SENSITEC
MAGNETORESISTIVE SENSORS

DATA SHEET

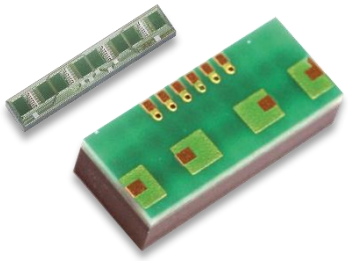
# AL779

## MagnetoResistive FixPitch Sensor (5 mm)

The AL779 is an AnisotropicMagnetoResistive (AMR) position sensor with a high resistance for low power applications. The sensor contains two Wheatstone bridges shifted against each other. The output signals are proportional to sine and cosine signals of the coordinate to be measured (see Fig. 2).

The MR strips of this FixPitch sensor geometrically match to a pole length of 5 mm (equal to a magnetic period of 10 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 output amplitude is almost constant in a wide working range between sensor and magnetic scale.

The bond version of AL779 is available as bare die. For SMD processing the sensor is available in a LGA package.



### Features

- Based on the AnisotropicMagnetoResistive (AMR) effect
- Contains two high resistance Wheatstone bridges on chip
- Sine and cosine output
- Adapted to 5 mm poles
- PerfectWave technology
- Ambient temperature range from -40 °C to +125 °C

### Advantages

- Easy to mount
- Contactless angle and position measurement
- Large air gap
- Excellent accuracy
- Minimized offset voltage
- Negligible hysteresis
- Low power consumption

### Applications

Incremental encoder for rotating movements in various applications, for example:

- Motor integrated encoder
- Low power applications

## Product Overview

| Article | Package | Delivery type |
|---|---|---|
| AL779ACA-AB[1] | Die on wafer | Waferbox |
| AL779AMA-AE | LGA6L | Tape on reel (2000) |
| AL779 Evalboard | Evalboard | ESD-Box |

## Quick Reference Guide

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| P | Pitch (magnetic pole length) | - | 5 | - | mm |
| $V_{CC}$ | Operating voltage (per bridge) | - | 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 | 370 | 440 | 510 | 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 |
| $T_{stg}$ | Ambient temperature | -40 | +150 | °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.

ESD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## 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. 2 | -2.0 | - | +2.0 | mV/V |
| $TC_{Voff}$ | Temperature coefficient of $V_{off}$[2][3] | $T_{amb}$ = (-40…+125) °C | -4.0 | - | +4.0 | mV/V/K |
| $V_{peak}$ | Signal amplitude per $V_{CC}$[4] | See Fig. 2 | 10.0 | 12.0 | 14.0 | mV/V |
| $TC_{Vpeak}$ | Temperature coefficient of $V_{peak}$[5] | $T_{amb}$ = (-40…+125) °C | -0.32 | -0.36 | -0.40 | %/K |
| $R_B$ | Bridge resistance[6] | | 370 | 440 | 510 | kΩ |
| $R_S$ | Sensor resistance[7] | | 185 | 220 | 255 | kΩ |
| $TC_{RB}$ | Temperature coefficient of $R_B$[8] | $T_{amb}$ = (-40…+125) °C | 0.22 | 0.26 | 0.30 | %/K |

## Accuracy

$T_{amb}$ = -40…+105 °C; $H_{ext}$=25 kA/mT; $V_{cc}$ = 5.0 V; unless otherwise specified.

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| ΔX | Measurement error[9] | | - | 50.0 | - | µm |
| k | Amplitude synchronism[10] | | - | 0.1 | - | % of $V_{peak}$ |

## Dynamic Data

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| f[11] | Frequency range | | - | - | 1 | MHz |

## General Data

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| P | Pitch (magnetic pole length) | See Fig. 1 | - | 5.0 | - | mm |
| d | Distance | See Fig. 1 | - | 2.0 | - | mm |
| $T_{amb}$ | Ambient temperature | | -40 | - | +125 | °C |

[2] For larger production volume can be restricted to target value +/- 2 (µV/V)/K.

[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] $\Delta X = |X_{real} - X_{measured}|$ 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.


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## Dimensions

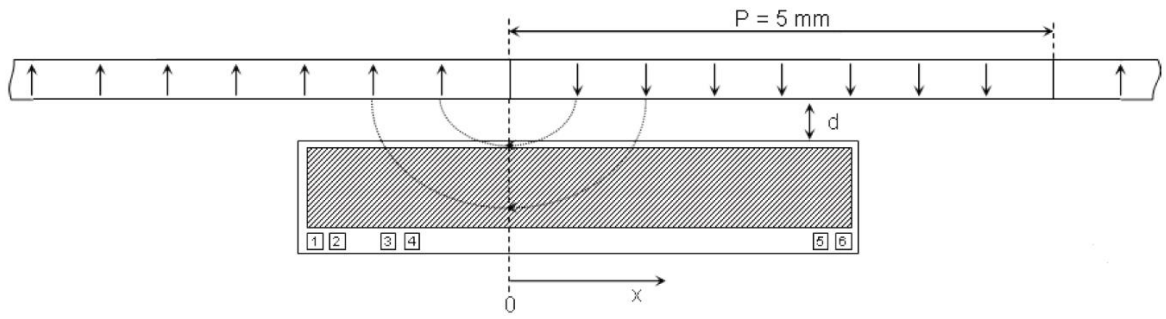


Fig. 1: Arrangement of sensor and magnetic scale. In this example the sensor moves in x-direction along the fixed scale.

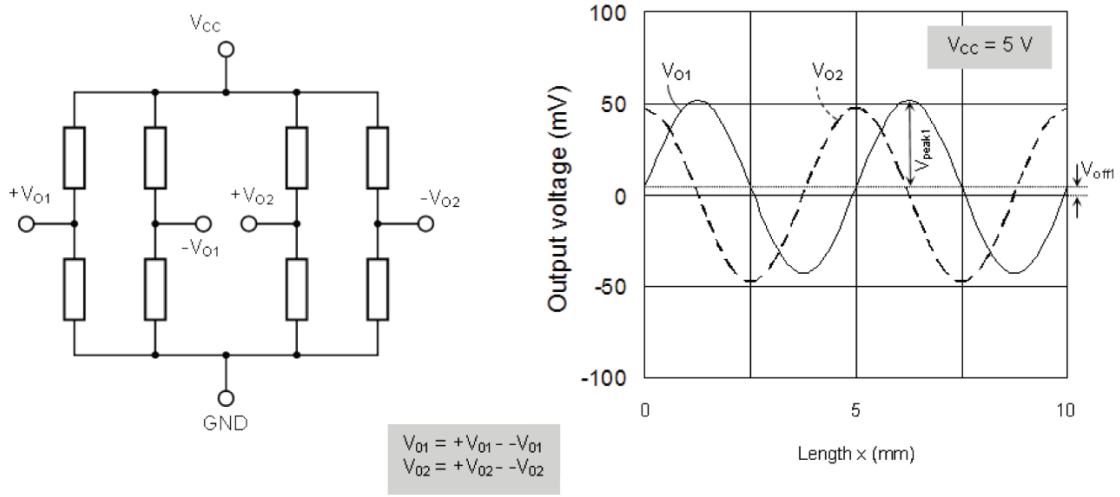


Fig. 2: Left: Simplified circuit diagram. Right: Output signals as function of linear displacements.


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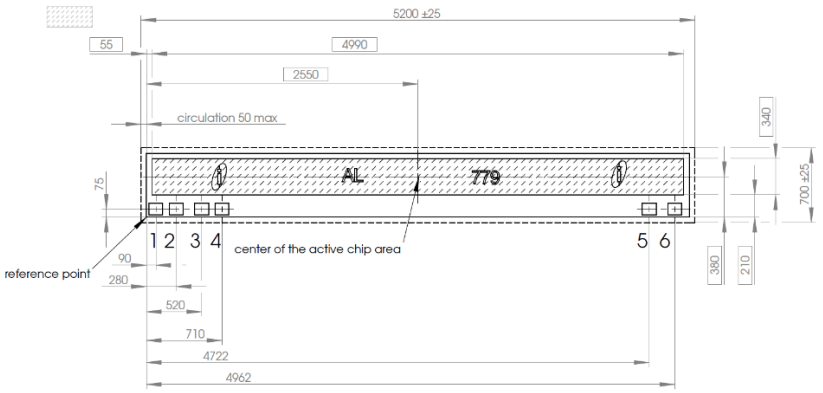
## Pinout AL779ACA

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


Fig. 3: Pinning of AL779ACA

## Technical drawing AL779ACA




| Pad | a x b |
|---|---|
| 1 | 130 x 110 |
| 2 | 130 x 110 |
| 3 | 130 x 110 |
| 4 | 130 x 110 |
| 5 | 130 x 110 |
| 6 | 130 x 110 |

Notes:

- All dimensions in µm.
- Pad dimensioning correlates to pad centre.
- The dashed outline drafted to dicing line.
- Pad numbers & chip designations do not appear on the chip.
- Pad dimensions: 130 µm x 110 µm
- ⚠The shaded area denotes the active chip area. This area must not be touched during handling or assembly since this may damage the chip.

Fig. 4 Chip outline for AL779ACA.

## Data for Packaging and Interconnection Technologies

| Parameter | Value | Unit |
|---|---|---|
| Chip area[12] | 5.2 x 0.7 | $mm^2$ |
| Chip thickness | 380 ± 25 | µm |
| Pad size | See Fig. 4 | - |
| Pad thickness | 0.4 | µm |
| Pad material | Au | - |

[12] Tolerances of chip see Fig. 4.

## Pinout AL779AMA

| 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 |

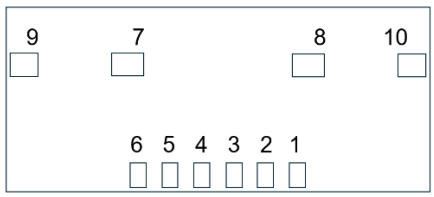
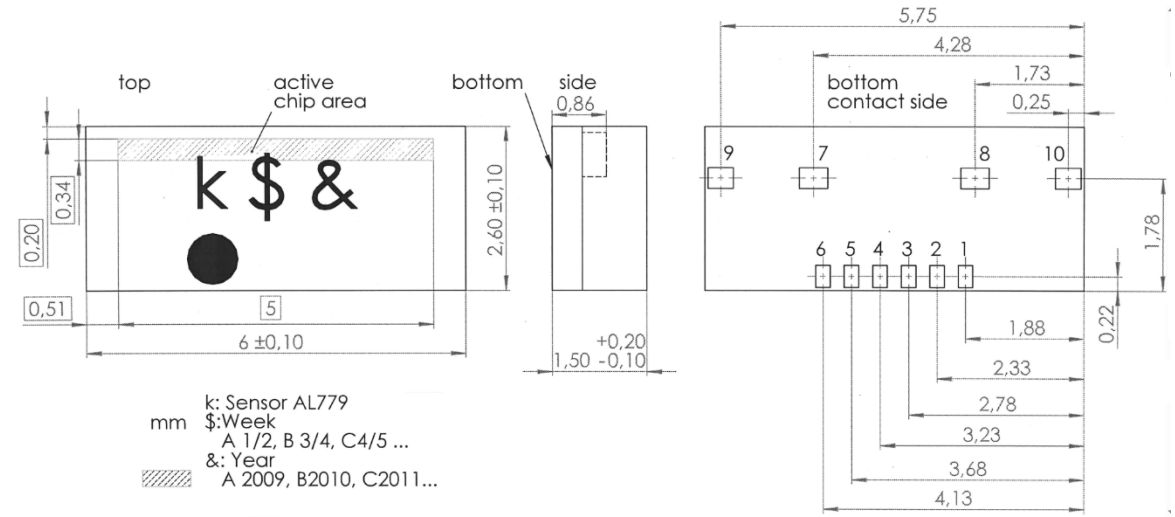



Fig. 5: Pinning of AL779AMA

## Technical drawing AL779AMA




Notes:

- If no other specification, all dimensions in mm.
- Dimensions of the pad are referenced to pad center
- Active chip area, damages are not permitted.

Tolerances:

- Pads: ±0.025
- Pads to housing edge: ±0.1
- Chip to housing edge: ±0.1

Fig. 6 LGA6L for AL779AMA.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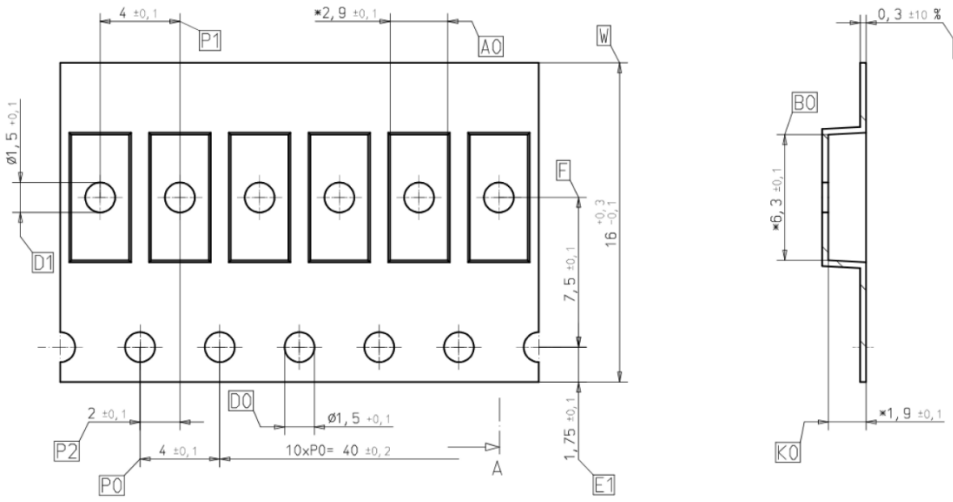
## Pinout AL779ACA

## Reel layout

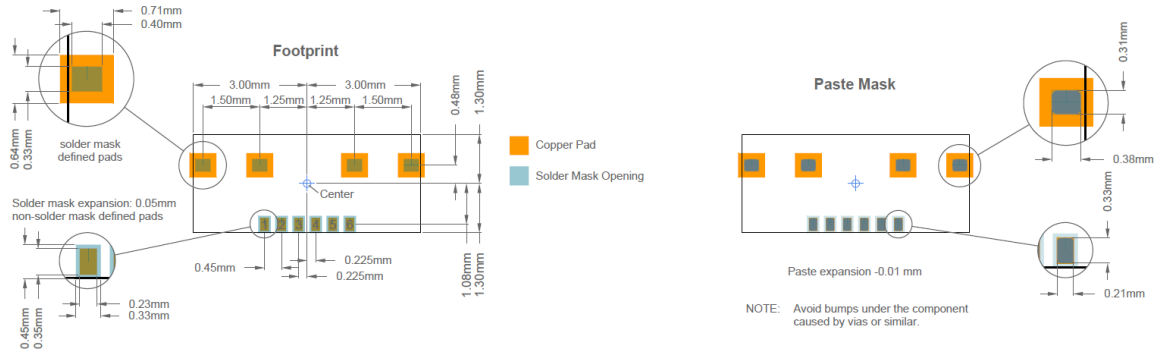



Notes:

- 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. 7 LGA6L tape & reel for AL779AMA-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. 8 LGA6L land pattern and reflow recommendation.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## Pinout Evalboard with AL779AMA-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 |

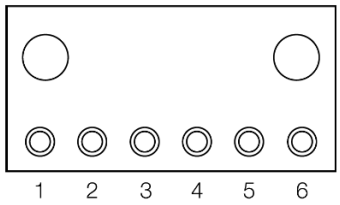
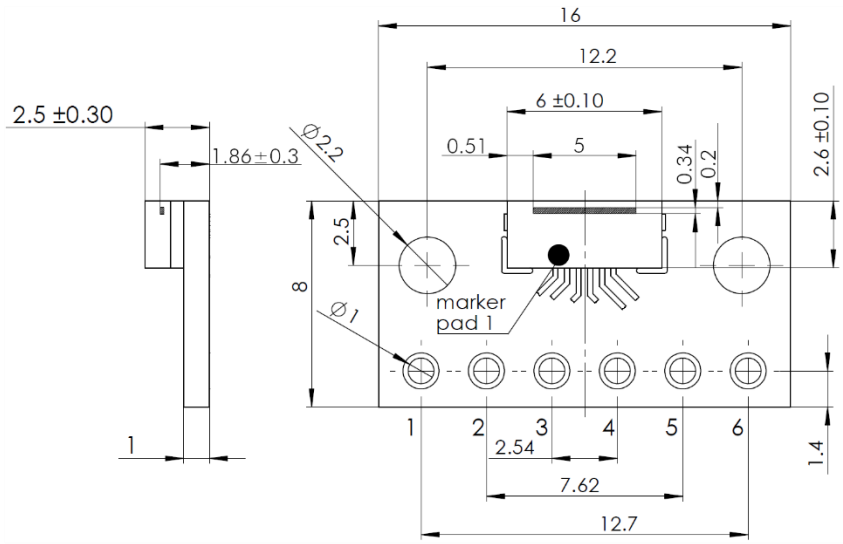



Fig. 9: Pinning of the evalboard

## Technical drawing Evalboard AL779AMA

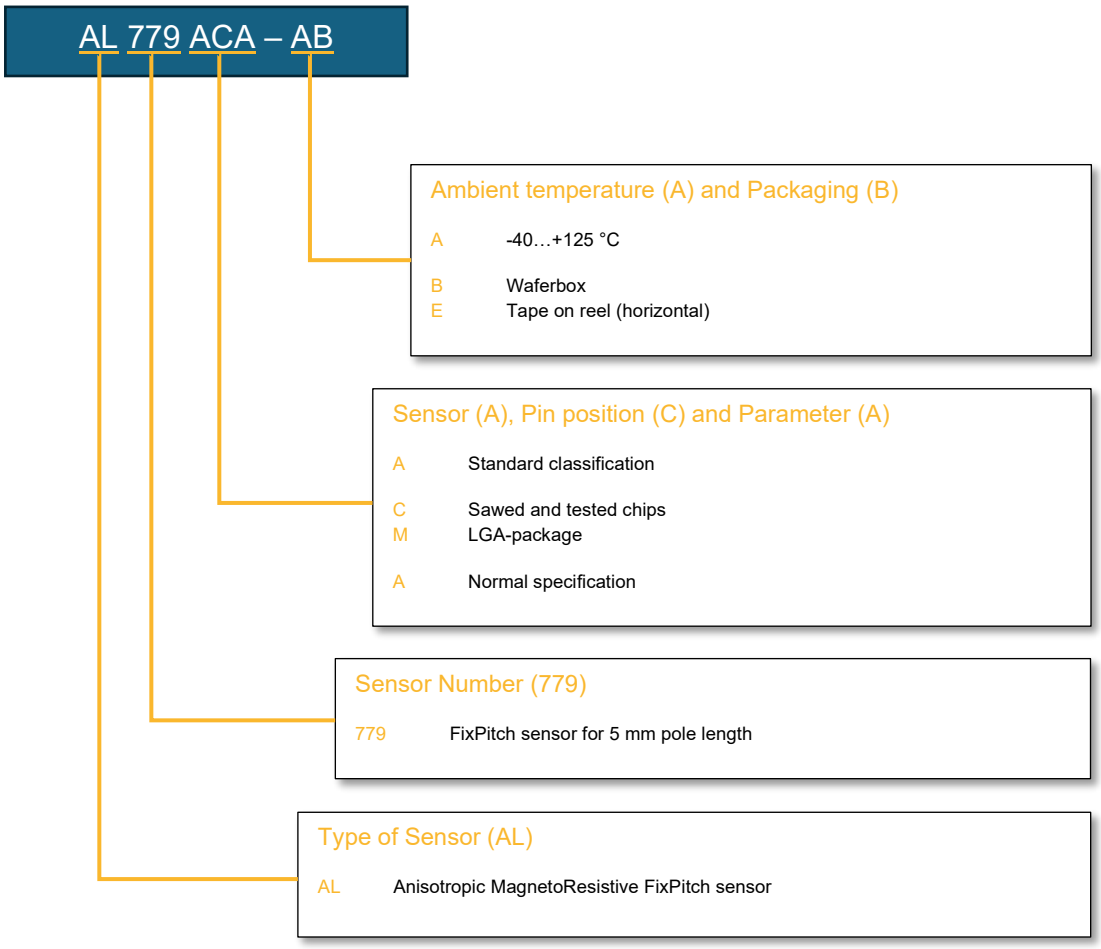



Notes:

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

Fig. 10 Outline of evalboard with AL779AMA-AE.

## Additional Information on Product Code





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# General Information

## Product Status

| Article | Status |
|---|---|
| AL779ACA-AB | The product is in series production. |
| AL779AMA-AE | The product is in series production. |
| AL779 Evalboard | This product is for evaluation of the AL779AMA-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 |
|---|---|---|
| AL779.DSE.05 | Change customized to portfolio product, add evalboard | 10/2025 |
| AL779.DKE.04 | Product Status (p. 7) | 09/2021 |
| AL779.DKE.03 | Various textual changes | 01/2016 |
| AL779.DKE.00 | Original (pp. 1-5) | 09/2009 |

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