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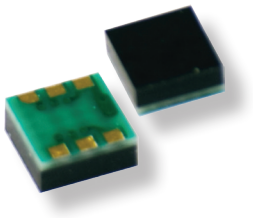
TA903

MagnetoResistive FreePitch Sensor



The TA903 is a position sensor based on the Tunnel MagnetoResistive (TMR) effect. The sensor contains two Wheatstone bridges with a common ground and supply pin, respectively. They are shifted at a relative angle of 90° to one another.

A rotating magnetic field in the sensor plane delivers two sinusoidal output signals depending on the angle α between sensor and magnetic field direction as shown in Fig. 1. The function of these signals is $+\sin\alpha$ and $+\cos\alpha$, i.e. the output signal has a periodicity of 1 per revolution.

The bond version of TA903 is available as bare die. For SMD processing, the sensor is available in LGA package.

Product Overview

Article Description	Package	Delivery Type
TA903ACA-AB	Die on wafer [1]	Waferbox
TA903AMA-AE	LGA6	Tape On Reel

[1] Minimum order quantities apply.

Quick Reference Guide

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{CC}	Supply voltage	1.8	5.0	5.5	V
V_{OUT}	Output amplitude per V_{CC}	70	100	130	mV/V
V_{OFF}	Offset voltage per V_{CC}	-3.0	-	+3.0	mV/V
R_B	Bridge resistance	6.0	10.0	14.0	kΩ
R_S	Sensor resistance	3.0	5.0	7.0	kΩ

Absolute Maximum Ratings

In accordance with the absolute maximum rating system (IEC60134).

Symbol	Parameter	Min.	Max.	Unit
V_{CC}	Supply voltage	-5.5	5.5	V
H_{ext}	External magnetic field strength	-	180	mT
ESD HBM	ESD tolerance according to HBM (for TA903ACA)	-	200	V
ESD HBM	ESD tolerance according to HBM (for TA903AMA)	-	2000	V
T_{amb}	Operating ambient temperature	-40	+125	°C
T_{stg}	Storage temperature	-40	+125	°C
T_{reflow}	Reflow temperature [1]	-	+250	°C

[1] Maximum temperature for reflow solder process.

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 Tunnel MagnetoResistive (TMR) effect
- Contains two Wheatstone bridges
- Sine and cosine output
- Temperature range from -40 °C to +125 °C

Advantages

- Contactless angle and position measurement
- Large air gap
- Excellent accuracy
- Position tolerant
- Minimal offset voltage

Applications

- Incremental or absolute position measurement (linear and rotatory motion)
- Motor commutation
- Rotational speed measurement
- Angle measurement (360° absolute at end of shaft)

ESD

RoHS-Compliant www.sensitec.com

Magnetic Data

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
H_{ext}	Magnetic field strength [1]		30	-	80	mT

[1] The stimulating magnetic field in the sensor plane necessary to ensure the minimum error as specified in “Accuracy”.

Electrical Data

T_{amb} = 25 °C; H_{ext} = 60 mT; V_{CC} = 5 V; unless otherwise specified

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{CC}	Supply voltage		1.8	5.0	5.5	V
V_{OUT}	Output amplitude per V_{CC} [2]		70	100	130	mV/V
TC_{VOUT}	Temperature coefficient of output amplitude [3]	T_{amb} = (-40...+125)°C	-0.12	-	-0.10	%/K
k	Amplitude synchronism [4]		98	100	102	%
φ	Phase between sine and cosine		88	90	92	deg
R_S	Sensor resistance [5]		3.0	5.0	7.0	kΩ
R_B	Bridge resistance [6]		6.0	10.0	14.0	kΩ
TC_{RS}	Temperature coefficient of sensor resistance [7]	T_{amb} = (-40...+125)°C	-0.08	-	-0.12	%/K
V_{OFF}	Offset voltage per V_{CC}		-3.0	-	+3.0	mV/V
TC_{VOFF}	Temperature coefficient of differential offset voltage [8]	T_{amb} = (-40...+125)°C	-5.0	-	+5.0	µV/V/K

[2] Maximal output voltage without offset influences. Periodicity of V_{OUT} is sinα and cosα

[3] $TC_{VOUT} = 100 \cdot \frac{V_{OUT(T2)} - V_{OUT(T1)}}{V_{OUT(T1)} \cdot (T_2 - T_1)}$ with T_1 = -40 °C; T_2 = +125 °C

[4] $k = 100 \cdot \frac{V_{OUT1}}{V_{OUT2}}$

[5] Sensor resistance between pads V_{CC} and GND

[6] Bridge resistance between pads $+V_{01}$ and $-V_{01}$, $+V_{02}$ and $-V_{02}$

[7] $TC_{RS} = 100 \cdot \frac{R_{S(T2)} - R_{S(T1)}}{R_{S(T1)} \cdot (T_2 - T_1)}$ with T_1 = -40 °C; T_2 = +125 °C

[8] $TC_{VOFF} = \frac{V_{OFF(T2)} - V_{OFF(T1)}}{T_2 - T_1}$ with T_1 = -40 °C; T_2 = +125 °C

Accuracy

T_{amb} = 25 °C; V_{CC} = 5 V; unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$\Delta\alpha_{nom,\ uncomp}$	Angular error	No compensation [1]	-	-	2.0	deg
$\Delta\alpha_{nom,\ comp\ (AO)}$	Angular error	Amplitude and offset compensated [2]	-	-	1.0	deg
$\Delta\alpha_{nom,\ comp\ (AOP)}$	Angular error	Amplitude, offset and phase compensated [3]	-	-	0.6	deg

1) $\Delta\alpha = |\alpha_{real} - \alpha_{measured}|$ without any signal compensation.

2) $\Delta\alpha = |\alpha_{real} - \alpha_{measured}|$ with amplitude and offset compensation due to deviations from ideal sinusoidal characteristics.

3) $\Delta\alpha = |\alpha_{real} - \alpha_{measured}|$ with amplitude, offset and phase compensation due to deviations from ideal sinusoidal characteristics.

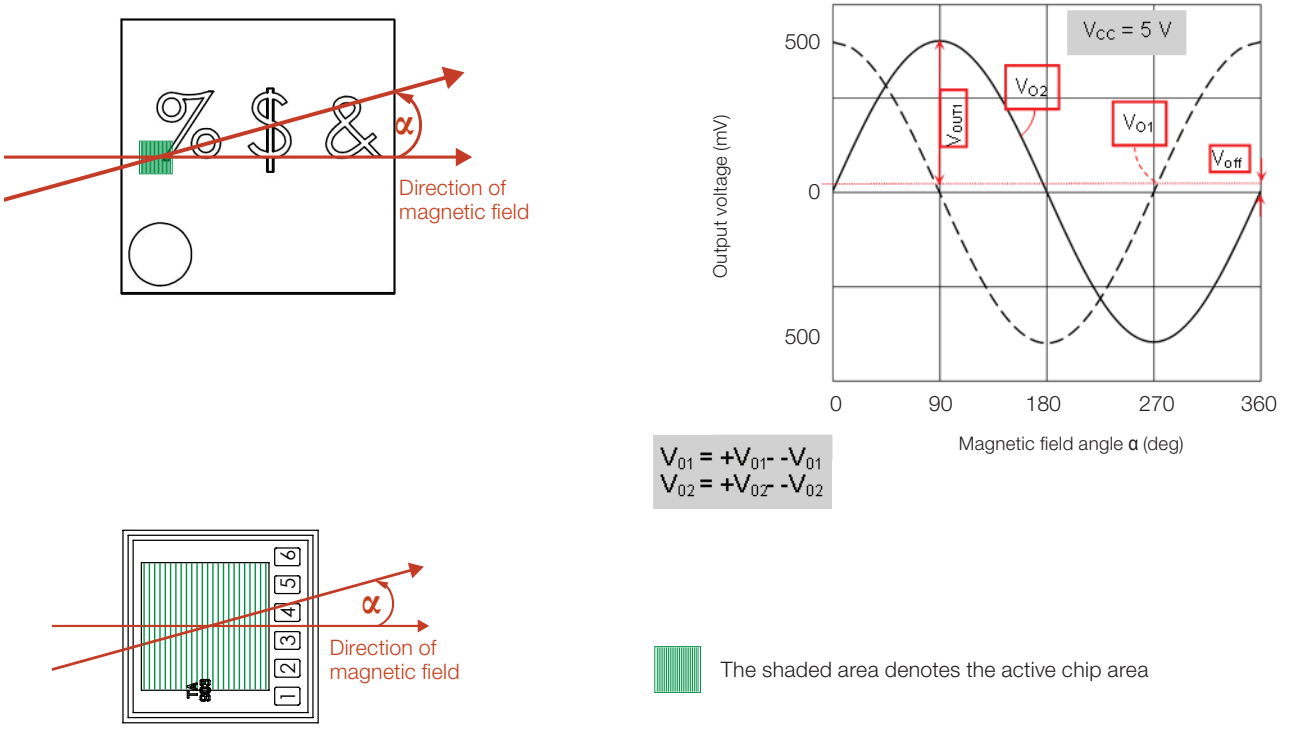


Fig. 1: Left: Simplified chip / package drawing with schematic of applied magnetic field.
Right: Output signals as a function of the magnetic field angle α.

TA903 Bare die

Pinning

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

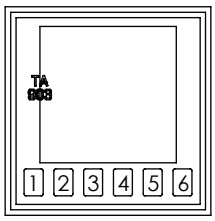
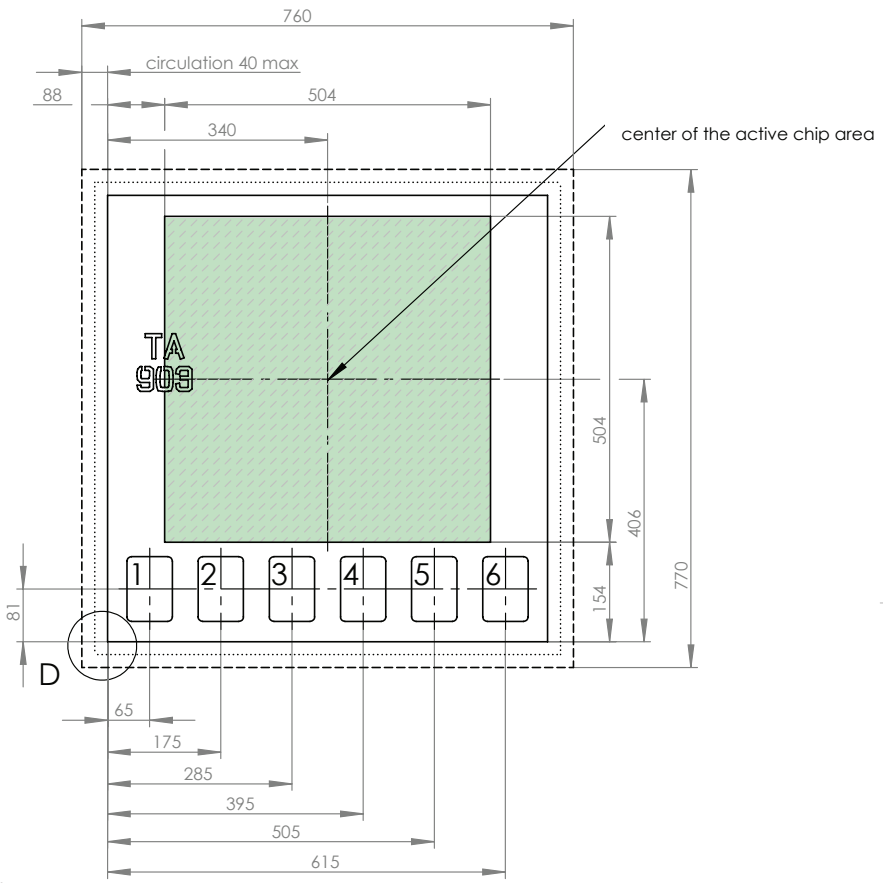


Fig. 2: TA903ACA

Dimensions



Notes:

- All dimensions in µm
- Pad dimensioning correlates to pad centre
- The dashed outline represents the dicing lane
- 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

Pad	Dimensions
1	70 x 100
2	70 x 100
3	70 x 100
4	70 x 100
5	70 x 100
6	70 x 100

Fig. 3: Dimensions of TA903ACA.

TA903 LGA6 Package

Pinning

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

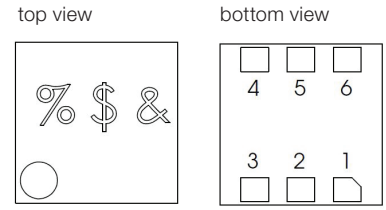
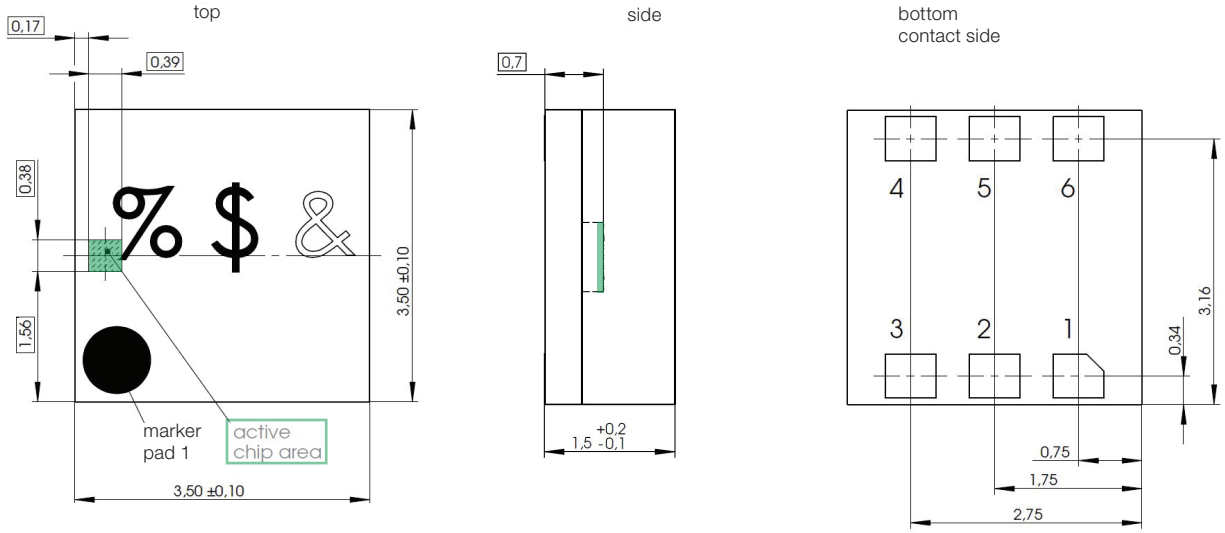


Fig. 4: TA903AMA-AE.

Dimensions



Notes

- All dimensions in mm
- Pad dimensioning correlates to pad centre
- Pad dimensions: 0.6 mm x 0.53 mm

Tolerances

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

Fig. 5: LGA6 outline for TA903AMA-AE.

General Information

Product Status

Article	Status
TA903ACA-AB	The product is under development, qualification is on going. Deliverables have a sample status. The datasheet is preliminary.
TA903AMA-AE	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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