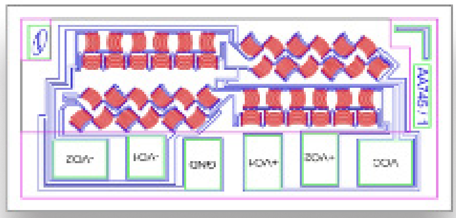
SENSITEC
MAGNETORESISTIVE SENSORS

DATA SHEET

AA745Cxx-LB

MagnetoResistive Angle Sensor



The AA745 is an angular sensor based on the Anisotropic MagnetoResistive (AMR) effect. The sensor contains two Wheatstone bridges with common ground and supply pin V_{cc}. 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).

Product Overview

Product Description	Package	Delivery Type
AA745CCC-LB	Diced single die wafer	Foil
AA745CCD-LB	Diced	Foil

Quick Reference Guide

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{CC}	Supply voltage	-	5.0	9.0	V
S	Sensitivity (α_1 = 0°; α_2 = 135°)	2.10	2.35	2.60	mV/deg
V_{off}	Offset voltage per V_{CC}	-2.0	-	+2.0	mV/V
V_{peak}	Signal amplitude per V_{CC}	12.0	13.0	14.0	mV/V
R_S	Sensor resistance	1.35	1.60	1.85	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	+150	°C
T_{stg}	Storage temperature	-65	+150	°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
- Sine and cosine output
- Temperature range from -40 °C to +150 °C
- Bond pads on one side

Advantages

- Non-contacting angle measurement
- Large air gap
- Saturation field distance < 300 µm
- Excellent accuracy
- Position tolerant
- Insensitive to interference field
- 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)

ESD

Magnetical Data

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
H_{ext}	Magnetic field strength [1]		-	25	-	kA/m
d_{sat}	Saturation field distance		-	300	-	µm

[1] The stimulating magnetic field in the sensor plane necessary to ensure the minimum error as specified in note 9.

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	9.0	V
S	Sensitivity [2]	$\alpha_1 = 0°$; $\alpha_2 = 135°$	2.1	2.35	2.6	mV/deg
TC_S	Temperature coefficient of sensitivity [3]		-0.31	-0.33	-0.35	%/K
V_{off}	Offset voltage per V_{CC}	See Fig. 1	-2.0	-	+2.0	mV/V
TC_{Voff}	Temperature coefficient of V_{off} [4]		-1.0	-	+1.0	(µV/V)/K
V_{peak}	Signal amplitude per V_{CC} [5]	See Fig. 1	12.0	13.0	14.0	mV/V
TC_{Vpeak}	Temperature coefficient of V_{peak} [6]		-0.31	-0.33	-0.35	%/K
$V_{peak,min}$	Signal amplitude per V_{CC} [5] at 150°C		6.0	-	-	mV/V
R_S	Bridge resistance [7]		1.35	1.60	1.85	kΩ
TC_{RB}	Temperature coefficient of R_B [8]		0.38	0.42	0.46	%/K

[2] Sensitivity changes with angle due to sinusoidal output.

[3] $TC_S = 100 \cdot \frac{S_{(T2)} - S_{(T1)}}{S_{(T1)} \cdot (T_2 - T_1)}$ with T_1 = -40 °C; T_2 = +150 °C.

[4] $TC_{Voff} = 100 \cdot \frac{V_{off(T2)} - V_{off(T1)}}{T_2 - T_1}$ with T_1 = -40 °C; T_2 = +150 °C.

[5] Maximal output voltage without offset influences. Periodicity of V_{peak} is sin(2α) and cos(2α).

[6] $TC_{Vpeak} = 100 \cdot \frac{V_{peak(T2)} - V_{peak(T1)}}{V_{peak(T1)} \cdot (T_2 - T_1)}$ with T_1 = -40 °C; T_2 = +150 °C.

[7] Sensor resistance between pads 6 and 3, 4 and 2, and 5 and 1.

[8] $TC_{RB} = 100 \cdot \frac{R_{B(T2)} - R_{B(T1)}}{R_{B(T1)} \cdot (T_2 - T_1)}$ with T_1 = -40 °C; T_2 = +150 °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
Δα	Angular error [9]	$H_{ext} \geq 40$ kA/m	0	0.05	0.10	deg
k	Amplitude synchronism [10]		-0.5	0	+0.5	% of V_{peak}

[9] Δx = \|xreal - xmeasured\| without offset influences due to deviations from ideal sinusoidal characteristics.

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

Dynamical Data

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
ω	Angular velocity of the magnetic field		0	-	1	MHz

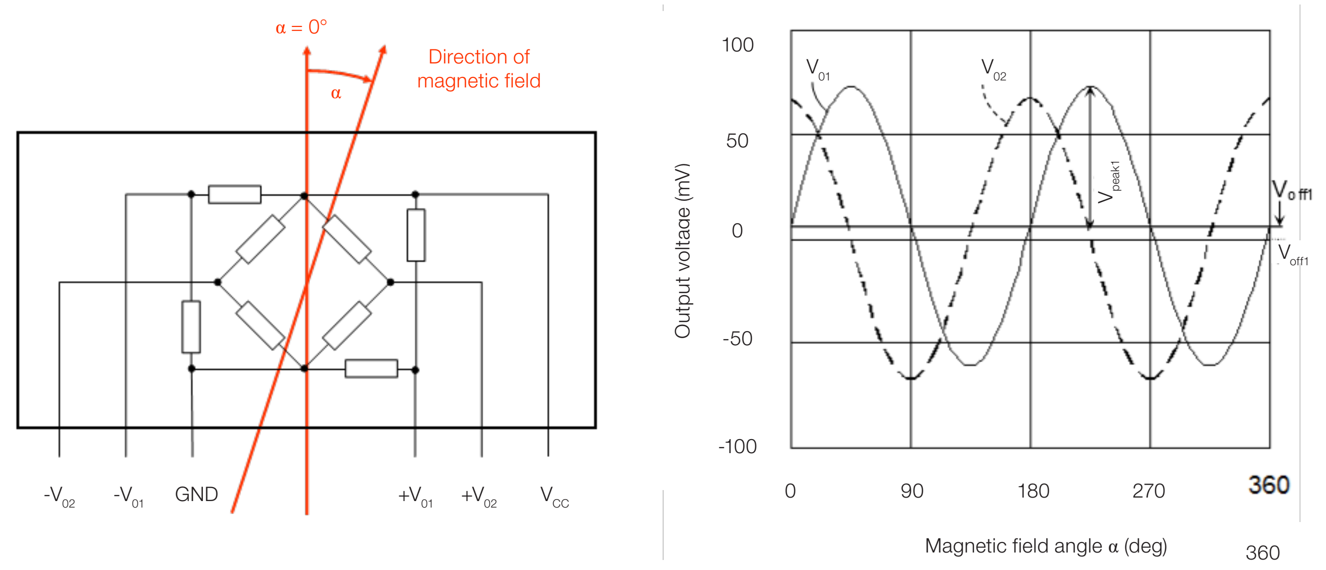


Fig. 1: *left*: Simplified circuit diagram with schematic of applied magnetic field.
right: Output signals as a function of the magnetic field angle α.

AA745 as Single Bare Die

Pinning

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

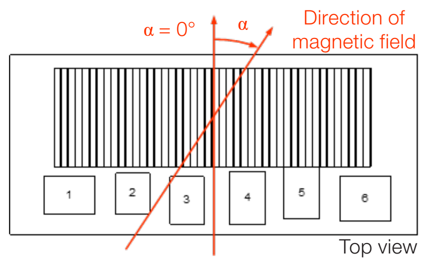
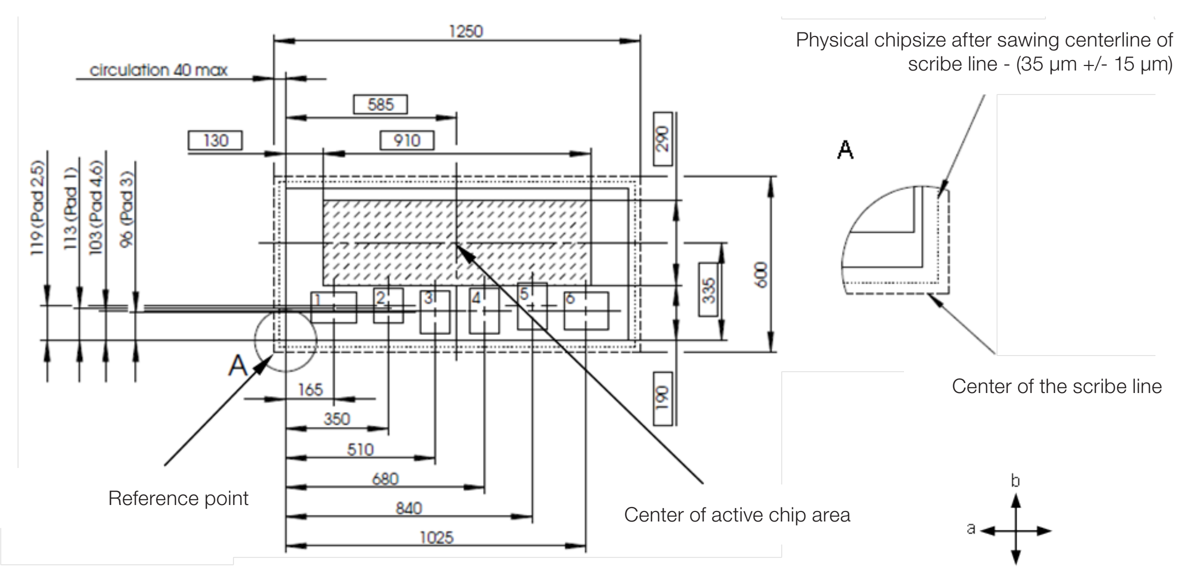


Fig. 2: AA745 shown with magnetic field direction.

Dimensions



Notes:
- All dimensions in µm.
- Pad dimensioning correlates to pad centre.
- The dashed outline drafted 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	150 x 105
2	100 x 118
3	100 x 143
4	100 x 155
5	100 x 145
6	150 x 125

Fig. 3: Chip outline of AA745 single bare die.

Data for Packaging and Interconnection Technologies

Parameter	Value	Unit
Chip area [1]	1.25 x 0.6	mm
Chip thickness	380 ± 10	µm
Pad diameter (all)	See Fig. 3	µm
Pad thickness	0.8	µm
Pad material	AlCu	-

[1] Tolerances of chip size see Fig. 3.

AA745 as Double Bare Die

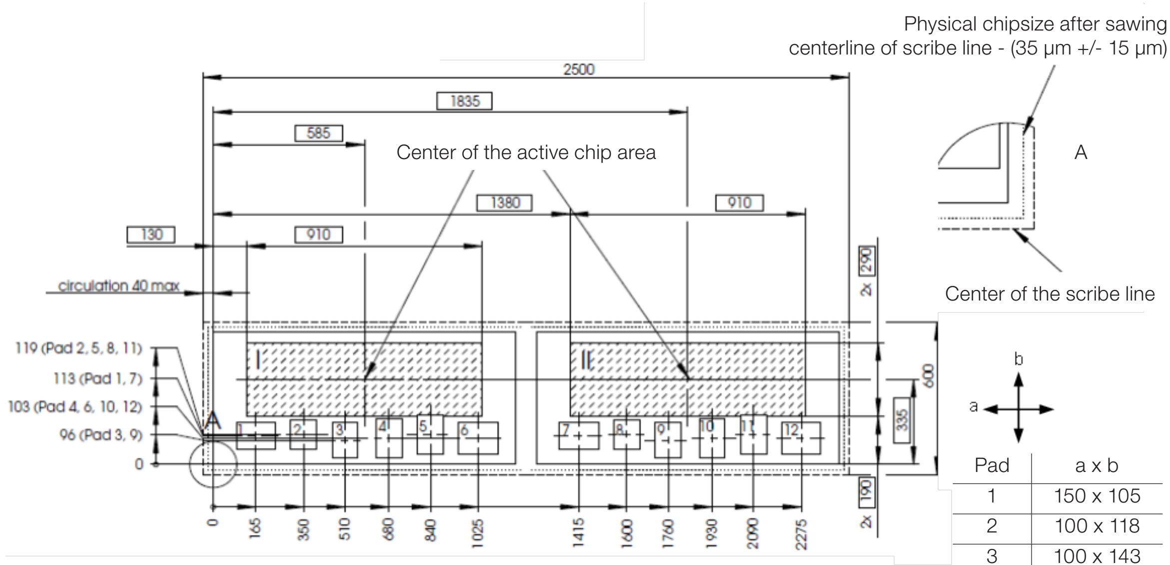
Pinning

Pad	Symbol	Parameter
1	$-V_{O2}$ (I)	Output voltage bridge 2
2	$-V_{O1}$ (I)	Output voltage bridge 1
3	GND (I)	Ground
4	$+V_{O1}$ (I)	Output voltage bridge 1
5	$+V_{O2}$ (I)	Output voltage bridge 2
6	V_{CC} (I)	Supply voltage

Pinning

Pad	Symbol	Parameter
7	$-V_{O2}$ (II)	Output voltage bridge 2
8	$-V_{O1}$ (II)	Output voltage bridge 1
9	GND (II)	Ground
10	$+V_{O1}$ (II)	Output voltage bridge 1
11	$+V_{O2}$ (II)	Output voltage bridge 2
12	V_{CC} (II)	Supply voltage

Dimensions



Pad	a x b
1	150 x 105
2	100 x 118
3	100 x 143
4	100 x 155
5	100 x 145
6	150 x 125
7	150 x 105
8	100 x 118
9	100 x 143
10	100 x 155
11	100 x 145
12	150 x 125

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. 4: Chip outline of AA745 double bare die.

Data for Packaging and Interconnection Technologies

Parameter	Value	Unit
Chip area [1]	2.5 x 0.6	mm
Chip thickness	380 ± 10	µm
Pad diameter (all)	See Fig. 4	µm
Pad thickness	0.4	µm
Pad material	AlCu	-

[1] Tolerances of chip size see Fig. 4.

General Information

Product Status

Article	Status
AA745Cxx-LB	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.

Changelist

Version	Description of the Change	Date
AA745.Cxx-LB.DSE.04	Disclaimer supplement	06/2022
AA745.Cxx-LB.DSE.03	Change of corporate design (pp. 1-7)	01/2022
AA745.Cxx-LB.DSE.02	Change of corporate design (pp. 1-7)	11/2020
AA745.Cxx-LB.DSE.01	Various textual changes	09/2013
AA745.Cxx-LB.DSE.00	Original (pp. 1-7)	02/2013

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