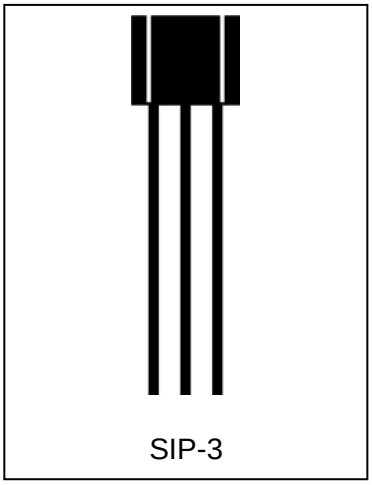
ChenYang
Technologies GmbH & Co. KG

Self-Adjusting Hall Effect Gear Tooth Sensor IC CYGTS9801

The CYGTS9801 is a sophisticated Hall Effect Gear Tooth IC featuring an on-chip 10-bit A/D Converter and logic that acts as a digital sample and hold circuit. A separate 4-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 will turn on BOP after the magnetic flux has reached its peak and decreased by an amount equal to the hysteresis. Similarly the output will turn off (BRP) after the flux has reached its minimum value and increased by an amount equal to the hysteresis.

Features

- High sensitivity
- Digital output signal
- Zero speed detection
- Short circuit protection
- Insensitive to orientation
- 4.5 to 24V supply operating range
- Self-adjusting magnetic range
- Wide operating temperature range
- High speed operation
- Output protection against electrical disturbances
- RoHS compliant



SIP-3

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 switch
- Tachometers, counters.

Device Information

Part number	Packing	Package	Ambient Temperature	Marking
CYGTS9801A	Bulk, 500pcs/bag	3-pin SIP	-40°C ~ 150°C	94M
CYGTS9801K	Bulk, 500pcs/bag	3-pin SIP	-40°C ~ 125°C	94M

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Absolute Maximum Ratings

Over operating free-air temperature range

Parameter	Symbol	Min. value	Max. value	Units
Power supply voltage	V_{DD}	-0.5	30	V
Output terminal voltage	OUT	-0.5	30	V
Output terminal current sink	I_{SINK}	0	30	mA
Operating ambient temperature	T_A	-50	150	°C
Maximum junction temperature	T_J	-55	165	°C
Storage temperature	T_{STG}	-65	175	°C

ESD Protection

Human Body Model (HBM) tests according to: standard EIA/JESD22-A114-B HBM

Parameter	Symbol	Min. value	Max. value	Units
ESD-Protection	V_{ESD}	-4.0	4.0	kV

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Magnetic Specifications

Over operating free-air temperature range (V_{DD}=12V, unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
B_{Back}	Bias magnetic field		-30	--	4000	Gs
B_{OP}	Turn on hysteresis	B_{Back}=3000Gs	15	30	45	Gs
B_{RP}	Turn off hysteresis	B_{Back}=3000Gs	15	30	45	Gs
--	Linear Region	V_{DD}=4.5V to 24 V	500	0	4000	Gs

1mT=10Gs

Electrical Specifications

Over operating free-air temperature range (V_{DD}=12V, unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_{DD}	Operating voltage	T_J<T_J(max)	4.5	--	24	V
I_{DD}	Operating supply current	V_{DD}=4.5V to 24 V	2.0	4.0	7.0	mA
V_{Qsat}	Output saturation voltage	I_O=20mA, T_A=25°C	--	150	400	mV
I_{QL}	Output leakage current	V_{DD} < 24V	--	--	10	µA
t_{rp}[1]	Response time	V_{DD}>4.5V, f=1kHz	0	--	50	mS
t_r[2]	Output rise time	R1=1kΩ, Co=20pF	--	--	0.5	µS
t_f	Output fall time	R1=1kΩ, Co=20pF	--	--	0.5	µS
f_{cu}	Upper corner frequency	-3dB, single pole	20	--	--	kHz
f_{cl}	Lower corner frequency	-3dB, single pole	--	0	--	Hz

1: Time required to initialize device.
2: Output Rise Time will be dominated by the RC time constant.

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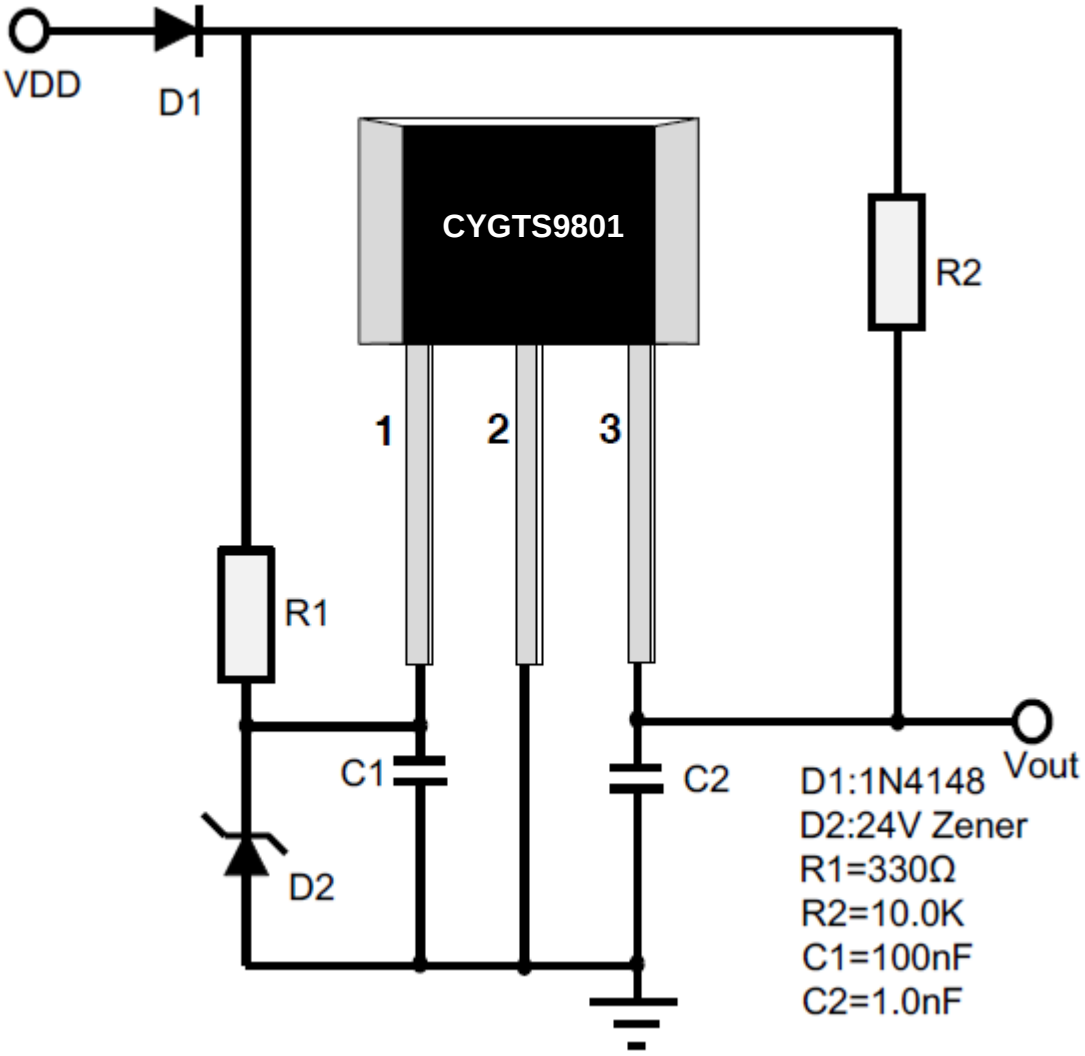
Application Circuit and Pin Configuration



Terminal name	Terminal number	type	Description
VDD	1	PWR	4.5V to 24 V power supply
GND	2	Ground	Ground
OUT	3	Output	Open-drain output required a pull-up resistor

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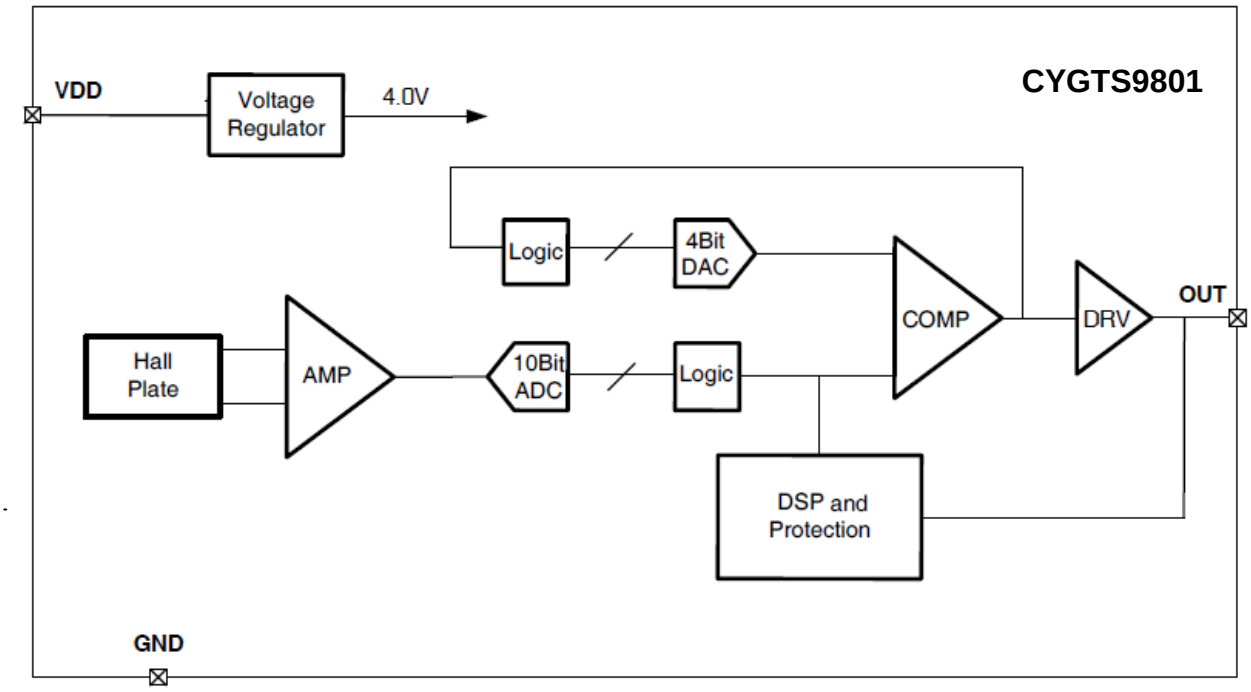
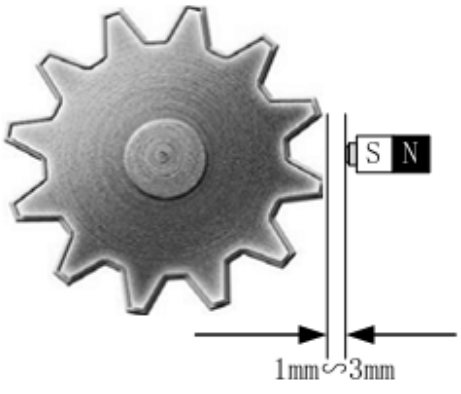
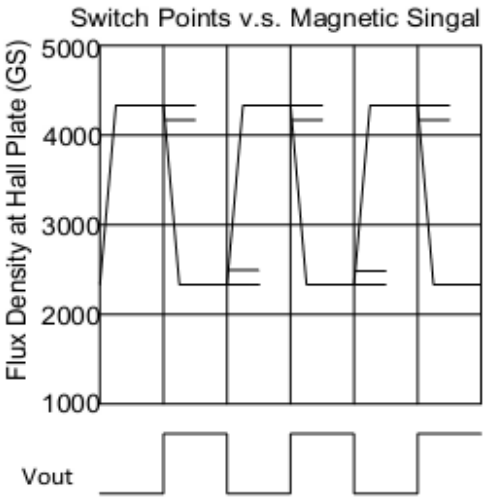
Block Diagram



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 CYGTS9801 is “self-adjusting”

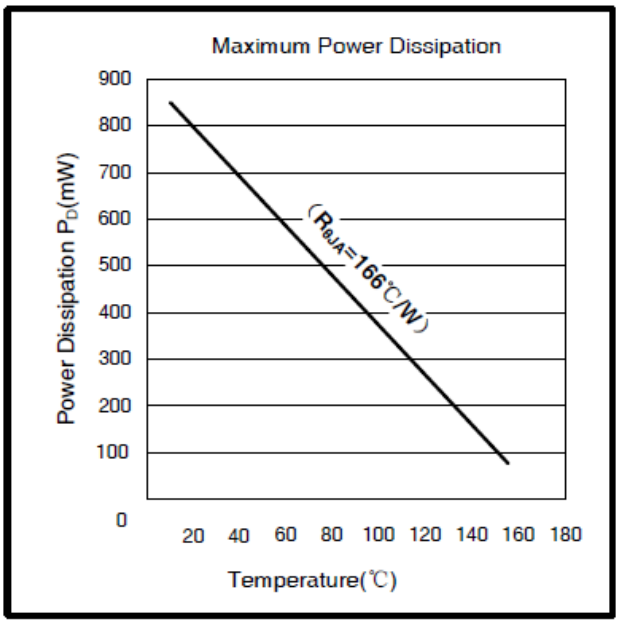
over a wide range of back bias flux eliminating the need for any trimming in the application. At the chip power on state, the output is reset to the high state whatever the field is. The output only changes after the first min is detected. The reset state holds no information about the field. If the 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

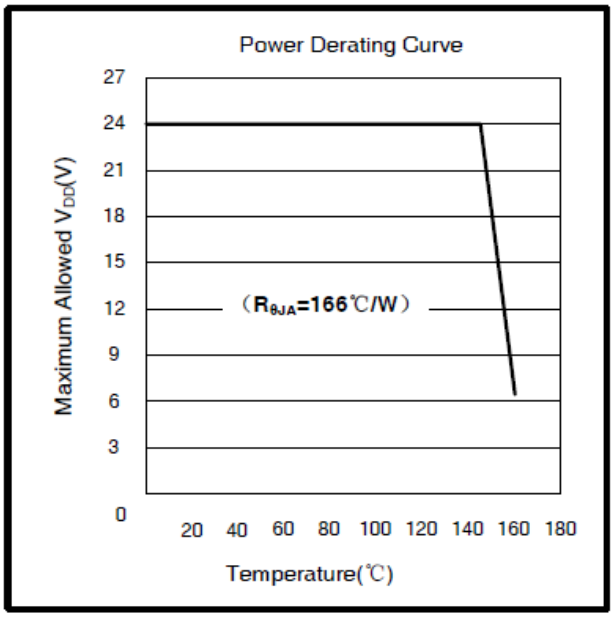
- the magnetic field strength (magnet used; pre-induction) and
- the toothed wheel that is used (dimensions, material, etc.)

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.

Thermal Characteristics

Symbol	Parameter	Test Conditions	Rating	Units
$R_{\theta JA}$	Package thermal resistance	Single-layer PCB, with copper limited to solder pads	166	°C/W

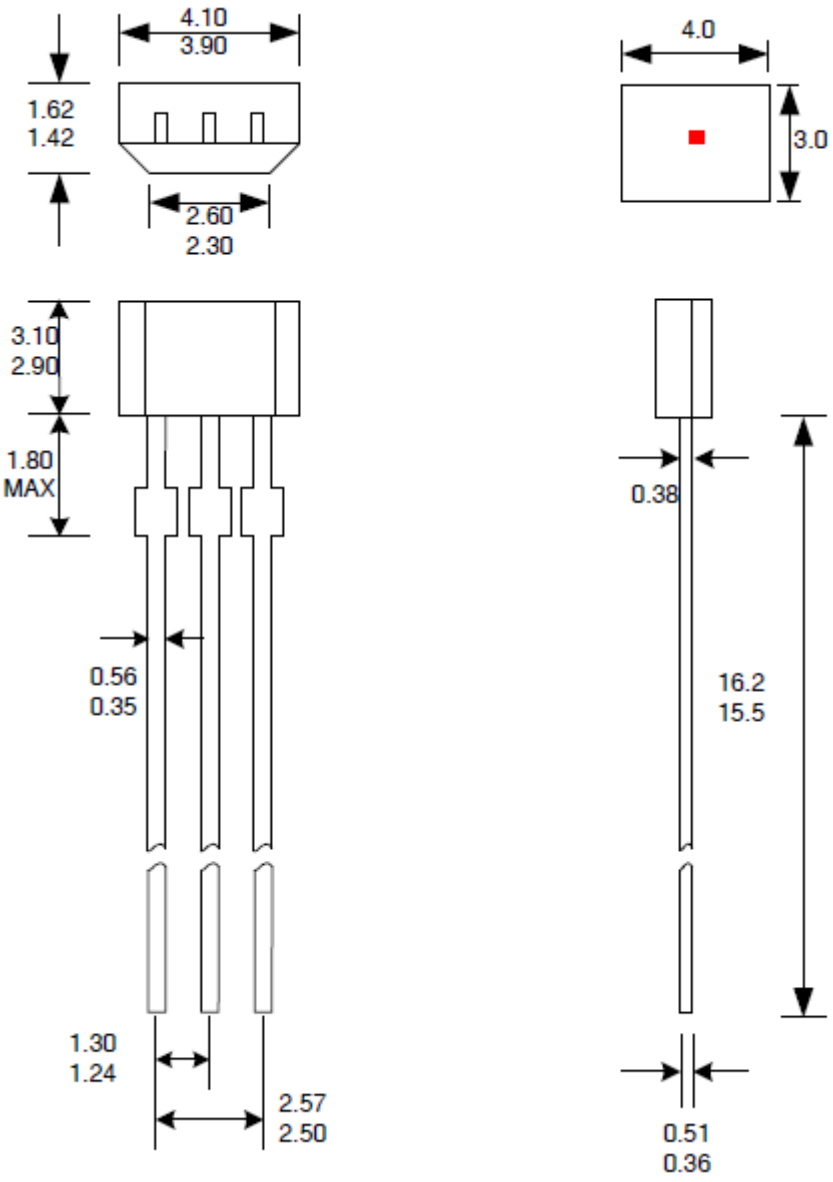




Package Designator

3 – Terminal UA Package

Dimension: in mm



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.

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