

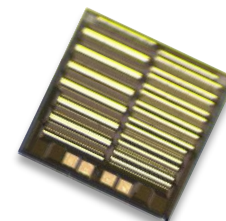
AA746

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



Product Overview

Article	Package	Delivery type
AA746ACA-AB ¹	Die on wafer	Waferbox
AA746ACA-AC	Bare die	Waffle pack (324)
AA746AMA-AE	LGA6L	Tape on reel (2000)
AA746 Evalboard	Evalboard	ESD-Box

Quick Reference Guide

Symbol	Parameter	Min.	Typ.	Max.	Unit
V _{CC}	Operating voltage (per bridge)	-	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 according 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

Stress 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.

¹ Minimum order quantities apply.

Features

- Based on the Anisotropic MagnetoResistive (AMR) effect
- Contains two resistance Wheatstone bridges
- Sine and cosine output
- Ambient 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)



Magnetic Data

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
H_{ext}^2	Magnetic field strength		5.0	-	-	kA/m

Electrical Data

$T_{amb} = +25^\circ\text{C}$; $H_{ext}=25\text{kA/mT}$; $V_{cc} = 5.0\text{V}$; unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{CC}	Operating voltage		-	5.0	-	V
V_{off}	Offset voltage per V_{CC}	See Fig. 1	-0.5	-	+0.5	mV/V
$TC_{V_{off}}$	Temperature coefficient of V_{off}^3	$T_{amb} = (-40\dots+125)^\circ\text{C}$	-2.0	-	+2.0	($\mu\text{V/V}$)/K
V_{peak}	Signal amplitude per V_{CC}^4	See Fig. 2	12.0	13.0	14.0	mV/V
$TC_{V_{peak}}$	Temperature coefficient of V_{peak}^5	$T_{amb} = (-40\dots+125)^\circ\text{C}$	-0.36	-0.42	-0.48	%/K
R_B	Bridge resistance ⁶		0.9	1.2	1.5	k Ω
R_S	Sensor resistance ⁷		0.45	0.60	0.75	k Ω
TC_{R_B}	Temperature coefficient of R_B^8	$T_{amb} = (-40\dots+125)^\circ\text{C}$	0.24	0.28	0.32	%/K

Accuracy

$T_{amb} = 25^\circ\text{C}$; $H_{ext}=5\text{kA/mT}$; $V_{cc} = 5.0\text{V}$; unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$\Delta\alpha$	Angular error ⁹		-	± 0.25	± 0.5	μm
k	Amplitude synchronism ¹⁰		-0.5	-	+0.5	% of V_{peak}

Dynamic Data

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
f^{11}	Angular velocity of the magnetic field		1	-	-	MHz

² The stimulating magnetic field in the sensor plane necessary to ensure the minimum error as specified in note 7.

³ $TC_{V_{off}} = 100 \cdot \frac{V_{off}(T_2) - V_{off}(T_1)}{(T_2 - T_1)}$ with $T_1 = +25^\circ\text{C}$; $T_2 = +125^\circ\text{C}$.

⁴ Maximum output voltage without offset influences. Periodicity of V_{peak} is $\sin(P)$ and $\cos(P)$.

⁵ $TC_{V_{peak}} = 100 \cdot \frac{V_{peak}(T_2) - V_{peak}(T_1)}{V_{peak}(T_{amb})(T_2 - T_1)}$ with $T_1 = +25^\circ\text{C}$; $T_2 = +125^\circ\text{C}$.

⁶ Bridge resistance between $+V_1$ and $-V_1$; $+V_2$ and $-V_2$.

⁷ Sensor resistance between V_{CC} and Gnd.

⁸ $TC_S = 100 \cdot \frac{R_B(T_2) - R_B(T_1)}{R_B(T_{amb})(T_2 - T_1)}$ with $T_1 = +25^\circ\text{C}$; $T_2 = +125^\circ\text{C}$.

⁹ $\Delta\alpha = |\alpha_{real} - \alpha_{measured}|$ without offset influences due deviations from ideal sinusoidal characteristics (ascertained at an ideal magnetic scale).

¹⁰ $k = 100 - 100 \frac{V_{peak1}}{V_{peak2}}$

¹¹ No significant amplitude attenuation up to this frequency.

General Data

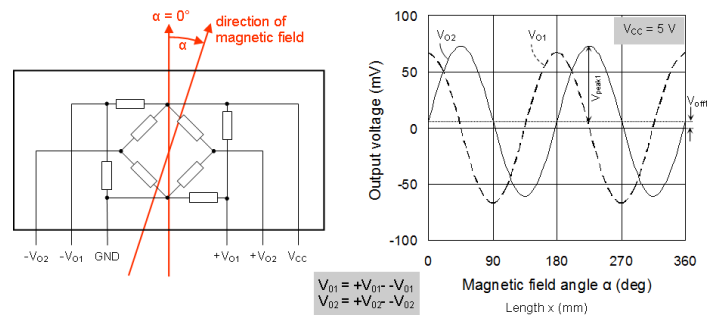


Fig. 1: left: Simplified circuit diagram with schematic of applied magnetic field.
right: Output signals as a function of the magnetic field angle α (see page 4/5).

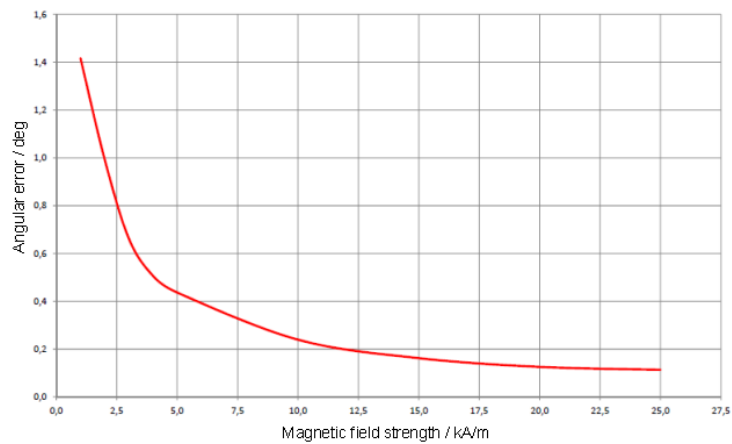


Fig. 2: Typical angular error vs. applied magnetic field strength.

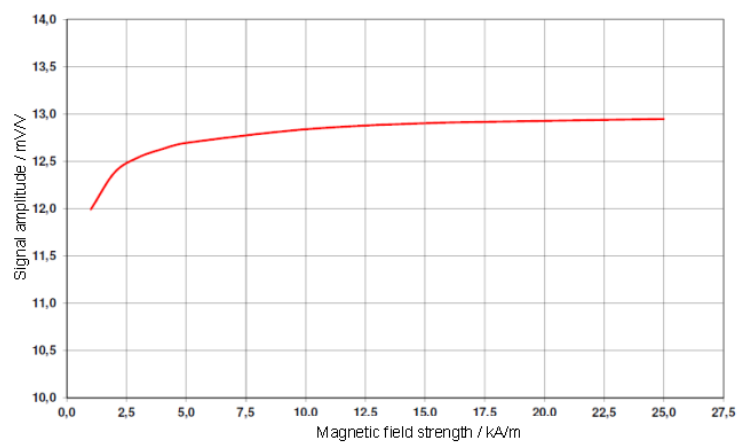
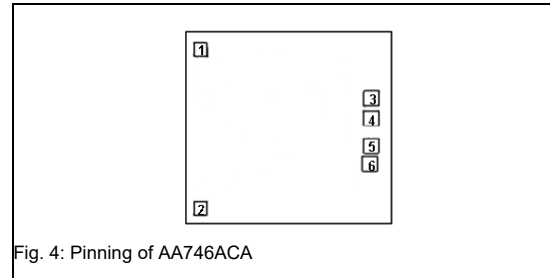
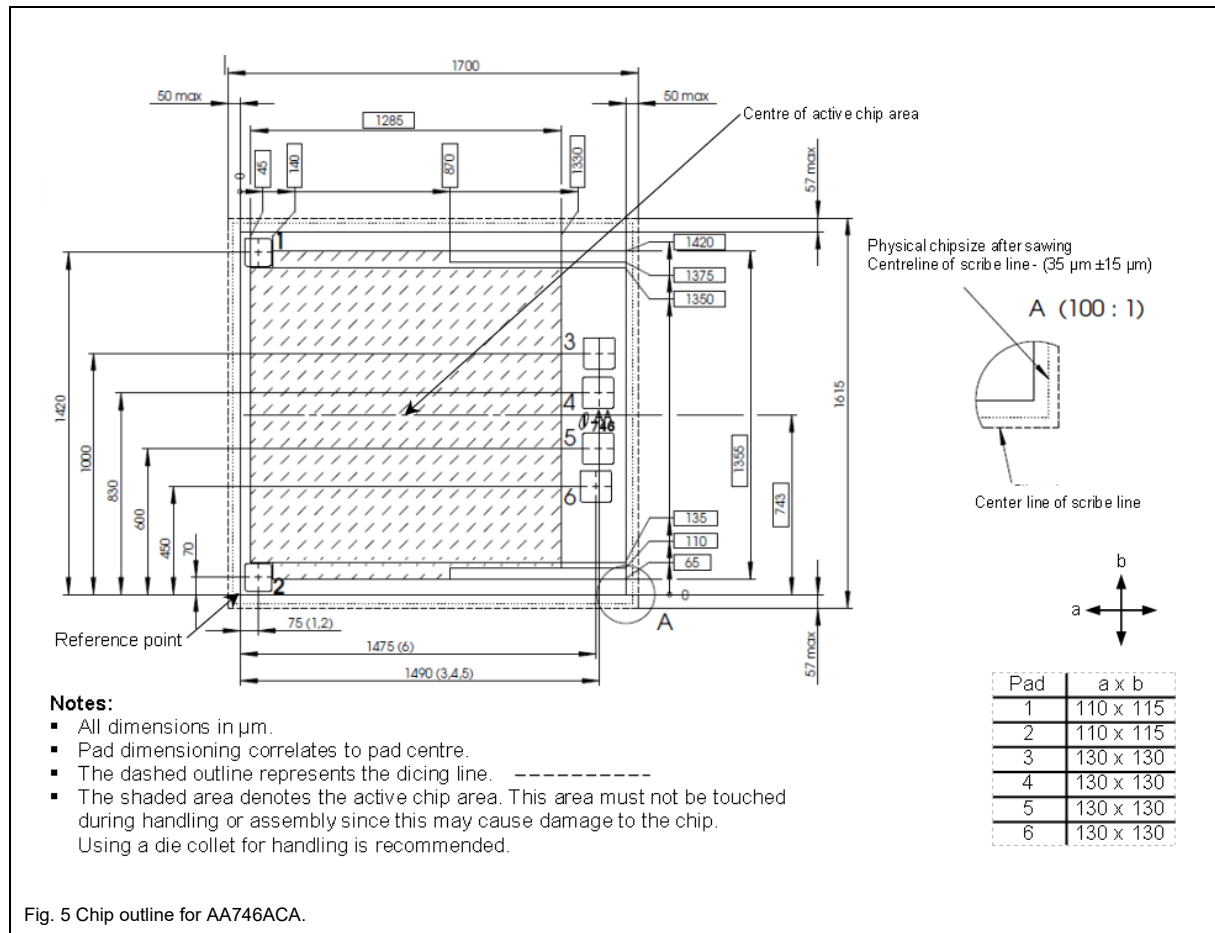


Fig. 3: Typical signal amplitude vs. applied magnetic field strength.

Pinout AA746ACA as Bare Die

Pad	Symbol	Parameter
1	V _{CC}	Supply voltage
2	GND	Ground
3	+V ₀₂	Positive output voltage bridge 2
4	-V ₀₂	Negative output voltage bridge 2
5	+V ₀₁	Positive output voltage bridge 1
6	-V ₀₁	Negative output voltage bridge 1


Technical drawing AA746ACA

Data for Packaging and Interconnection Technologies

Parameter	Value	Unit
Chip area	1.7 x 1.6	mm ²
Chip thickness	525 $\pm$ 10	μm
Pad size	See Fig. 5	-
Pad thickness	0.8	μm
Pad material	AlCu	-

Pinout AA746AMA

Pad	Symbol	Parameter
1	+V ₀₁	Positive output voltage bridge 1
2	+V ₀₂	Positive output voltage bridge 2
3	Gnd	Ground
4	V _{CC}	Supply voltage
5	-V ₀₁	Negative output voltage bridge 1
6	-V ₀₂	Negative output voltage bridge 2
7-10	NC	Not connected

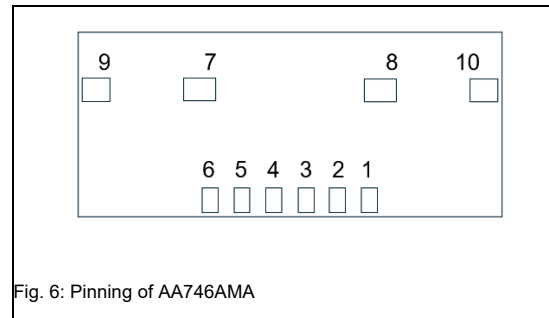


Fig. 6: Pinning of AA746AMA

Technical drawing AA746AMA

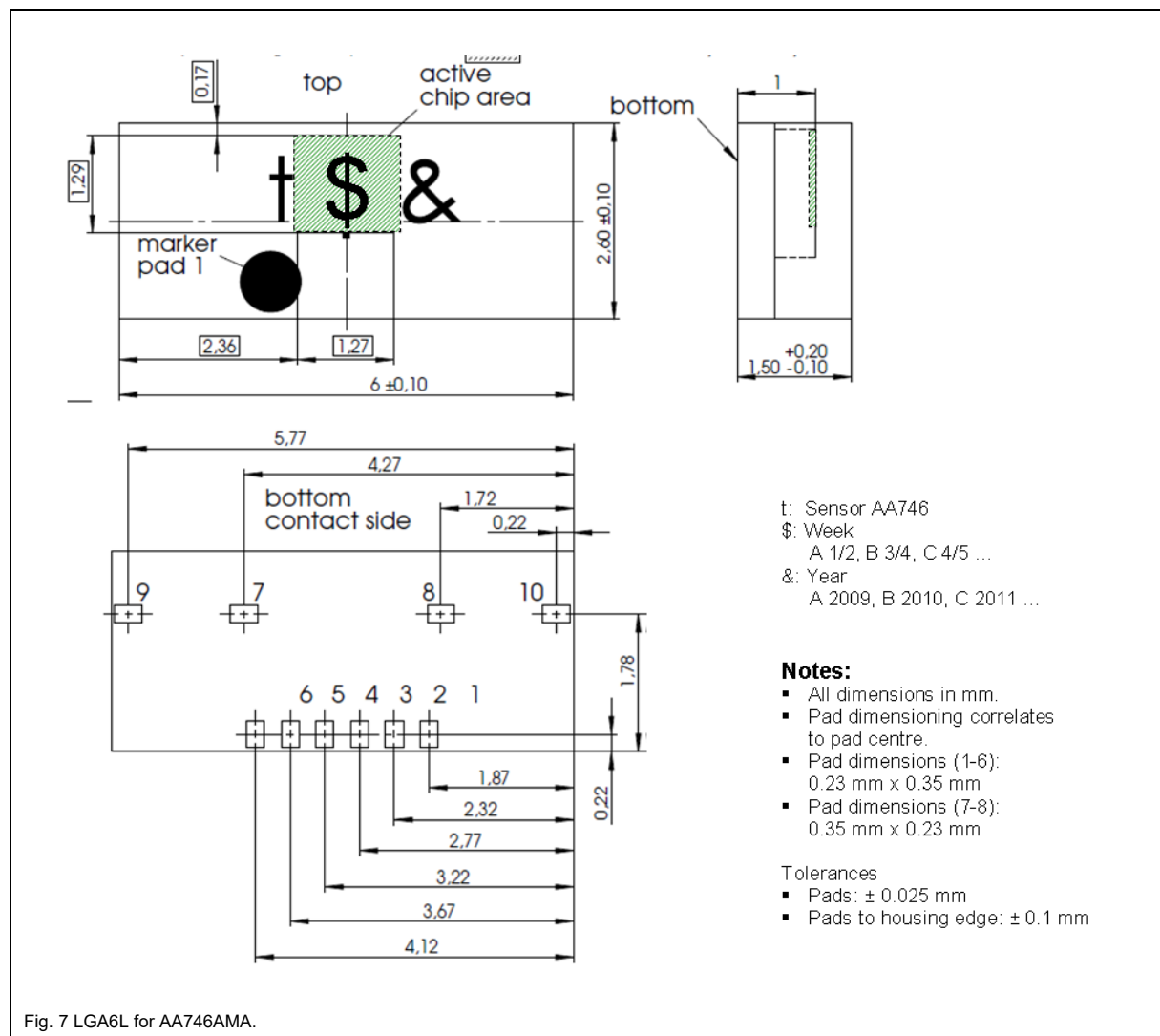
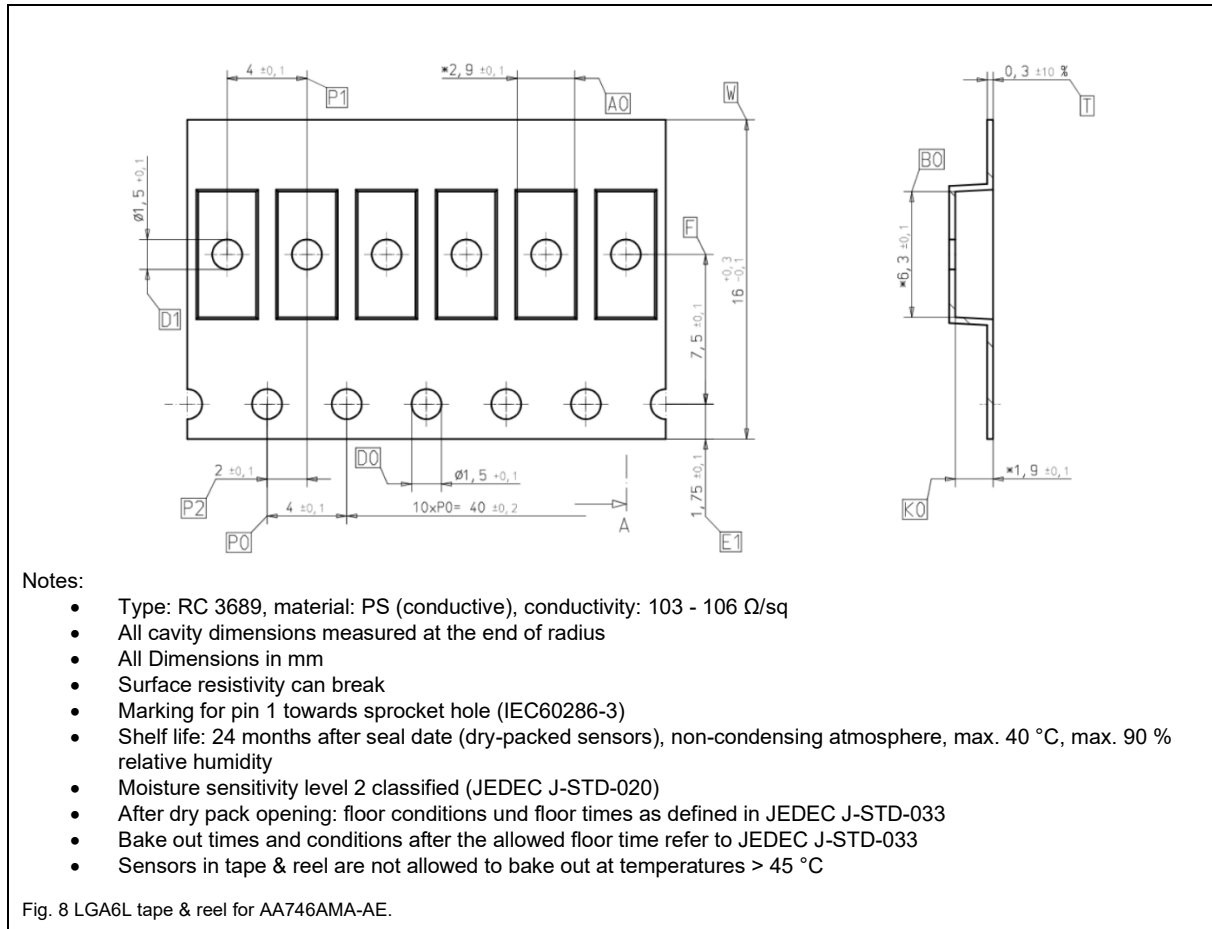


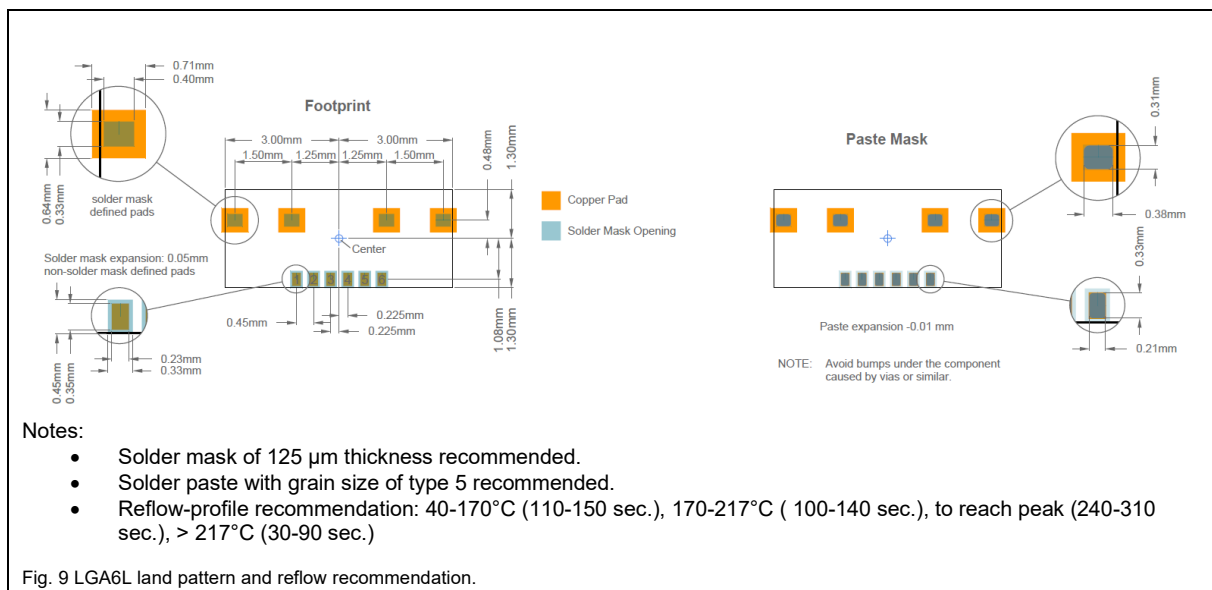
Fig. 7 LGA6L for AA746AMA.

Pinout AA746ACA

Reel layout

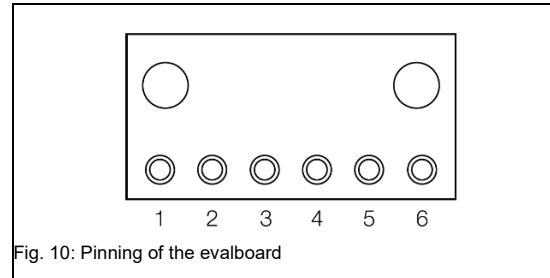


Land pattern layout

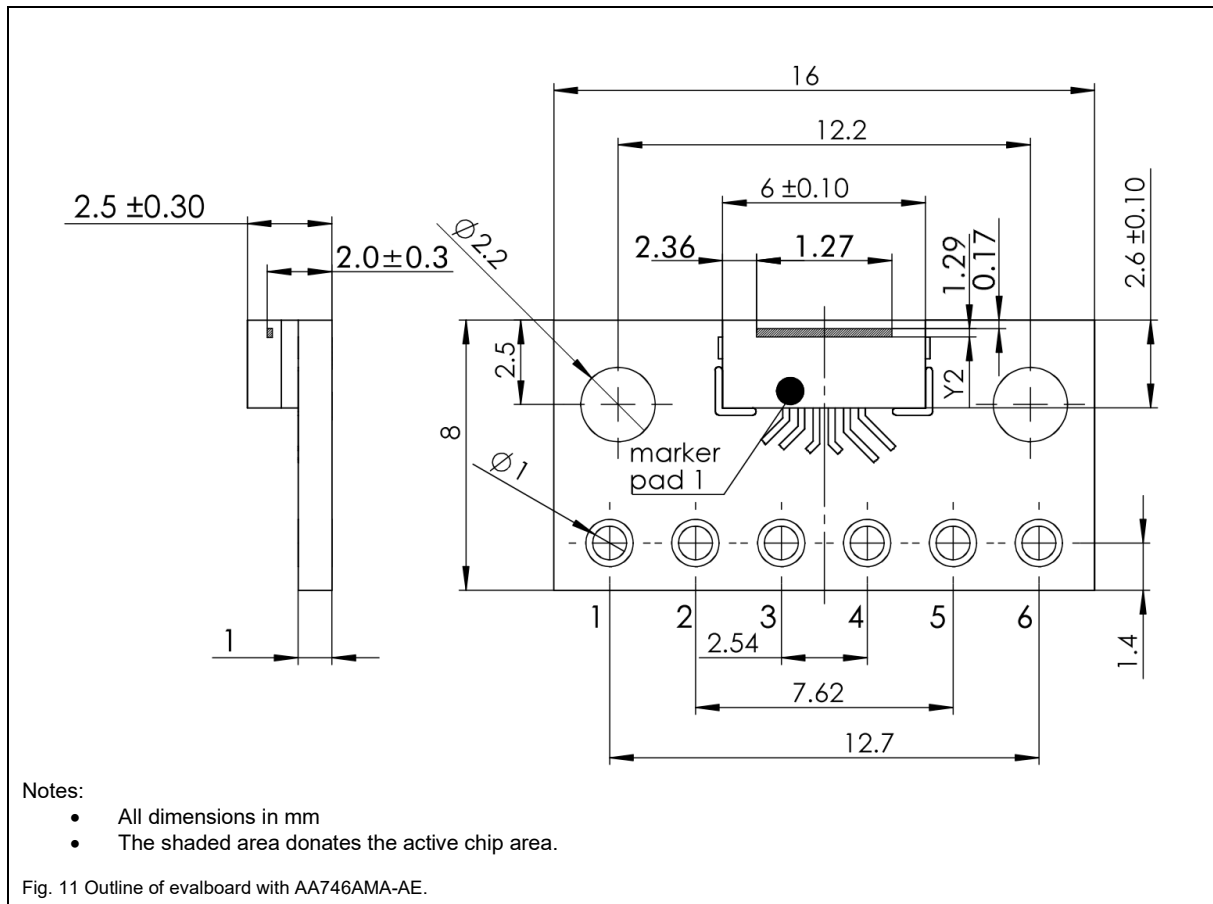


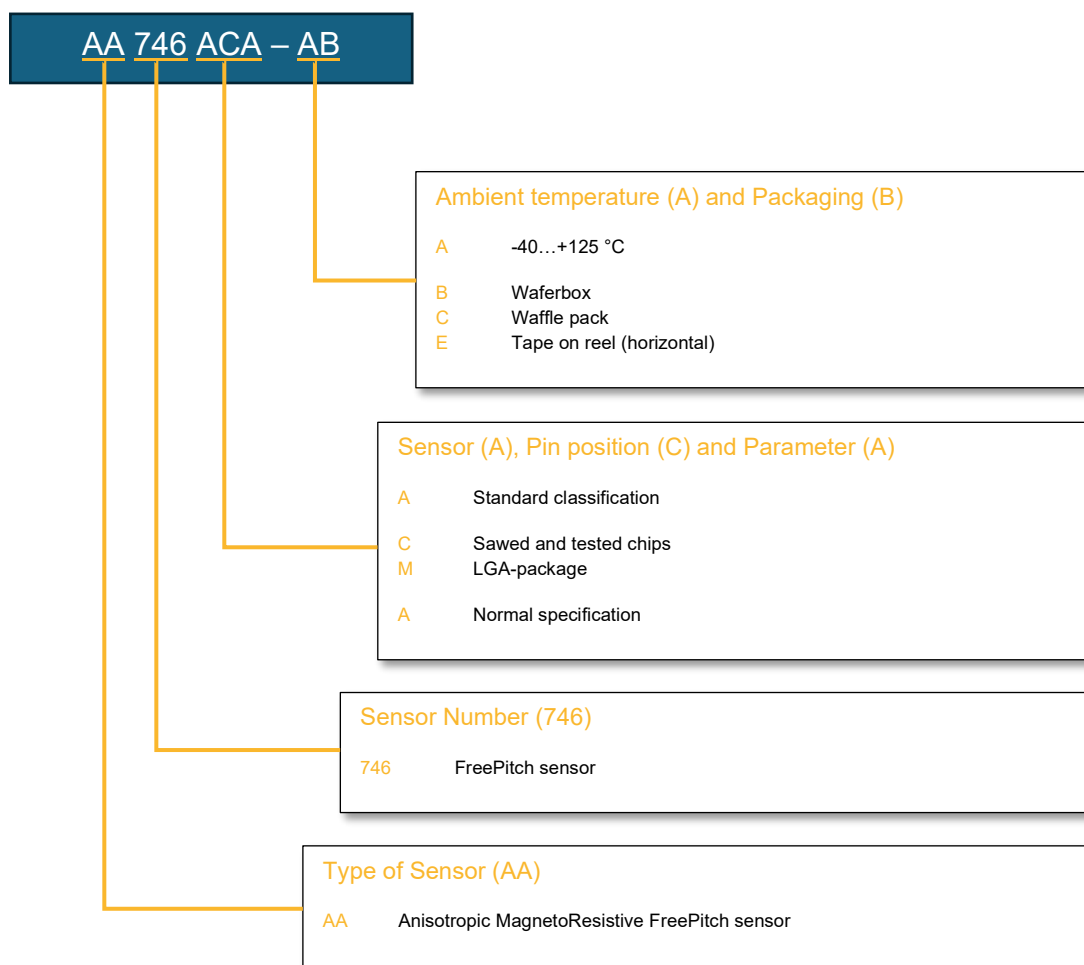
Pinout Evalboard with AA746AMA-AE

Pad	Symbol	Parameter
1	+V ₀₁	Positive output voltage bridge 1
2	+V ₀₂	Positive output voltage bridge 2
3	Gnd	Ground
4	V _{CC}	Supply voltage
5	-V ₀₁	Negative output voltage bridge 1
6	-V ₀₂	Negative output voltage bridge 2



Technical drawing Evalboard AA746AMA



Additional Information on Product Code


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.
AA746 Evalboard	This product is for evaluation of the AA746AMA-AE sensor.
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 Change	Date
AA746.DSE.09	Add evalboard informations	10/2025
AA746.DKE.08	Disclaimer supplement	06/2022
AA746.DKE.07	Change of corporate design (pp. 1-7)	01/2022
AA746.DKE.00	Original (pp. 1-7)	10/2012

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