SENSITEC
MAGNETORESISTIVE SENSORS

DATA SHEET

AL795

MagnetoResistive FixPitch Sensor (0.5 mm)

The AL795 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 0.5 mm (equal to a magnetic period of 1 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 resistances in this PurePitch sensor are distributed over several poles (8), thus the errors in the 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 AL795 is available as bare die. For SMD processing, the sensor is available in a SIL6 or LGA package.

Product Overview of AL795

Article description	Package	Delivery type
AL795ACA-AC	Bare die	Waffle pack (192)
AL795ACA-AB	Die on wafer [1]	Waferbox
AL795AKA-AC	SIL6	Waffle pack (90)
AL795AMA-AE	LGA6L	Tape on reel (2500)

[1] Minimum order quantities apply.

Quick Reference Guide

Symbol	Parameter	Min.	Typ.	Max.	Unit
P	Pitch (magnetic pole length)	-	0.5	-	mm
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}	9.0	11.0	13.0	mV/V
R_B	Bridge resistance	3.0	4.6	6.2	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 0.5 mm poles
- PurePitch design (8 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
- Microscope table positioning

ESD

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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 °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	-0.5	-	+0.5	mV/V
TC_{Voff}	Temperature coefficient of V_{off} [2]	T_{amb} = (-40...+125)°C	-2	-	+2	(µV/V)/K
V_{peak}	Signal amplitude per V_{CC} [3]	See Fig.2	9	11	13	mV/V
TC_{Vpeak}	Temperature coefficient of V_{peak} [4]	T_{amb} = (-40...+125)°C	-4.8	-4.2	-3.6	10^{-3}/K
R_B	Bridge resistance [5]		3.0	4.6	6.2	kΩ
R_S	Sensor resistance [6]		1.5	2.3	3.1	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] $TC_{Vpeak} = 100 \cdot \frac{V_{peak(T2)} - V_{peak(T1)}}{V_{peak(T1)} \cdot (T_2 - T_1)}$ 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] $TC_{RB} = 100 \cdot \frac{R_{B(T2)} - R_{B(T1)}}{R_{B(T1)} \cdot (T_2 - T_1)}$ with T_1 = +25 °C; T_2 = +125 °C.

Accuracy

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
ΔX	Measurement error [8]		-	3.0	5.0	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 attenuation.

General Data

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
P	Pitch (magnetic pole length)	See Fig. 1	-	0.5	-	mm
d	Distance [11]	See Fig. 1	-	0.15	-	mm
T_{amb}	Ambient temperature		-40	-	125	°C

[11] See Fig. 3 for detailed information.

Output Signal Information

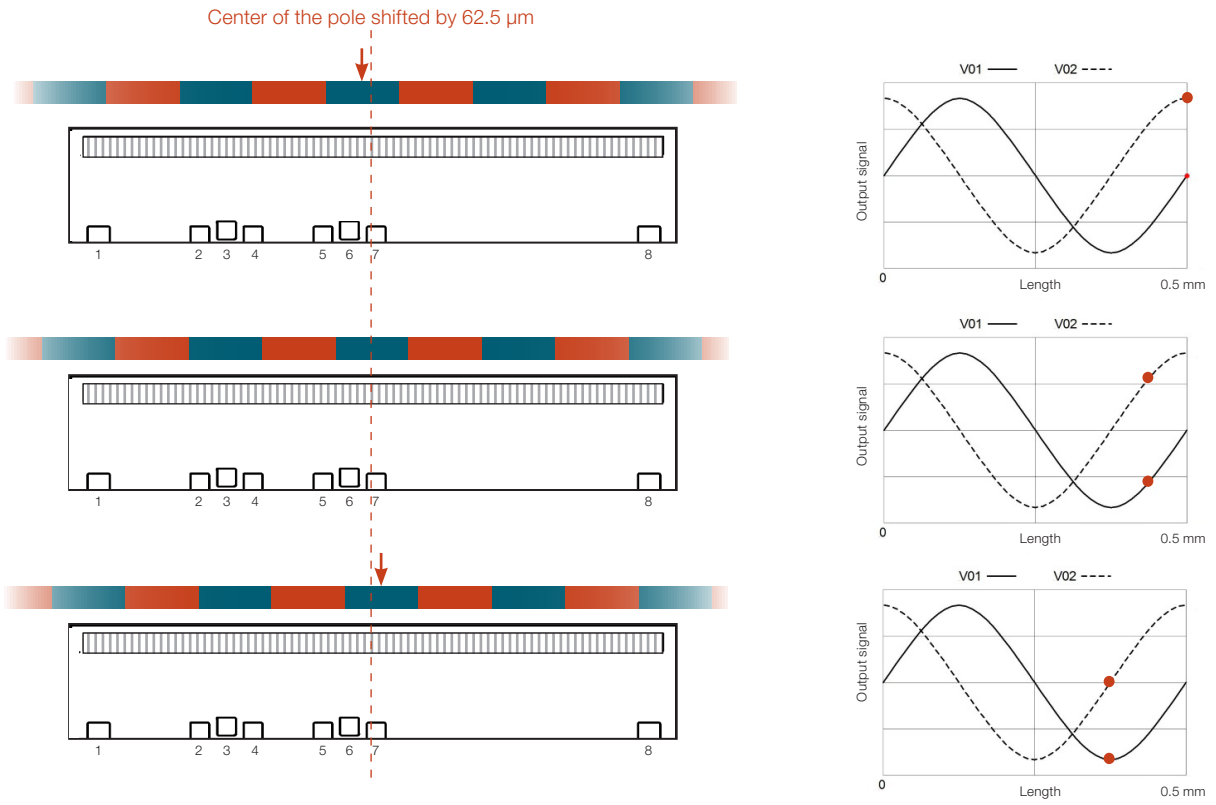


Fig. 1: Sensor signal as function of the relative position of sensor and magnetic scale.

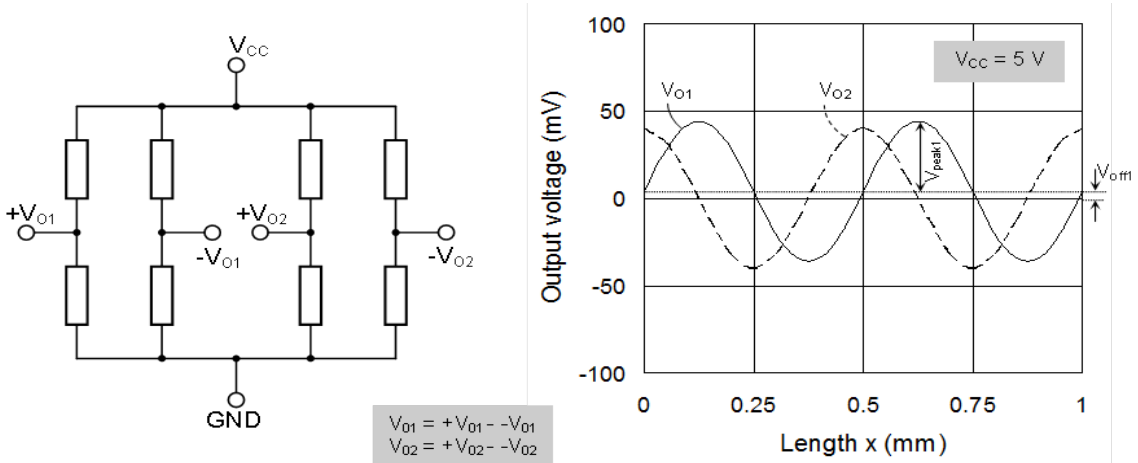


Fig. 2: *left:* Simplified circuit diagram.
right: Output signals as function of linear displacement.

Typical Performance Graphs

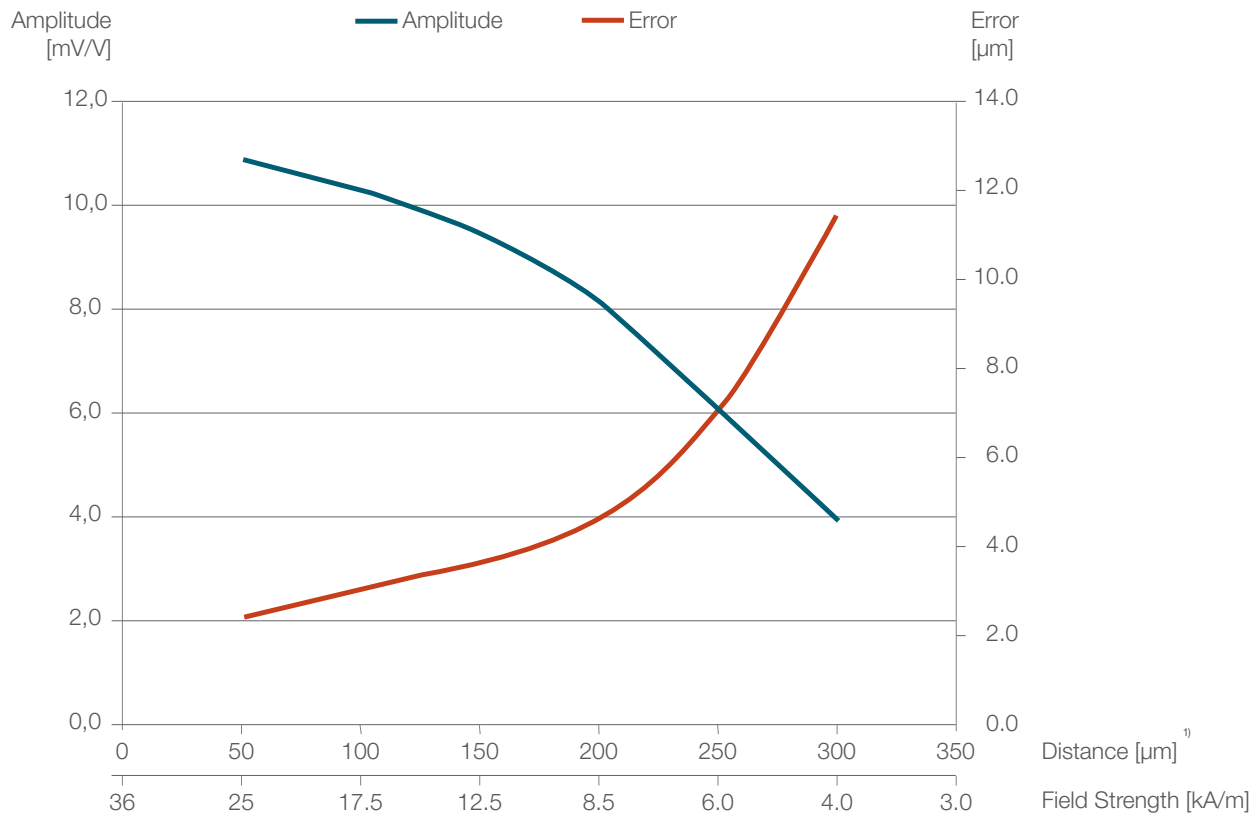


Fig. 3: Amplitude and error vs. distance and field strength.

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

AL795ACA Bare Die

Pinning

Pad	Symbol	Parameter	Pad dimension [µm]
1	V_{CC}	Supply voltage	155 x 130
2	$-V_{O1}$	Negative output voltage bridge 1 (equal to 4)	130 x 130
3	$+V_{O1}$	Positive output voltage bridge 1	130 x 140
4	$-V_{O1}$	Negative output voltage bridge 1 (equal to 2)	130 x 130
5	$-V_{O2}$	Negative output voltage bridge 2 (equal to 7)	130 x 130
6	$+V_{O2}$	Positive output voltage bridge 2	130 x 140
7	$-V_{O2}$	Negative output voltage bridge 2	130 x 130
8	GND	Ground	155 x 130
9 - 12	NC	Not connected	155 x 130

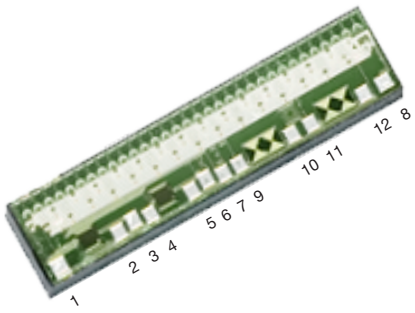
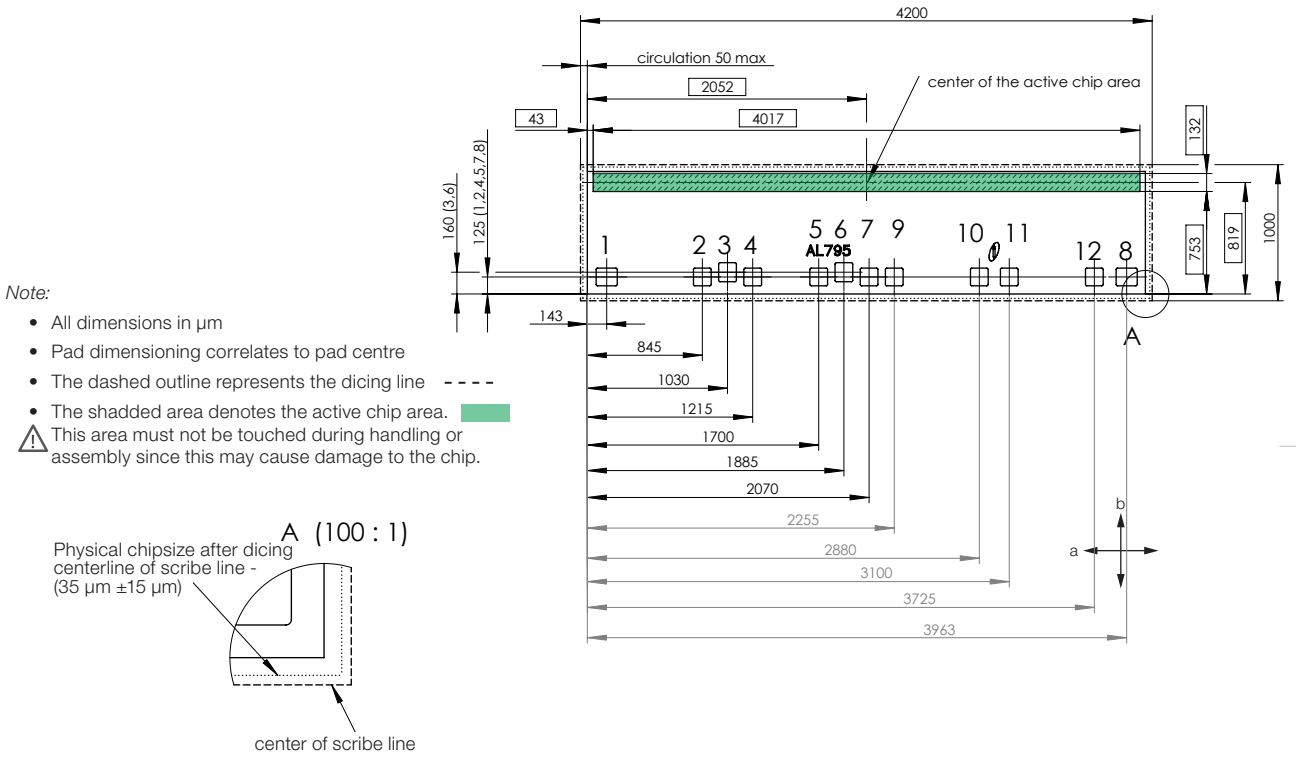


Fig. 4: AL795ACA.

Dimensions



Note:

- All dimensions in µm
- Pad dimensioning correlates to pad centre
- The dashed outline represents the dicing line - - - -
- The shadded area denotes the active chip area.

⚠ This area must not be touched during handling or assembly since this may cause damage to the chip.

Fig. 5: Chip outline for AL795ACA.

Data for Packaging and Interconnection Technologies

Parameter	Value	Unit
Chip area [1]	4.2 x 1.0	mm^2
Chip thickness	525 ± 3	µm
Pad size	See Fig. 5	-
Pad material	AlCu	-

[1] Tolerances of chip see Fig. 5.

AL795AKA SIL6 Package

Pinning

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

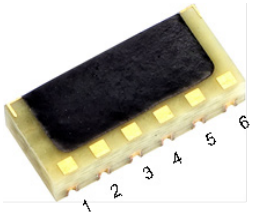
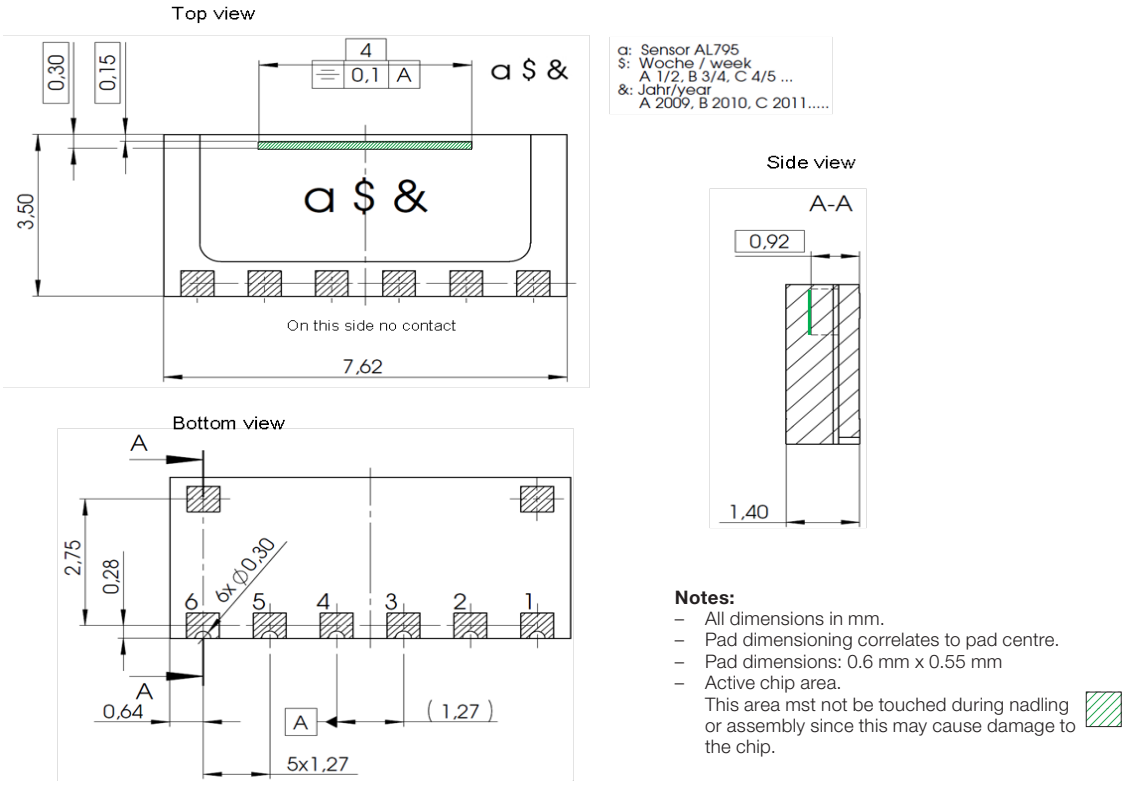


Fig. 6: AL795AKA.

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 AL795AKA.

AL795AMA 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

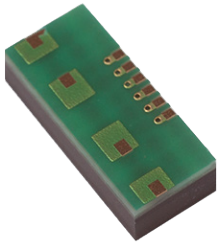


Fig. 8: AL795AMA.

Dimensions

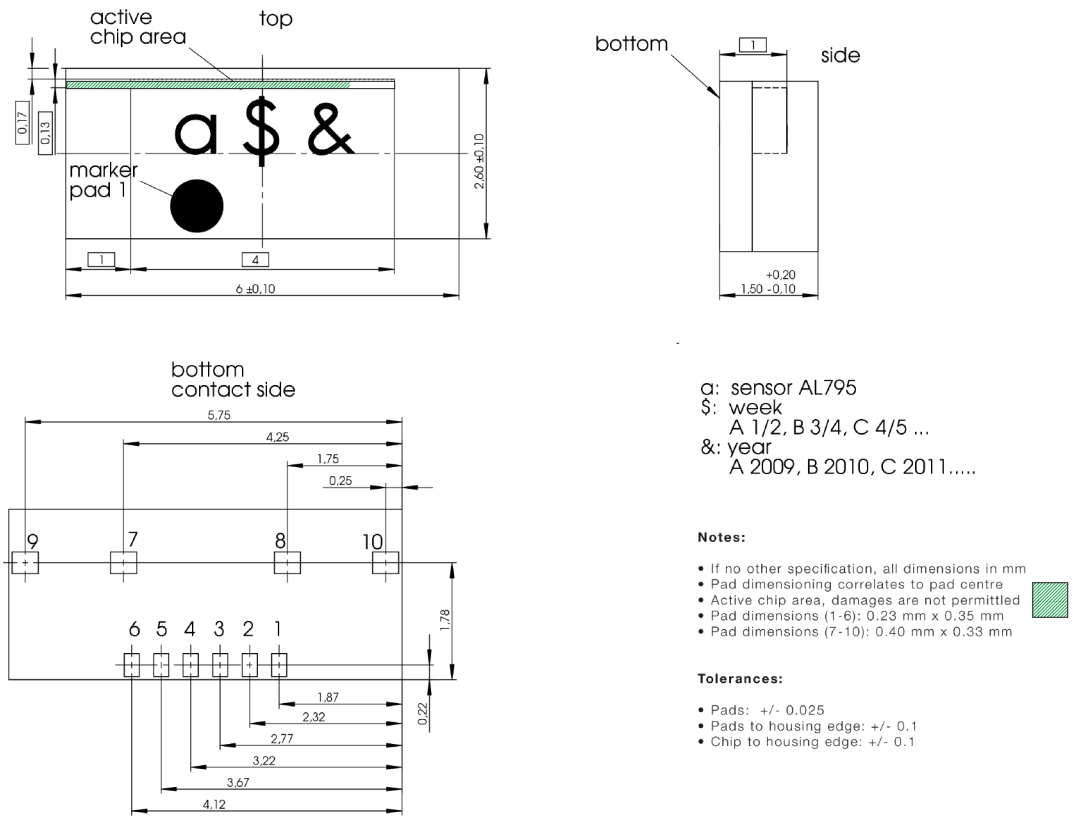


Fig. 9: LGA6L for AL795AMA.

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
AL795ACA-AC	The product is in series production.
AL795ACA-AB	The product is in series production.
AL795AKA-AC	The product is in series production.
AL795AMA-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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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
AL795.DSE.12	Disclaimer supplement	06/2022
AL795.DSE.11	Change of corporate design (pp. 1-10)	01/2022
AL795.DSE.00	Original (pp. 1-10)	10/2012

Sensitec GmbH
Schanzenfeldstr. 2 · 35578 Wetzlar · Germany
Tel. +49 6441 5291-0 · Fax +49 6441 5291-117
www.sensitec.com · sensitec@sensitec.com