

Product Data Sheet

TMR Angle sensor chip

Product Series: BBT-A903P8-DT03P Angle Sensor

Part Number: BBT-A903P8-DT03P

Version: Ver 1.5



Table of Contents

1. General Description	2
2. Key Features	2
3. Typical Application	2
4. Absolute Maximum Parameters	3
5. Magnetic Data	3
6. Electrical Characteristics	3
7. Accuracy	5
8. Internal circuit and Pin direction	5
9. Typical output curve	6
10. Package information	7
11. Product packaging	8

1. General Description

The BBT-A903P8-DT03P angle sensor is a Tunnel Magneto-resistance (TMR) sensor, which is composed of two Wheatstone bridges integrated in a SOP8L package. Sine and cosine bridges are layout by 90 deg to one another. The output can be configured to represent one pair of sine and cosine functions by applied magnetic field in x-y plane and its sensor can detect 360 deg/ 1 rotation. These raw signals (sine wave and cosine wave) are provided in the form of differential output signals and can be further processed directly within the Microcontroller Unit.

BBT-A903P8-DT03P has two independent VDD and GND pins, for the P- and N-bridge respectively. In this way, two completely independent 180° phase-shift bridge signals are generated, which can be used for advanced safety concepts to perform cross-checking of P and N signals and achieve high diagnostic coverage for any sensor failure.

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.

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

5. Magnetic Data

Parameter	Symbol	Conditions	Min	Typ	Max	Unit	Remarks
Magnetic field	H _{ext}		20		130	mT	

6. Electrical Characteristics

Conditions (unless otherwise noted): V_{cc} = 5.0 V; H_{ext} = 30 mT; T_{opt} = 25°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}	T _{opt} =25 °C H _{ext} =50 mT	125	150	175	mV/V
Differential output voltage amplitude	V _{out_Differential}	T _{opt} =25 °C H _{ext} =50 mT	250	300	350	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°C ~ 150°C H _{ext} :20-80mT	-0.15		-0.10	%/K
Bridge resistance temperature drift coefficient	TCR _{bridge}	-40°C ~ 150°C H _{ext} :20-80mT	-0.07	-0.05	-0.03	%/K
Bias voltage temperature drift factor	TCV _{offset}	-40°C ~ 150°C	-3	—	3	uV/V/K
Amplitude synchronization	k		97	100	103	%

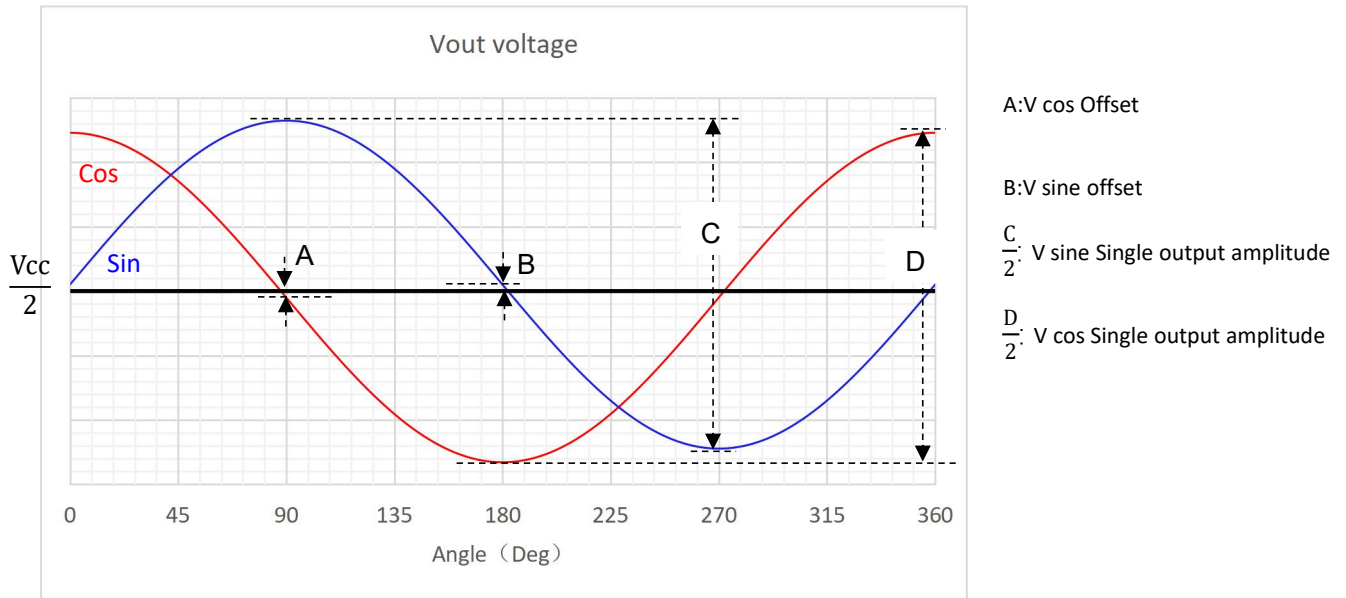


Fig. 1 explanation of amplitude and offset definition. The scale in the figure has been exaggerated to make the signals easier to see.

7. Accuracy

Conditions (unless otherwise noted): $V_{cc} = 5.0\text{ V}$; $H_{ext} = 20\sim 130\text{ mT}$; $T_{opt} = -40^{\circ}\text{C}\sim 150^{\circ}\text{C}$.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Angle Error (after Compensation)	Angle Error	$-40^{\circ}\text{C}\sim 150^{\circ}\text{C}$ $H_{ext} \leq 40\text{ mT}$			1.5	deg.
		$-40^{\circ}\text{C}\sim 150^{\circ}\text{C}$ $H_{ext} \leq 40\sim 60\text{ mT}$			1.0	
		$-40^{\circ}\text{C}\sim 150^{\circ}\text{C}$ $H_{ext} \leq 60\sim 100\text{ mT}$			0.8	
		$-40^{\circ}\text{C}\sim 150^{\circ}\text{C}$ $H_{ext} \leq 100\sim 130\text{ mT}$			2.0	
Phase difference between sine and cosine	Orthogonality		87	90	93	deg.
Hysteresis error	Accommodated	$< 40\text{ mT}$		0.07		deg.
		$40\cdots 60\text{ mT}$		0.05		deg.
		$60\cdots 100\text{ mT}$		0.08		deg.
		$100\cdots 130\text{ mT}$		0.14		deg.

8. Internal circuit and Pin direction

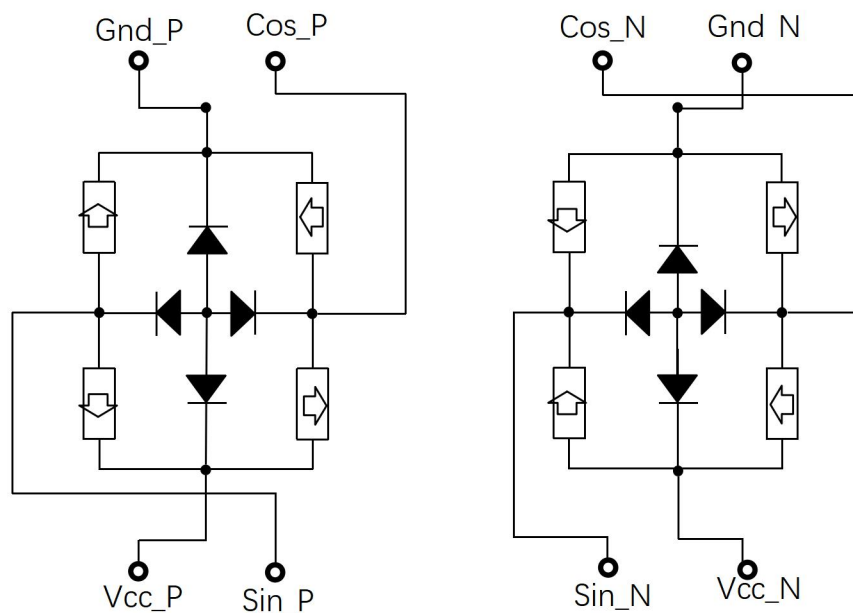


Fig. 2 Schematic diagram of the circuit of the BBT-A903P8-DT03P sensor with independent ground.

9. Typical output curve

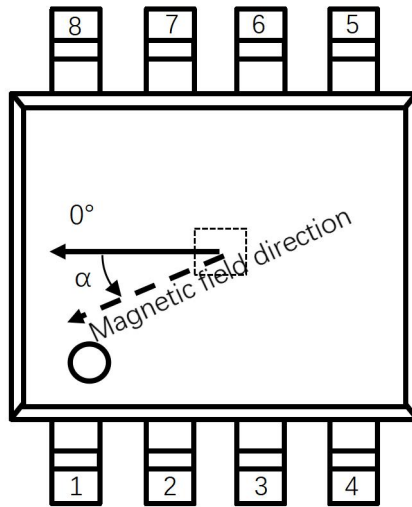


Fig. 3 BBT-A903P8-DT03P Angle and magnetic field detection direction

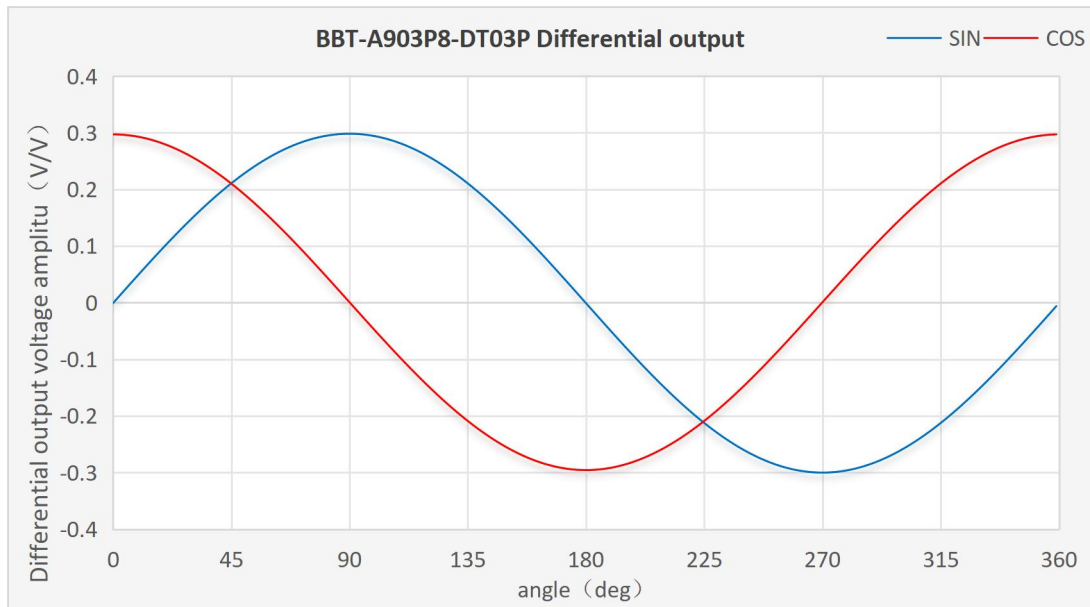
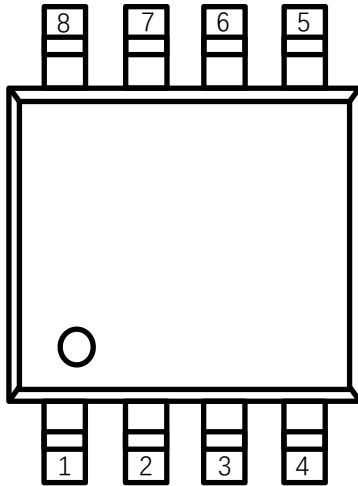


Fig. 4 BBT-A903P8-DT03P Sensor output signal in V divided by applied voltage V_{cc} .

10. Package information

10.1 Pin configuration & Pin description



Pin NO.	BBT-A903P8-DT03P	Function remark
1	SIN_P	Analog positive sine output
2	Vcc_P	Supply voltage P-bridge
3	COS_P	Analog positive cosine output
4	GND_P	Ground P-bridge
5	COS_N	Analog negative cosine output
6	Vcc_N	Supply voltage P-bridge
7	SIN_N	Analog negative sine output
8	GND_N	Ground N-bridge

10.2 Package Outline

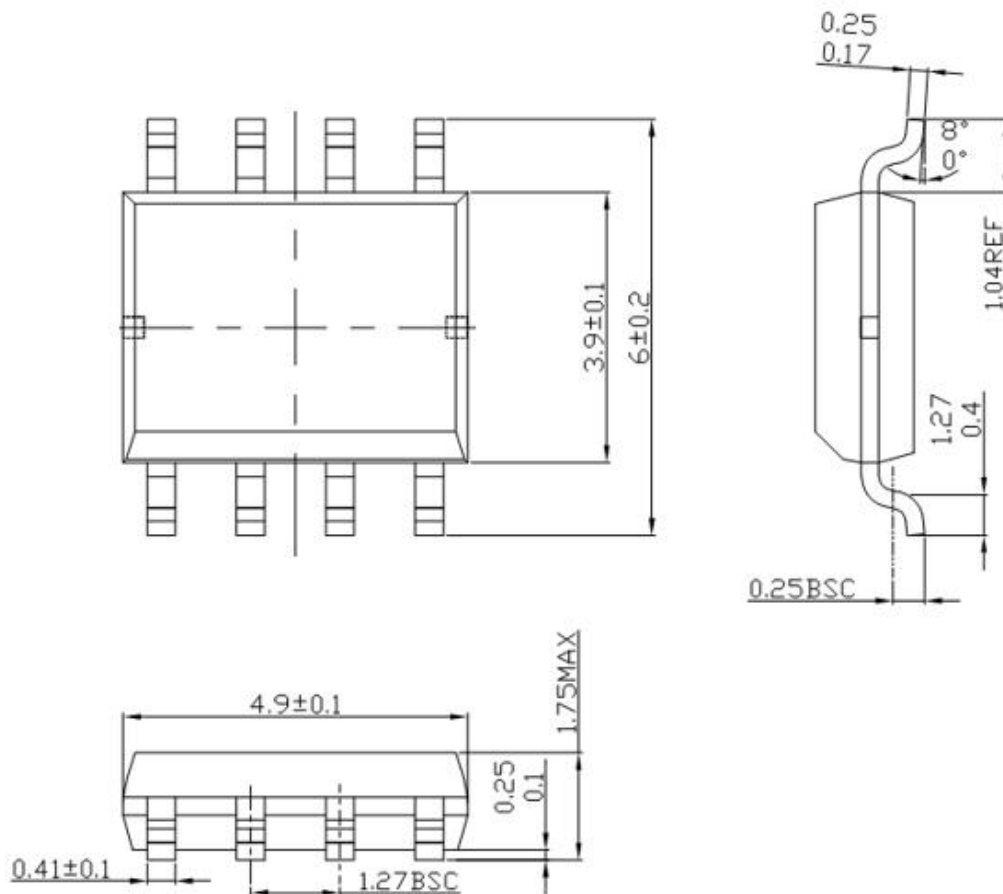
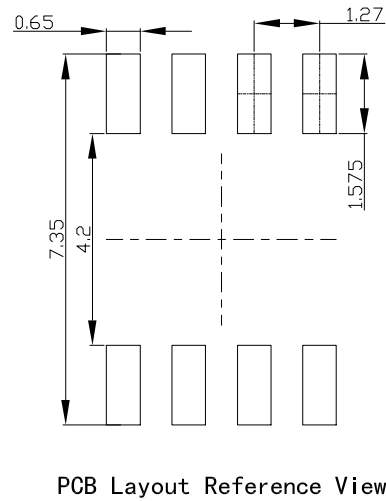
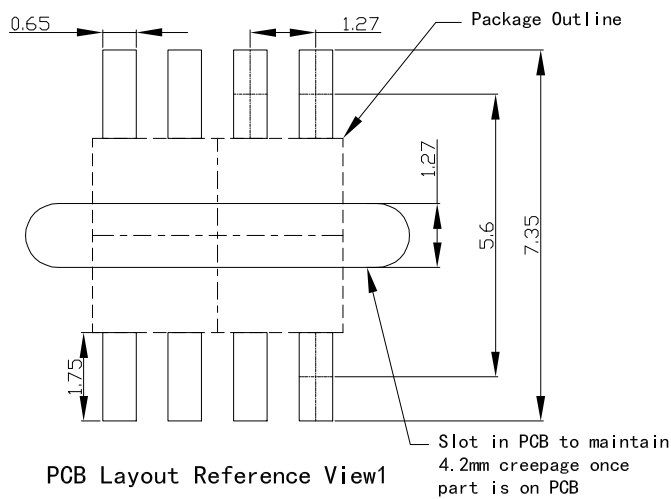


Fig.5 Outline package diagram of BBT-A903-D series sensor (unit: mm).

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

10.3 Footprint

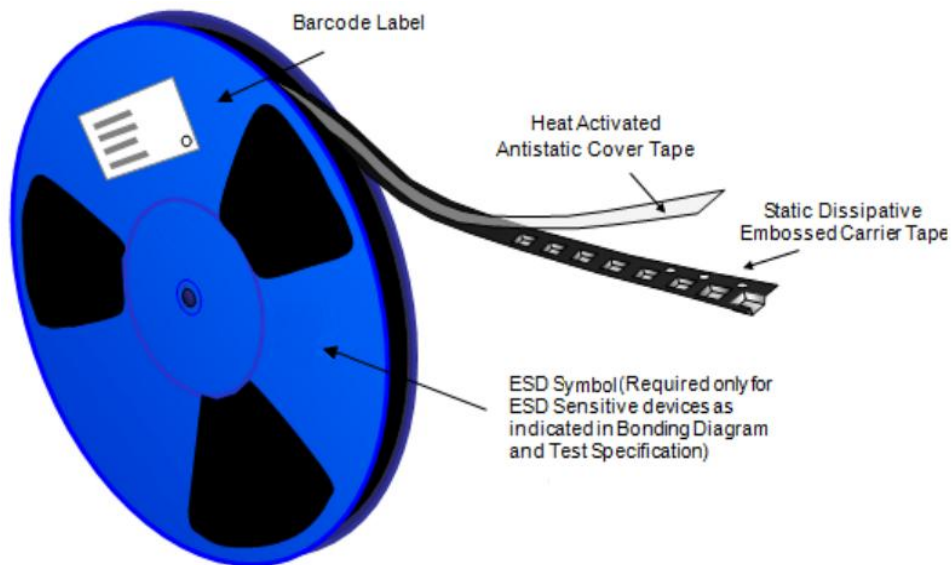


For PCB assemblies that cannot support a slotted design, the above stretched footprint may be used

Fig.6 footprint of the sensor chips with sop8 package(unit: mm).

11. Product packaging

Item	Request	Remark
Reels	13 inch	See Figure 7
Carrier tape	12mm wide	See Figure 7
Empty front length	400 mm	Refer to EIA-481 requirements
Trail length	160 mm	Refer to EIA-481 requirements
Number of standard packages	4000 / 13" Reel	Planning criteria for volume products
MSL Level	MSL 3	J-STD-020E
Weight	0.073g/pcs	Bare chip Weight



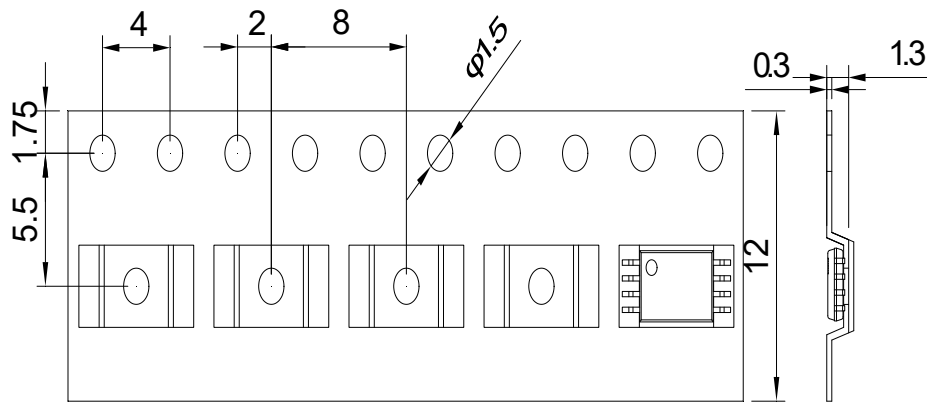


Fig.7 Reels and Carrier tape

The information provided herein by ESSTMAGS Technology is believed to be accurate and reliable. Publication neither conveys nor implies any license under patent or other industrial or intellectual property rights. ESSTMAGS reserves the right to make changes on product specifications for the purpose of improving product quality, reliability, and functionality. ESSTMAGS does not assume any liability arising out of the application and use of its products. ESSTMAGS's customers using or selling this product for use in appliances, devices, or systems where malfunction can reasonably be expected to result in personal injury do so at their own risk and agree to fully indemnify ESSTMAGS for any damages resulting from such application.