SENSITEC
MAGNETORESISTIVE SENSORS

DATA SHEET

AA746C

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 (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(2α) and cos(2α).

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

Product Overview

Article	Package	Delivery type
AA746CCA-AB[1]	Die on wafer	Waferbox
AA746CMA-AE	LGA6L	Tape on reel (2000)
AA746CHA-AE	SO8	Tape on reel (4000)
AA746C 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}	-2.0	-	+2.0	mV/V
V_{peak}	Signal amplitude per V_{CC}	10.5	11.5	12.5	mV/V
R_S	Sensor resistance	0.80	0.95	1.10	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.

Features

- Based on the AnisotropicMagnetoResistive (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)

[1] Minimum order quantities apply.

ESD

Magnetic Data

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

Electrical Data

T_{amb} = +25 °C; H_{ext}=25kA/mT; V_{cc} = 5.0V; 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	-2.0	-	+2.0	mV/V
TC_{Voff}	Temperature coefficient of V_{off}[3]	T_{amb} = (-40…+125) °C	-2.0	-	+2.0	(µV/V)/K
V_{peak}	Signal amplitude per V_{CC}[4]	See Fig. 1	10.5	11.5	12.5	mV/V
TC_{Vpeak}	Temperature coefficient of V_{peak}[5]	T_{amb} = (-40…+125) °C	-0.36	-0.42	-0.48	%/K
R_B	Bridge resistance[6]		0.80	0.95	1.10	kΩ
R_S	Sensor resistance[7]		1.6	1.9	2.2	kΩ
TC_{RB}	Temperature coefficient of R_B[8]	T_{amb} = (-40…+125) °C	0.22	0.26	0.30	%/K

Accuracy

T_{amb} = 25 °C; H_{ext}=5 kA/mT; V_{cc} = 5.0 V; unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Δα	Angular error[9]		-	±0.25	±0.4	deg
Hyst	Angle hysteresis[10]		-	±0.20	±0.3	deg
k	Amplitude synchronism[11]		-0.5	-	+0.5	% of V_{peak}

Dynamic Data

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
f[12]	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 9.

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

[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 $T_1 = +25°C;\ T_2 = +125°C$.

[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 $T_1 = +25°C;\ T_2 = +125°C$.

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

[10] Angular difference between clockwise and counterclockwise rotation.

[11] $k = 100 - 100\frac{V_{peak1}}{V_{peak2}}$

[12] No significant amplitude attenuation up to this frequency.

General Data

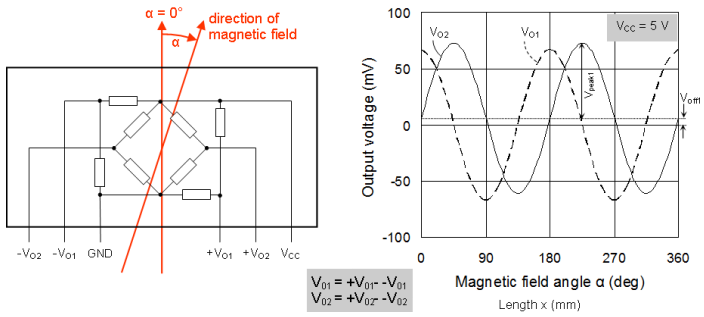


Fig. 1: left: Simplified circuit diagram for bare die and LGA6L package with schematic of applied magnetic field.
right: Output signals as a function of the magnetic field angle α.

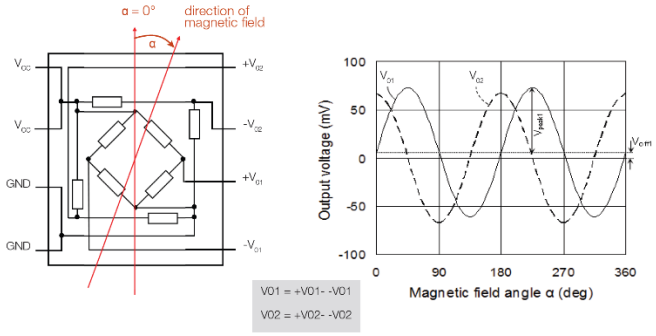


Fig. 2: left: Simplified circuit diagram for SO8 package with schematic of applied magnetic field.
right: Output signals as a function of the magnetic field angle α.

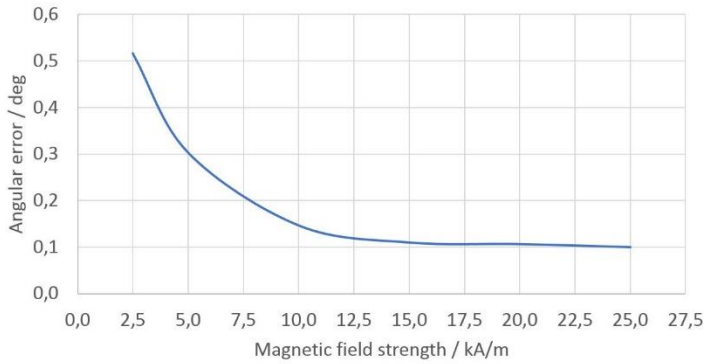


Fig. 3: Typical angular error vs. applied magnetic field strength.

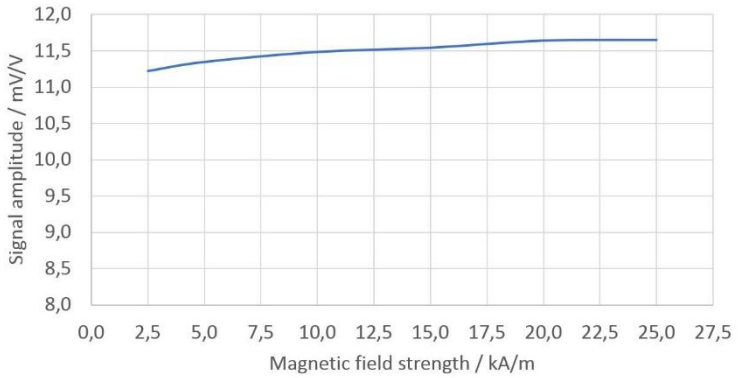


Fig. 4: Typical signal amplitude vs. applied magnetic field strength.

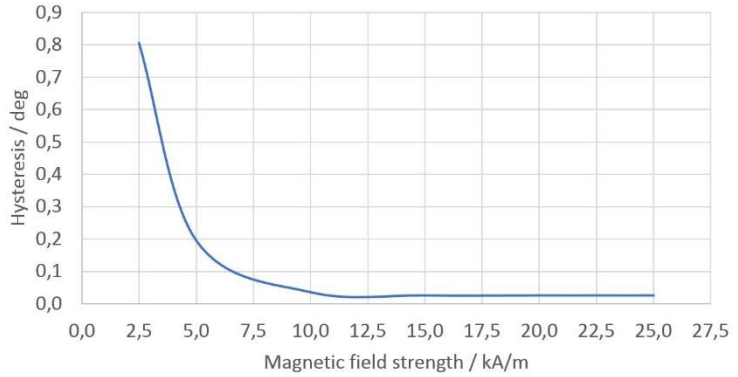


Fig. 5: Typical signal hysteresis vs. applied magnetic field strength.

Pinout AA746CCA 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

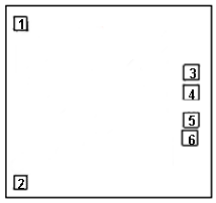
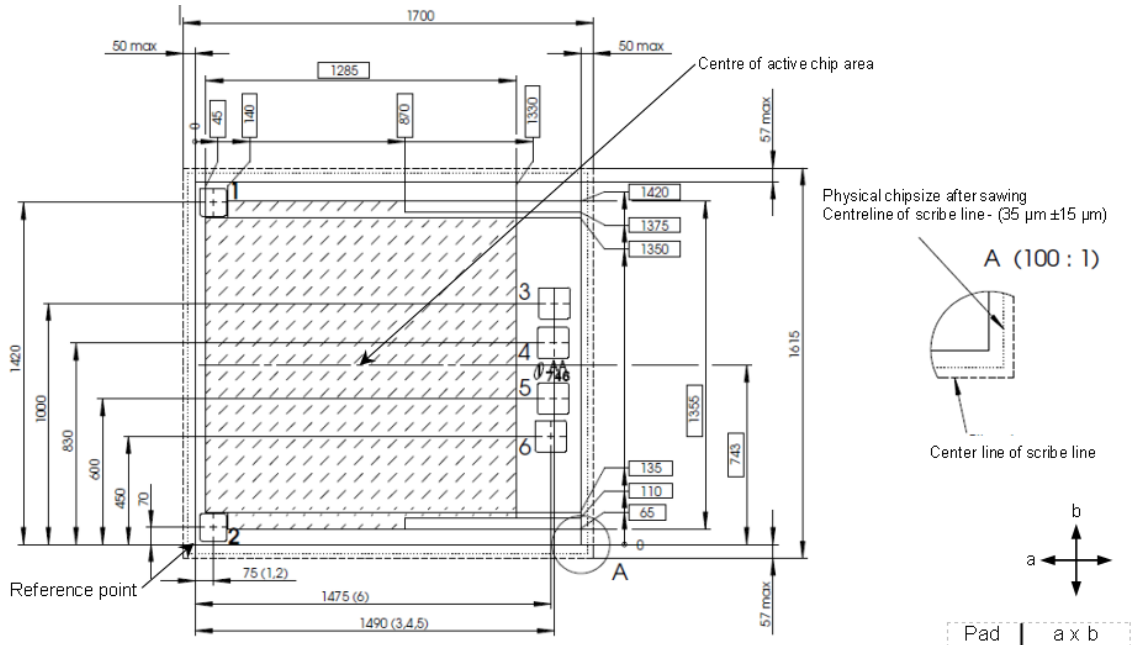


Fig. 6: Pinning of AA746CCA

Technical drawing AA746CCA



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. 7 Chip outline for AA746CCA.

Data for Packaging and Interconnection Technologies

Parameter	Value	Unit
Chip area	1.7 x 1.6	mm^2
Chip thickness	254 ± 10	µm
Pad size	See Fig. 7	-
Pad thickness	0.8	µm
Pad material	AlCu	-

Pinout AA746CMA

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

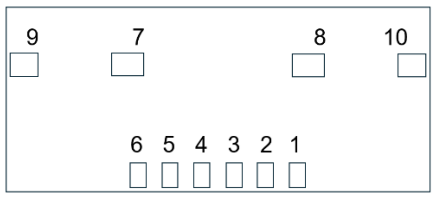


Fig. 8: Pinning of AA746CMA

Technical drawing AA746CMA

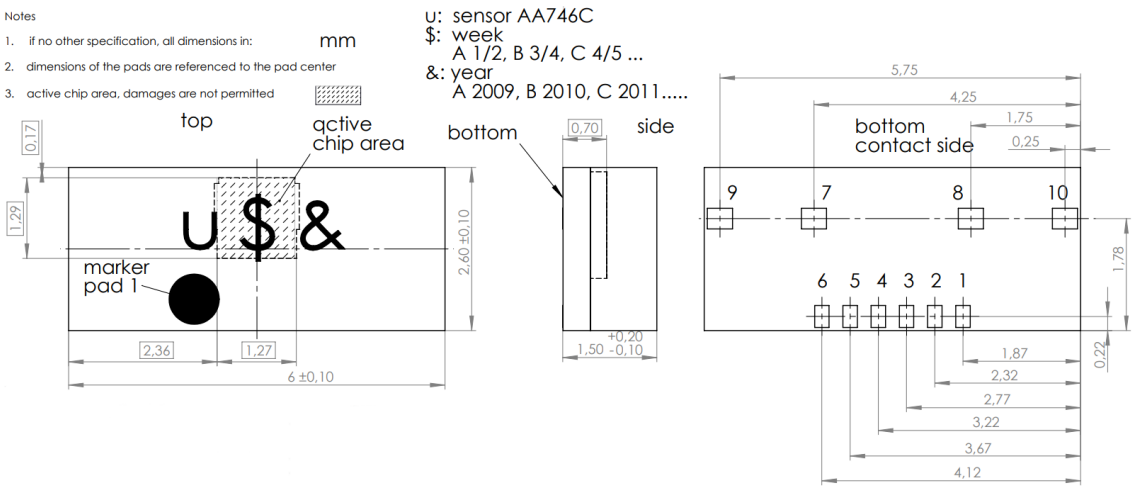
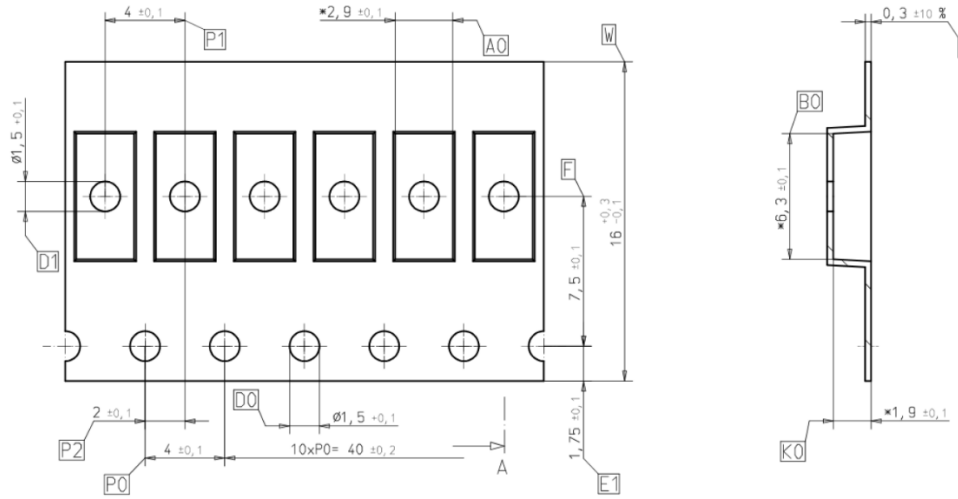


Fig. 9 LGA6L for AA746CMA.

Reel layout

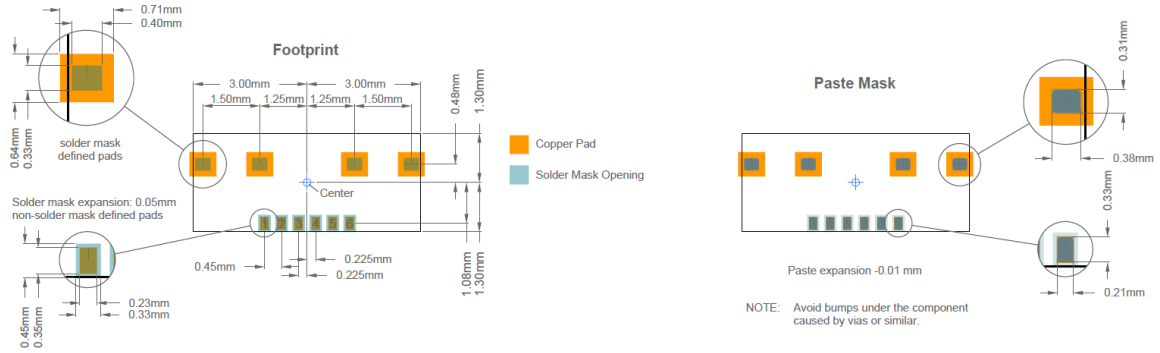


Notes:

- Type: RC 3689, material: PS (conductive), conductivity: 103 - 106 Ω/sq
- All cavity dimensions measured at the end of radius
- All Dimensions in mm
- Surface resistivity can break
- Marking for pin 1 towards sprocket hole (IEC60286-3)
- Shelf life: 24 months after seal date (dry-packed sensors), non-condensing atmosphere, max. 40 °C, max. 90 % relative humidity
- Moisture sensitivity level 2 classified (JEDEC J-STD-020)
- After dry pack opening: floor conditions und floor times as defined in JEDEC J-STD-033
- Bake out times and conditions after the allowed floor time refer to JEDEC J-STD-033
- Sensors in tape & reel are not allowed to bake out at temperatures > 45 °C

Fig. 10 LGA6L tape & reel for AA746CMA-AE.

Land pattern layout



Notes:

- Solder mask of 125 µm thickness recommended.
- Solder paste with grain size of type 5 recommended.
- Reflow-profile recommendation: 40-170°C (110-150 sec.), 170-217°C (100-140 sec.), to reach peak (240-310 sec.), > 217°C (30-90 sec.)

Fig. 11 LGA6L land pattern and reflow recommendation.

Pinout AA746CHA

Pad	Symbol	Parameter
1	V_{CC}	Supply voltage
2	V_{CC}	Supply voltage
3	Gnd	Ground
4	Gnd	Ground
5	$-V_{01}$	Negative output voltage bridge 1
6	$+V_{01}$	Positive output voltage bridge 1
7	$-V_{02}$	Negative output voltage bridge 2
8	$+V_{02}$	Positive output voltage bridge 2

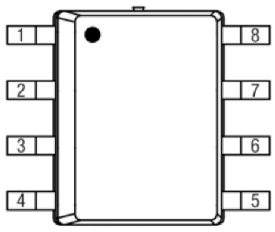


Fig. 12: Pinning of AA746CHA

Technical drawing AA746CHA

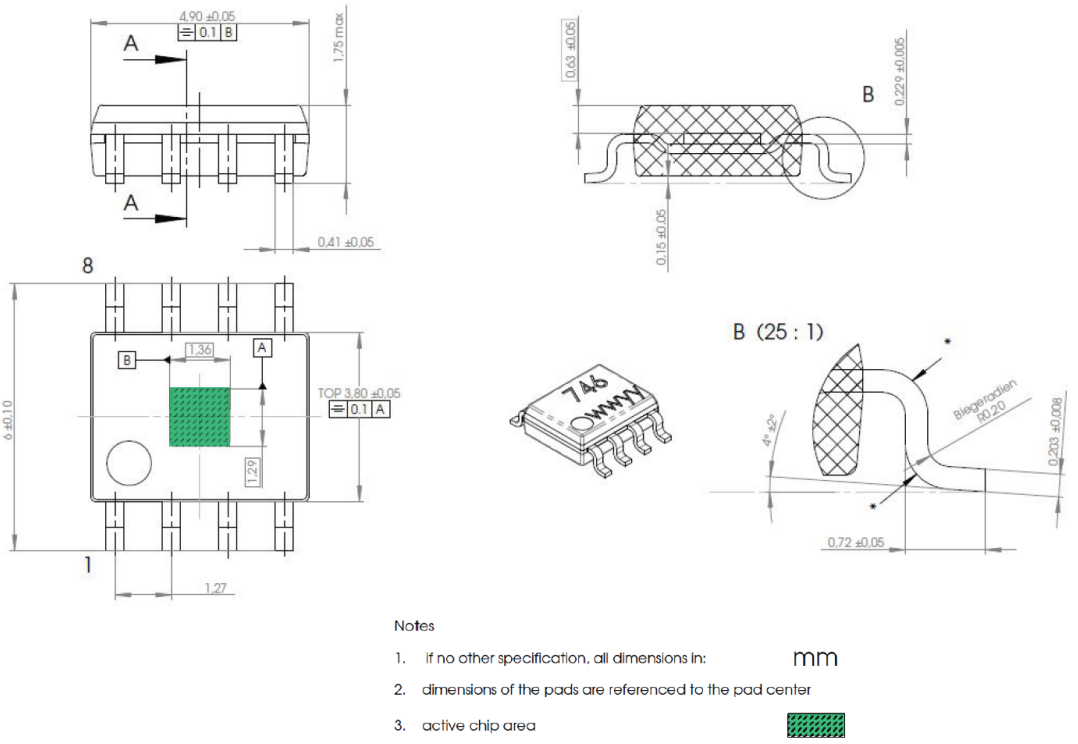


Fig. 13 SO8 for AA746CHA.

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).

Pinout Evalboard with AA746CMA-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

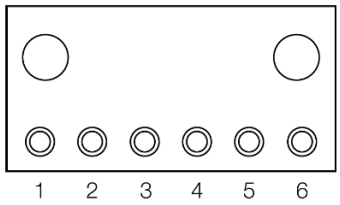
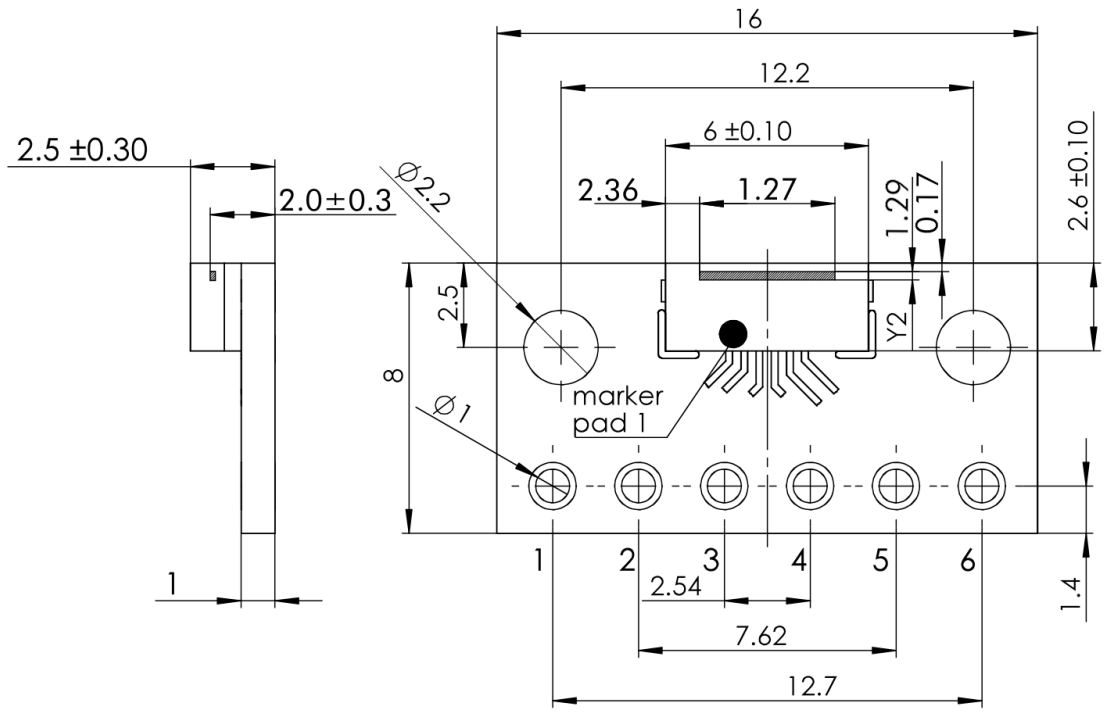


Fig. 14: Pinning of the evalboard

Technical drawing Evalboard AA746CMA

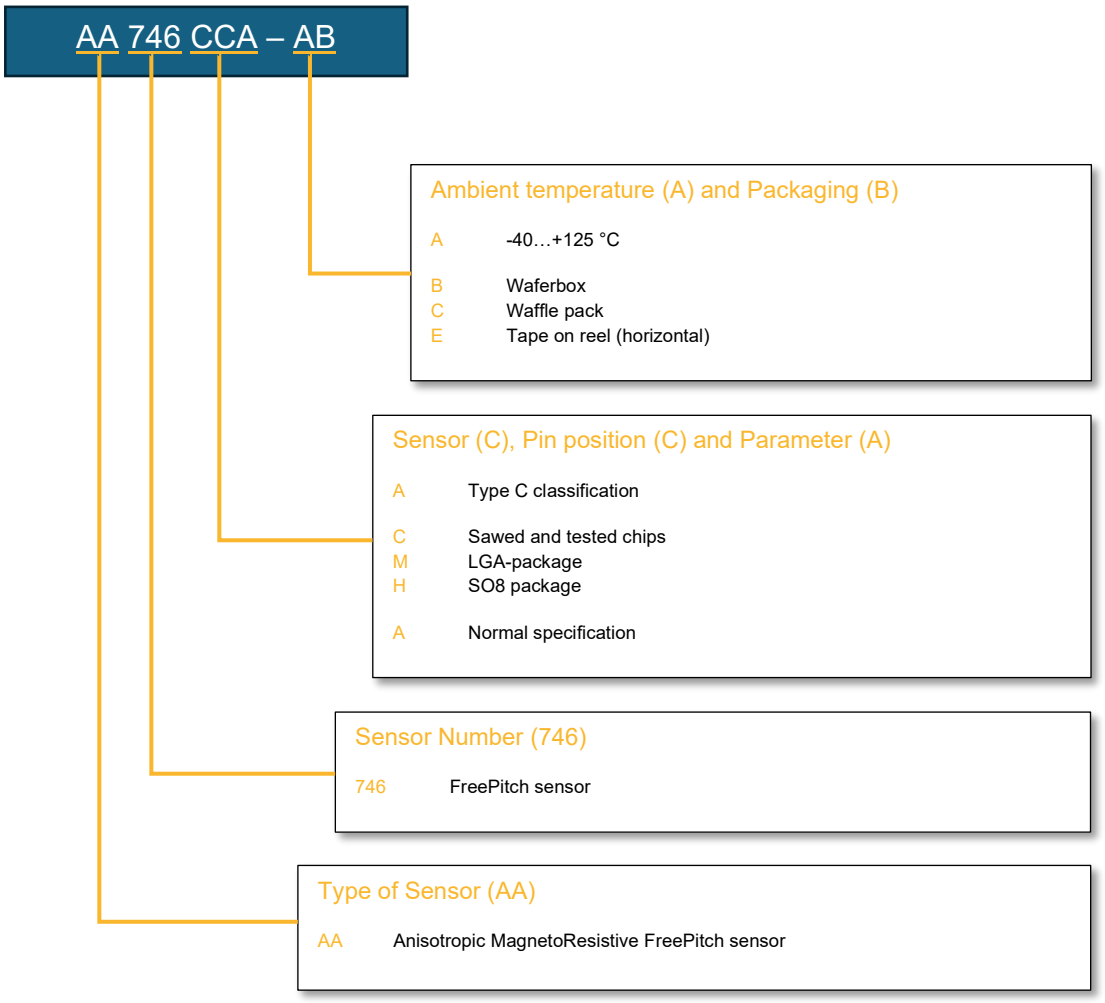


Notes:

- All dimensions in mm
- The shaded area donates the active chip area.

Fig. 15 Outline of evalboard with AA746CMA-AE.

Additional Information on Product Code



General Information

Product Status

Article	Status
AA746CCA-AB[13]	The product is in series production.
AA746CMA-AE	The product is in series production.
AA746CHA-AE	The product is in series production.
AA746C Evalboard	This product is for evaluation of the AA746CMA-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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[13] Minimum order quantities apply.

Application Information

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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.

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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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