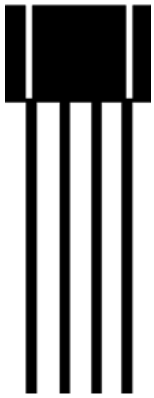
Self-Adjusting Two-Wire Hall Effect Gear Tooth Sensor IC CYGTS9804

The CYGTS9804 is a sophisticated IC featuring an on-chip 12-bit A/D Converter and logic that acts as a digital sample and hold circuit. A separate 6-bit D/A converter provides a fixed hysteresis. The sensor does not have a chopper delay. It uses a single Hall plate which is 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 output has been designed as a two wire current interface. The IDD (off) is 7mA (Typ.) when the flux has reached its peak and decreased by an amount equal to the hysteresis. Similarly the IDD (on) will reach to 14mA (Typ.) when the flux has reached its minimum value and increased by an amount equal to the hysteresis.

Features

- High sensitivity
- Two-wire current interface
- Zero speed detection
- Short circuit protection
- Insensitive to orientation
- Wide voltage working range
- Self-adjusting magnetic range
- On-chip 12 bit A/D converter
- High speed operation
- No chopper delay applications
- RoHS compliant



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Applications

Automotive and Heavy Duty Vehicles:

- ABS Sensors
- Camshaft and crankshaft speed and position
- Transmission speed
- Tachometers

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	8.0	12	24	V
Supply Current Off	I_{DD}	V_{DD} = 12V	5.5	7.0	8.5	mA
Supply Current On	I_{DD}	V_{DD} = 12V	12.0	14.0	16.5	mA
Power-Up State	POS	$V_{DD} > V_{DD(min)}$	H	H	H	
Supply Current	I_{DD}	V_{DD} = 5.0V to 30V	3.0	--	20.0	mA
Output Current Limit	I_{Limit}	V_{DD} = 12V	50	100	150	mA
Clock Frequency	F_{clk}	Operating	400	500	600	KHz
Output Rise Time	T_r	I_{DD}=4mA-->16mA	--	--	1.0	uS
Output Fall Time	T_f	I_{DD}=16mA-->4mA	--	--	1.0	uS
Bandwidth	BW	Operating	--	--	15	KHz
Thermal Resistance	RTH	Operating	--	--	200	℃/Watt

Absolute Maximum Ratings

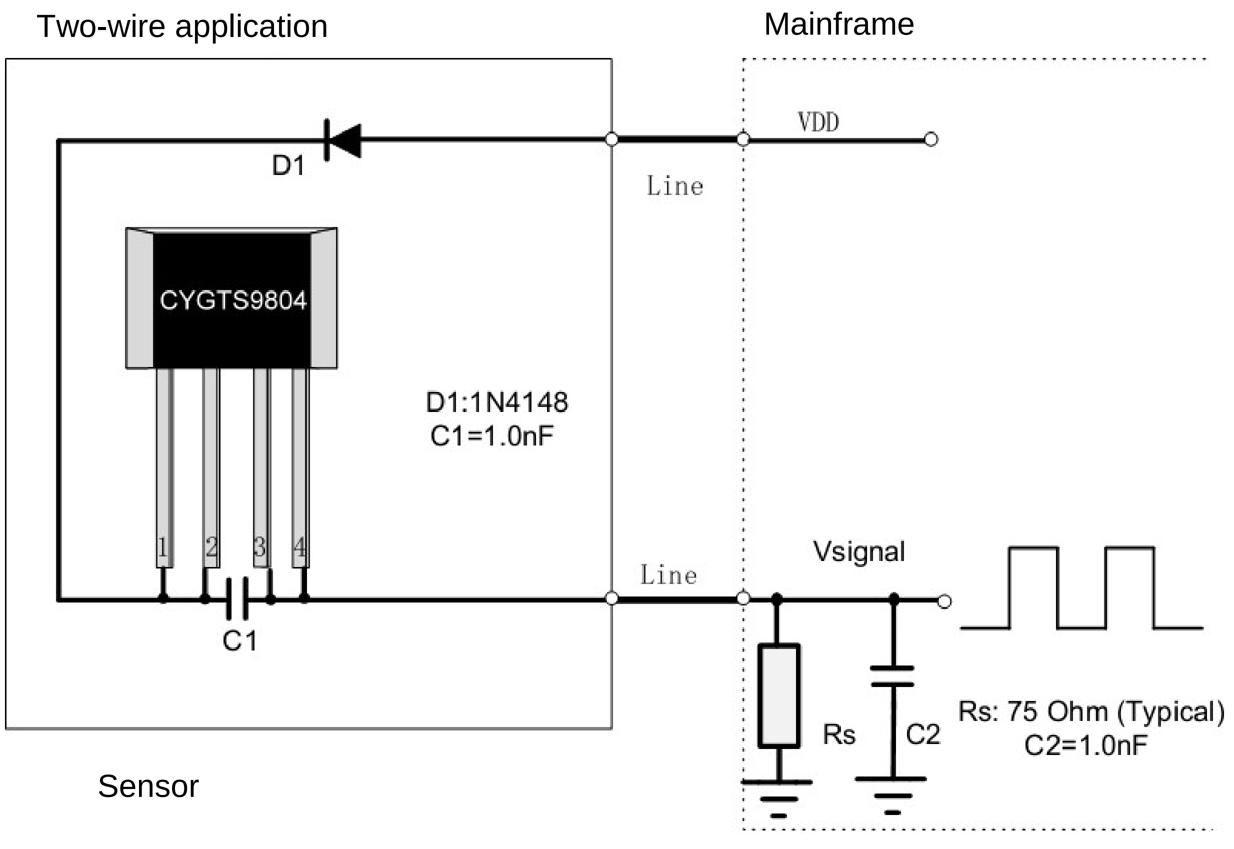
Parameter	Limit Values	
	Min.	Max.
Supply Voltage (Operating), V_{DD}	-0.3V	30V
Output Voltage, V_Q	-0.3V	30V
Supply Current (Fault), I_{DD}	--	50mA
Output Current (Fault), I_{OUT}	--	30mA
Output Current (Fault), I_{fault}	--	200mA
Junction temperature, T_J (5000h)	--	150°C
Junction temperature, T_J (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

ESD Protection

Human Body Model (HBM) tests

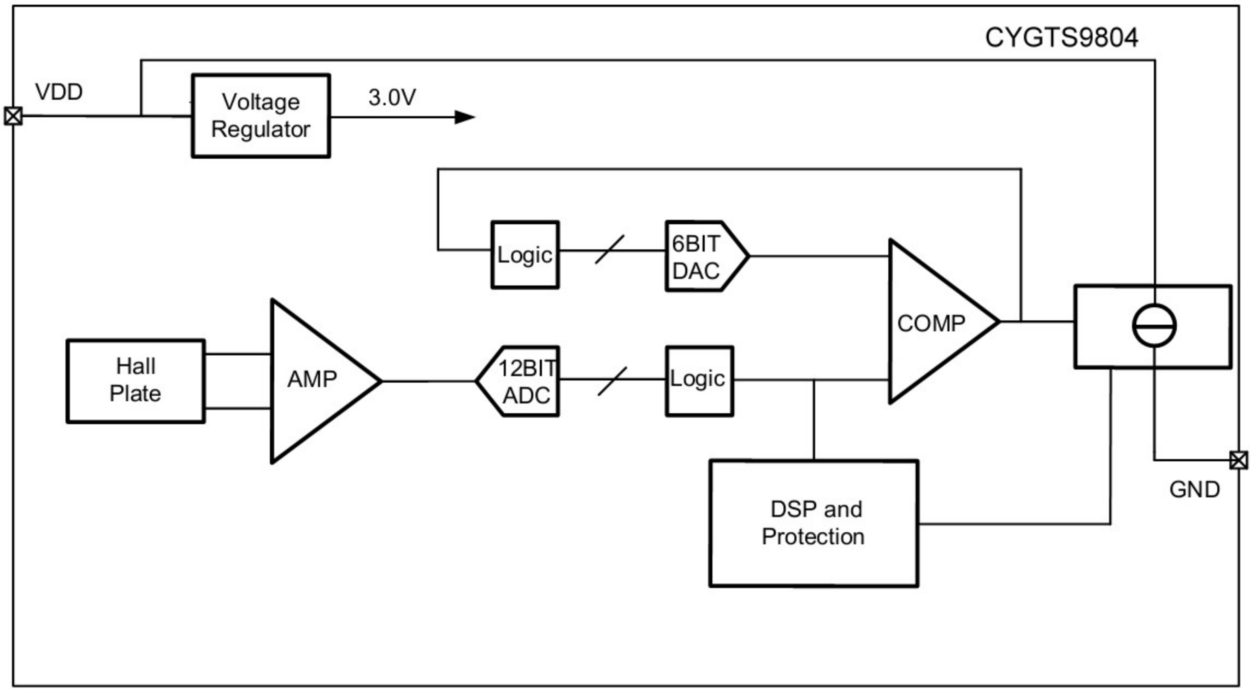
Parameter	Symbol	Max.	Unit	Note
ESD	V_{ESD}	8	kV	According to standard EIA/JESD22-A114-B HBM

Application Circuit and Pin Configuration

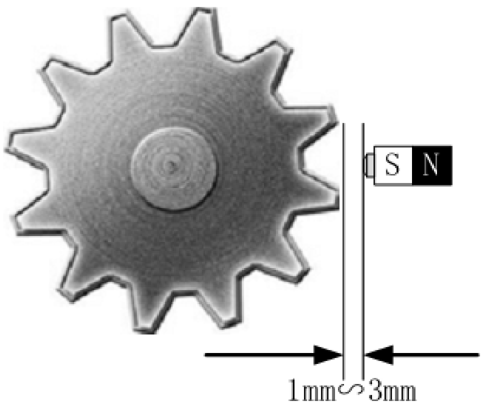


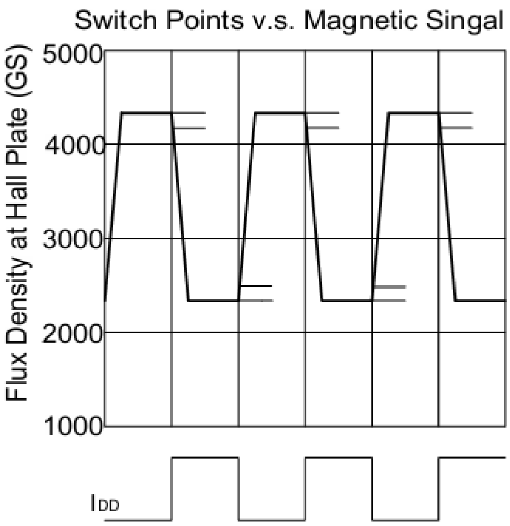
Number	Name	Function
1	VDD	Connects power supply to chip
2	VDD	Connects power supply to chip
3	GND	Ground terminal
4	GND	Ground terminal

Block Diagram



Gear Tooth Sensing

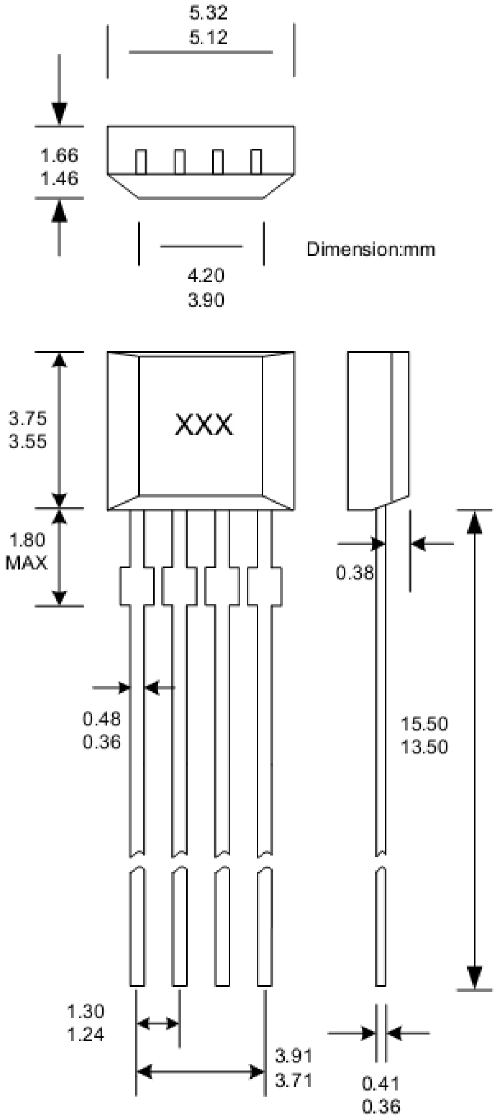


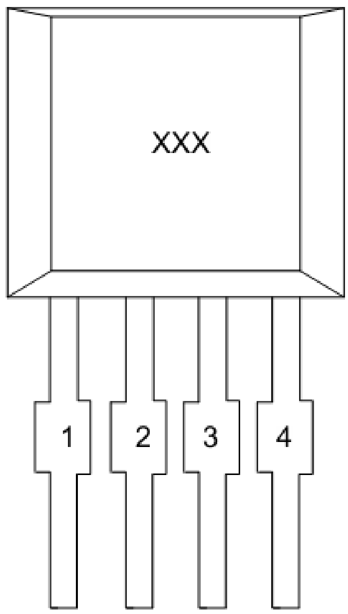


In the case of Ferromagnetic toothed wheel application the IC has to be biased by the south pole of a permanent magnet (Maximum 4000Gs). When assembling the sensor system, suggest to choose a magnet as back bias flux from 1000Gs to 4000Gs. Normally the South pole of magnet faces the unbranded side of 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 CYGTS9804 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.)

Physical Characteristics





Pin 1- V_{DD} (Voltage Supply)
Pin 2- V_{DD} (Voltage Supply)
Pin 3- G_{ND} (Ground)
Pin 4- G_{ND} (Ground)

Notes:

1. Exact body and lead configuration at vendor's option within limits shown.
2. Height does not include mold gate flash.
3. Where no tolerance is specified, dimension is nominal.