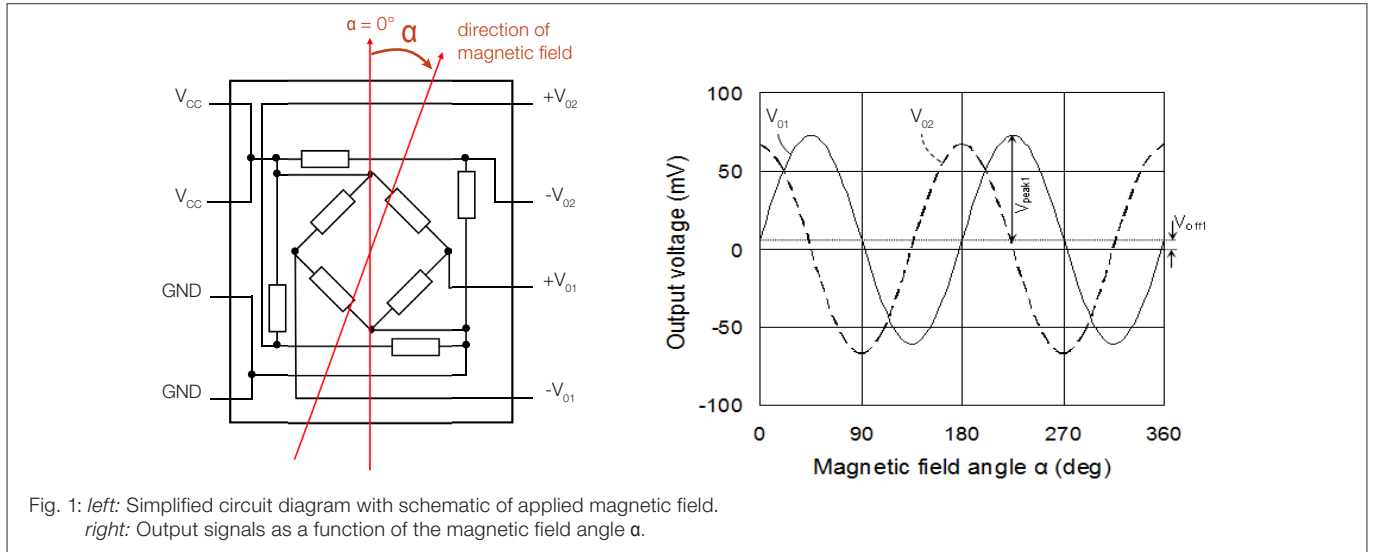


Fig. 1: *left*: Simplified circuit diagram with schematic of applied magnetic field. *right*: Output signals as a function of the magnetic field angle α .

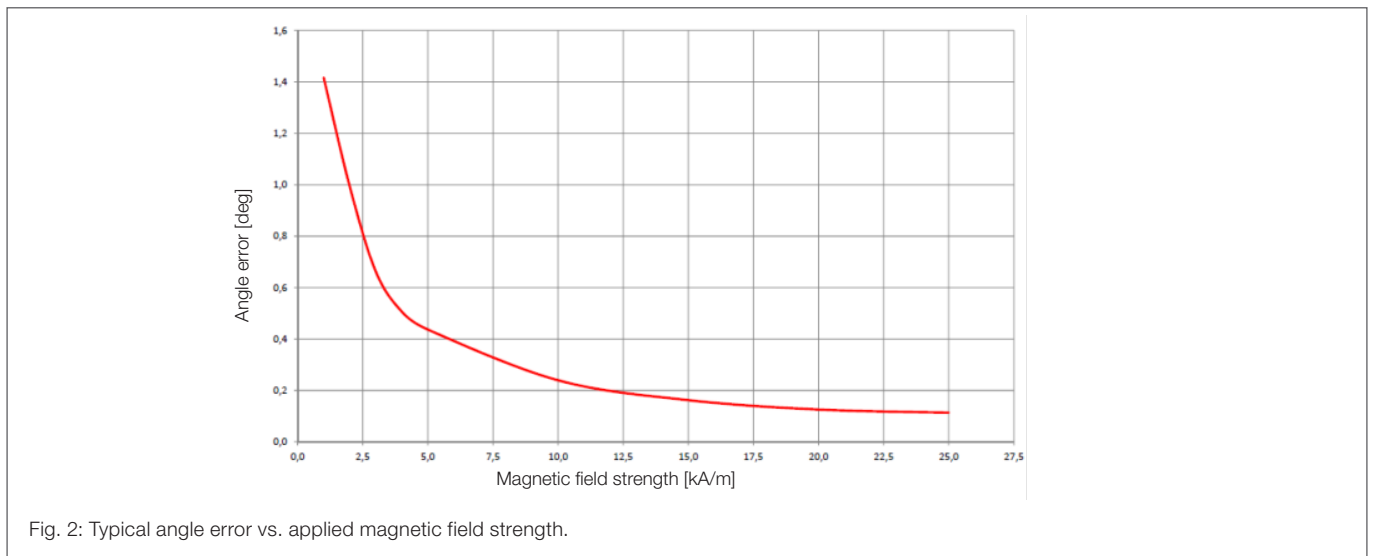


Fig. 2: Typical angle error vs. applied magnetic field strength.

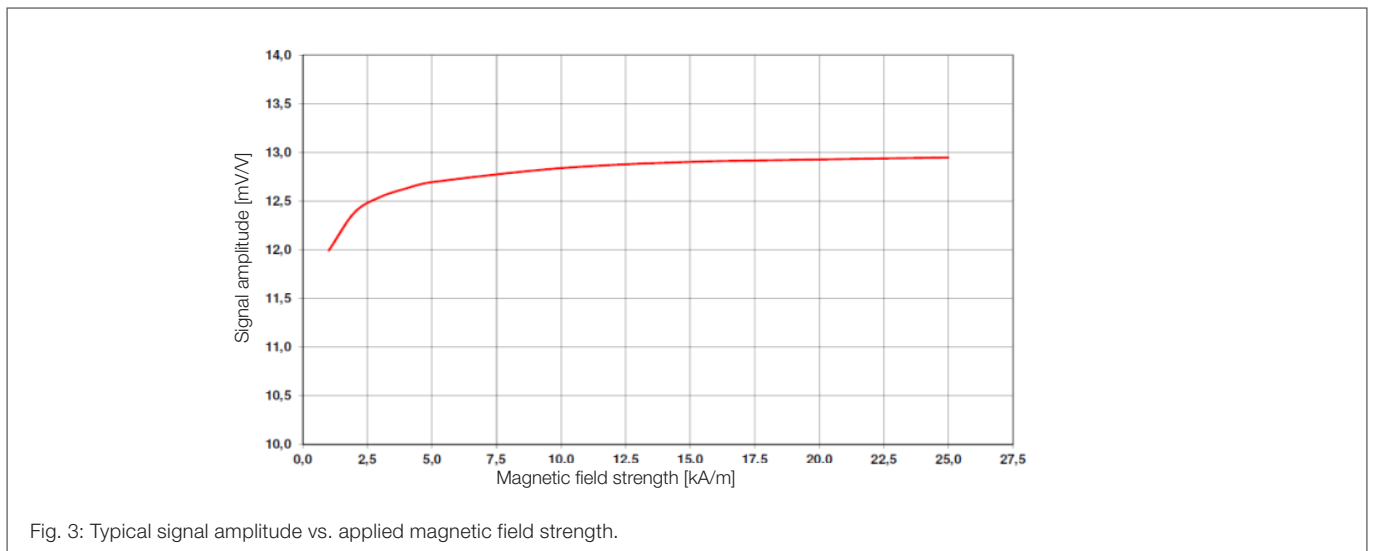


Fig. 3: Typical signal amplitude vs. applied magnetic field strength.

AA746 in SO8-housing

Pinning

Pin	Symbol	Parameter
1	V_{CC}	Supply voltage ¹⁾
2	V_{CC}	Supply voltage ¹⁾
3	GND	Ground ²⁾
4	GND	Ground ²⁾
5	$-V_{O1}$	Output voltage bridge 1
6	$+V_{O1}$	Output voltage bridge 1
7	$-V_{O2}$	Output voltage bridge 2
8	$+V_{O2}$	Output voltage bridge 2

¹⁾ Pin 1 and 2 are internally connected.

²⁾ Pin 3 and 4 are internally connected.

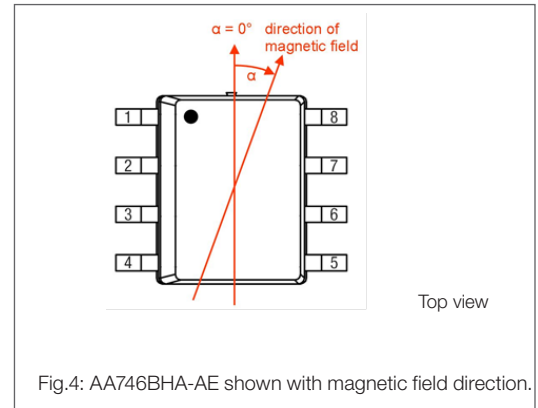


Fig.4: AA746BHA-AE shown with magnetic field direction.

Dimensions

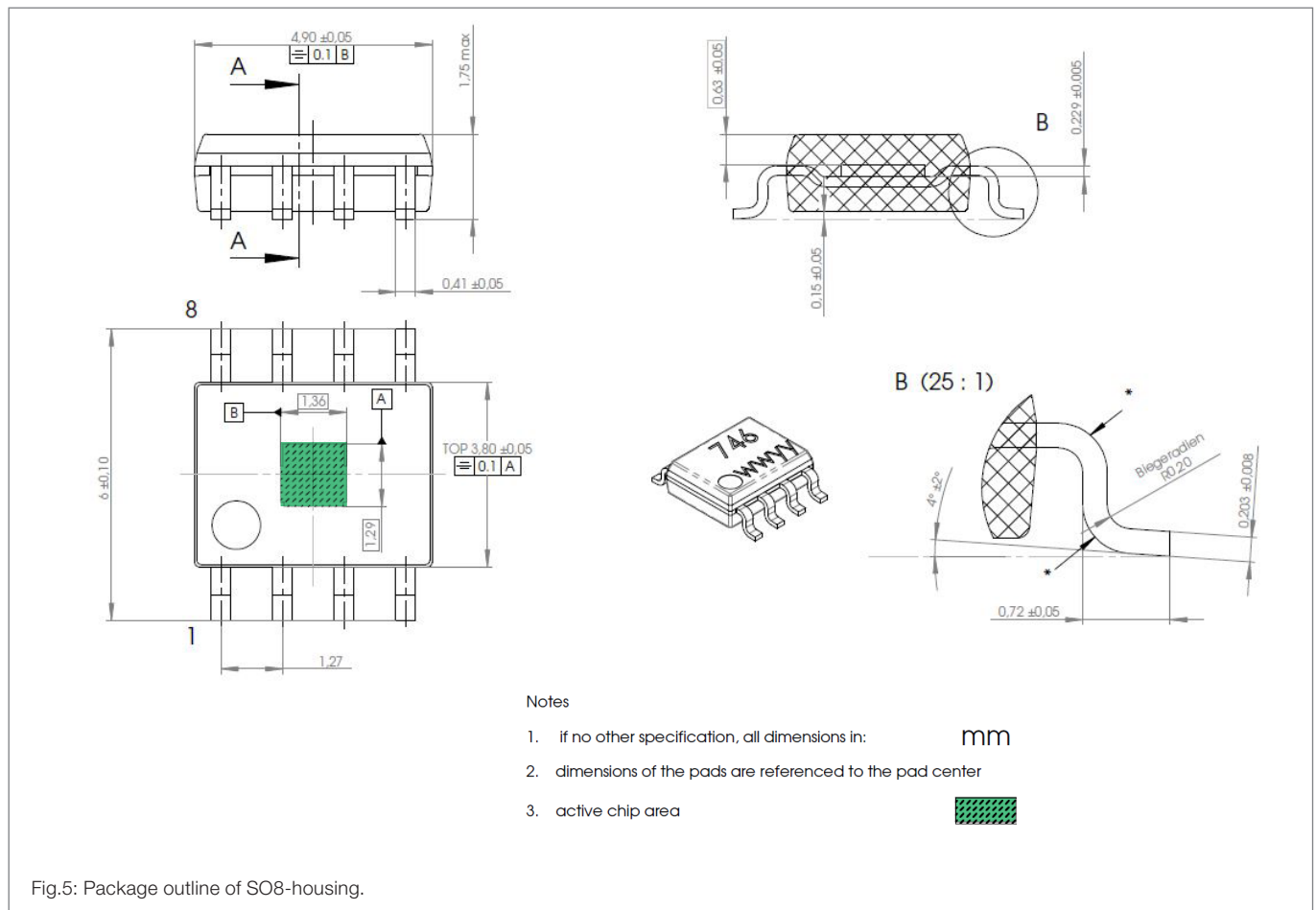


Fig.5: Package outline of SO8-housing.

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

General Information

Product Status

Article	Status
AA746BHA-AE	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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General Information

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Changelist

Version	Description of the Change	Date
AA746B.DSE.05	Change of footnotes	07/2023
AA746B.DSE.04	Disclaimer supplement	06/2022
AA746B.DSE.03	Change of corporate design (pp. 1-6)	01/2022
AA745B.DSE.00	Original (pp. 1-8)	12/2017

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