

AL797

MagnetoResistive FixPitch Sensor (2.5 mm)

The AL797 is an AnisotropicMagnetoResistive (AMR) position sensor. The sensor contains two Wheatstone bridges shifted against each other. The output signals are proportional to sine and cosine of the coordinate to be measured (see Fig. 1).

The MR strips of this FixPitch sensor geometrically match to a pole length of 2.5 mm (equal to a magnetic period of 5 mm). Additionally, the sensor layout incorporates PerfectWave technology, i. e. the position of each block of MR strips has a special arrangement to filter higher harmonics and to increase the signal quality. The resistores in this FixPitch sensor are distributed over several poles (2), thus the errors in the magnetic measurement scale are reduced without any signal delay. The amplitude is almost constant in a wide working range between sensor and magnetic scale. The bond version of AL797 is available as bare die. For SMD processing, the sensor is available in a Sil6, LGA or SIL8 package.

Product Overview of AL797

Article description	Package	Delivery Type
AL797ACA-AB ¹⁾	Die on Wafer	Waferbox
AL797ACA-AC	Bare Die	Waffle pack (108 pcs)
AL797AKA-AC	SIL6	Waffle pack (90 pcs)
AL797AMA-AE	LGA6L	Tape on reel (2000 pcs)
AL797AMS-AE	SIL8	Tape on reel (2000 pcs)
AL797AMS-AS	SIL8-D	Tape on reel (2000 pcs)
AL797 Evalboard	Evalboard	ESD-Box

¹⁾ minimum order quantities apply.

Quick Reference Guide

Symbol	Parameter	min.	typ.	max.	Unit
P	Pitch (magnetic pole length)	-	2.5	-	mm
V _{CC}	Supply voltage	-	5.0	-	V
V _{off}	Offset voltage per V _{CC}	-1.0	-	+1.0	mV/V
V _{peak}	Signal amplitude per V _{CC}	9.0	11.0	13.0	mV/V
R _B	Bridge resistance	4.9	5.4	5.9	kΩ

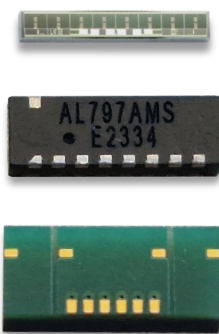
Absolute Maximum Ratings

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
T _{stg(Die)}	Storage temperature (Die)	-65	+150	°C
T _{stg(others)}	Storage temperature (others)	-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 AnisotropicMagnetoResistive (AMR) effect
- Contains two wheatstone bridges on Chip
- Sine and Cosine output
- Adapted to 2.5 mm poles
- PurePitch design (2 poles)
- PerfectWave technology
- Ambient temperature range from -40 °C to +125 °C

Advantages

- Contactless angle and position measurement
- Large air gap
- Excellent accuracy
- Minimized offset voltage
- Negligible hysteresis

Applications

Incremental or absolute encoder for linear or rotary movements in various industrial applications, such as:

- Motor integrated encoder
- Motorfeedback system
- Linear guide



Magnetic Data

Symbol	Parameter	Conditions	min.	typ.	max.	Unit
H_{ext}	Magnetic field strength ¹⁾		15.0	25.0	-	kA/m

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

Electrical Data

$T_{amb} = +25^{\circ}\text{C}$, $H_{ext} = 25 \text{ kA/m}$; $V_{CC} = 5.0 \text{ V}$; 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. 2	-1.0	-	+1.0	mV/V
TC_{Voff}	Temperature coefficient of V_{off} ²⁾	$T_{amb} = (-40 \dots +125)^{\circ}\text{C}$	-2.0	-	+2.0	($\mu\text{V/V}$)/K
V_{peak}	Signal amplitude per V_{CC} ³⁾	See Fig. 2	9.0	11.0	13.0	mV/V
TC_{Vpeak}	Temperature coefficient of V_{peak} ⁴⁾	$T_{amb} = (-40 \dots +125)^{\circ}\text{C}$	-0.48	-0.42	-0.36	%/K
R_B	Bridge resistance ⁵⁾		4.9	5.4	5.9	k Ω
R_S	Sensor resistance ⁶⁾		2.45	2.7	2.95	k Ω
TC_{RB}	Temperature coefficient of R_B ⁷⁾	$T_{amb} = (-40 \dots +125)^{\circ}\text{C}$	0.24	0.28	0.32	%/K
FIT	FIT-Rate		-	tbd	-	$\times 10^9 \text{ h}$
MTTF	Mean time to failure	At 55°C	-	tbd	-	years

²⁾ $TC_{Voff} = 100 \cdot \frac{V_{off}(T_2) - V_{off}(T_1)}{T_2 - T_1}$ with $T_1 = +25^{\circ}\text{C}$; $T_2 = +125^{\circ}\text{C}$.

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

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

⁵⁾ Bridge resistance between $+V_{O1}$ and $-V_{O1}$, $+V_{O2}$ and $-V_{O2}$.

⁶⁾ Sensor resistance between V_{CC} and GND.

⁷⁾ $TC_{RB} = 100 \cdot \frac{R_B(T_2) - R_B(T_1)}{R_B(T_{amb}) \cdot (T_2 - T_1)}$ with $T_1 = +25^{\circ}\text{C}$; $T_2 = +125^{\circ}\text{C}$.

Accuracy

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

Symbol	Parameter	Conditions	min.	typ.	max.	Unit
ΔX	Measurement error ⁸⁾		-	15.0	25.0	μm
k	Amplitude synchronism ⁹⁾		-	0.1	1	% of V_{peak}

⁸⁾ $\Delta X = |X_{real} - X_{measured}|$ without offset influences due deviations from ideal sinusoidal characteristics (ascertained at an ideal magnetic scale).

⁹⁾ $k = 100 \cdot 100 \cdot \frac{V_{peak1}}{V_{peak2}}$

Dynamic Data

Symbol	Parameter	Conditions	min.	typ.	max.	Unit
f	Frequency range		1.0 ¹⁰⁾	-	-	MHz

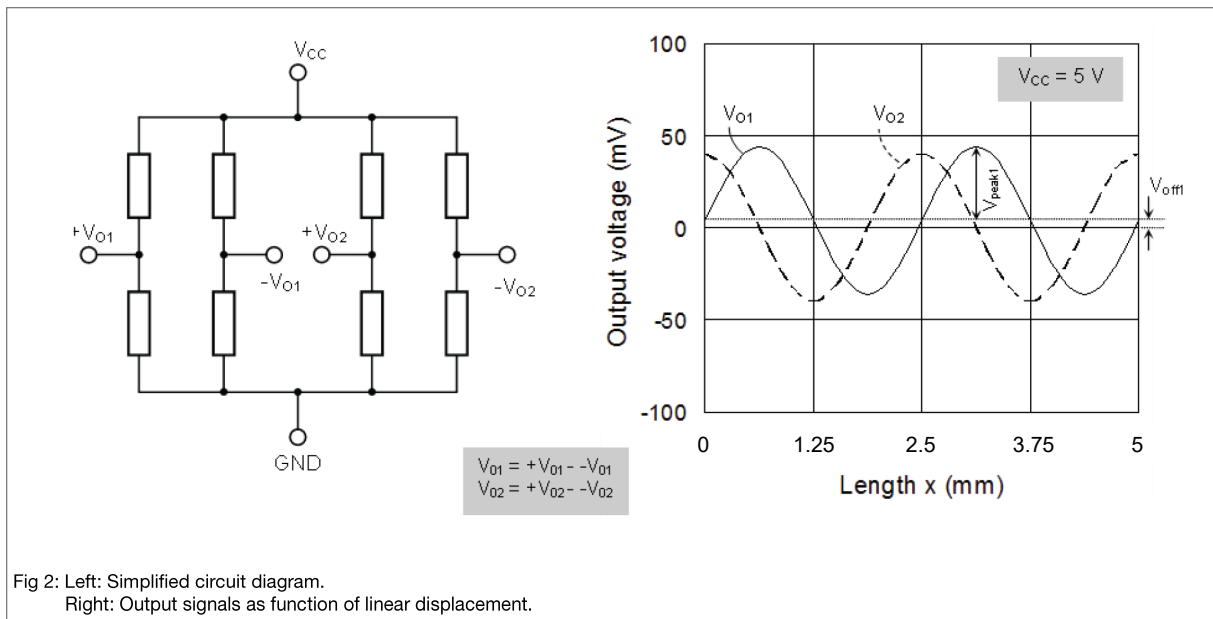
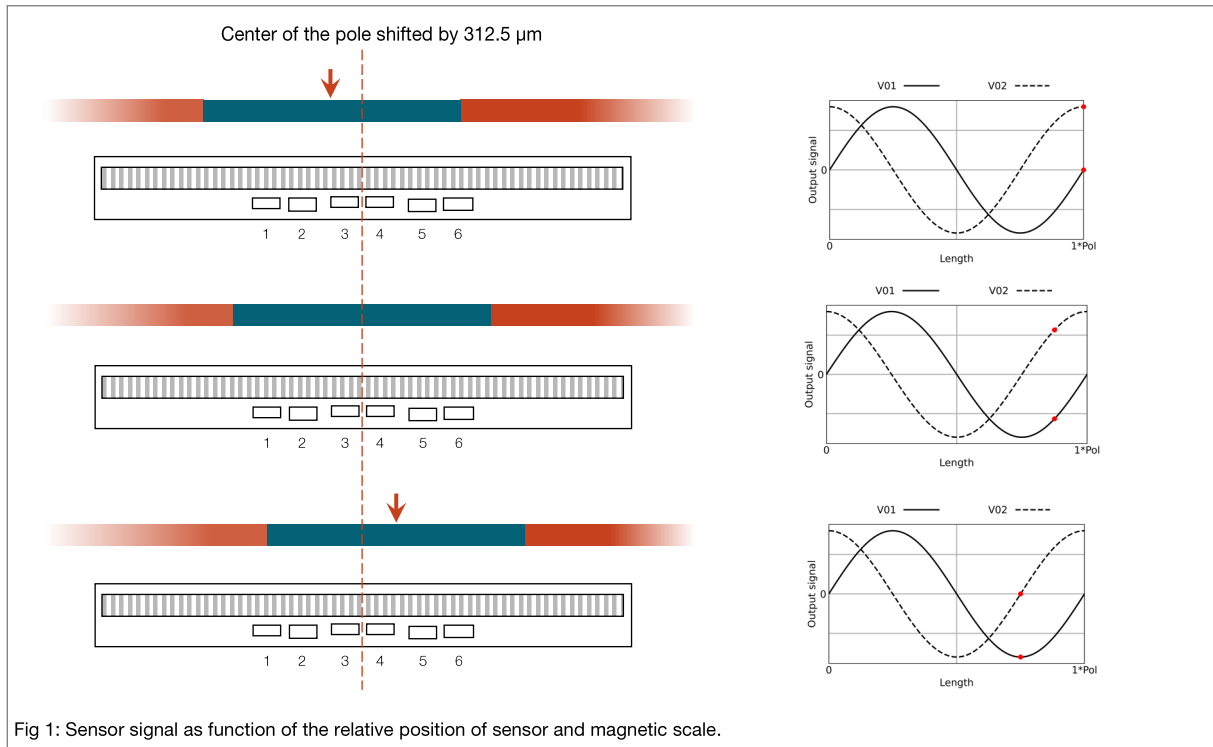
¹⁰⁾ No significant amplitude loss in this frequency range.

General Data

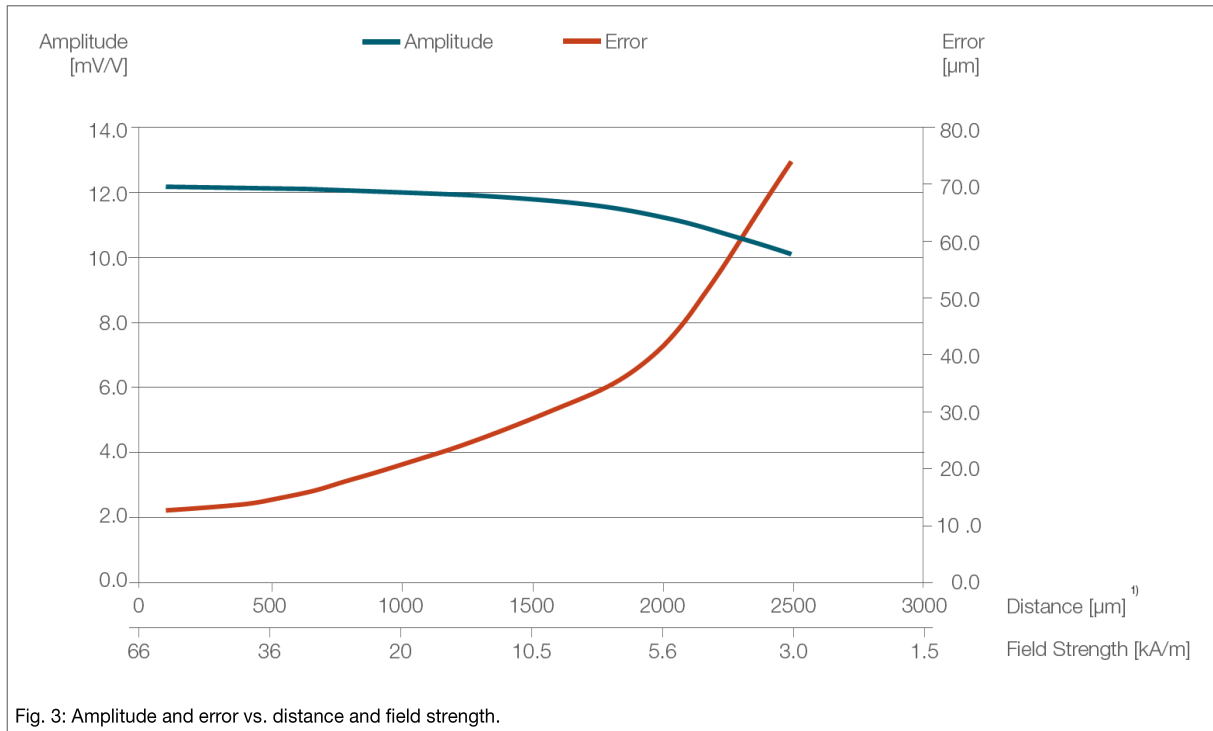
Symbol	Parameter	Conditions	min.	typ.	max.	Unit
P	Pitch (magnetic pole length)	See Fig. 1	-	2.5	-	mm
d	Distance ¹¹⁾		-	1.0	-	mm
T_{amb}	Ambient temperature		-40	-	+125	$^{\circ}\text{C}$

¹¹⁾ See Fig. 3 for detailed information.

Output Signal Information



Typical Performance Graphs



¹⁾ In use with a plastic bounded hard ferrite magnetic scale ($B_r = 220$ mT, thickness 1 mm, mounted on stainless steel),

AL797ACA Bare Die

Pinout

Pad	Symbol	Parameter
1	+V _{O1}	Positive output voltage bridge 1
2	+V _{O2}	Positive output voltage bridge 2
3	V _{CC}	Supply voltage
4	GND	Ground
5	-V _{O1}	Negative output voltage bridge 1
6	-V _{O2}	Negative output voltage bridge 2

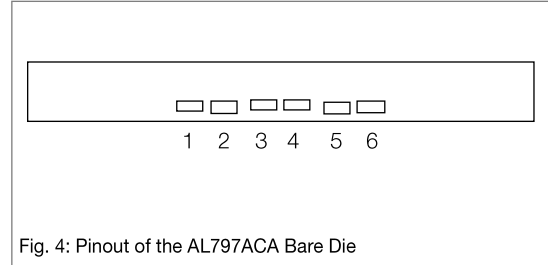


Fig. 4: Pinout of the AL797ACA Bare Die

Dimensions

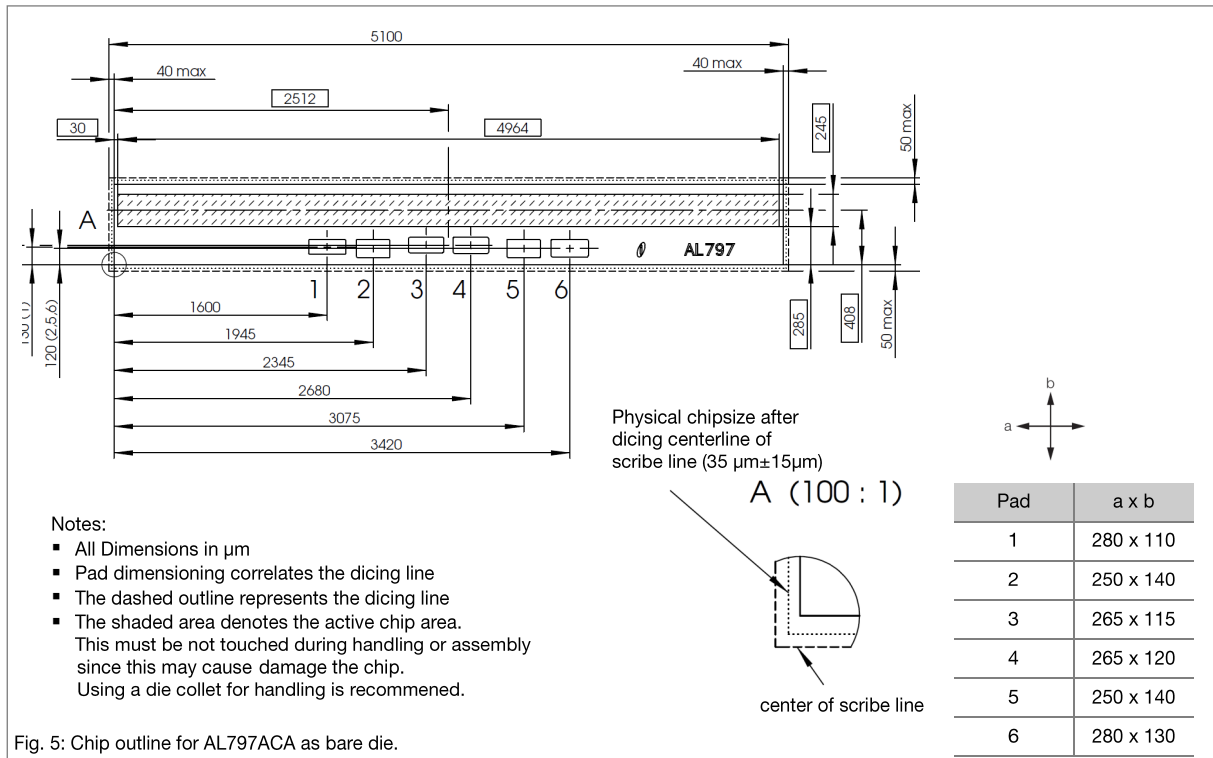


Fig. 5: Chip outline for AL797ACA as bare die.

Data for Packaging and Interconnection Technologies

Parameter	Value	Unit
Chip area ¹⁾	5.1 x 0.7	mm ²
Chip thickness	525 ± 10	μm
Pad size	See Fig. 5	-
Pad thickness	0.8	μm
Pad material	AICu	-

¹⁾ Tolerances of chip see Fig. 5.

AL797AKA SIL6 Package

Pinout

Pad	Symbol	Parameter
1	+V _{O1}	Positive output voltage bridge 1
2	+V _{O2}	Positive output voltage bridge 2
3	V _{CC}	Supply voltage
4	GND	Ground
5	-V _{O1}	Negative output voltage bridge 1
6	-V _{O2}	Negative output voltage bridge 2

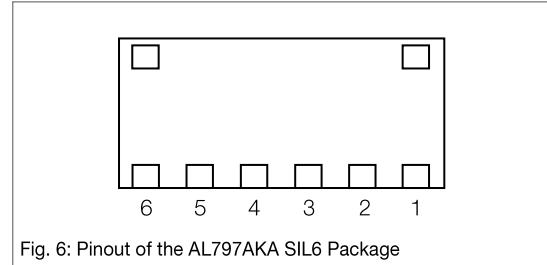


Fig. 6: Pinout of the AL797AKA SIL6 Package

Dimensions

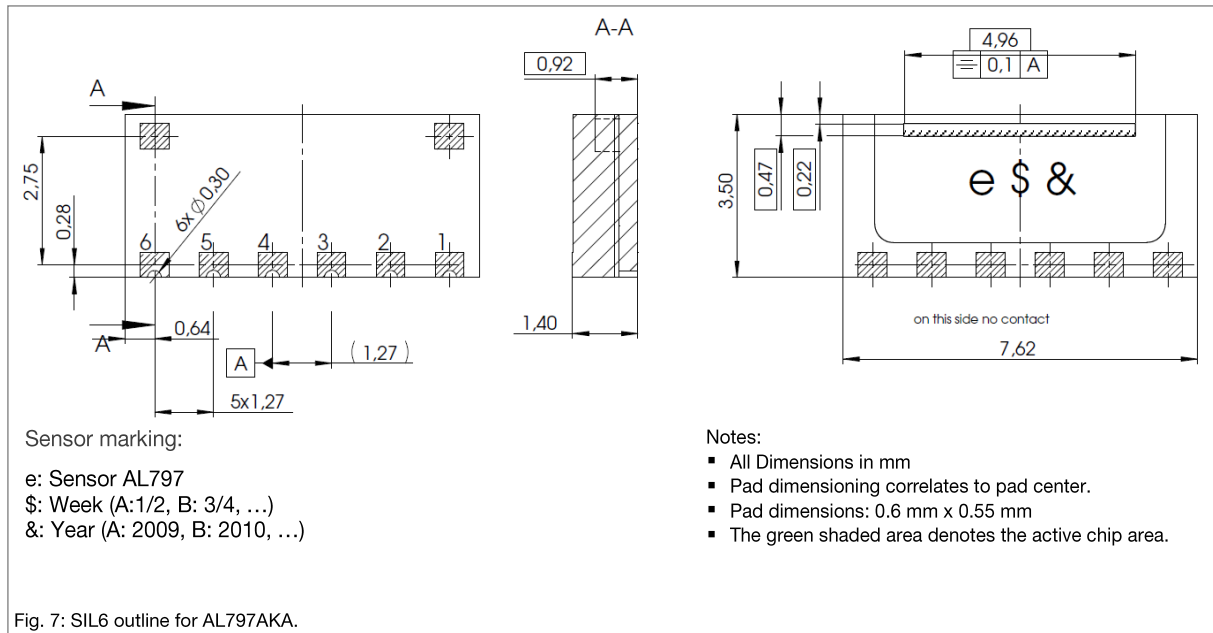


Fig. 7: SIL6 outline for AL797AKA.

AL797AMA LGA6L Package

Pinout

Pad	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
7-10	NC	Not connected

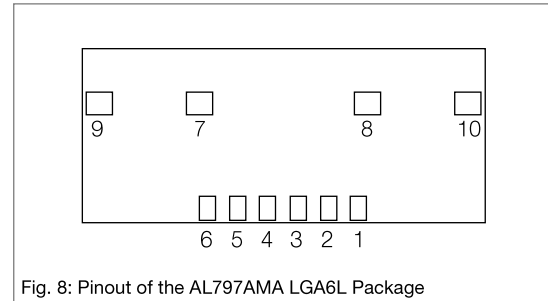


Fig. 8: Pinout of the AL797AMA LGA6L Package

Dimensions

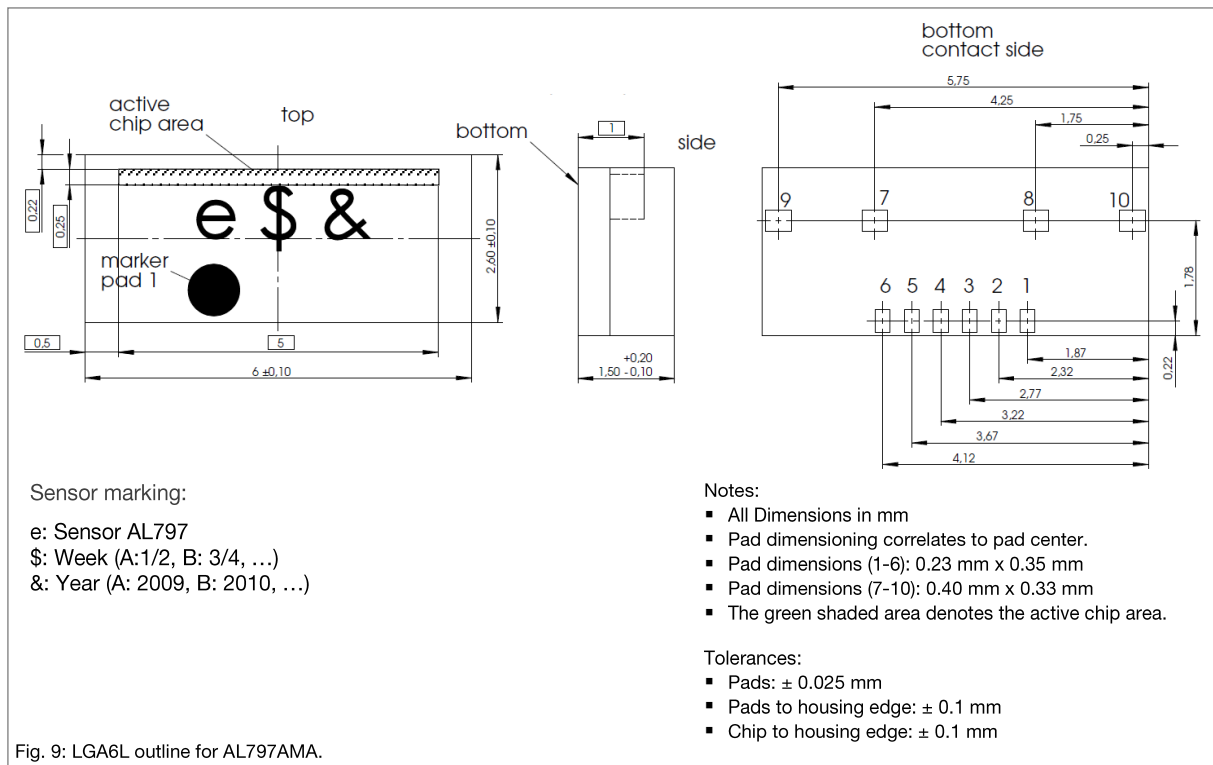
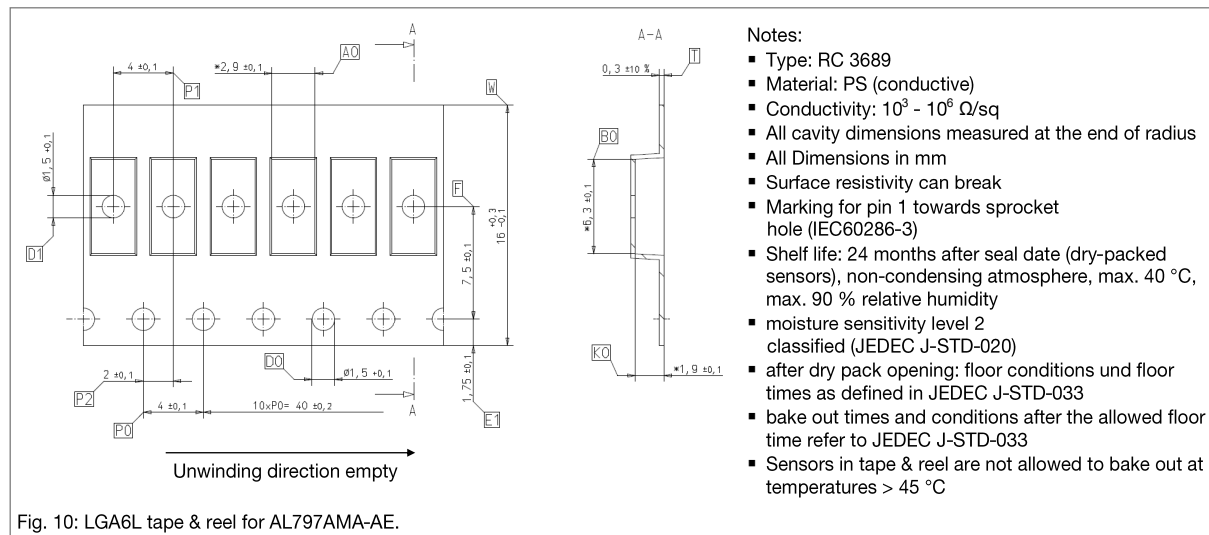


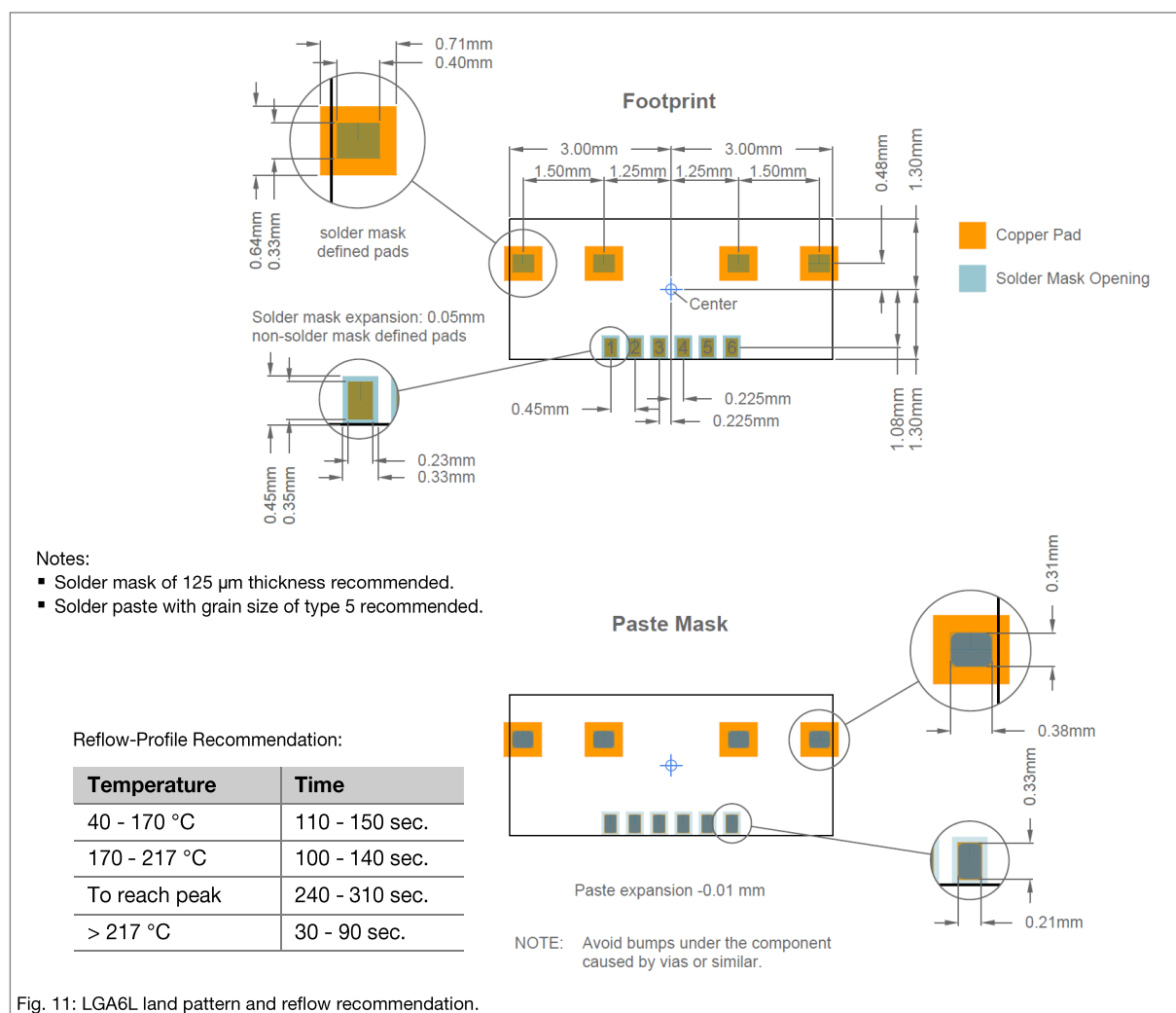
Fig. 9: LGA6L outline for AL797AMA.

AL797AMA LGA6L Package

Reel layout



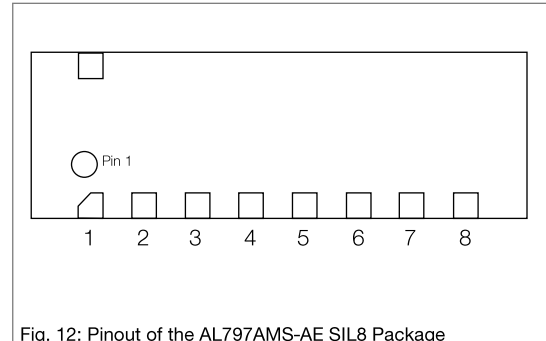
Land pattern layout



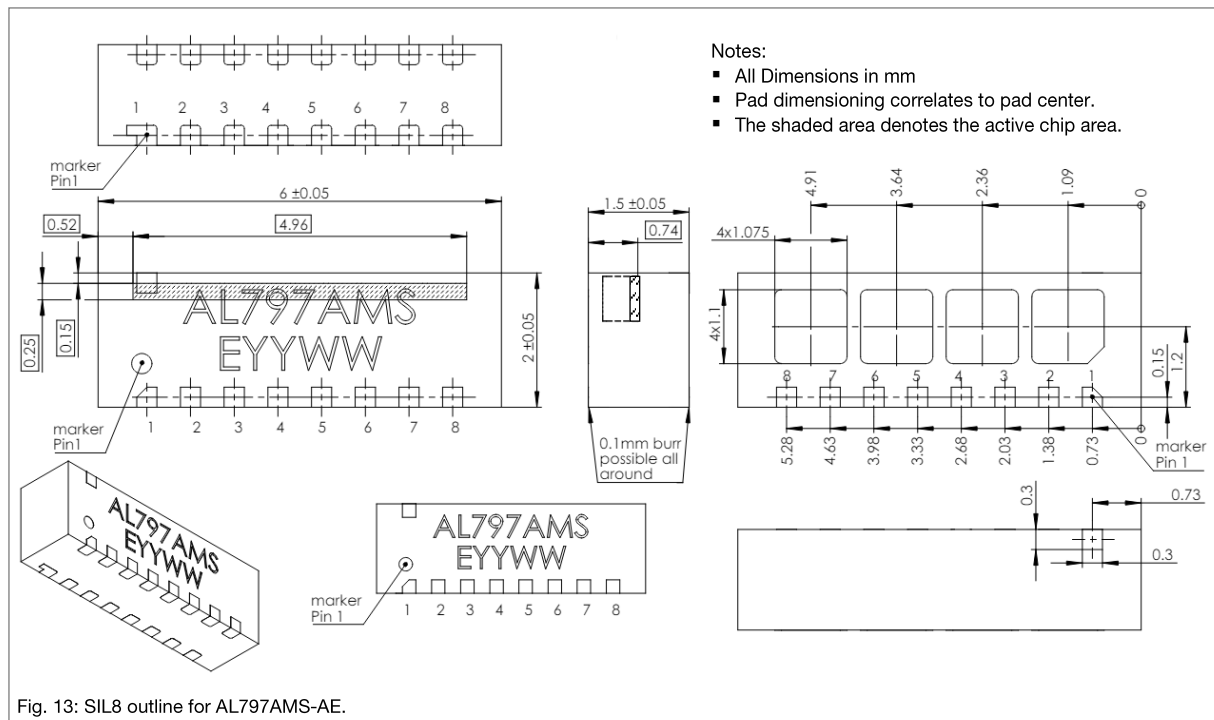
AL797AMS-AE SIL8 Package

Pinout

Pad	Symbol	Parameter
1	NC	Not connected
2	+V _{O1}	Positive output voltage bridge 1
3	+V _{O2}	Positive output voltage bridge 2
4	V _{CC}	Supply voltage
5	GND	Ground
6	-V _{O1}	Negative output voltage bridge 1
7	-V _{O2}	Negative output voltage bridge 2
8	NC	Not connected

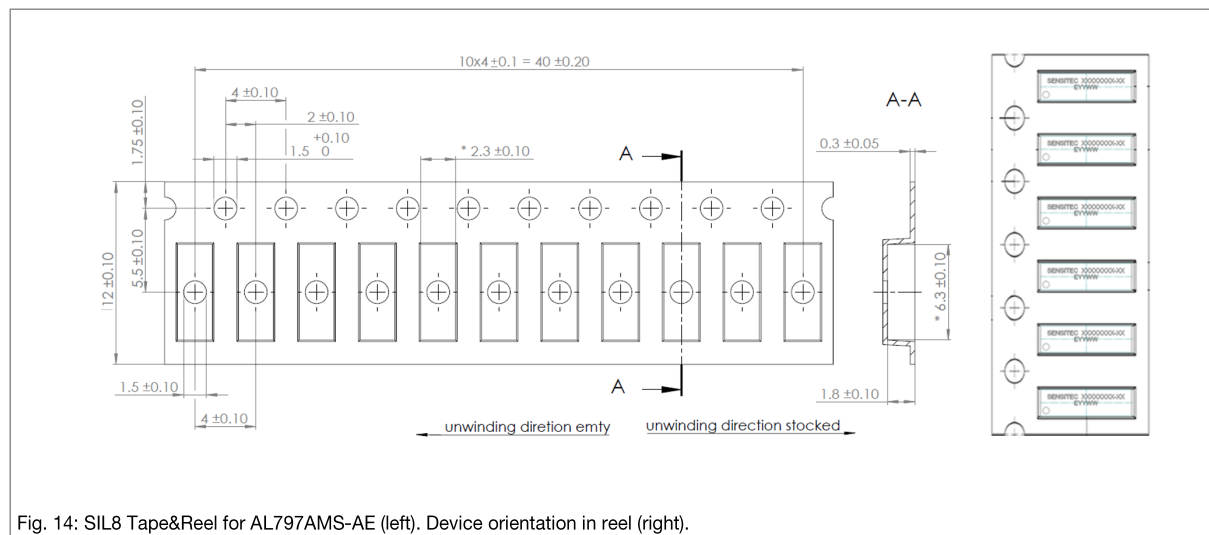


Dimensions

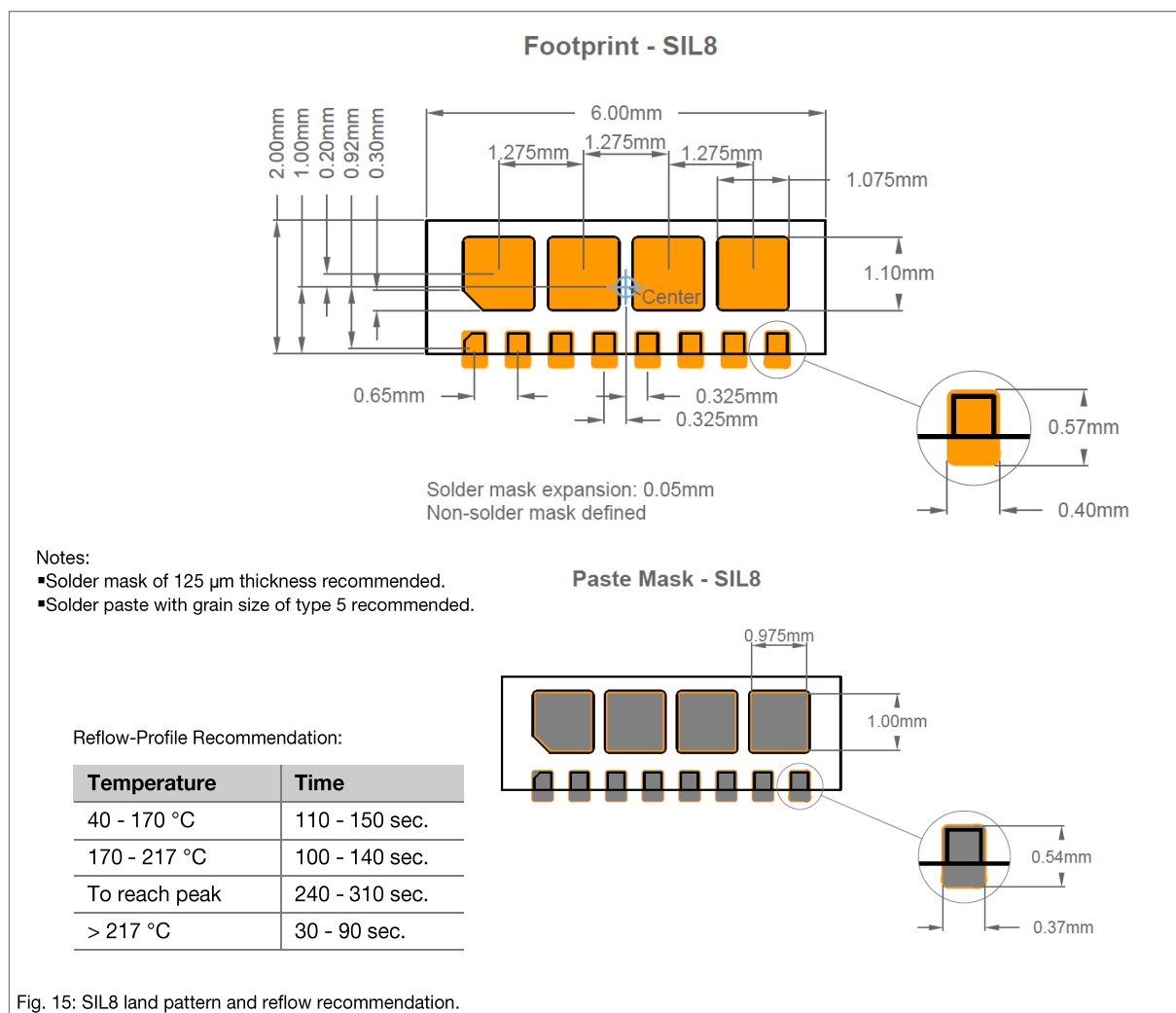


AL797AMS-AE SIL8 Package

Reel layout



Land pattern layout



AL797AMS-AS SIL8-D Package

Pinout

Pad	Symbol	Parameter
1	NC	Not connected
2	+V _{O1}	Positive output voltage bridge 1
3	+V _{O2}	Positive output voltage bridge 2
4	V _{CC}	Supply voltage
5	GND	Ground
6	-V _{O1}	Negative output voltage bridge 1
7	-V _{O2}	Negative output voltage bridge 2
8	NC	Not connected

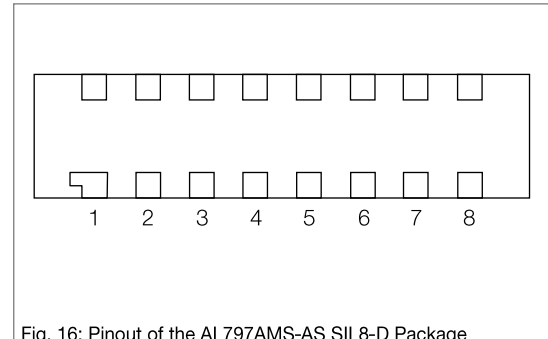
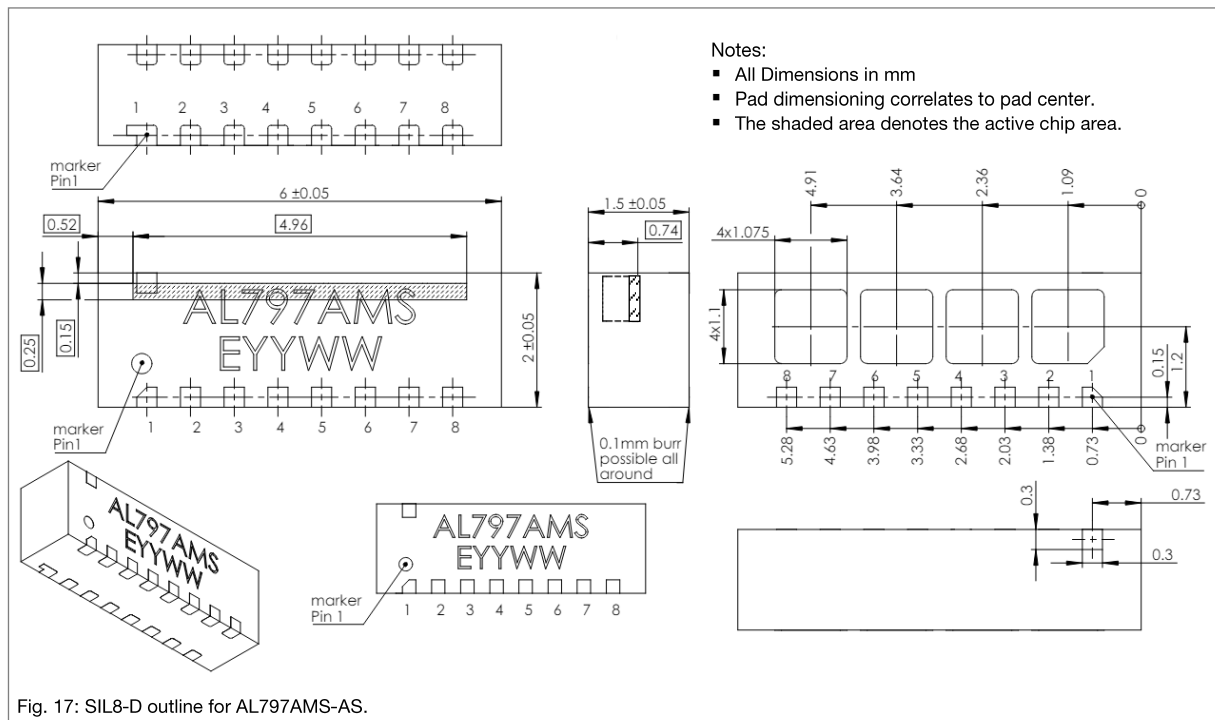


Fig. 16: Pinout of the AL797AMS-AS SIL8-D Package

Dimensions



AL797AMS-AS SIL8-D Package

Reel layout

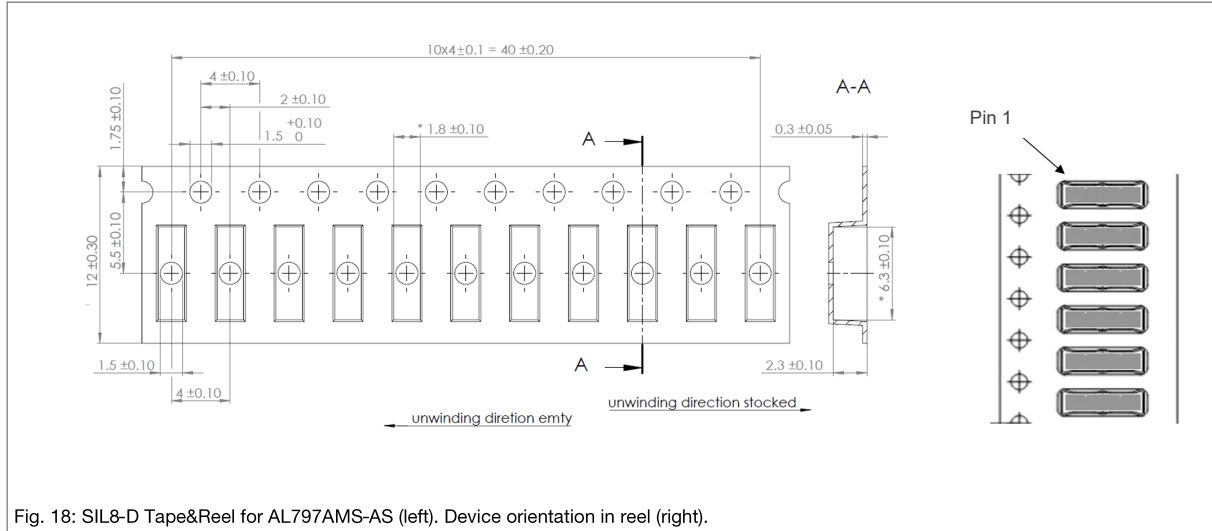


Fig. 18: SIL8-D Tape&Reel for AL797AMS-AS (left). Device orientation in reel (right).

Land pattern layout

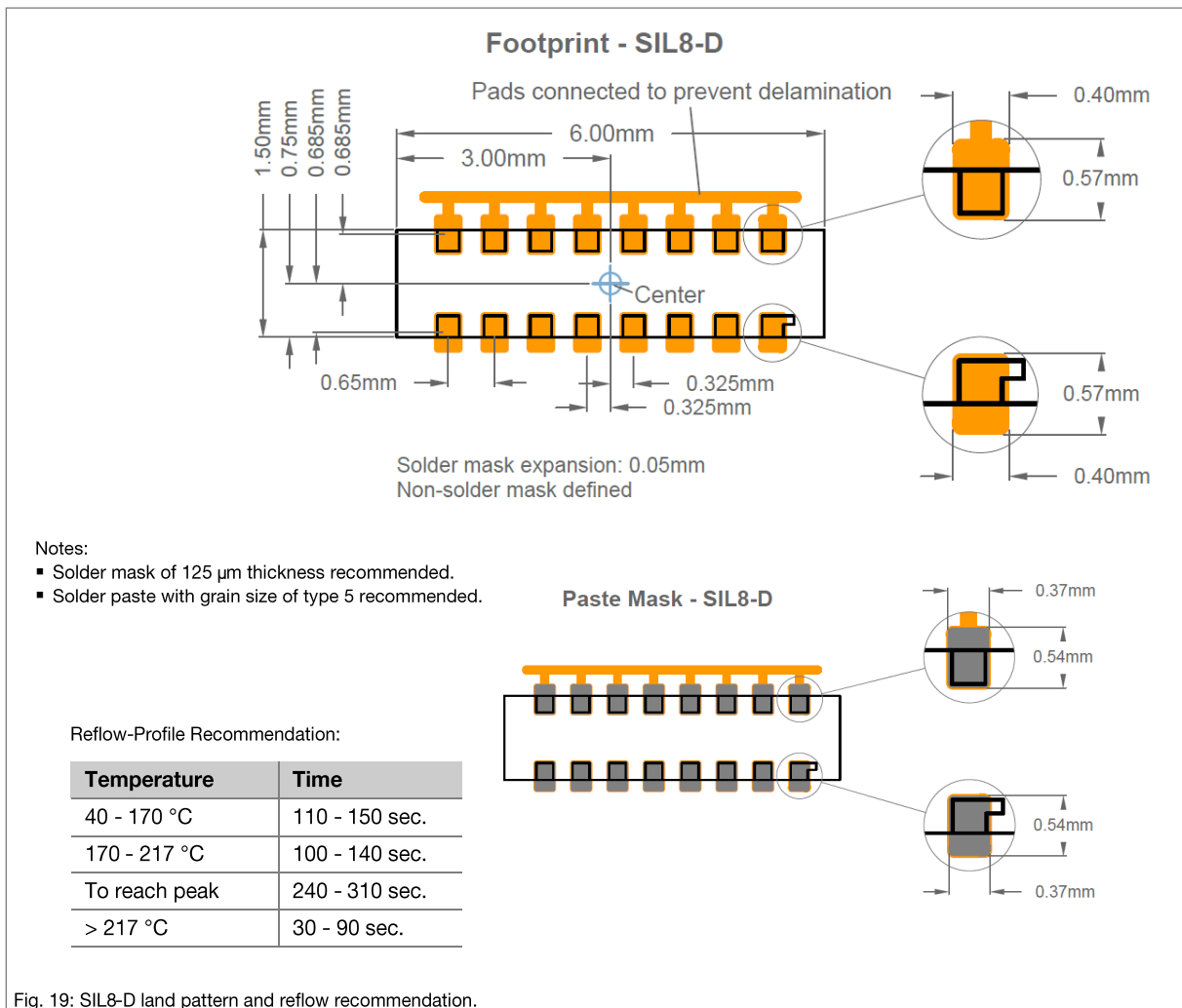


Fig. 19: SIL8-D land pattern and reflow recommendation.

Evalboard with AL797AMA-AE

Pinout

Pad	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

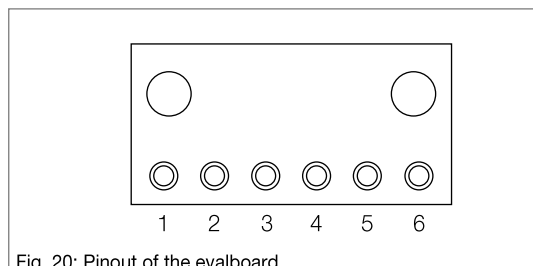


Fig. 20: Pinout of the evalboard

Dimensions

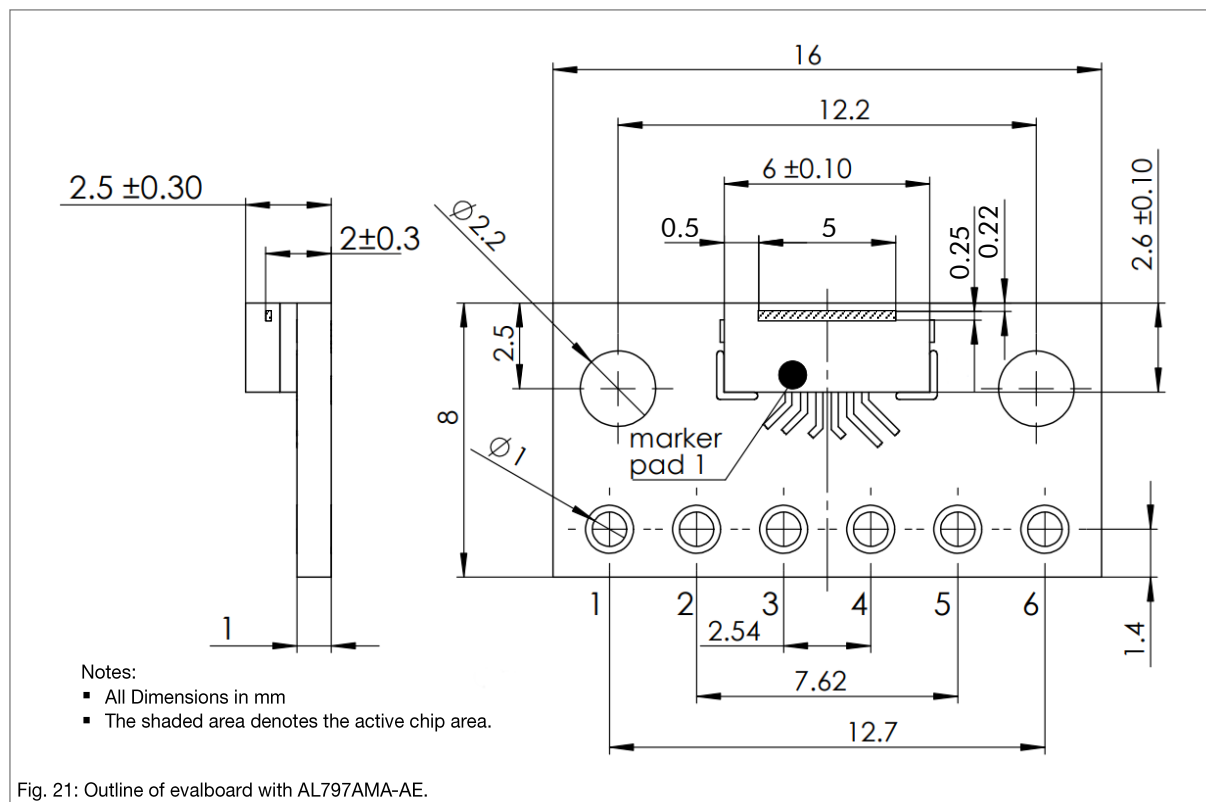
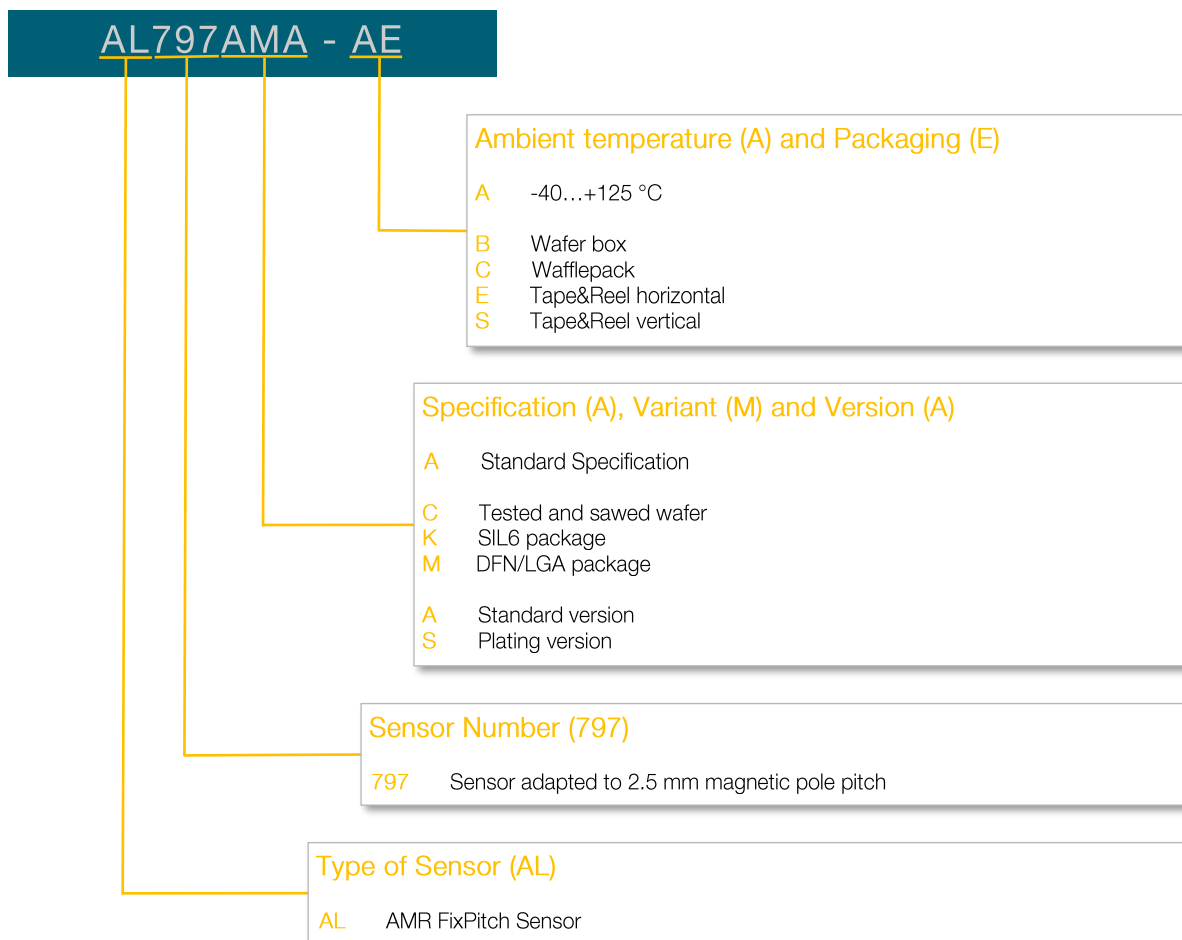


Fig. 21: Outline of evalboard with AL797AMA-AE.

Additional Information on Ordering Code



Special Design Features



Sensors with PerfectWave design provide the best signal quality, highest accuracy and optimal sensor linearity by filtering out higher harmonics in the signal. The linearity of the sensor is assured, even for weak magnetic field measurement.



In PurePitch sensors, the FixPitch principle is extended over several poles in order to increase accuracy still further. This arrangement reduces the influence of errors in the measurement scale and improves the immunity to interference fields.



FixPitch sensors are adapted to the pole length (pitch) of the measurement scale. The linearity of the sensor is optimized and the influence of interference fields is minimized.

General Information

Product Status

Article	Status
AL797ACA-AB	The product is in series production.
AL797ACA-AC	The product is in series production.
AL797AKA-AC	The product is in series production.
AL797AMA-AE	The product is in series production.
AL797AMS-AE	The product is under development, qualification is on going. Deliverables have a sample status. The datasheet is preliminary.
AL797AMS-AS	The product is under development, qualification is on going. Deliverables have a sample status. The datasheet is preliminary.
AL797 Evalboard	This product is for evaluation of the AL797AMA-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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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 the Change	Date
AL797.DSE.15	Add evalboard information (p. 13)	11/2024
AL797.DSE.14	Layout improvements (pp. 1-15), Change technical drawing (p. 9, p. 11)	05/2024
AL797.DSE.13	Disclaimer supplement	06/2022
AL797.DSE.12	Change of corporate design (pp. 1-10)	12/2021
AL797.DSE.00	Original (pp. 1-10)	10/2012

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