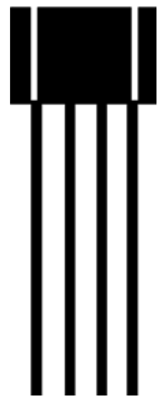
ChenYang
Technologies GmbH & Co. KG

Self-Adjusting Hall Effect Gear Tooth Sensor IC CYGTS9803 with Dual-Channel Outputs

The CYGTS9803 is a dual-channel gear tooth sensor, with two Hall sensing elements, each providing a separate digital output, for speed and direction signal processing capability. The sensor does not have a chopper delay and uses two Hall plates which are immune to rotary alignment problems. The bias magnet can be from 1000GS to 4000Gs. As the signal is sampled, the logic recognizes an increasing or decreasing flux density. The dual-channel outputs (OUTA and OUTB) are provided in the sensor. The OUTA will turn on (BOP) after the flux has reached its peak and decreased by an amount equal to the hysteresis. Similarly the OUTA will turn off (BRP) after the flux has reached its minimum value and increased by an amount equal to the hysteresis. The OUTB have the same function as OUTA. But due to the flux phase sequencing, the OUTA and OUTB have phase shift, which can be used to determine gear rotation direction.

Features

- High sensitivity
- Two matched Hall effect switches on a single chip
- 1.4mm Hall element spacing
- Dual-Channel output signal
- True zero speed detection
- Short circuit protection
- Insensitive to orientation
- Wide voltage working range
- Self-adjusting magnetic range
- High speed operation
- No chopper delay applications
- RoHS compliant



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Applications

Automotive and Heavy Duty Vehicles:

- Camshaft and crankshaft speed and position
- Transmission speed
- Tachometers
- Anti-skid/traction control

Industrial Areas:

- Sprocket speed
- Chain link conveyor speed/distance
- Stop motion detector
- High speed low cost proximity
- Tachometers, counters.

Magnetic Specifications

DC Operating Parameters T_A = -40°C to 150°C, V_{DD} = 4.0V to 24V (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Back Bias Range	B_{BIAS}	Operating	-30	--	4000	Gs
Linear Region		V_{DD} = 12V	500	--	5000	Gs
Hysteresis	B_{hys}		10	--	80	Gs

10Gs=1mT

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Electrical Specifications

DC Operating Parameters T_A = -40°C to 150°C, V_{DD} = 4.0V to 24V (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Supply Voltage	V_{DD}	Operating	4.0	12	24	V
Supply Current	I_{DD}	V_{DD} = 12V	5.0	7.0	9.0	mA
Power-Up State	$POS_{(OUTA)}$	$V_{DD} > V_{DD(min)}$	H	H	H	
	$POS_{(OUTB)}$		H	H	H	
Supply Current	I_{DD}	V_{DD} = 4.0V to 30V	2.0	--	12.0	mA
Leakage Current	I_{LEAK}	V_{OUT} = 4.0V to 30V	--	--	10	uA
Output Current	I_{OUT}	Operating	--	--	25	mA
Output Saturation Voltage	V_{SAT}	V_{DD} = 12V, I_{OUT} = 25 mA	--	--	600	mV
Output Current Limit	I_{Limit}	V_{DD} = 12V	50	100	150	mA
Output Short Circuit Shutdown	T_{FAULT}	Fault	10		20	uS
Clock Frequency	F_{clk}	Operating	400	500	600	KHz
Output Rise Time	T_r	V_{DD}=12V, R1 = 1.0K, Cload=10pF	--	--	400	nS
Output Fall Time	T_f	V_{DD}=12V R1 = 1.0K, Cload=10pF	--	--	400	nS
Bandwidth	BW	Operating	--	--	15	KHz
Thermal Resistance	RTH	Operating	--	--	200	℃/Watt

Absolute Maximum Ratings

Parameter	Limit Values	
	Min.	Max.
Supply Voltage (Operating), V_{DD}	-0.3V	30V
Output Voltage, V_Q	-0.3V	30V
Supply Current (Fault), I_{DD}	--	50mA
Output Current (Fault), I_{OUT}	--	30mA
Output Current (Fault), I_{fault}	--	200mA
Junction temperature, T_J (5000h)	--	150°C
Junction temperature, T_J (2000h)	--	160°C
Junction temperature, T_J (1000h)	--	170°C
Junction temperature, T_J (100h)	--	180°C
Operating Temperature Range, T_A	- 40°C	150°C
Storage Temperature Range, T_S	- 65°C	150°C

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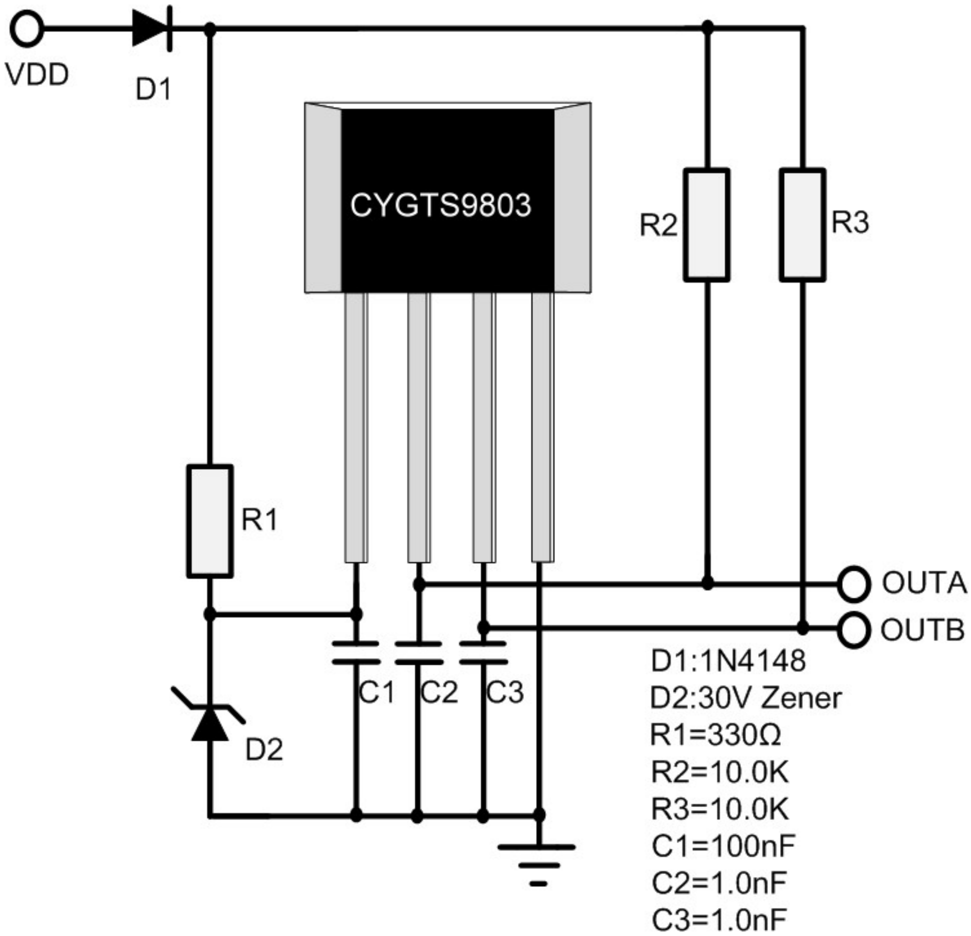
ESD (Emergency Shutdown System) Protection

Human Body Model (HBM) tests

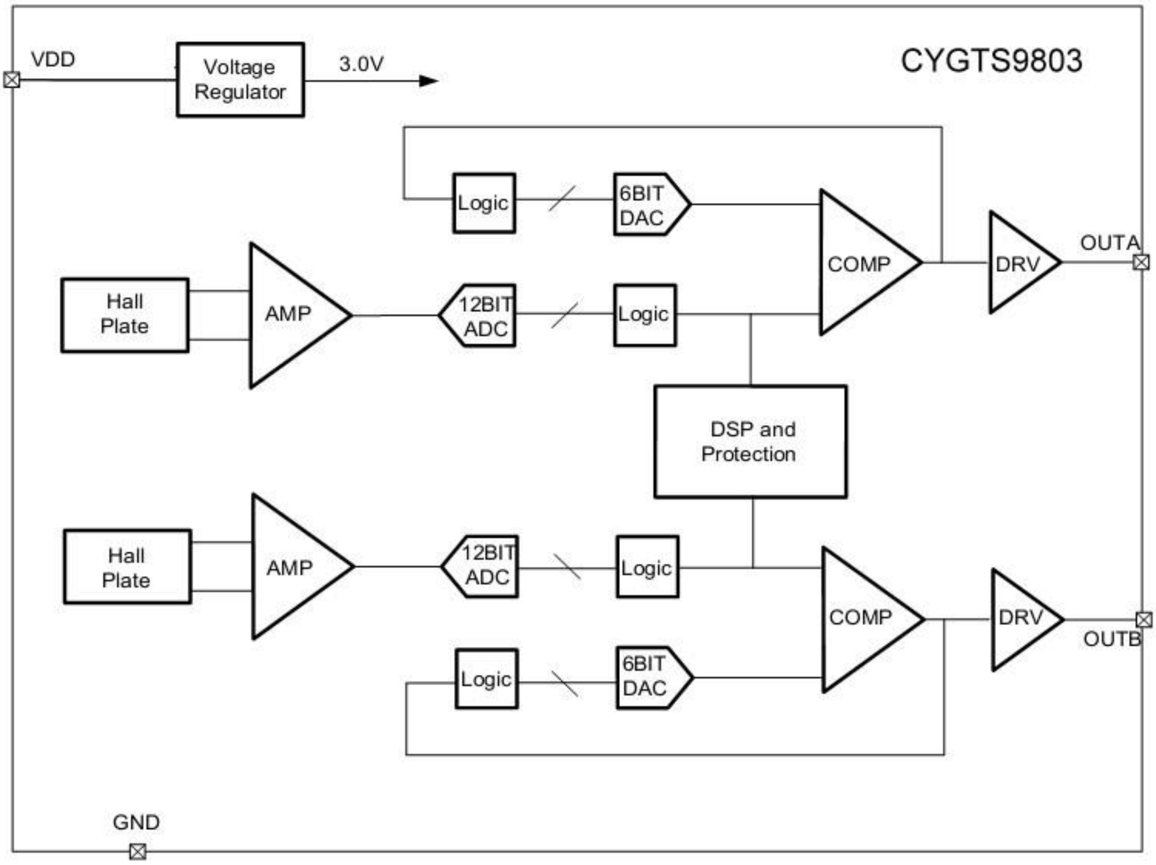
Parameter	Symbol	Max.	Unit	Note
ESD	V_{ESD}	8	kV	According to standard EIA/JESD22-A114-B HBM

Application Circuit and Pin Configuration

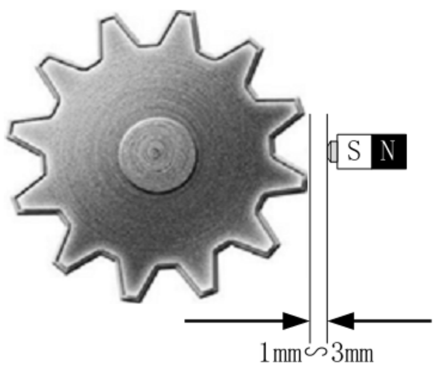


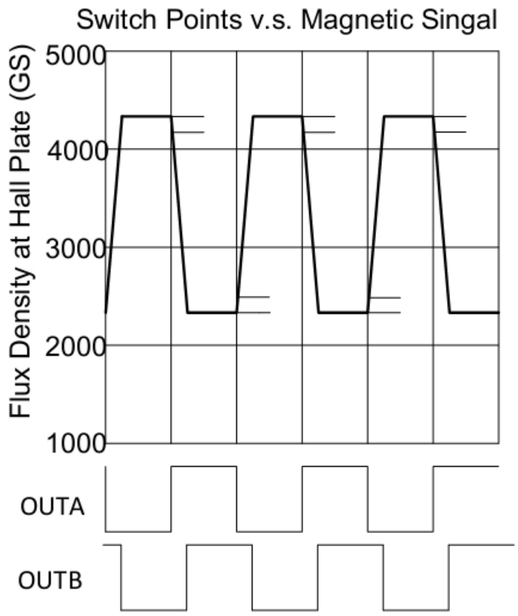
Number	Name	Function
1	VDD	Connects power supply to chip
2	OUTA	Signal OUTA Output
3	OUTB	Signal OUTB Output
4	GND	Ground terminal

Block Diagram



Gear Tooth Sensing



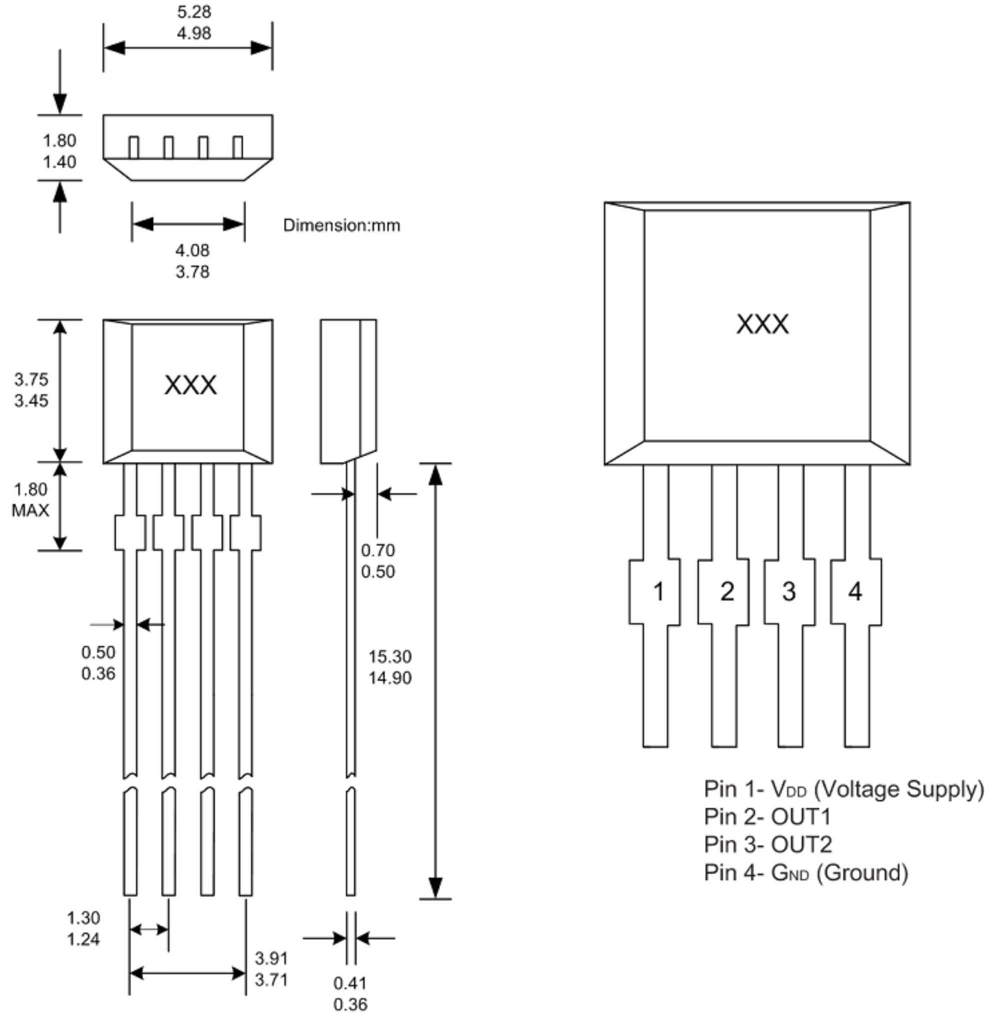


In the case of Ferromagnetic toothed wheel application the IC has to be biased by the south pole of a permanent magnet (Maximum 4000Gs). When assembling the sensor system, suggest to choose a magnet as back bias flux from 1000Gs to 4000Gs. Normally the South pole of magnet faces the unbranded side of the IC. The magnet should be glued to the back surface (non branded side) of the IC using an adhesive or suitable epoxy. The sensor SC9003 is “Self adjusting” over a wide range of back bias flux eliminating the need for any trimming in the application. At the chip power on state, the output is reset to the high state whatever the field is. The output only changes after the first min is detected. The reset state holds no information about the field. If the supply of the chip is raised slowly, the reset state is not stable; the output maybe can’t set to the high state. The maximum air gap depends on

- the magnetic field strength (magnet used; pre-induction) and
- the toothed wheel that is used (dimensions, material, etc.)

It is strongly recommended that an external ceramic bypass capacitor in the range 10nF to 1uF be connected between the supply and ground of the device to reduce external noise. The series resistor in combination with the bypass capacitor creates a filter for EMC pulse. The pull-up resistor should be chosen to limit the current through the output transistor; do not exceed the maximum continuous output current of the device.

Physical Characteristics



Notes:

1. Exact body and lead configuration at vendor’s option within limits shown.
2. Where no tolerance is specified, dimension is nominal.