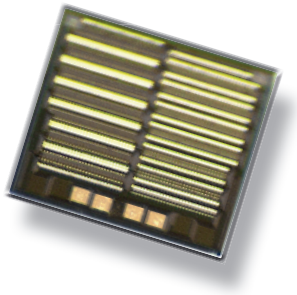
SENSITEC
MAGNETORESISTIVE SENSORS

AA746

MagnetoResistive FreePitch Sensor



The AA746 is an angular 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(2α) and cos(2α).

The AA746 is optimized for a low magnetic field strength down to 5 kA/m.

The bond version of AA746 is available as bare die on wafer or waffle pack. For SMD processing, the sensor is available in a LGA-package.

Product Overview

Article description	Package	Delivery Type
AA746ACA-AB	Die on wafer [1]	Waferbox
AA746ACA-AC	Bare die	Waffle pack (324)
AA746AMA-AE	LGA6L	Tape and Reel (2500)

[1] Minimum order quantities apply.

Quick Reference Guide

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{CC}	Supply voltage	-	5.0	-	V
V_{off}	Offset voltage per V_{CC}	-0.5	-	+0.5	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	kΩ

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	°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 °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

RoHS-Konform 2002/95/EG

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 7.

Electrical Data

T_{amb} = 25 °C; H_{ext} = 25 kA/m; V_{CC} = 5 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	-0.5	-	+0.5	mV/V
TC_{Voff}	Temperature coefficient of V_{off} [2]	T_{amb} = (-40...+125)°C	-2.0	-	+2.0	(µV/V)/K
V_{peak}	Signal amplitude per V_{CC} [3]	See Fig. 1	12.0	13.0	14.0	mV/V
TC_{Vpeak}	Temperature coefficient of V_{peak} [4]	T_{amb} = (-40...+125)°C	-0.36	-0.42	-0.48	%/K
R_S	Sensor resistance [5]		0.45	0.60	0.75	kΩ
R_B	Bridge resistance [6]		0.9	1.2	1.5	kΩ
TC_{RB}	Temperature coefficient of R_B [7]	T_{amb} = (-40...+125)°C	0.24	0.28	0.32	%/K

[2] $TC_{Voff} = \frac{V_{off(T2)} - V_{off(T1)}}{T_2 - T_1}$ with T_1 = +25 °C; T_2 = +125 °C.

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

[4] $TC_{Vpeak} = 100 \cdot \frac{V_{peak(T2)} - V_{peak(T1)}}{V_{peak(T1)} \cdot (T_2 - T_1)}$ with T_1 = +25 °C; T_2 = +125 °C.

[5] Sensor resistance between pads 1 and 2 (bare die); pads 3 and 4 (LGA6L).

[6] Bridge resistance between pads 3 and 4, 5 and 6 (bare die); pads 1 and 5, 2 and 6 (LGA6L).

[7] $TC_{RB} = 100 \cdot \frac{R_{B(T2)} - R_{B(T1)}}{R_{B(T1)} \cdot (T_2 - T_1)}$ with T_1 = +25 °C; T_2 = +125 °C.

Accuracy

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Δα	Angular error [8]		-	±0.25	±0.5	deg
k	Amplitude synchronism [9]		-0.5	0	+0.5	% of V_{peak}

[8] $\Delta_\alpha = |\alpha_{real} - \alpha_{measured}|$ without offset influences due to deviations from ideal sinusoidal characteristics.

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

Dynamic Data

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

[10] No significant amplitude attenuation.

General Data

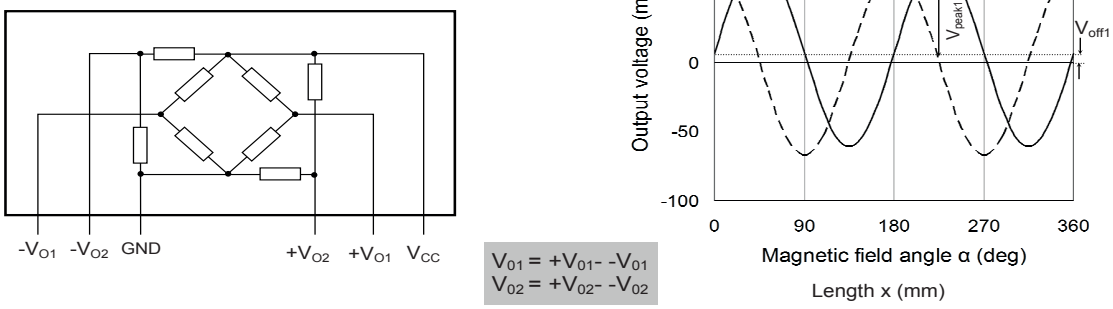


Fig. 1: *left:* Simplified circuit diagram with schematic of applied magnetic field.
right: Output signals as a function of the magnetic field angle α (see page 4/5).

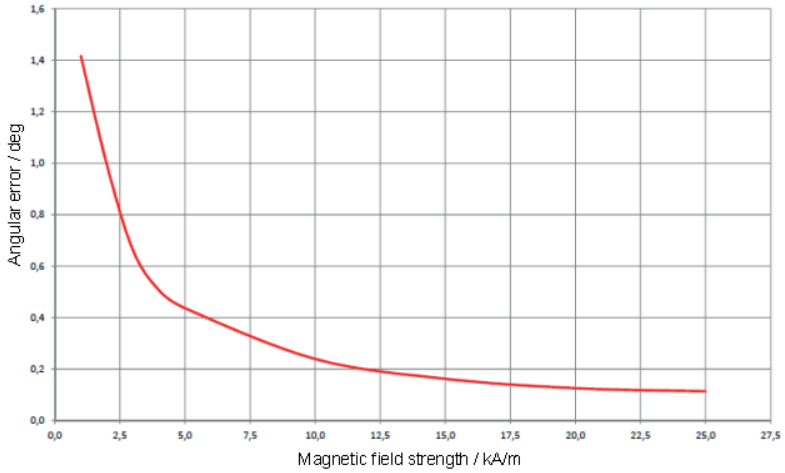


Fig. 2: Typical angular error vs. applied magnetic field strength.

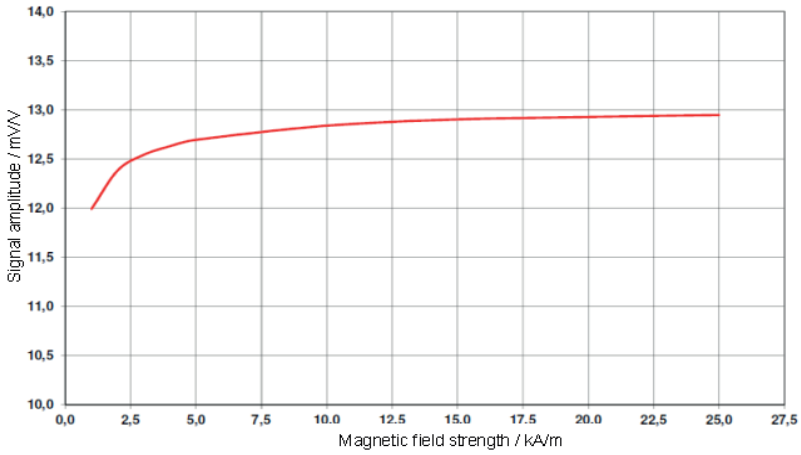


Fig. 3: Typical signal amplitude vs. applied magnetic field strength.

AA746ACA as Bare Die

Pinning

Pin	Symbol	Parameter
1	V_{CC}	Supply voltage
2	GND	Ground
3	$+V_{O2}$	Positive output voltage bridge 2
4	$-V_{O2}$	Negative output voltage bridge 2
5	$+V_{O1}$	Positive output voltage bridge 1
6	$-V_{O1}$	Negative output voltage bridge 1

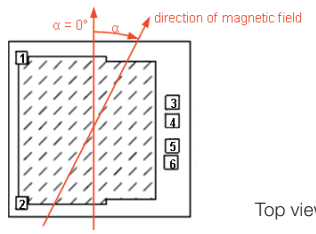
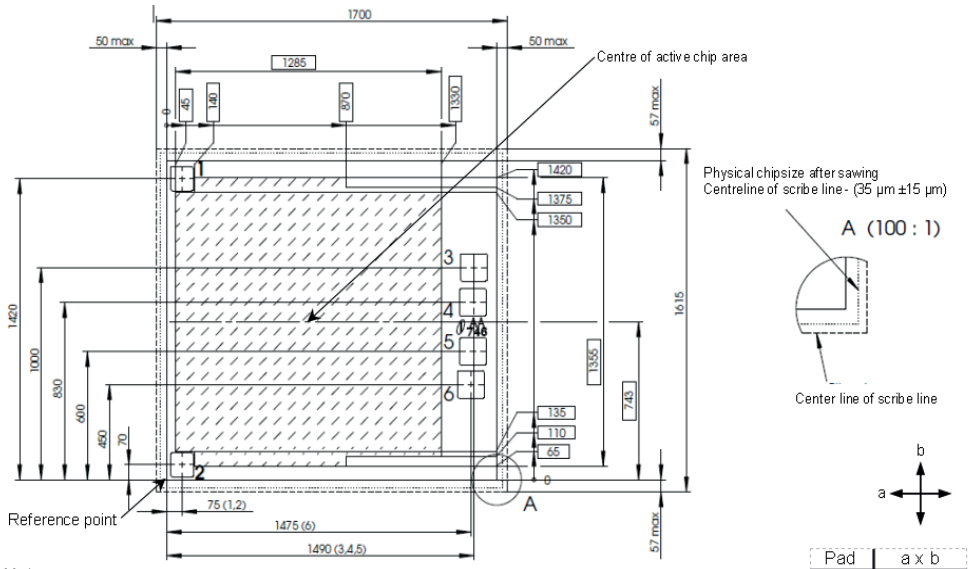


Fig. 4: AA746ACA shown with magnetic field direction.

Dimensions



Pad	a x b
1	110 x 115
2	110 x 115
3	130 x 130
4	130 x 130
5	130 x 130
6	130 x 130

Notes:
- All dimensions in µm.
- Pad dimensioning correlates to pad centre.
- The dashed outline represents the dicing line. ----------
- The shaded area denotes the active chip area. This area must not be touched during handling or assembly since this may cause damage to the chip. Using a die collet for handling is recommended.

Fig. 5: Chip outline of bare die.

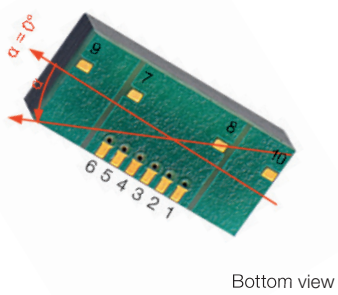
Data for Packaging and Interconnection Technologies

Parameter	Value	Unit
Chip area	1.7 x 1.6	mm
Chip thickness	525 ± 10	µm
Pad diameter (all)	See Fig. 5	µm
Pad thickness	0.8	µm
Pad material	AlCu	-

AA746AMA in LGA6L Housing

Pinning

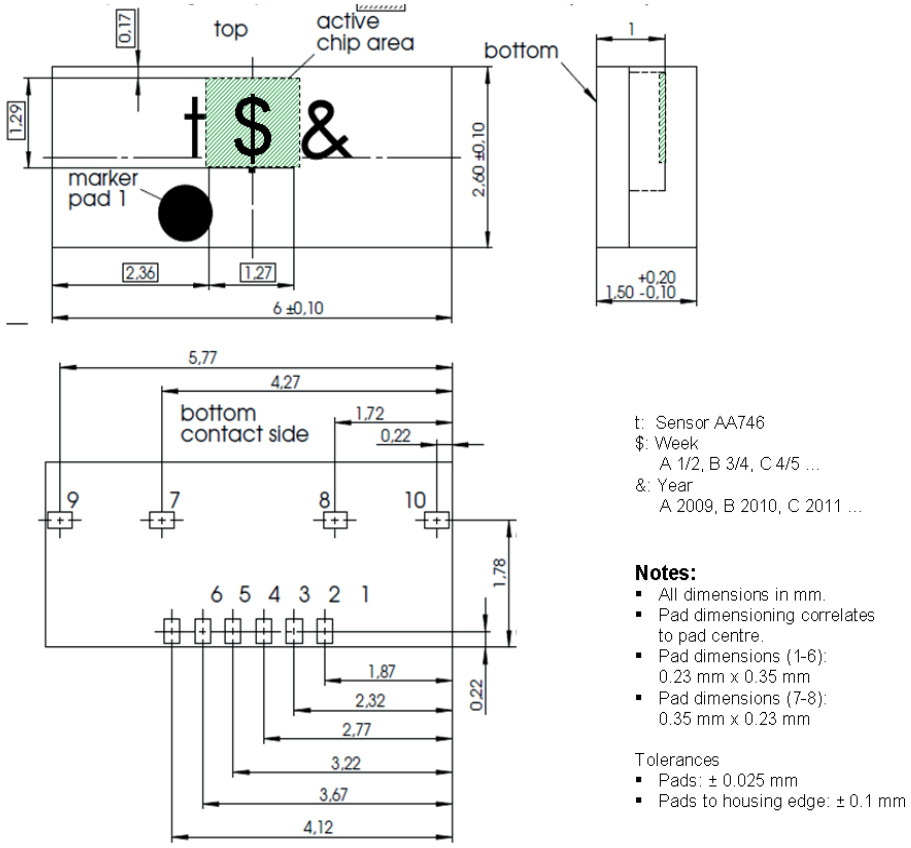
Pin	Symbol	Parameter
1	$+V_{O1}$	Positive output voltage bridge 1
2	$+V_{O2}$	Positive output voltage bridge 2
3	GND	Ground
4	V_{CC}	Supply voltage
5	$-V_{O1}$	Negative output voltage bridge 1
6	$-V_{O2}$	Negative output voltage bridge 2
7	n.c.	Not connected
8	n.c.	Not connected
9	n.c.	Not connected
10	n.c.	Not connected



Bottom view

Fig. 6: AA746AMA.

Dimensions



t: Sensor AA746
$: Week
A 1/2, B 3/4, C 4/5 ...
&: Year
A 2009, B 2010, C 2011 ...

Notes:
- All dimensions in mm.
- Pad dimensioning correlates to pad centre.
- Pad dimensions (1-6): 0.23 mm x 0.35 mm
- Pad dimensions (7-8): 0.35 mm x 0.23 mm

Tolerances
- Pads: ± 0.025 mm
- Pads to housing edge: ± 0.1 mm

Fig. 7: Package outline of LGA6L.

General Information

Product Status

Article	Status
AA746ACA-AB	The product is in series production.
AA746ACA-AC	The product is in series production.
AA746AMA-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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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.

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Changelist

Version	Description of the Change	Date
AA746A.DSE.07	Change of corporate design (pp. 1-7)	01/2022
AA746A.DSE.00	Original (pp. 1-7)	10/2012

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