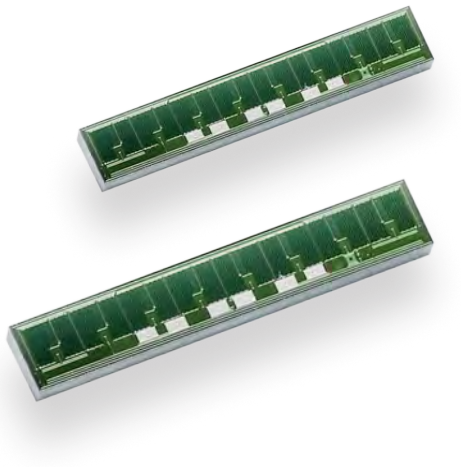
SENSITEC
MAGNETORESISTIVE SENSORS

DATA SHEET

AL796

MagnetoResistive FixPitch Sensor (2 mm)



The AL796 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. 2).

The MR strips of this FixPitch sensor geometrically match to a pole length of 2 mm (equal to a magnetic period of 4 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 sev - eral 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 AL796 is available as bare die. For SMD processing, the sensor is available in a Sil6, LGA or SIN8 package.

Product Overview of AL796

Article description	Package	Delivery type
AL796ACA-AC	Bare Die	Wafer pack (192)
AL796ACA-AB	Die on Wafer [1]	Waferbox
AL796AKA-AC	SIL6	Wafer pack (90)
AL796AMA-AE	LGA6L	Tape on reel (2500)
AL796AIA-AE	SIN8	Tape on reel (2500)
AL796AIA-AS	SIN8-D	Tape on reel (2500)

[1] Minimum order quantities apply.

Quick Reference Guide

Symbol	Parameter	Min.	Typ.	Max.	Unit
P	Pitch (magnetic pole length)	-	2	-	mm
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}	9.0	11.0	13.0	mV/V
R_B	Bridge resistance	2.2	3.4	4.6	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 bare die version	-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 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, for example:

- Motor integrated encoder
- Motorfeedback system

ESD

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Magnetic Data

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
H_{ext}	Magnetic field strength [1]		5.0	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 °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.2	-2.0	-	+2.0	mV/V
TC_{Voff}	Temperature coefficient of V_{off} [2]	T_{amb} = (-40...+125)°C	-4.0	-	+4.0	(µV/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...+125)°C	-0.48	-0.42	-0.36	%/K
R_B	Bridge resistance [5]		2.2	3.4	4.6	kΩ
R_S	Sensor resistance [6]		1.1	1.7	2.3	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(P) and cos(P).

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

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

[6] Sensor resistance between V_{CC} and GND.

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

Accuracy

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
ΔX	Measurement error [8]		-	5.0	7.0	µm
k	Amplitude synchronism [9]		-	0.1	1	% of V_{peak}

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

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

Dynamic Data

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
f	Frequency range		1 [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	-	mm
d	Distance [11]	See Fig. 1	-	0.7	-	mm
T_{amb}	Ambient temperature		-40	-	+125	°C

[11] See Fig. 3 for detailed information.

Output Signal Information

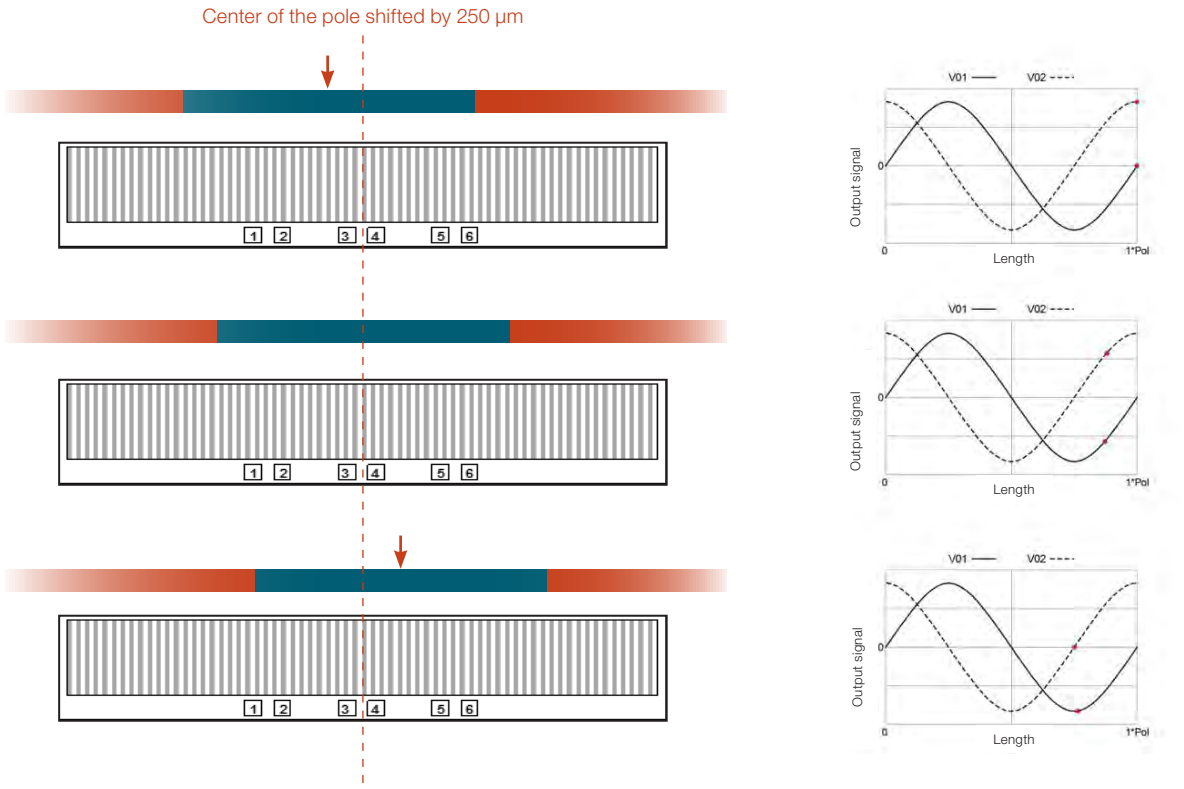


Fig. 1: Sensor signal as function of the relative position of sensor and magnetic scale.

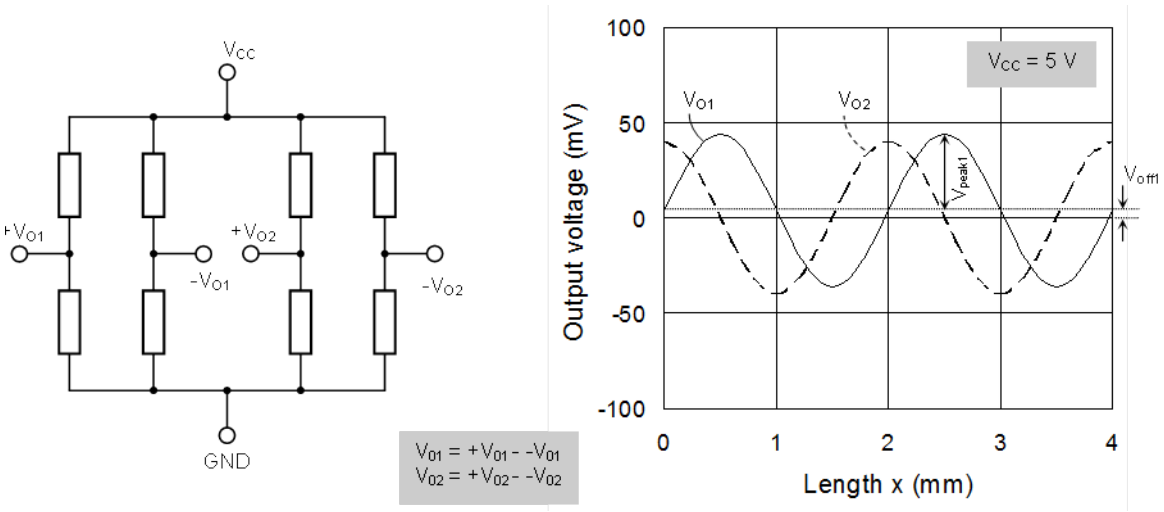


Fig. 2: left: Simplified circuit diagram.
right: Output signals as function of linear displacement.

Typical Performance Graphs

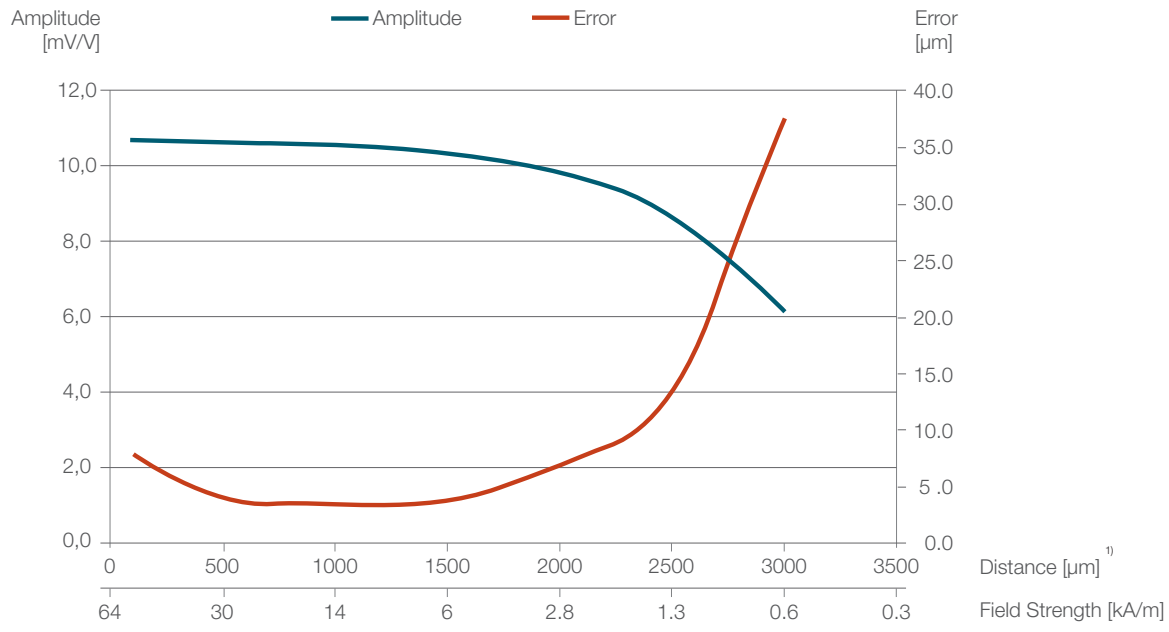


Fig. 3: Amplitude and error vs. distance and field strength.

1) In use with a plastic bound hard ferrite magnetic scale (Br = 220 mT, thickness 1 mm, mounted on stainless steel).

AL796ACA Bare Die

Pinning

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

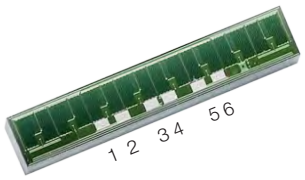
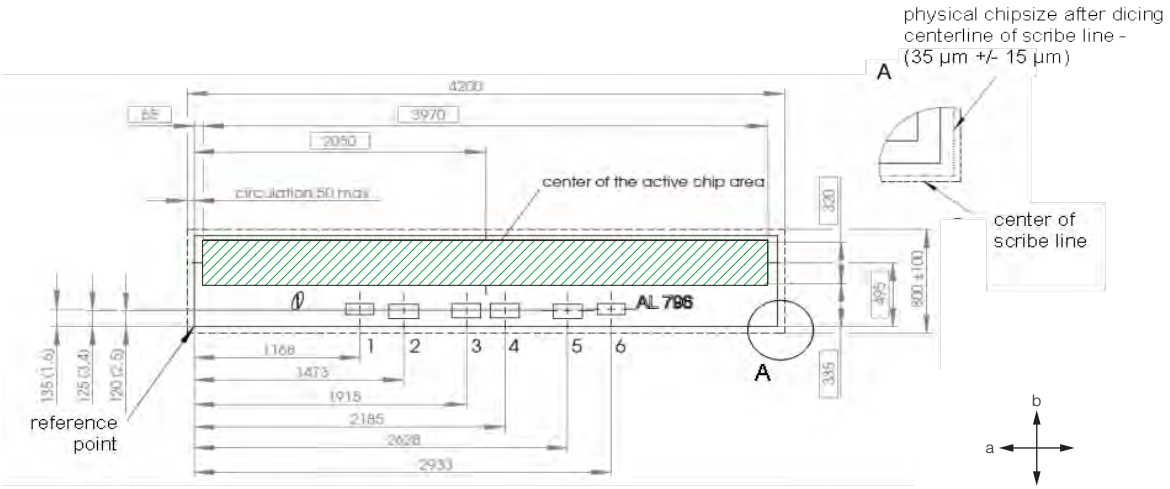


Fig. 4: AL796ACA.

Mechanical Data



Notes:

- All dimensions in µm.
- Pad dimensioning correlates to pad center.
- 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.

Pad	a x b
1	195 x 90
2	205 x 110
3	200 x 110
4	200 x 110
5	205 x 110
6	195 x 90

Fig. 5: Chip outline for AL796ACA as bare die.

Data for Packaging and Interconnection Technologies

Parameter	Value	Unit
Chip area [1]	4.2 x 0.8	mm^2
Chip thickness	525 ± 10	µm
Pad size	See Fig. 5	-
Pad thickness	0.8	µm
Pad material	AlCu	-

[1] Tolerances of chip see Fig.5.

AL796AKA SIL6 Package

Pinning

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

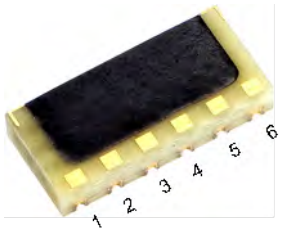
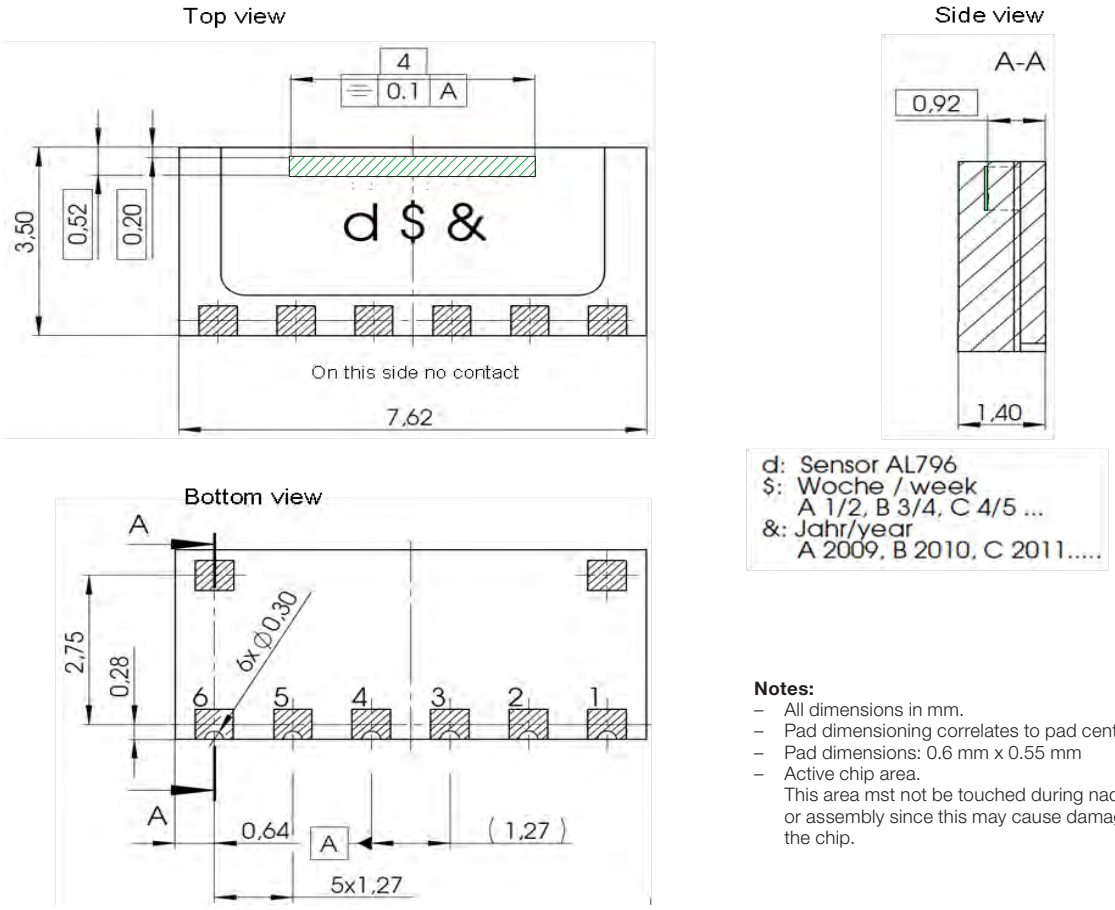


Fig. 6: AL796AKA.

Dimensions



Notes:
- All dimensions in mm.
- Pad dimensioning correlates to pad centre.
- Pad dimensions: 0.6 mm x 0.55 mm
- Active chip area.
  This area mst not be touched during nadling or assembly since this may cause damage to the chip.

Fig. 7: SIL6 outline for AL796AKA.

AL796AMA LGA6L Package

Pinning

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

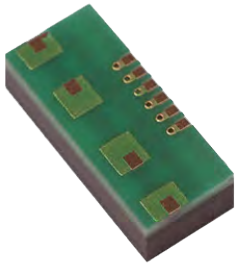


Fig. 8: AL796AMA.

Dimensions

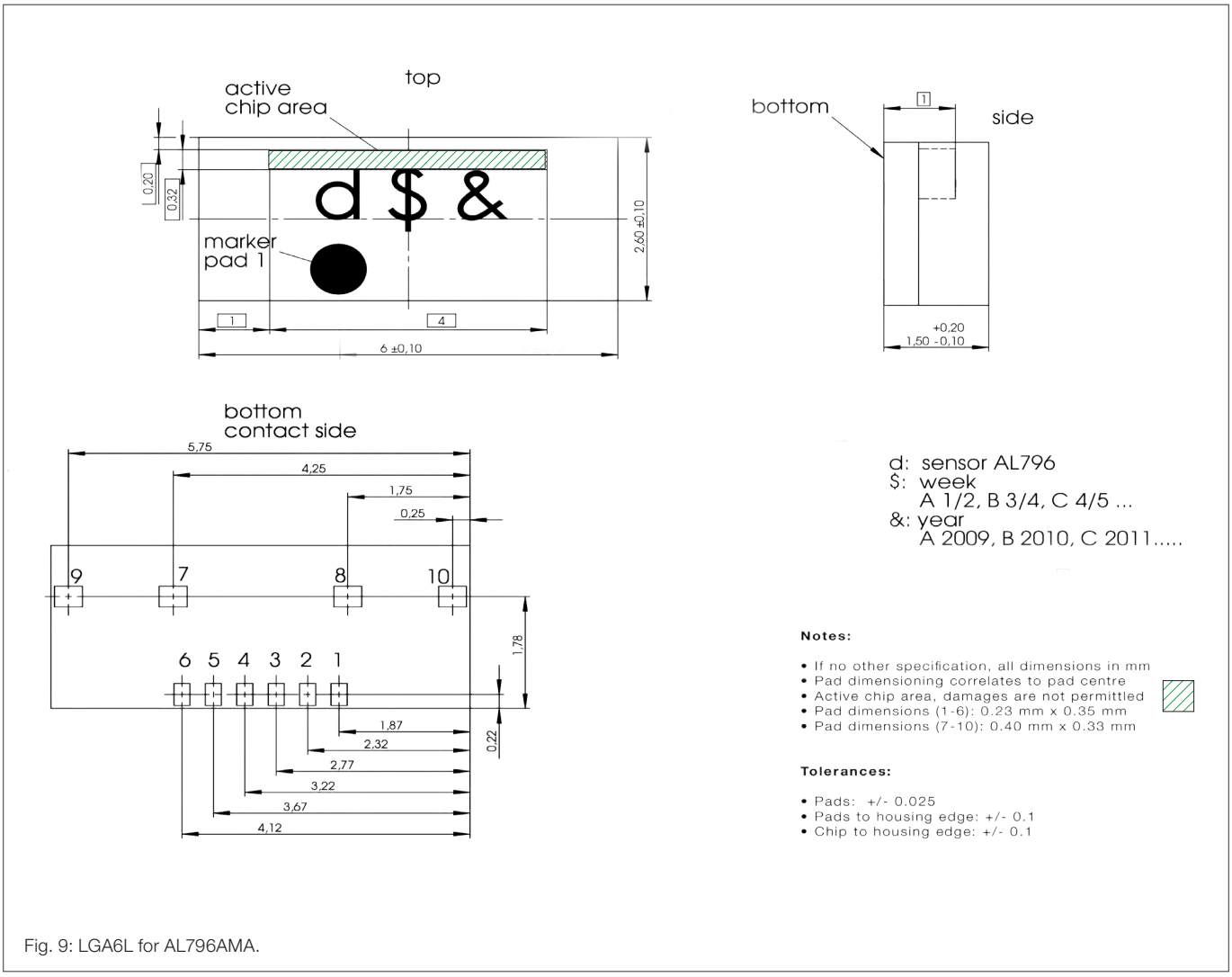


Fig. 9: LGA6L for AL796AMA.

AL796AIA SIN8 Package

Pinning

Pad	Symbol
1	n.c.
2	$+V_{O1}$
3	$+V_{O2}$
4	V_{CC}
5	GND
6	$-V_{O1}$
7	$-V_{O2}$
8	n.c.

Fig. 10: AL796AIA (SIN8).

Dimensions

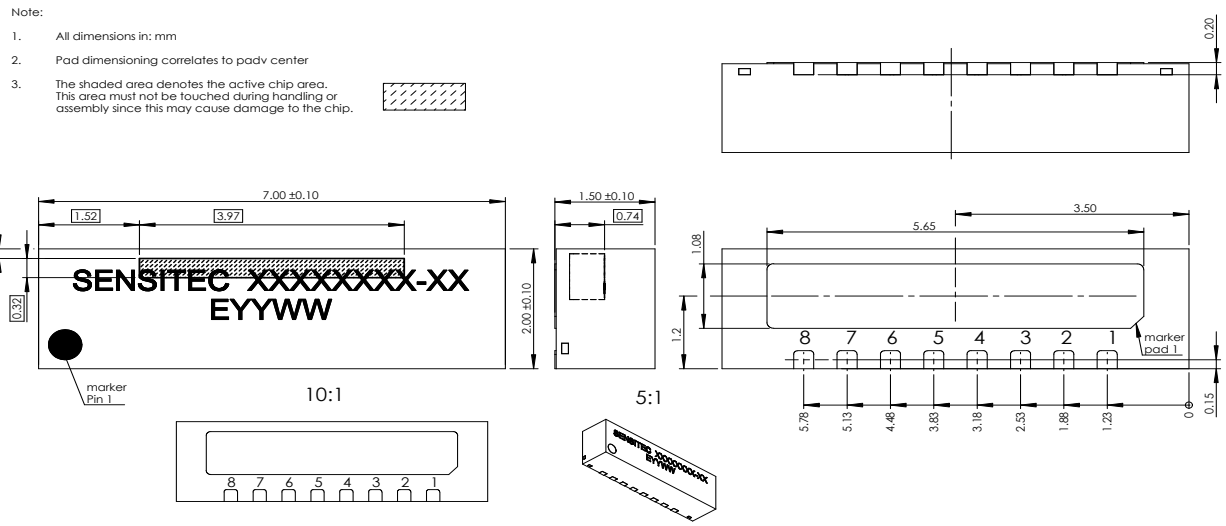


Fig. 11: SIN8 for AL796AIA.

AL796AIA SIN8-D Package

Pinning

Pad	Symbol
1	n.c.
2	$+V_{O1}$
3	$+V_{O2}$
4	V_{CC}
5	GND
6	$-V_{O1}$
7	$-V_{O2}$
8	n.c.

Fig. 12: AL796AIA (SIN8-D).

Dimensions

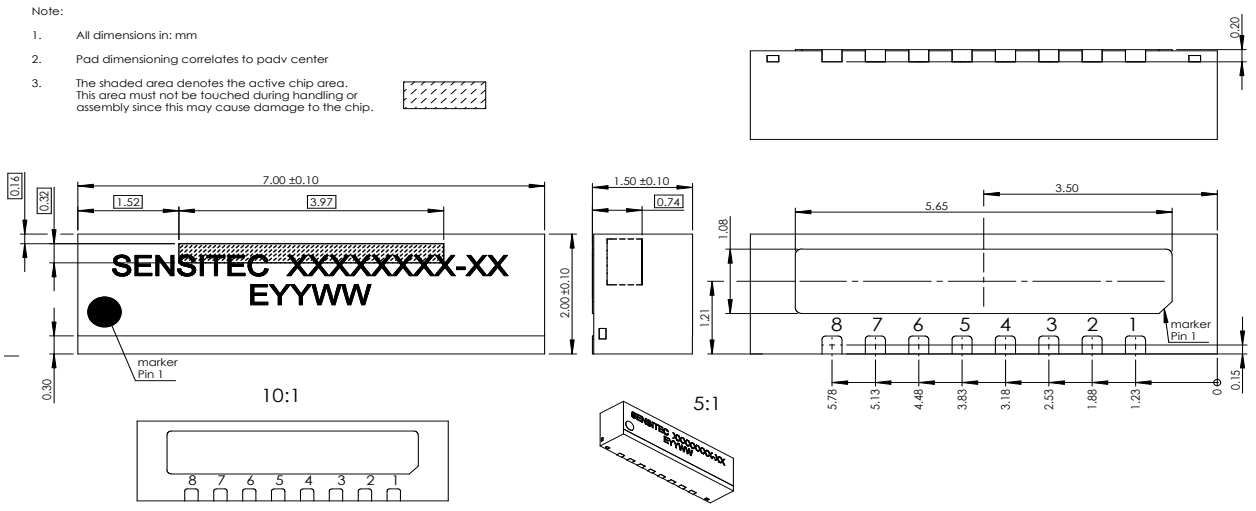


Fig. 13: SIN8-D for AL796AIA.

Special Design Features

PerfectWave

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.

PurePitch

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

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
AL796ACA-AC	The product is in series production.
AL796ACA-AB	The product is in series production.
AL796AKA-AC	The product is in series production.
AL796AMA-AE	The product is in series production.
AL796AIA-AE	The product is under development, qualification is on going. Deliverables have a sample status. The datasheet is preliminary.
AL796AIA-AS	The product is under development , qualification is on going. Deliverables have a sample status. The datasheet is preliminary.
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
AL796.DSE.13	New product variant/Technical changes (p. 1, p. 8. p. 11) / New page (p. 9)	03/2022
AL796.DSE.12	New page (p. 8) / various textual changes	12/2021
AL796.DSE.11	Various textual changes	01/2020
AL796.DSE.00	Original (pp. 1-7)	04/2012

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