

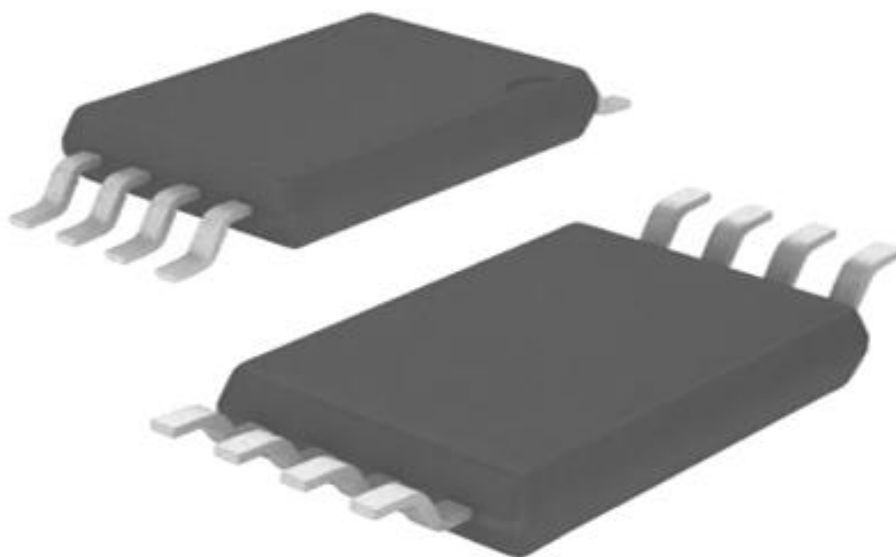
Product Data Sheet

Angle sensor chip

Product Series: BBT-A903TS8-SM03P angle sensors

Part Number: BBT-A903TS8-SM03P

Version: Ver 1.7.A



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1. General Description

BBT-A903TS8-SM03P angle sensor is Tunneling Magneto Resistance (TMR) sensor which consists of 2 Wheatstone bridges in a TSSOP8L package. Each Wheatstone bridge has two single ended outputs, one single ended output represents a positive cosine or a positive sine function and the other single ended output represents a negative cosine or a negative sine function. Two sine functions or two cosine functions are both phase-shifted by 120°. The two Wheatstone bridges are phase shifted by 90°.

The output represents sine and cosine functions by applied magnetic field in x-y plane and this sensor can detect 360 deg / 1 rotation. Sine and cosine single ended signals have a layout of 90-deg angle rotation to one another.

2. Key Features

- Magnetic angle sensor, employing the TMR effect.
- Compatible with a wide range of supply voltages
- Low hysteresis
- Superior temperature stability
- Sine and Cosine Outputs (2 times sine and cosine outputs) as single ended outputs
- Differential output also available with improved accuracy

3. Typical Application

- Absolute Rotary Angle Sensor.
- EPS Motor-shaft Angle Sensor.
- Steering Wheel Angle Sensor.
- Pedal Position Sensor.
- Throttle Position Sensor.
- Wiper angle sensor.

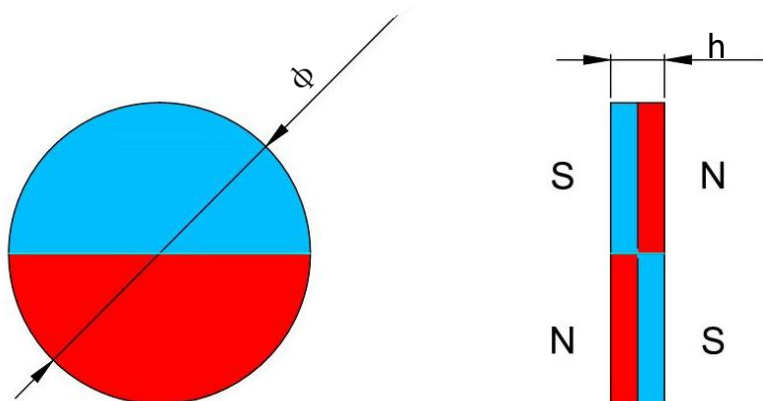
4. Absolute Maximum Parameters

Parameter	Symbol	Limit value	unit
Supply voltage	V _{cc}	+5.5	V
ESD (Human Body Model).	ESD(HBM)	4	kV
ESD (Machine Model).	ESD(MM)	0.4	kV
ESD (CDM)	ESD (CDM)	0.5	kV
External magnetic field strength	H _{ext}	200	mT
Storage temperature	T _{stg}	-55 ~ +150	°C
Operating temperature	T _{opt}	-40 ~ +150	°C
Reflow temperature	T _{reflow}	260	°C

Remark: When the operating conditions of the product exceed the limit parameters, it may cause irreparable damage to the product. Working at the limit parameters for a long time may lead to a decline in product performance and product reliability.

5. Magnetic Data

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Magnetic field	H _{ext}		20		130	mT
Diameter of the magnet	φ	Axial plane bipolar magnetization		8		mm
Thickness of the magnet	h			1		mm



6. Electrical Characteristics

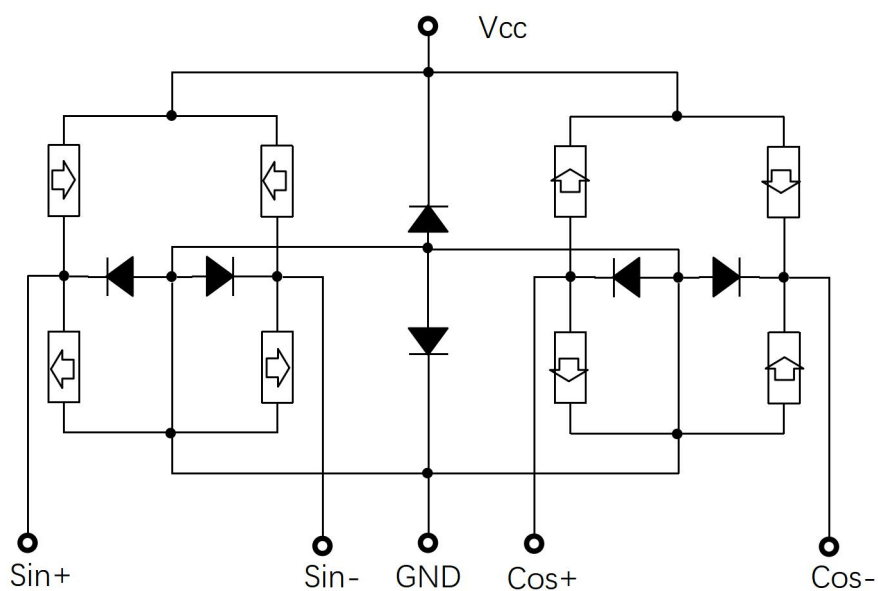
Conditions (unless otherwise noted): $V_{cc} = 5.0\text{ V}$; $H_{ext} = 30\text{ mT}$; $T_{opt} = 25^{\circ}\text{C}$.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operating voltage	V_{cc}		1.8	5	5.5	V
Bridge resistance	R_b		3	—	7	kOhm
Single output voltage amplitude	V_{out_single}		125	150	175	mV/V
Differential output voltage amplitude	$V_{out_Differential}$		215	260	305	mV/V
Bias voltage	V_{offset}		-5	—	5	mV/V
Bias voltage single ended	V_{offset_single}	Deviation from $V_{cc}/2$	-5	—	5	mV/V
Temperature Coefficient of differential output	TCV_{out}	$-40^{\circ}\text{C} \sim 150^{\circ}\text{C}$ Hex:20-80mT	-0.25		0	%/K
Bridge resistance temperature drift coefficient	TCR_{bridge}	$-40^{\circ}\text{C} \sim 150^{\circ}\text{C}$ Hex:20-80mT	-0.07	-0.05	-0.03	%/K
Bias voltage temperature drift factor	TCV_{offset}	$-40^{\circ}\text{C} \sim 150^{\circ}\text{C}$	-3	—	3	$\mu\text{V/V/K}$
Amplitude synchronization	k		97	100	103	%

7. Accuracy

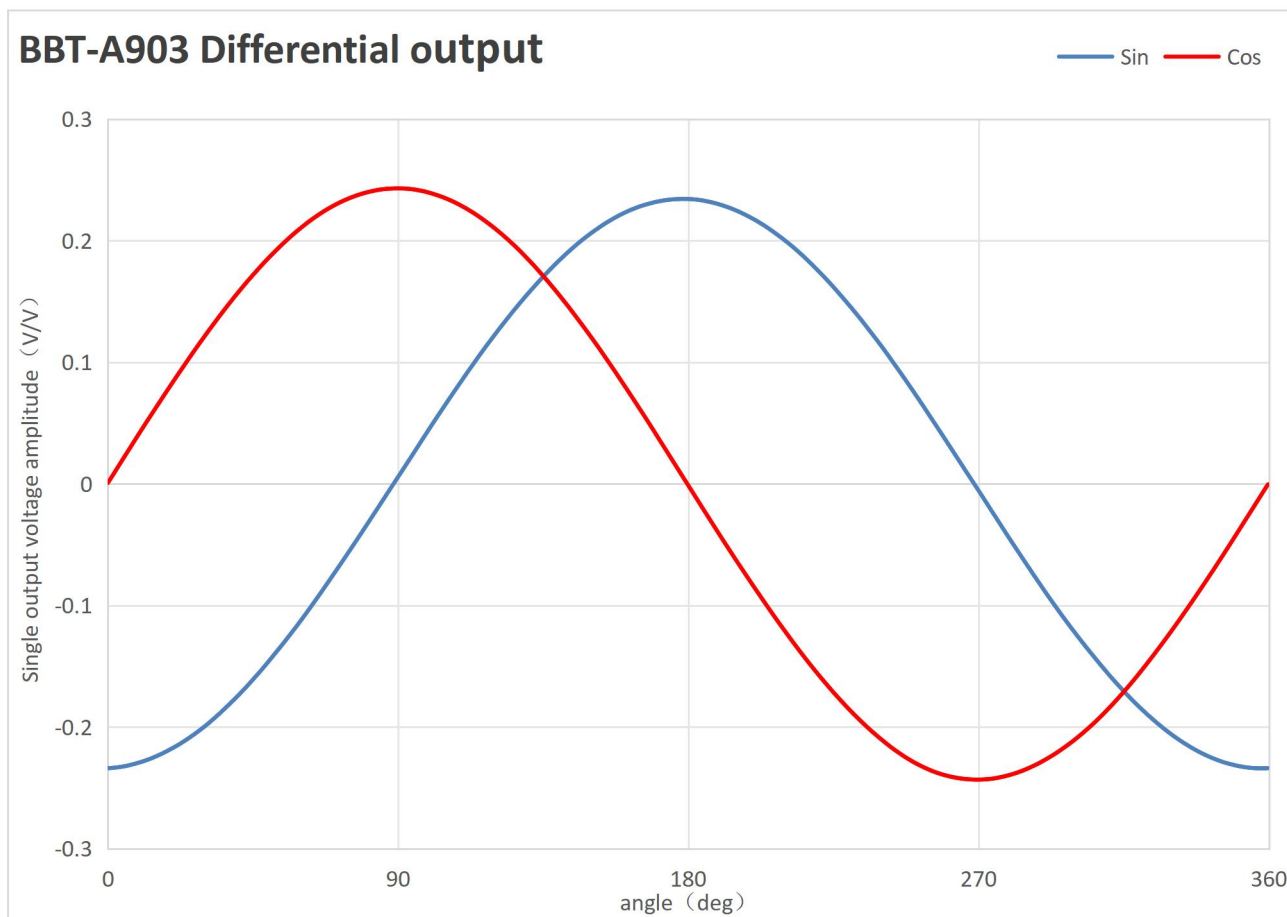
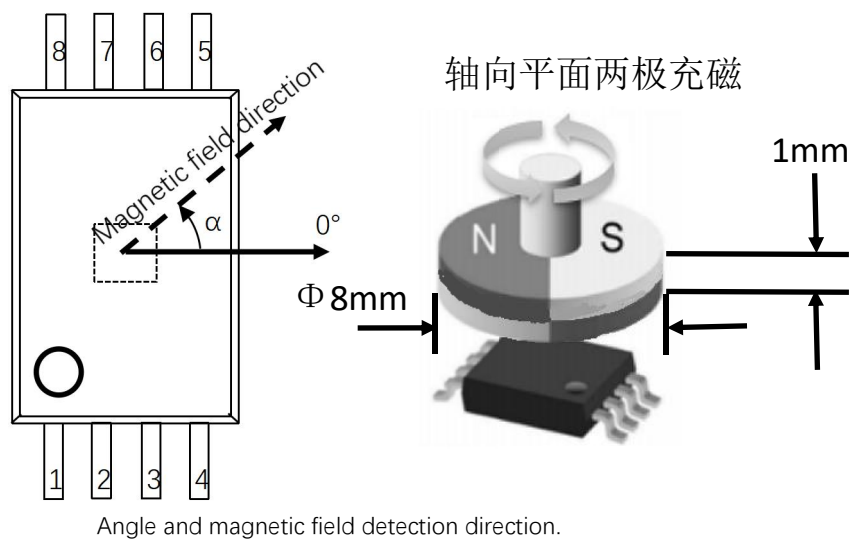
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Angle Error (after Compensation)	Angle Error	-40°C~150°C Hex≤40mT			1.5	deg.
		-40°C~150°C Hex≤40~60mT			1.0	
		-40°C~150°C Hex≤60~100mT			0.8	
		-40°C~150°C Hex≤100~130mT			2.0	
Phase difference between sine and cosine	Orthogonality		87	90	93	deg.
Hysteresis error	Accommodated	< 40 mT		0.07		deg.
		40~60 mT		0.05		deg.
		60~100 mT		0.08		deg.
		100~130 mT		0.14		deg.

8. Internal circuit and Pin direction



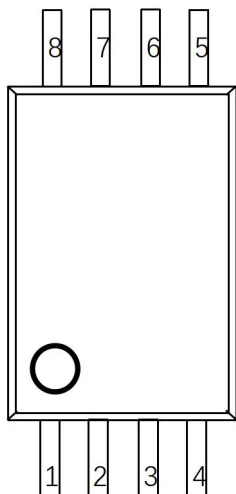
Schematic diagram of the circuit of the BBT-A903TS8-SM03P sensor with independent ground.

9. Typical output curve



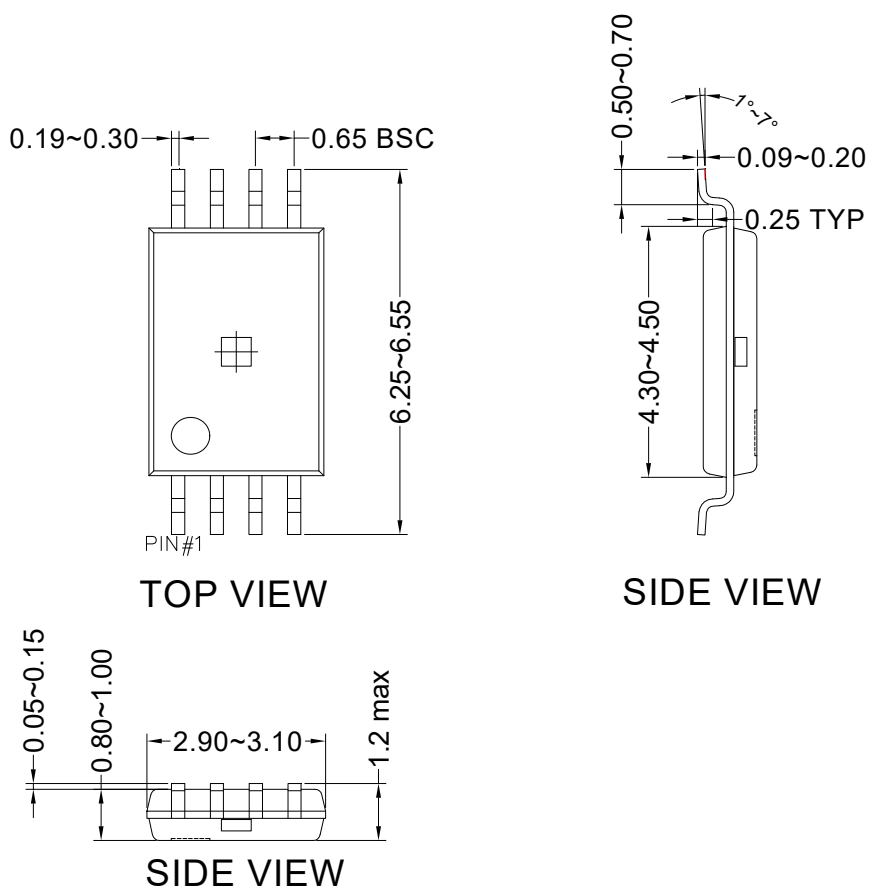
10. Package information

10.1 Pin configuration & Pin description



Pin NO.	Symbol	Function
1	SIN-	Analog negative sine output
2	Vcc	Supply voltage of sine and cosine bridge
3	SIN+	Analog positive sine output
4	GND	Ground of sine and cosine bridge
5	COS+	Analog positive cosine output
6	NONE	No contact
7	COS-	Analog negative cosine output
8	NONE	No contact

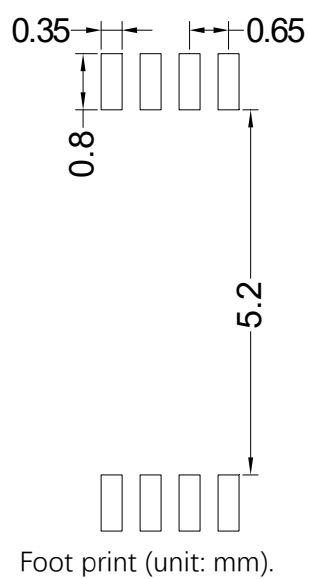
10.2 Package Outline



Outline package diagram of BBT-A903TS8-SM03P series sensor (unit: mm).

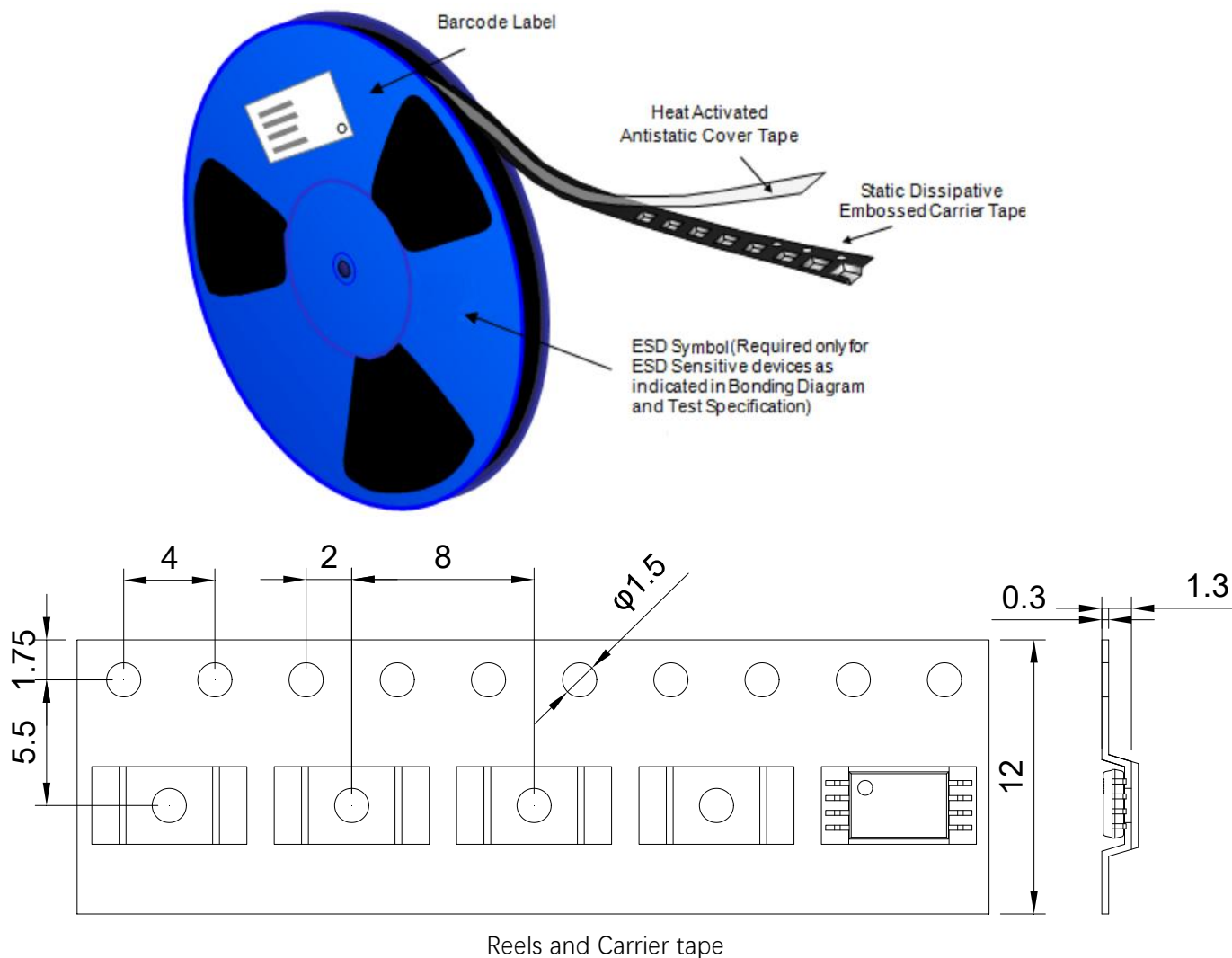
Note: The pin plating is electroless tin-plated-8 μ m.

10.3 PCB layout



11. Product packaging

Item	Request	Remark
Reels	7 inch / 13 inch	See Figure 6
Carrier tape	12mm wide	See Figure 6
Empty front length	400 mm	Refer to EIA-481 requirements
Trail length	160 mm	Refer to EIA-481 requirements
Number of standard packages	5000 / 13" Reel	Planning criteria for volume products
MSL Level	MSL 1	J-STD-020E



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