Catalogue

Hall Effect Switch IC with Dual Outputs &

Hall Effect Gear Tooth Sensor ICs

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CYD8526 Dual Channel Hall Effect Switch With Speed and Direction Outputs

The CYD8526 is a dual-channel Hall-effect sensor IC ideal for use in speed and direction sensing applications incorporating encode ring-magnet targets. The Hall elements are both photo lithographically aligned to better than 1um. Maintaining accurate displacement between the two active Hall elements eliminates the major manufacturing hurdle encountered in fine-pitch detection applications. The CYD8526 is a sensitive, temperature-stable magnetic device suitable for use in harsh automotive and industrial environments..

The Hall elements of the sensor CYD8526 are spaced 1.4mm apart, which provides excellent speed and ddirection information for small-geometric targets. Extremely low-drift amplifiers guarantee symmetry between the switches to maintain signal quadrature. An on-chip regulator allows the use of this device over a wide operating voltage range of 3.5V to 24V.

The CYD8526 is available in a 4-pin SIP package and a plastic SOT89B package. The packages are lead (Pb) free, with 100% matte tin leadframe plating.

Features

- Two matched Hall switches on a substrate
- Dual channel outputs for speed and direction
- Good temperature stability
- High sensitivity (B_{OP} and B_{RP})
- 3.5V to 24V supply voltage
- Solid-state reliability
- Small package sizes
- RoHS compliant

Applications

- Anti-pinch electric motor control
- Motor and fan control
- Magnetic encoder
- Rotating shaft monitoring
- Auto-motive transmission position
- Garage door openers
- Power sliding doors
- Sunroofs motors

Device information

Part number	Packing	Mounting	Temperature	B_{OP} (typ.)	BRP (Typ.)
CYD8526VB	Bulk, 1000pcs/bag	4-pin SIP	-40°C~150°C	+10.0mT	-10.0mT

Electrical Specifications

Over operating free-air temperature range (V_{DD} = 5.0V, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_{DD}	Operating supply voltage	$T_J < T_{J\ (max)}$	3.50	--	24	V
I_{DD}	Operating supply current	V_{DD}=3.5 to 24V	2.0	4.0	6.5	mA
t_{on}	Power on time		--	35	50	µs
I_{OL}	Off-state leakage current	Output Hi-Z	--	--	1	µA
$R_{DS(on)}$	FET on resistance	V_{DD}=5V, Io=10mA, TA=25°C	--	20	--	Ω
td	Output delay time	B=B_{RP} to B_{OP}	--	13	25	µs
tr	Output rise time	R1=1kΩ, Co=50pF	--	--	0.5	µs
tf	Output fall time	R1=1kΩ, Co=50pF	--	--	0.2	µs
f_{BW}	Bandwidth		40	--	--	kHz

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Magnetic Specifications

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
B_{OP}	Operating point	VB Package	7.0	10.0	13.0	mT
B_{RP}	Release point		-13.0	-10.0	-7.0	mT
B_{HYS}	Hysteresis		--	20	--	mT
Bo	Magnetic Offset	$Bo=(B_{OP}+B_{RP})/2$	--	0	--	mT

1mT = 10Gs

Absolute Maximum Ratings

Over operating free-air temperature range

Parameter	Symbol	Min	Max.	Unit
Supply Voltage	V_{DD}	-0.5	35	V
Output voltage	V_{OUT}	-0.5	35	V
Output Sink Current, I_{OUT}	I_{SINK}	0	30	mA
Operating Temperature Range	T_A	-40	150	°C
Maximum junction temperature	T_J	-55	165	°C
Storage Temperature Range	T_{STG}	-65	175	°C

Note: Stresses above those listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Thermal Characteristics

Symbol	Parameter	Test Conditions	Rating	Units
R_{QJA}	VB Package thermal resistance	Single-layer PCB, with copper limited to solder pads	177	℃/W
R_{QJA}	BU Package thermal resistance	Single-layer PCB, with copper limited to solder pads	140	℃/W

ESD Protection

Human body model (HBM) tests according to: Standard EIA/JESD22-A114-B HBM

Parameter	Symbol	Min.	Max.	units
ESD-Protection	V_{ESD}	-6	6	KV

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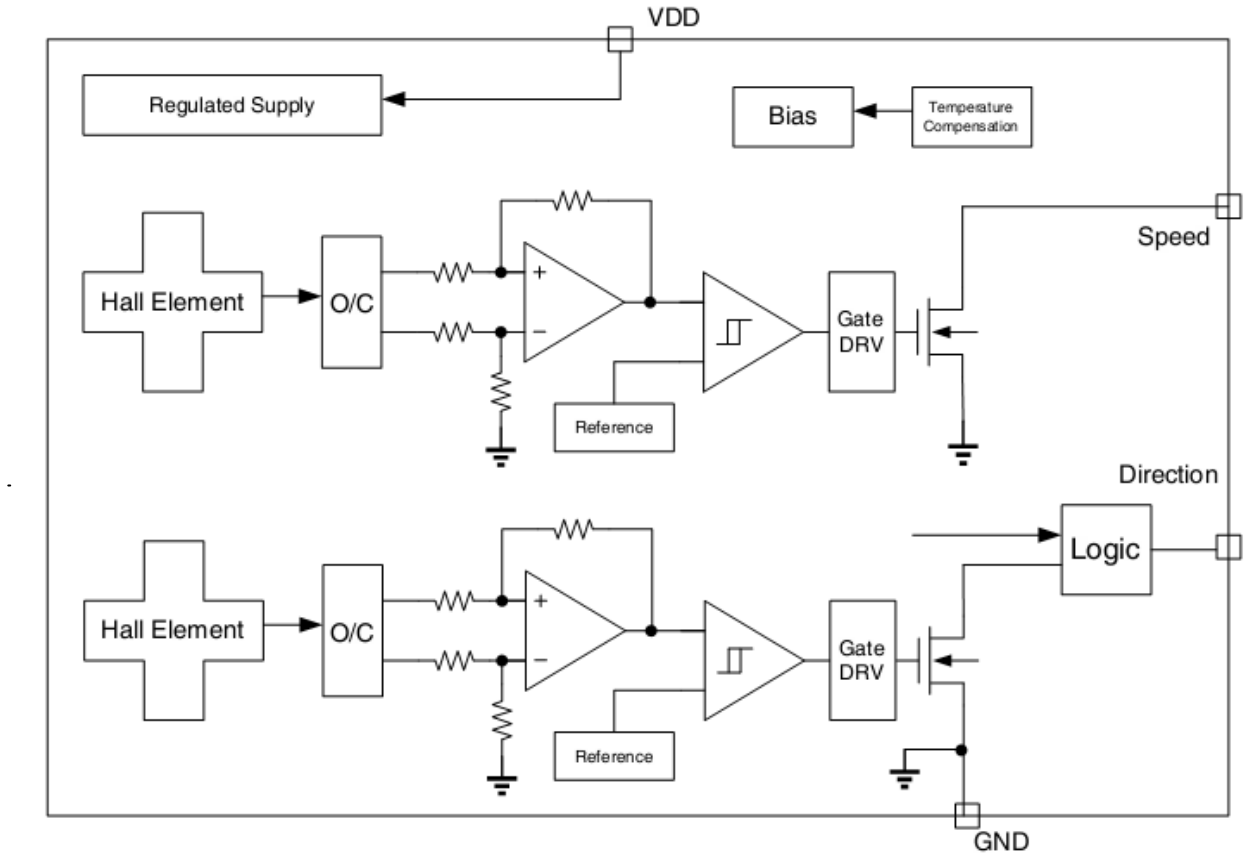
Functional Diagram



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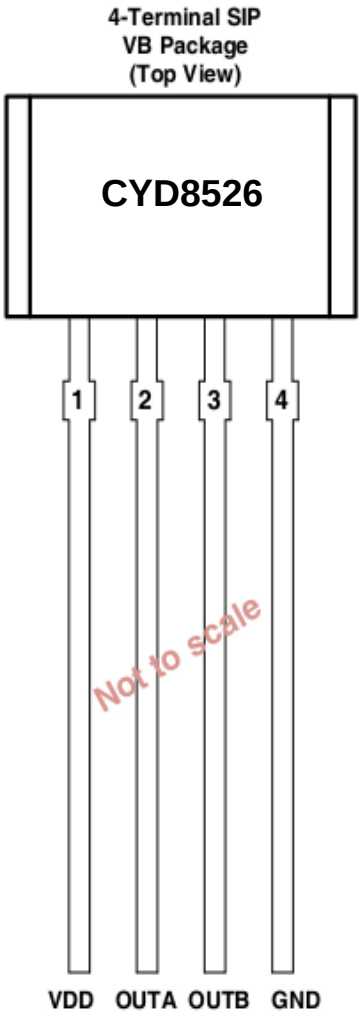
Terminal Configuration and Functions



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Pin Arrangement

Terminal		Type	Description
Name	Pin (VB Package)		
V_{DD}	1	Power supply	3.5 to 24 V power supply
Direction output	2	Output	Direction output, OC, needs a pull-up resistor
Speed output	3	Output	Speed output, OC, needs a pull-up resistor
GND	4	Ground	Ground terminal

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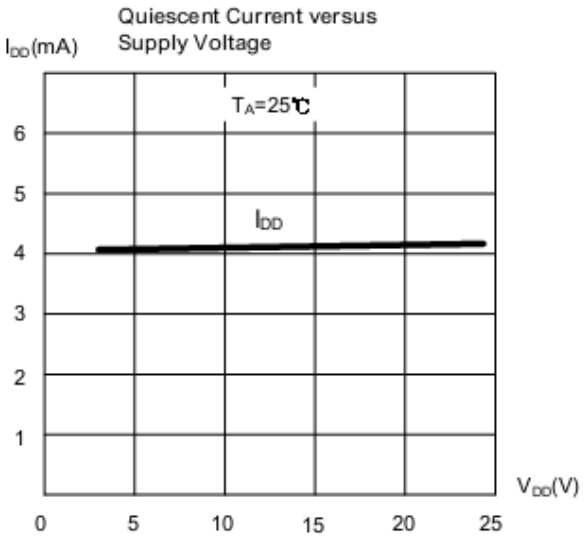
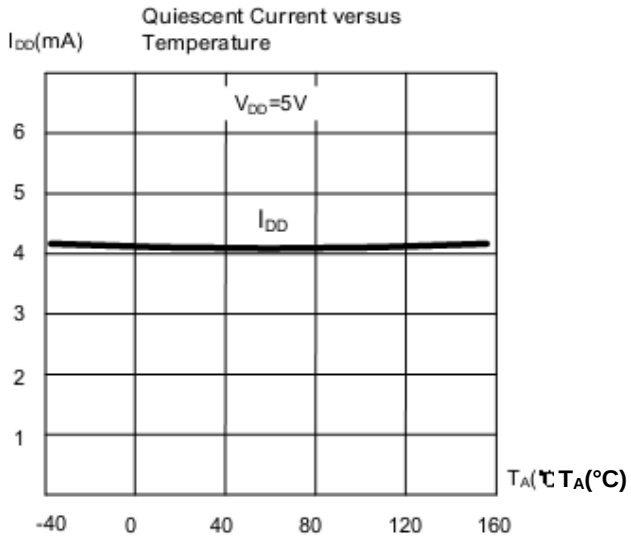
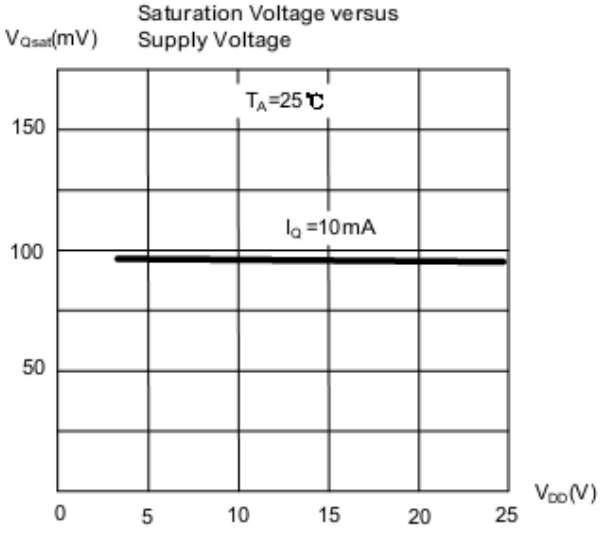
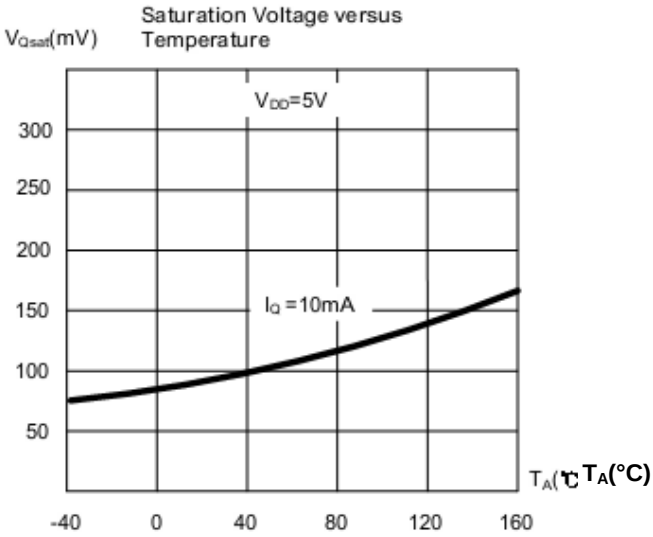
Characteristic Data









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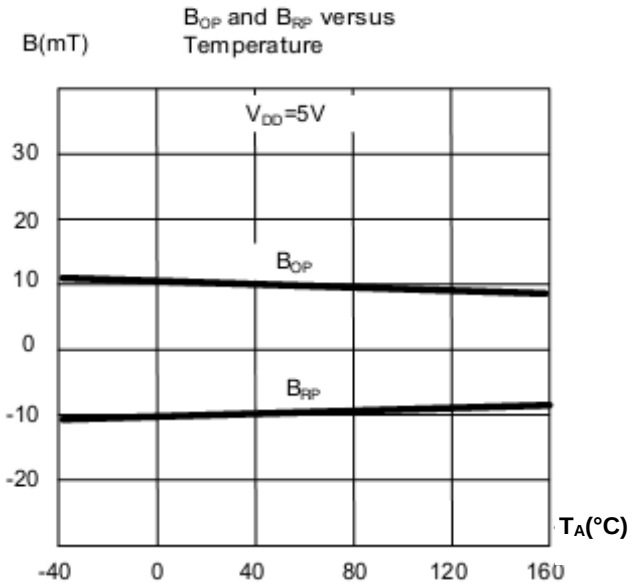
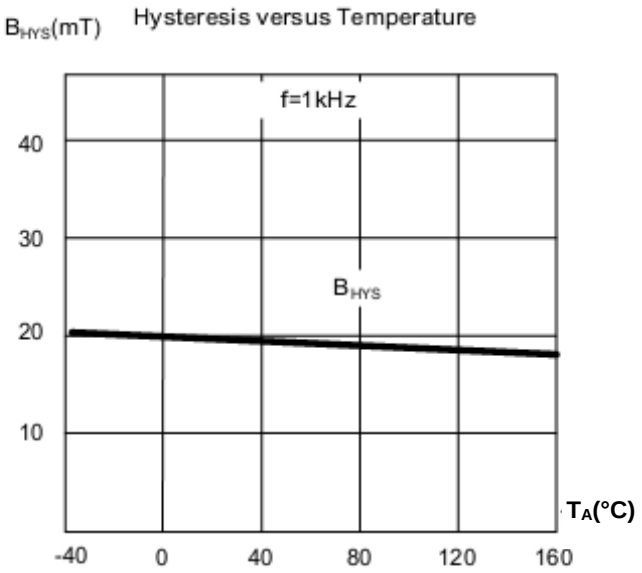
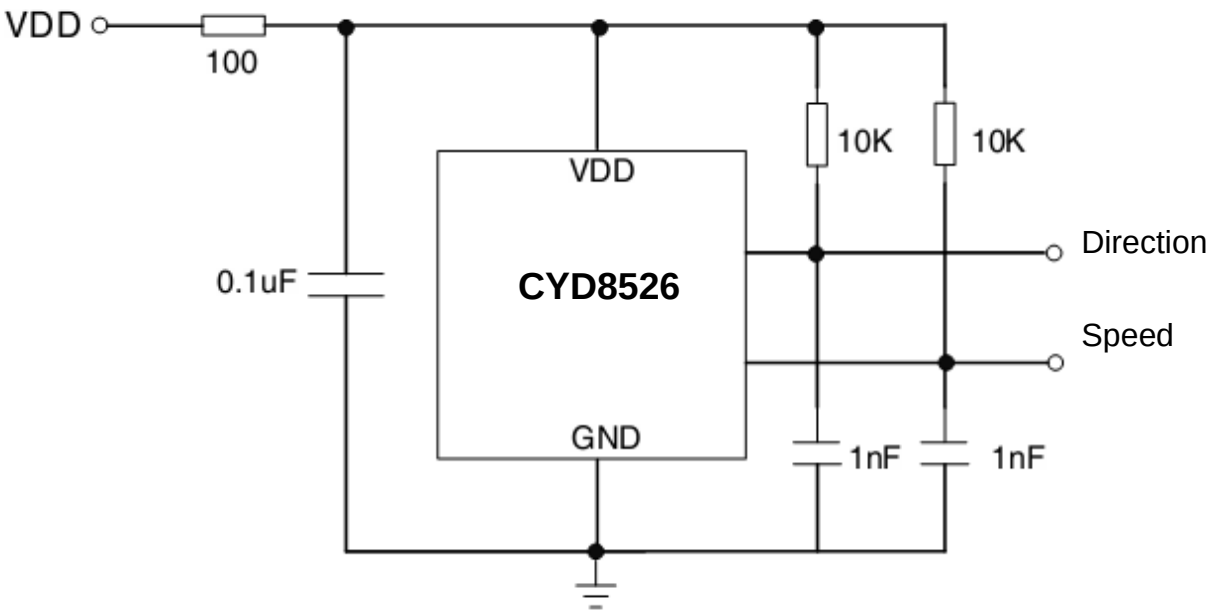
Characteristic Data (Continued)





Typical Application Circuit



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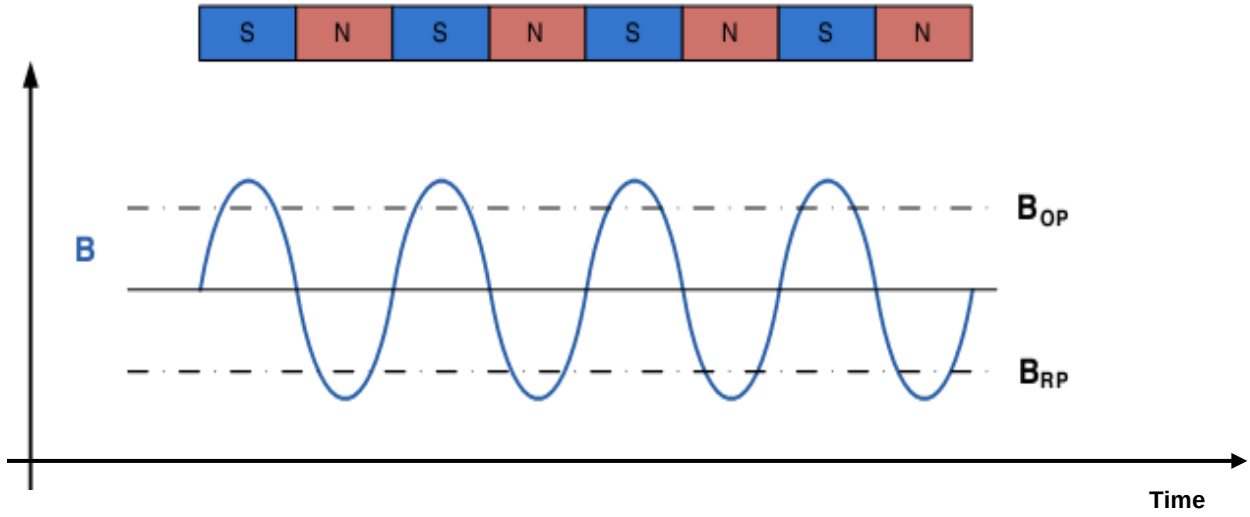
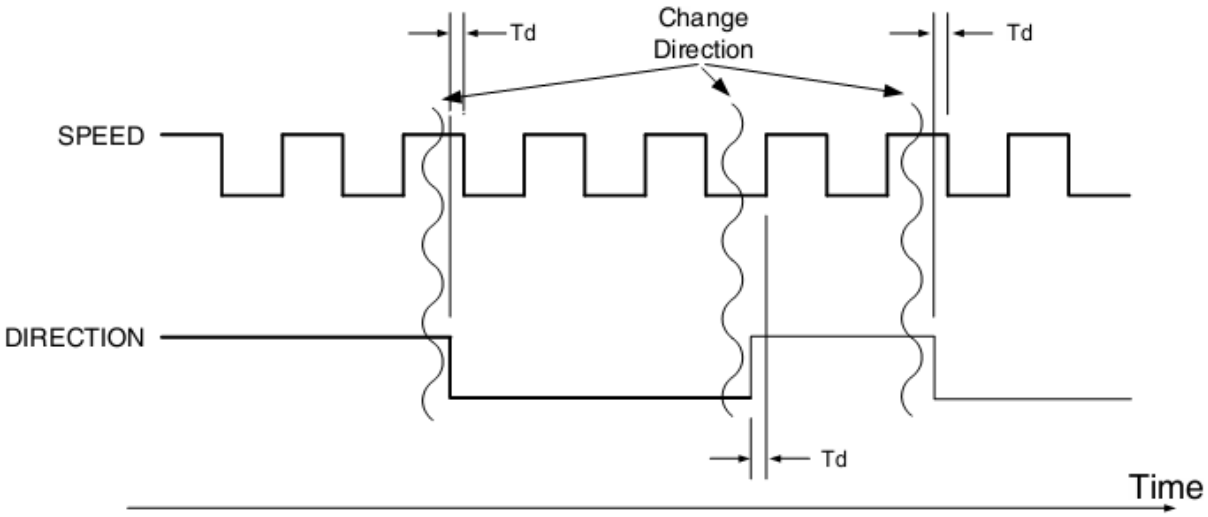
Typical Output Waveform





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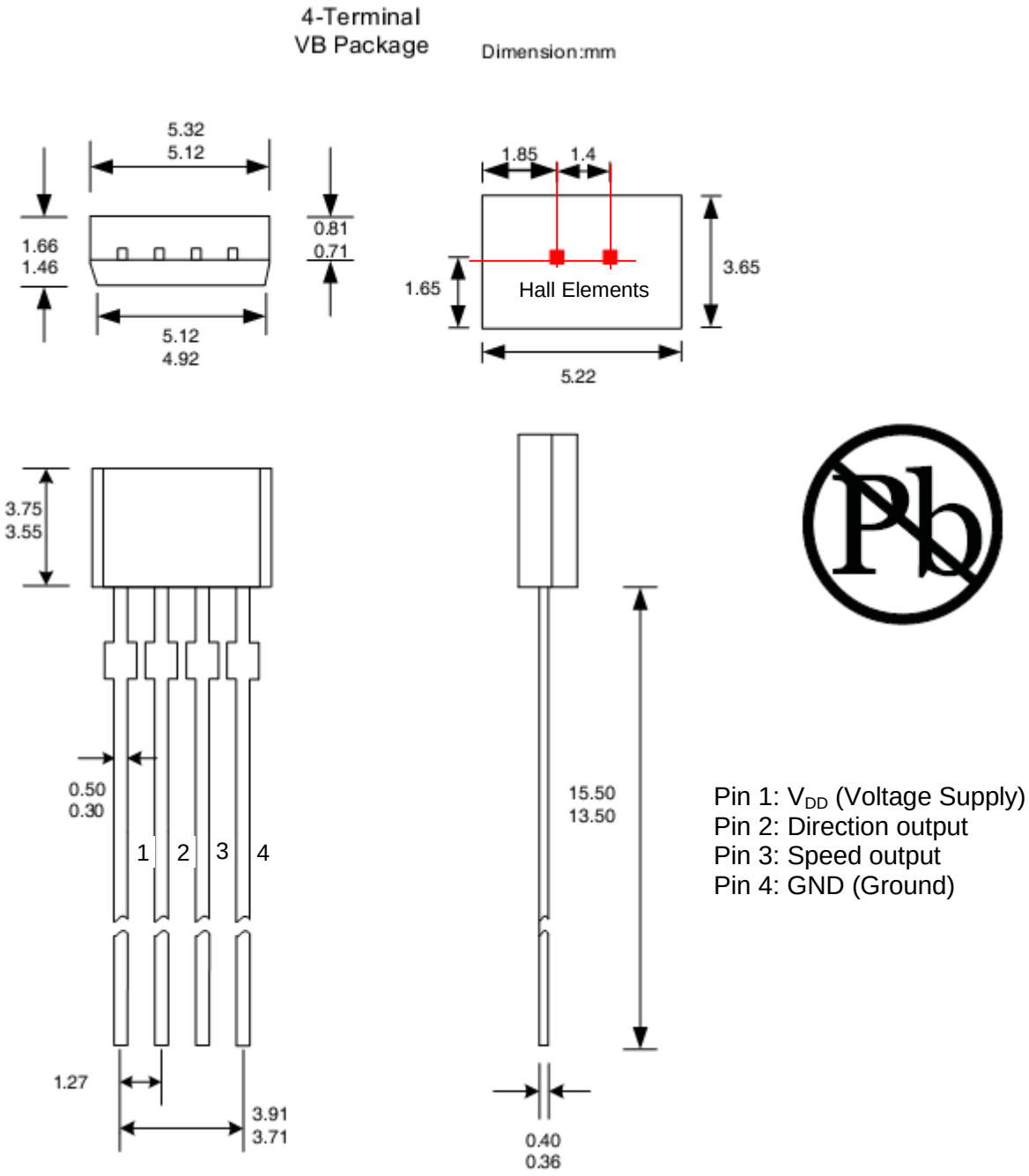
Geometric Dimensions (Package)



Pin 1: V_{DD} (Voltage Supply)
Pin 2: Direction output
Pin 3: Speed output
Pin 4: GND (Ground)

Notes:

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

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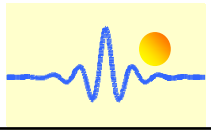

CYD8536 Dual Channel Sensitive Hall Effect Switch With Quadrature Outputs

The CYD8536 a dual-channel, bipolar switch with two Hall Effect sensing elements, each providing a separate digital output for rotational speed measurement and direction detection. The Hall elements are photolithogrphically aligned to better than 1µm. Maintaining accurate mechanical location between the two active Hall elements eliminates the major manufacturing hurdle encounted in fine-pitch detection applications. The CYD8536 is a highly sensitive, temperature stable magnetic sensing device, which is ideal for use in ring magnet based speed and direction systems located in harsh automotive and uíndustrial environments.

The Hall elements of the sensor CYD8536 are spaced 1.6mm apart, which provides excellent speed and direction information for small-geometric targets. Extremely low-drift amplifiers guarantee symmetry between the switches to maintain signal quadrature. An on-chip regulator allows the use of this device over a wide operating voltage range of 2.8V to 24V.

The CYD8536 is available in a 4-pin SIP package. The package is lead (Pb) free, with 100% matte tin leadframe plating.

Features

- Two matched Hall switches on a substrate
- Dual channel outputs
- Good temperature stability
- High sensitivity (B_{OP} and B_{RP})
- 2.8V to 24V supply voltage
- Solid-state reliability
- Small package sizes
- RoHS compliant

Applications

- Anti-pinch electric motor control
- Motor and fan control
- Magnetic encoder
- Rotating shaft monitoring
- Auto-motive transmission position
- Garage door openers
- Power sliding doors
- Sunroofs motors

Device information

Part number	Packing	Mounting	Temperature	B_{OP} (typ.)	BRP (Typ.)
CYD8536VB	Bulk, 1000pcs/bag	4-pin SIP	-40°C~150°C	+2.0mT	-2.0mT

Electrical Specifications

Over operating free-air temperature range (V_{DD} = 5.0V, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_{DD}	Operating supply voltage	$T_J < T_{J\ (max)}$	2.80	--	24	V
I_{DD}	Operating supply current	V_{DD}=2.8 to 24V	1.5	3.0	4.5	mA
t_{on}	Power on time		--	35	50	µs
I_{OL}	Off-state leakage current	Output Hi-Z	--	--	1	µA
$R_{DS(on)}$	FET on resistance	V_{DD}=5V, Io=10mA, TA=25°C	--	20	--	Ω
td	Output delay time	B=B_{RP} to B_{OP}	--	13	25	µs
tr	Output rise time	R1=1kΩ, Co=50pF	--	--	0.5	µs
tf	Output fall time	R1=1kΩ, Co=50pF	--	--	0.2	µs
f_{BW}	Bandwidth		40	--	--	kHz

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Magnetic Specifications

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
B_{OP}	Operating point	VB Package	0.5	2.0	3.5	mT
B_{RP}	Release point		-3.5	-2.0	-0.5	mT
B_{HYS}	Hysteresis		--	4.0	--	mT
Bo	Magnetic Offset	$Bo=(B_{OP}+B_{RP})/2$	--	0	--	mT

1mT = 10Gs

Absolute Maximum Ratings

Over operating free-air temperature range

Parameter	Symbol	Min	Max.	Unit
Supply Voltage	V_{DD}	-0.5	28	V
Output voltage	V_{OUT}	-0.5	28	V
Output Sink Current, I_{OUT}	I_{SINK}	0	30	mA
Operating Temperature Range	T_A	-40	150	°C
Maximum junction temperature	T_J	-55	165	°C
Storage Temperature Range	T_{STG}	-65	175	°C

Note: Stresses above those listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Thermal Characteristics

Symbol	Parameter	Test Conditions	Rating	Units
R_{QJA}	VB Package thermal resistance	Single-layer PCB, with copper limited to solder pads	177	℃/W
R_{QJA}	BU Package thermal resistance	Single-layer PCB, with copper limited to solder pads	140	℃/W

ESD Protection

Human body model (HBM) tests according to: Standard EIA/JESD22-A114-B HBM

Parameter	Symbol	Min.	Max.	units
ESD-Protection	V_{ESD}	-6	6	KV

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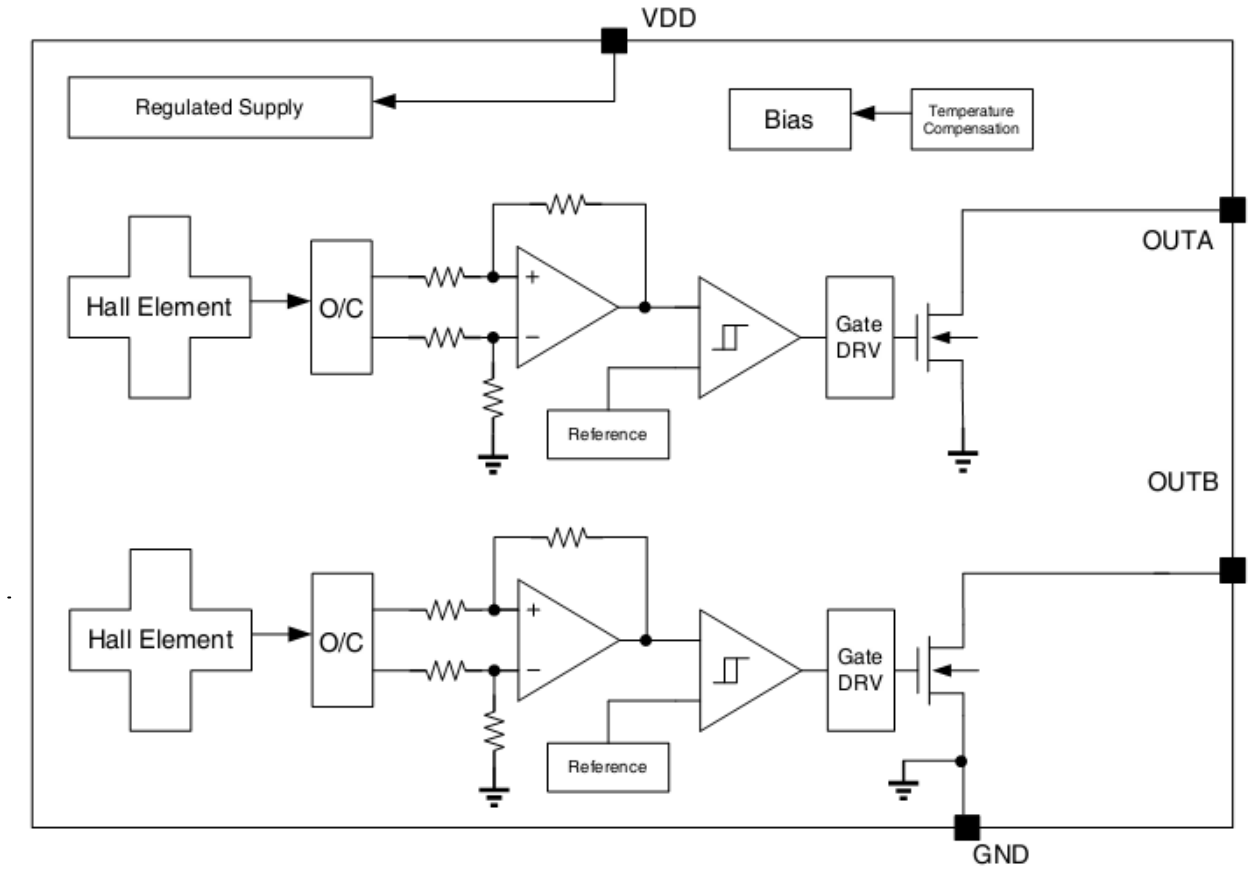
Functional Diagram



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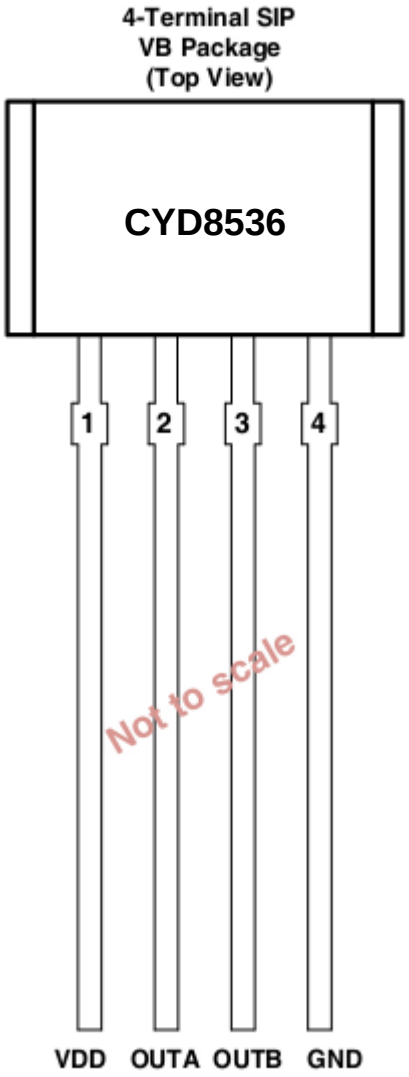
Terminal Configuration and Functions



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Pin Arrangement

Terminal		Type	Description
Name	Pin (VB Package)		
V_{DD}	1	Power supply	2.8V to 24V power supply
OUTA	2	Output A	A Channel output, OC, needs a pull-up resistor
OUTB	3	Output B	B Channel output, OC, needs a pull-up resistor
GND	4	Ground	Ground terminal

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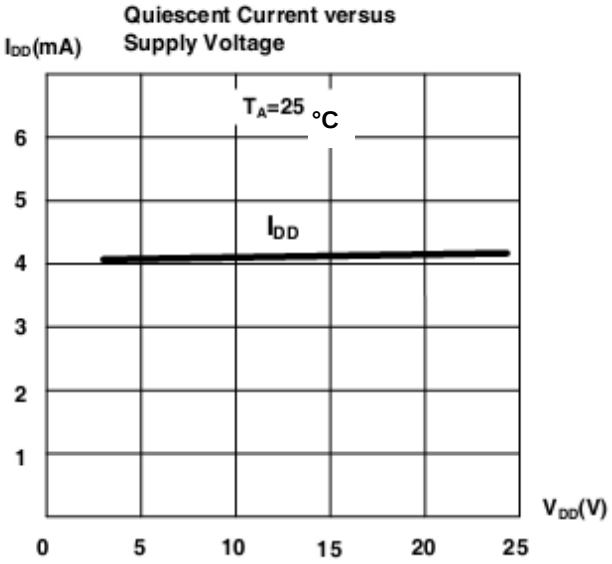
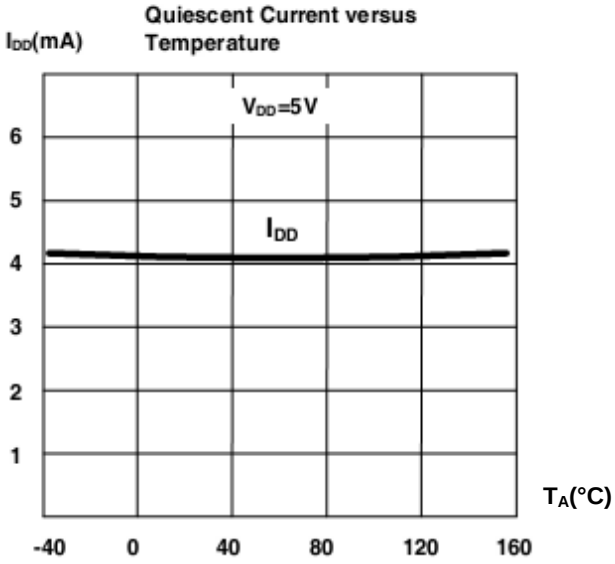
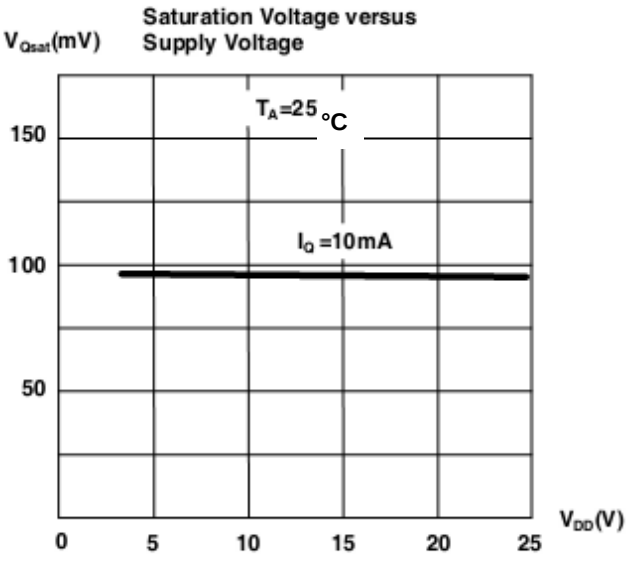
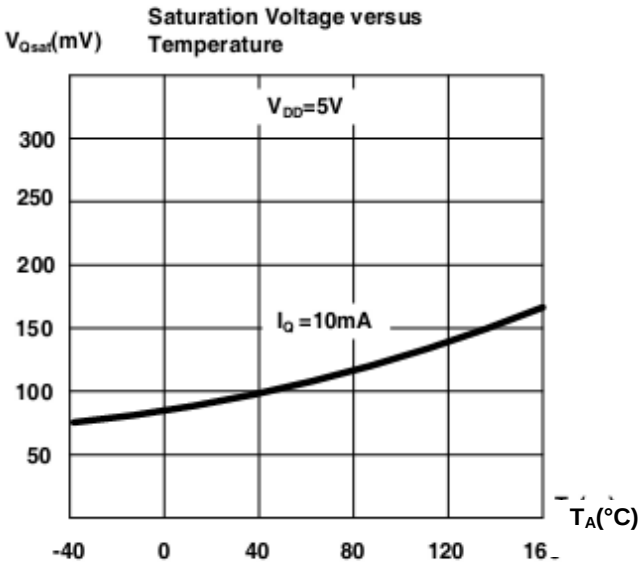
Characteristic Data









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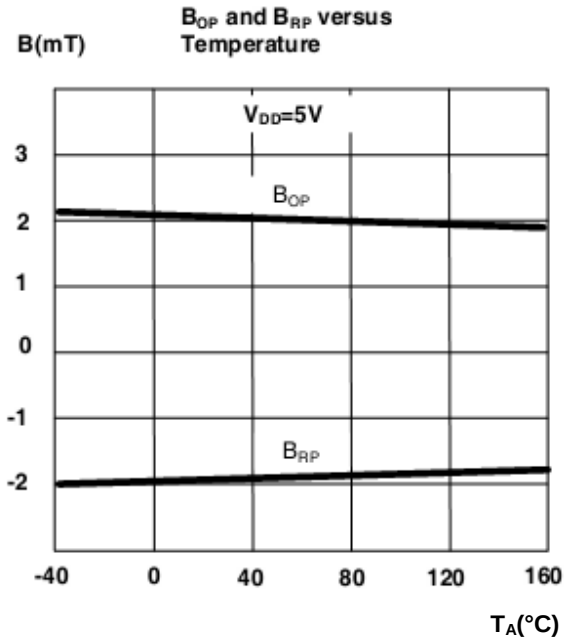
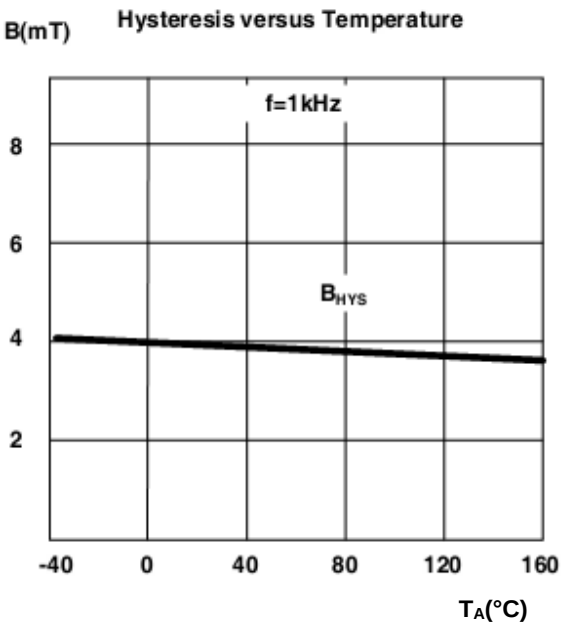
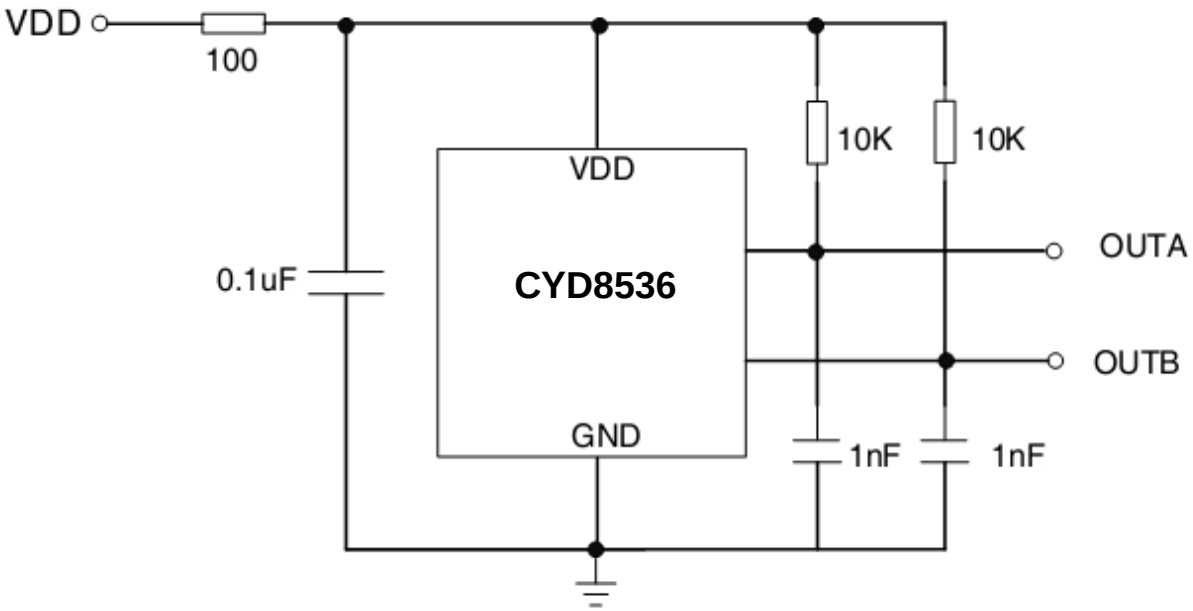
Characteristic Data (Continued)





Typical Application Circuit



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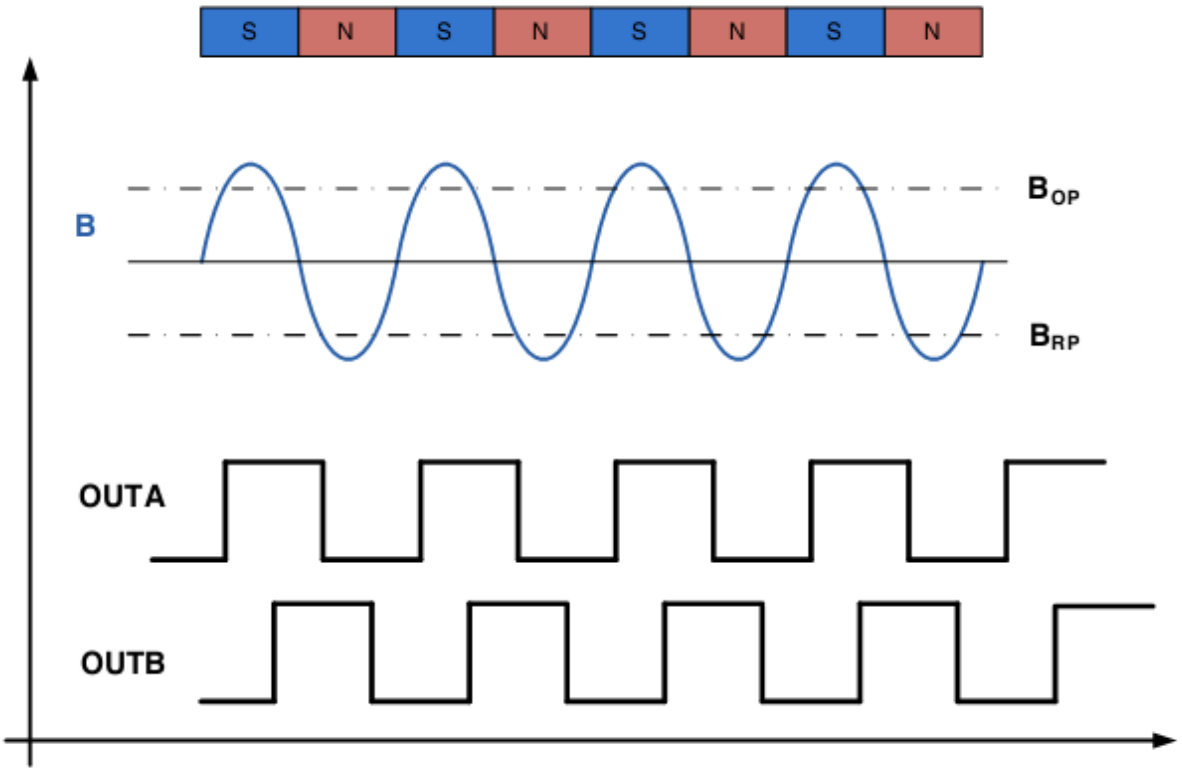
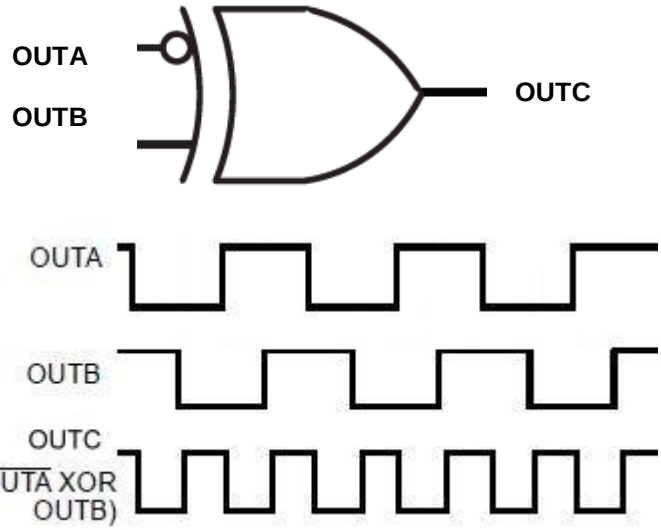
Typical Output Waveform



Using the following logic operation ($\overline{\text{OUTA}}$ XOR OUTB) one can get a new output signal OUTC, the frequency of which is the double as the frequency of the output OUTA or OUTB.



The signal OUTC can be used for speed measurement while OUTA and OUTB are used for direction detection.

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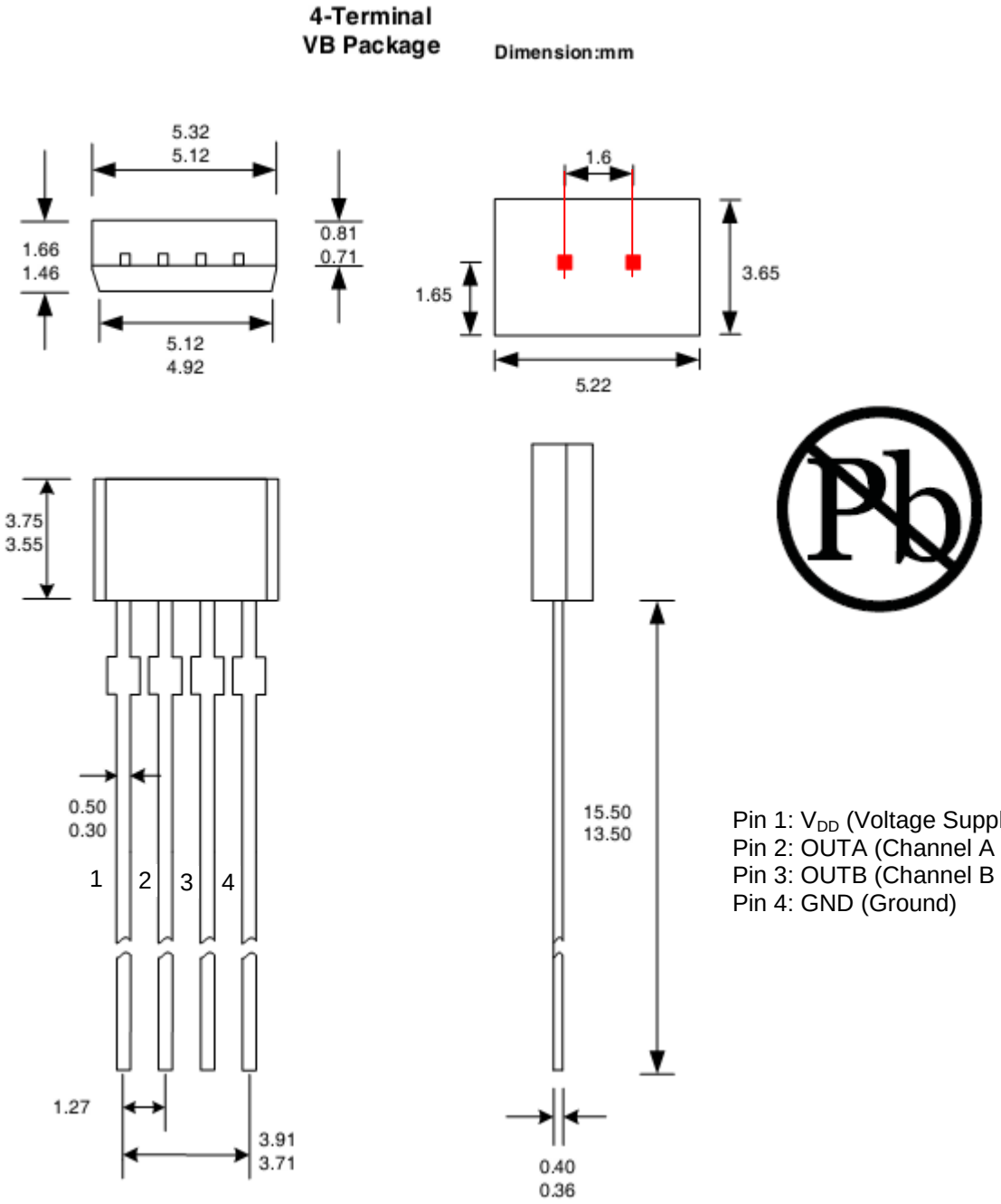
Geometric Dimensions (Package)



Pin 1: V_{DD} (Voltage Supply)
Pin 2: OUTA (Channel A output)
Pin 3: OUTB (Channel B output)
Pin 4: GND (Ground)

Notes:

1. Exact body and lead configuration at vendor's option within limits shown
2. Height does not include mold gate flash

Where no tolerance is specified, dimension is nominal

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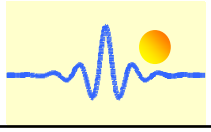

CYD8546 Dual Channel Sensitive Hall Effect Switch With Quadrature Outputs

The CYD8546 a dual-channel, bipolar switch with two Hall Effect sensing elements, each providing a separate digital output for rotational speed measurement and direction detection. The Hall elements are photolithogrphically aligned to better than 1µm. Maintaining accurate mechanical location between the two active Hall elements eliminates the major manufacturing hurdle encounted in fine-pitch detection applications. The CYD8546 is a highly sensitive, temperature stable magnetic sensing device, which is ideal for use in ring magnet based speed and direction systems located in harsh automotive and uíndustrial environments.

The Hall elements of the sensor CYD8546 are spaced 0.95mm apart, which provides excellent speed and direction information for small-geometric targets. Extremely low-drift amplifiers guarantee symmetry between the switches to maintain signal quadrature. An on-chip regulator allows the use of this device over a wide operating voltage range of 2.5V to 24V.

The CYD8546 is available in a 4-pin SIP package. The package is lead (Pb) free, with 100% matte tin leadframe plating.

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Features

- Two matched Hall switches on a substrate
- Dual channel outputs
- Good temperature stability
- High sensitivity (B_{OP} and B_{RP})
- 2.5V to 24V supply voltage
- Reverse voltage protection
- Built-in pull-up resistor
- RoHS compliant

Applications

- Anti-pinch electric motor control
- Motor and fan control
- Magnetic encoder
- Rotating shaft monitoring
- Auto-motive transmission position
- Garage door openers
- Power sliding doors
- Sunroofs motors

Device information

Part number	Packing	Mounting	Temperature	B_{OP} (typ.)	BRP (Typ.)
CYD8546VB	Bulk, 1000pcs/bag	4-pin SIP	-40°C~150°C	+2.0mT	-2.0mT

Electrical Specifications

Over operating free-air temperature range (V_{DD} = 5.0V, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_{DD}	Operating supply voltage	$T_J < T_{J\ (max)}$	2.50	--	24	V
I_{DD}	Operating supply current	V_{DD}=2.5 to 24V	1.5	3.0	4.5	mA
t_{on}	Power on time		--	35	50	µs
I_{OL}	Off-state leakage current	Output Hi-Z	--	--	1	µA
Rup	Internal Pull-up resistor		5.0	10	15	kΩ
$R_{DS(on)}$	FET on resistance	V_{DD}=5V, Io=10mA, TA=25°C	--	20	--	Ω
td	Output delay time	B=B_{RP} to B_{OP}	--	13	25	µs
tr	Output rise time	R1=1kΩ, Co=50pF	--	--	0.5	µs
tf	Output fall time	R1=1kΩ, Co=50pF	--	--	0.2	µs
f_{BW}	Bandwidth		40	--	--	kHz

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Magnetic Specifications

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
B_{OP}	Operating point	VB Package	1.0	2.0	3.0	mT
B_{RP}	Release point		-3.0	-2.0	-1.0	mT
B_{HYS}	Hysteresis		--	4.0	--	mT
Bo	Magnetic Offset	$Bo=(B_{OP}+B_{RP})/2$	--	0	--	mT

1mT = 10Gs

Absolute Maximum Ratings

Over operating free-air temperature range

Parameter	Symbol	Min	Max.	Unit
Supply Voltage	V_{DD}	-28	28	V
Output voltage	V_{OUT}	-0.5	28	V
Output Sink Current, I_{OUT}	I_{SINK}	0	30	mA
Operating Temperature Range	T_A	-40	150	°C
Maximum junction temperature	T_J	-55	165	°C
Storage Temperature Range	T_{STG}	-65	175	°C

Note: Stresses above those listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Thermal Characteristics

Symbol	Parameter	Test Conditions	Rating	Units
R_{QJA}	VB Package thermal resistance	Single-layer PCB, with copper limited to solder pads	177	℃/W

ESD Protection

Human body model (HBM) tests according to: Standard EIA/JESD22-A114-B HBM

Parameter	Symbol	Min.	Max.	units
ESD-Protection	V_{ESD}	-4	4	KV

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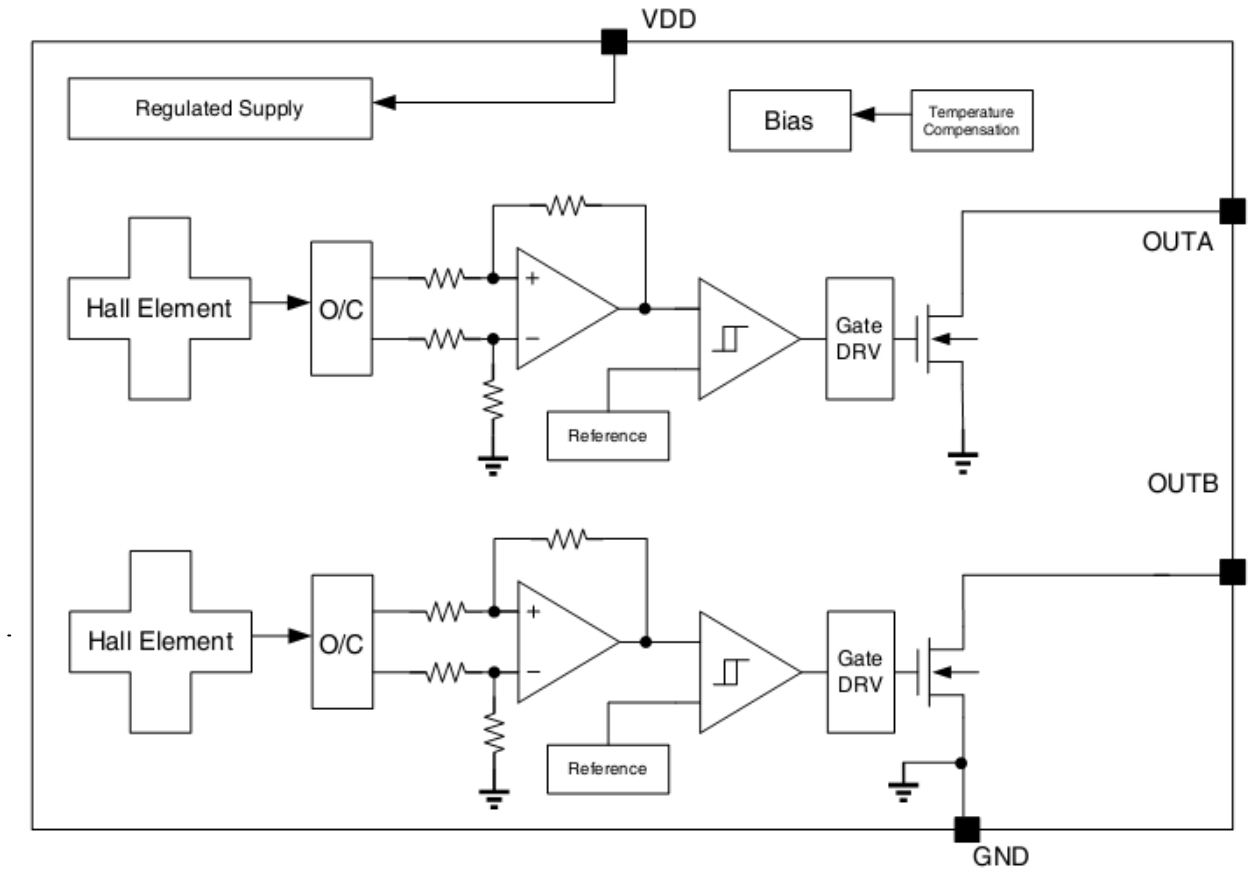
Functional Diagram



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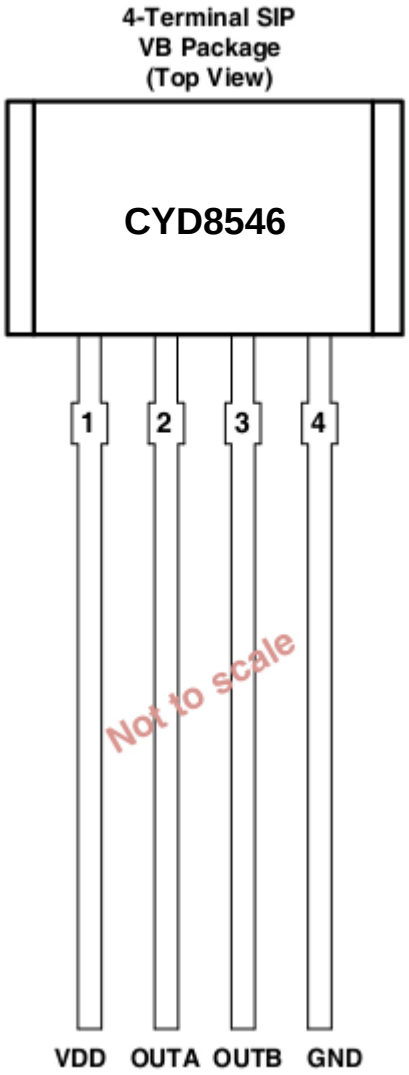
Terminal Configuration and Functions



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Pin Arrangement

Terminal		Type	Description
Name	Pin (VB Package)		
V_{DD}	1	Power supply	2.5V to 24V power supply
OUTA	2	Output A	A Channel output with internal pull-up resistor
OUTB	3	Output B	B Channel output with internal pull-up resistor
GND	4	Ground	Ground terminal

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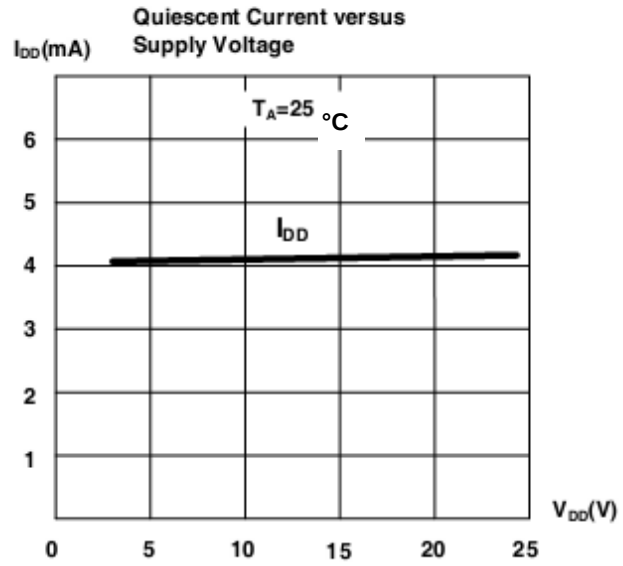
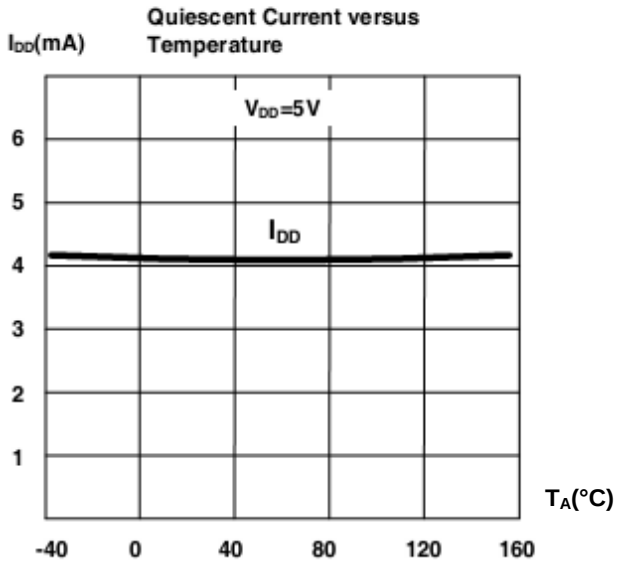
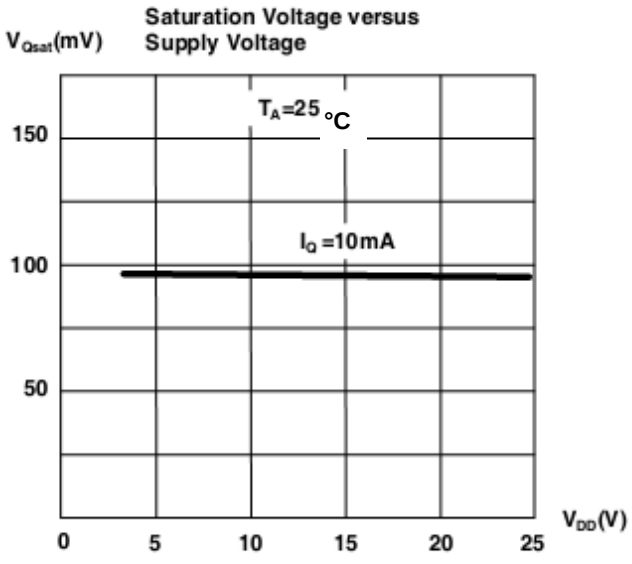
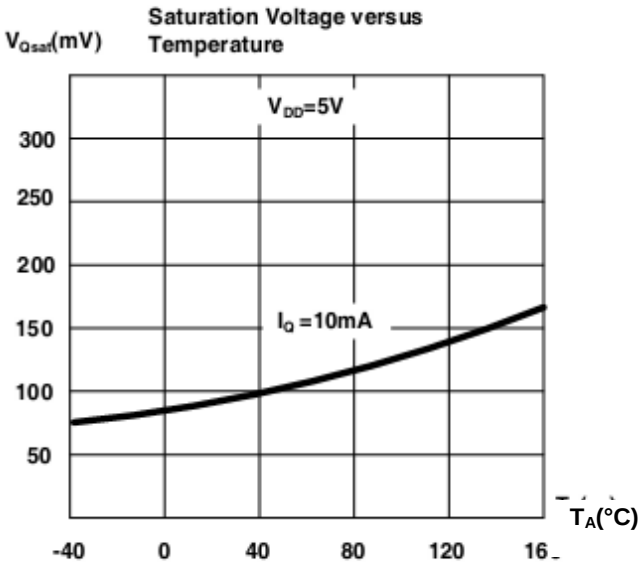
Characteristic Data









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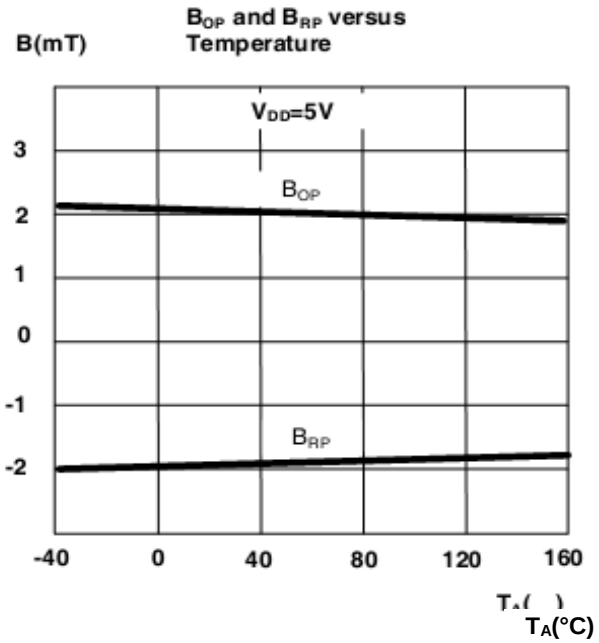
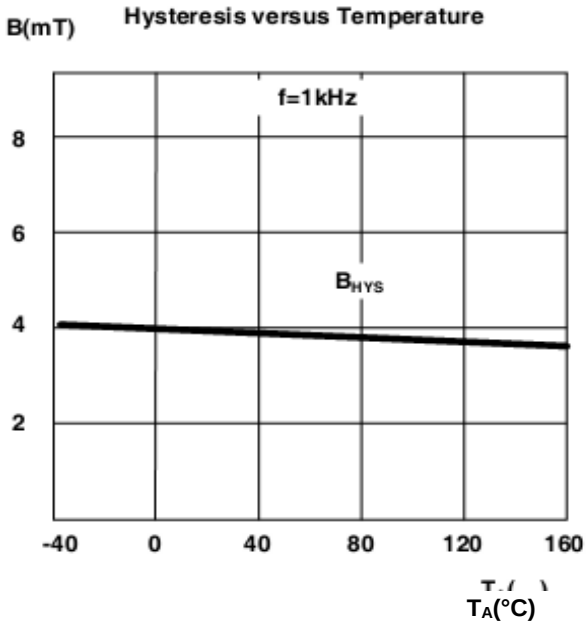
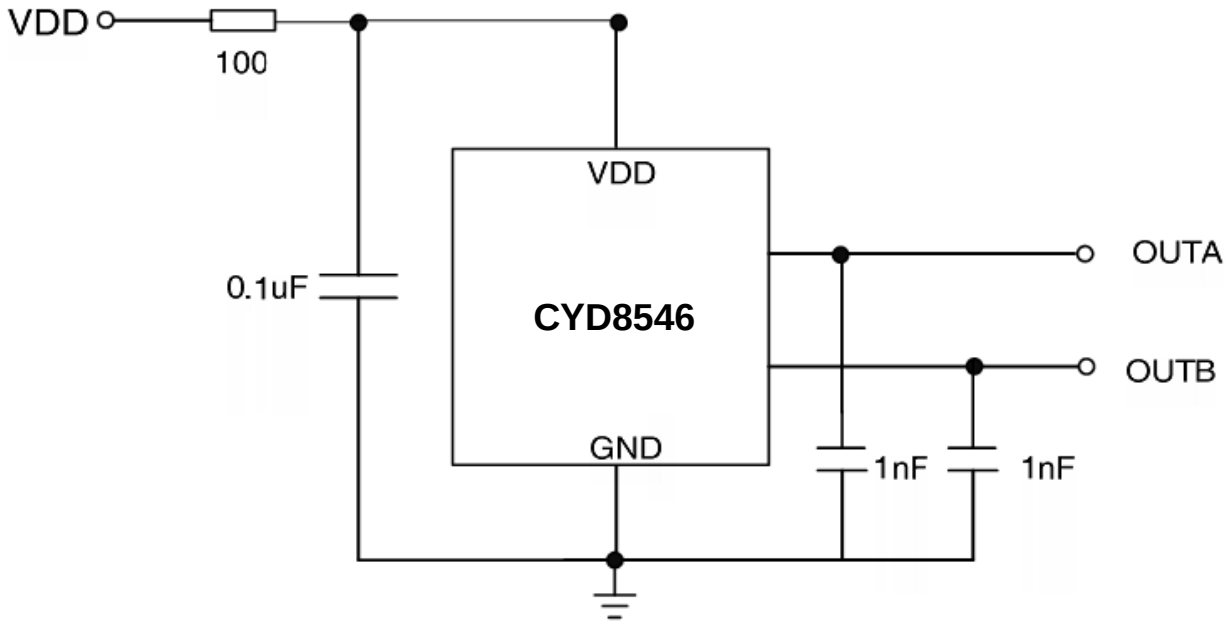
Characteristic Data (Continued)





Typical Application Circuit



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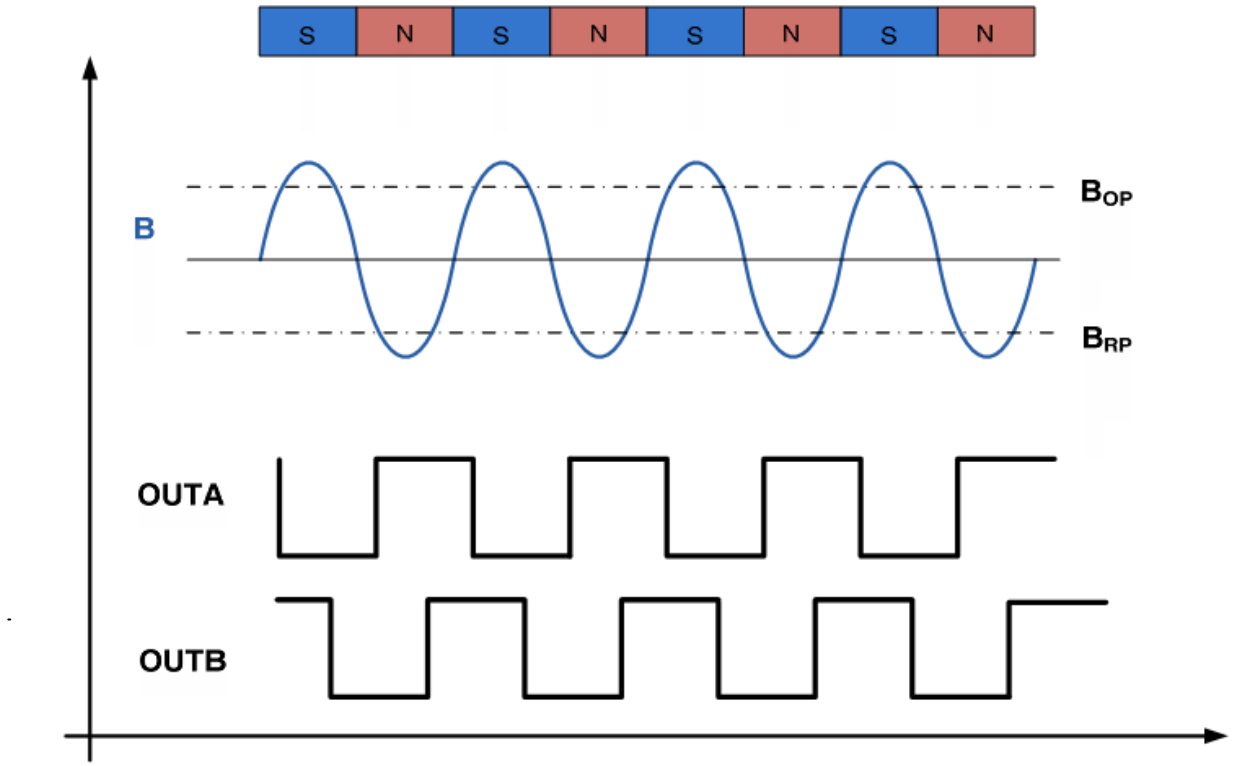
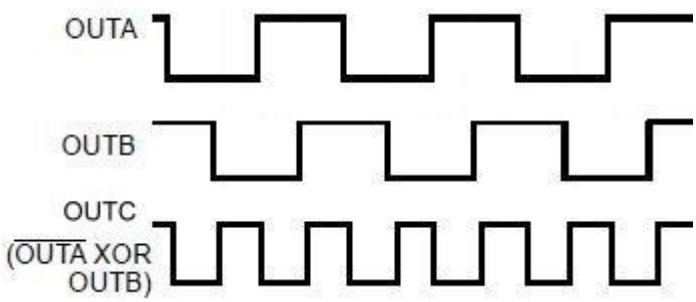
Typical Output Waveform



Using the following logic operation ($\overline{\text{OUTA}}$ XOR OUTB) one can get a new output signal OUTC, the frequency of which is the double as the frequency of the output OUTA or OUTB.



The signal OUTC can be used for speed measurement while OUTA and OUTB are used for direction detection.

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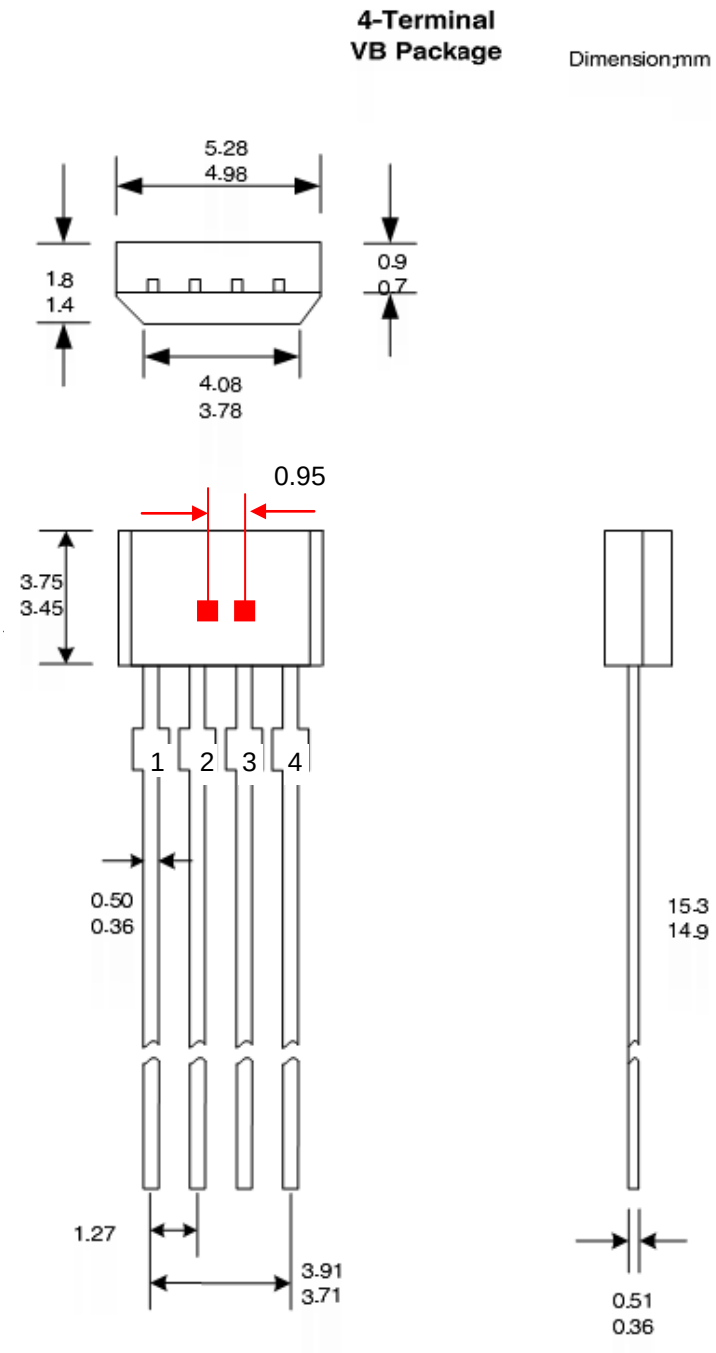
Geometric Dimensions (Package)



Pin 1: V_{DD} (Voltage Supply)
Pin 2: OUTA (Channel A output)
Pin 3: OUTB (Channel B output)
Pin 4: GND (Ground)

Notes:

3. Exact body and lead configuration at vendor's option within limits shown
4. Height does not include mold gate flash

Where no tolerance is specified, dimension is nominal

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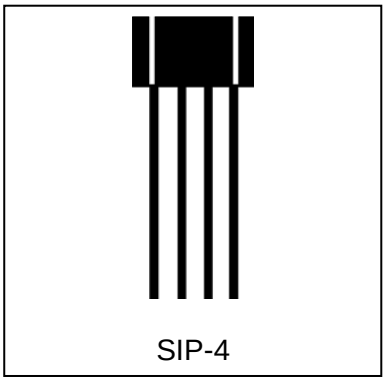
CYGTS9621 High Accuracy Differential Speed Sensor IC with Zero-Crossing Output Signal

The differential Hall Effect Gear Tooth sensor CYGTS9621 provides a high sensitivity and a superior stability over temperature and symmetrical thresholds in order to achieve a stable duty cycle. CYGTS9621 is particularly suitable for rotational speed detection and timing applications of ferromagnetic toothed wheels such as anti-lock braking systems, transmissions, crankshafts, etc. The integrated circuit, which is based on Hall Effect principle, is response to changing differential magnetic fields created by rotating ring magnets and by ferrous targets when coupled with a magnet and provides a digital signal output with frequency proportional to the rotational speed. A differential Hall IC is not influenced by radial vibration within the effective airgap of the sensor and require no external signal processing.

Features

- Integrated filter capacitor
- Accurate true zero-crossing switch-point
- South and North pole pre-induction possible
- Large air gap
- 3.8V to 24V supply operating range
- Wide operating temperature range -40°C ~150°C
- Protection against over-voltage in all PIN
- Reverse-current protection in power supply V_{DD} PIN
- Output protection against electrical disturbances



SIP-4

Applications

Automotive and Heavy Duty Vehicles	Industrial Areas:
• Camshaft and crankshaft speed and position • Transmission speed • Tachometers • Anti-skid/traction control	• Sprocket speed • Chain link conveyor speed/distance • Stop motion detector • High speed low cost proximity • Tachometers, counters.

Device Information

Part number	Packing	Mounting	Temperature range	Marking
CYGTS9621VB	Bulk, 500pcs/bag	4-pin SIP	-40°C~150°C	9621

Operating Range

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Back Bias Range	B_{Bias}	Operating	-500	--	500	mT
Differential Magnetic Field	ΔB	f=1kHz	-100	--	100	mT
Supply Voltage	V_{DD}	Operating	3.8	12	24	V
Operating Temperature	T_A		-40	~	150	°C
Storage Temperature	T_S		-65	~	175	°C

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Electrical and Magnetic Specifications

Operating Parameters T_A = -40°C to 150°C, V_{DD} = 12V (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ.	Max	Unit
Supply Voltage	V_{DD}	Operating	3.8	12	24	V
Supply Current	I_{DD}	VDD=3.8 to 24 V	2.5	3.5	4.5	mA
Output Saturation Voltage	V_{sat}	I_{out}=20mA, T_A=25°C	--	150	400	mV
Output Leakage Current	I_{Leak}	V_{out} =24V	--	--	10	µA
Overvoltage protection at supply voltage	V_{SP}	I_{DD} = 10mA	30	35	40	V
Overvoltage protection at output terminal	V_{OP}	I_{out} =1mA, V_{out}=High	30	35	40	V
Over current protection	OCP[1]	T_A=25°C	40	- -	- -	mA
Power on time	t_{po}[2]	V_{DD} >3.8V	- -	3.8	9.0	ms
Settling time	t_{settle}[3]	V_{DD}>3.8V, f=1kHz	0	--	50	ms
Response time	$t_{response}$[4]	V_{DD}>3.8V, f=1kHz	3.8	--	59	ms
Output Rise Time	T_R[5]	R1=1kΩ C=20pF	--	--	0.2	µs
Output Fall Time	T_F	R1=1kΩ C=20pF	--	--	0.2	µs
Upper corner frequency	fcu	-3dB, single pole	20	--		kHz
Lower corner frequency	fcl	-3dB, single pole	--	--	10	Hz
Back Bias Range	B_{Bias}	Operating	-500		500	mT
Differential Magnetic Field	ΔB[6]	f=1kHz	-100		100	mT
Positive and negative hysteresis	B_{HYS}	f=1kHz, ΔB=5mT	0.4	1.2	2.0	mT

1 I_{OUT} does not change state when I_{OUT}=OCP.
2 Time required initializing device.
3 Time required for the output switch points to be within specification.
4 Equal to t_{po} + t_{settle}.
5 Output Rise Time will be dominated by the RC time constant.
6 Exceeding this limit might result in decreased duty cycle performance and the phase accuracy.

Absolute Maximum Ratings

Parameter	Symbol	Minimal value	Maximal value	Unit
Power supply voltage	V_{DD}	-30	30	V
Power output current	I_{DD}	-10	25	mA
Output terminal voltage	V_{OUT}	-0.5	30	V
Output terminal current sink	I_{SINK}	0	40	mA
Operating ambient temperature	T_A	-40	150	°C
Maximum junction temperature	T_J	-55	165	°C
Storage temperature	T_{STG}	-65	175	°C

Note: Stresses above those listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

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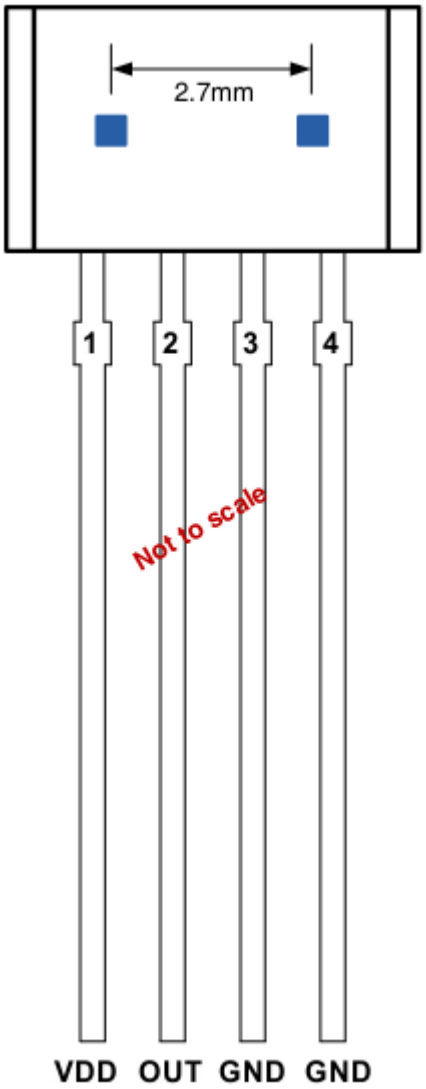
ESD (Emergency Shutdown System) Protection

Human Body Model (HBM) Tests

Parameter	Symbol	Max.	Unit	Note
ESD	V_{ESD}	±4.0	kV	According to Standard EIA/JESD22-A114-B-HBM

Pin Configuration

4-Terminal SIP VB package (Top View)



Pin No.	Symbol	Type	Description
1	V_{DD}	Supply voltage	3.8V to 24V power supply
2	OUT	Output	Open-drain output required a pull-up resistor
3	GND	Ground	Ground terminal
4	GND	Ground	Ground terminal

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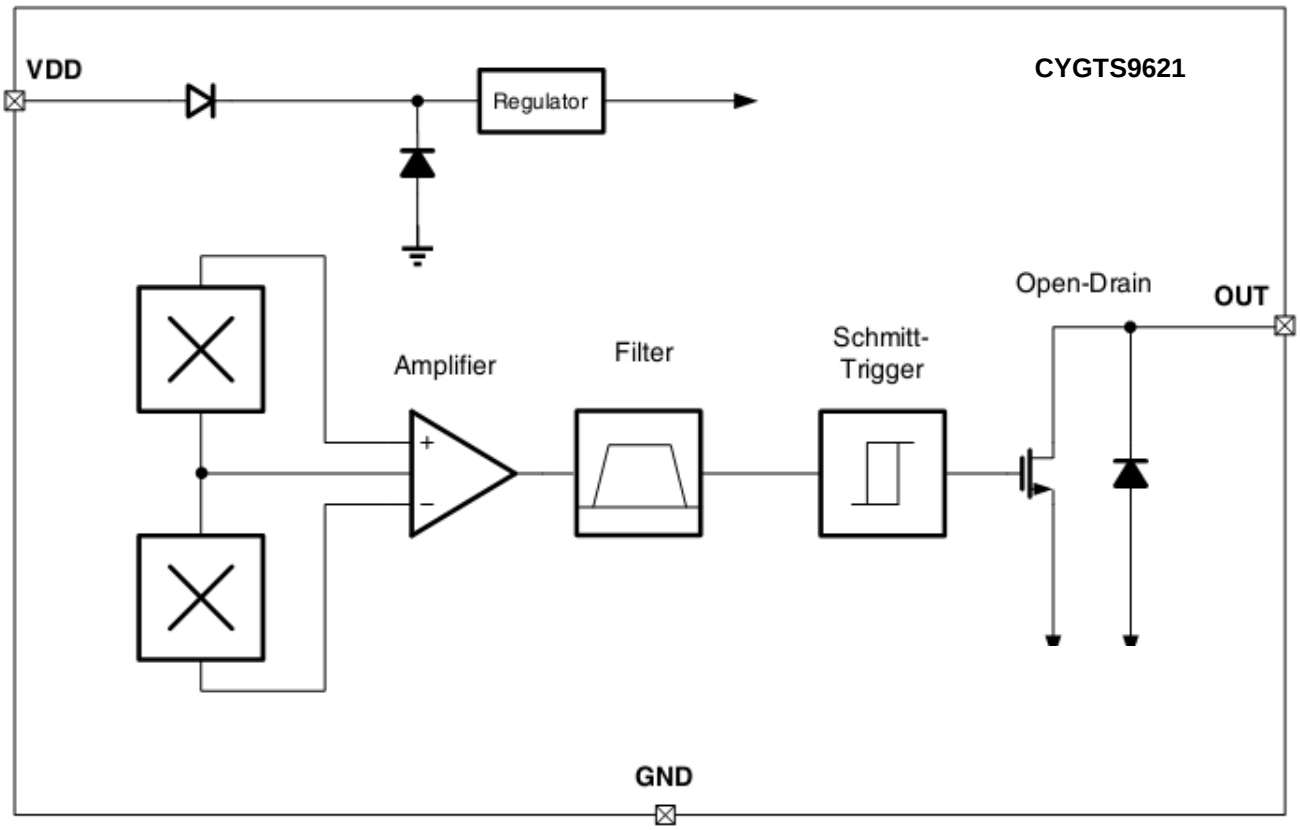
Functional Block Diagram



Functional Description

The CYGTS9621 sensor IC contains two integrated Hall sensor element that are used to differentially respond to a magnetic field across the surface of the IC. The trigger switches the output off (output high) when the differential magnetic field crosses zero while increasing in strength (referred to positive direction), and switches the output on (output low) when the differential magnetic field crosses zero while decreasing strength (the negative direction).

The operation is achieved through the use of two separate comparators. Both comparators use the same reference point, 0G, to provide high accuracy, but one comparator has a positive hysteresis, BHYS1, and the other a negative hysteresis, BHYS2. Therefore, one comparator switches (BOP) at the zero crossing on an increasing differential signal and the other switches (BRP) at the zero crossing on a decreasing differential signal. The hysteresis on each comparator precludes false switching on noise or target jitter.

The CYGTS9621 can be exploited to detect toothed wheel rotation in a rough environment. Jolts against the toothed wheel and ripple have no influence on the output signal. Furthermore, the device can be operated in a two-wire as well as in a three wire-configuration.

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Electro Magnetic Compatibility – (values depend on R_{Series}!)

Ref. ISO 7637-1; see the test circuit for EMC tests;
$\triangle B_{PP}$ =10mT (ideal sinusoidal signal); V_{DD}=13.5V, f_B=1 kHz; T_A=25℃; R_{Series}≥200Ω;

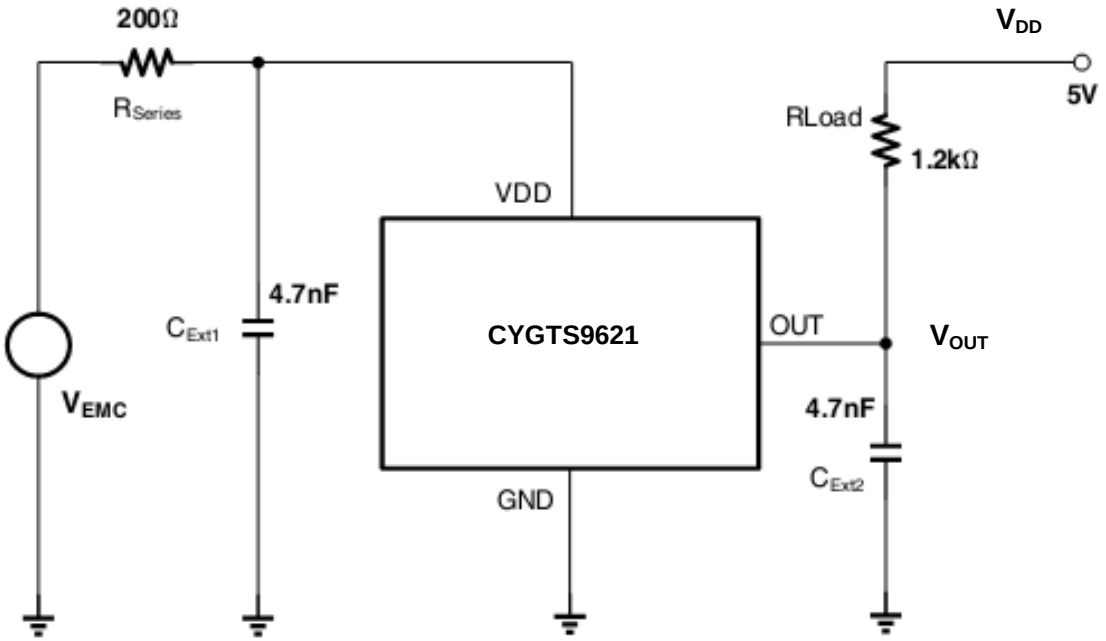
Parameter	Symbol	Level /Typ.	Status
Test pulse 1	V_{EMC}	IV /-100V	C
Test pulse 2		IV / 100V	C
Test pulse 3a		IV /-150V	A
Test pulse 3b		IV / 100V	A
Test pulse 4		IV /-7V	A
Test pulse 5		IV / 86.5V	C

1. *Test criteria for status A: No missing pulse and no additional pulse on the IC output signal, and duty cycle and jitter are in specification limits.*

2. *Test criteria for status B: No missing pulse and no additional pulse on the IC output signal.*

3. *Test criteria for status C: One or more parameter can be out of specification during the exposure but returns automatically to normal operation after exposure is removed.*

Test Circuit for EMC Tests



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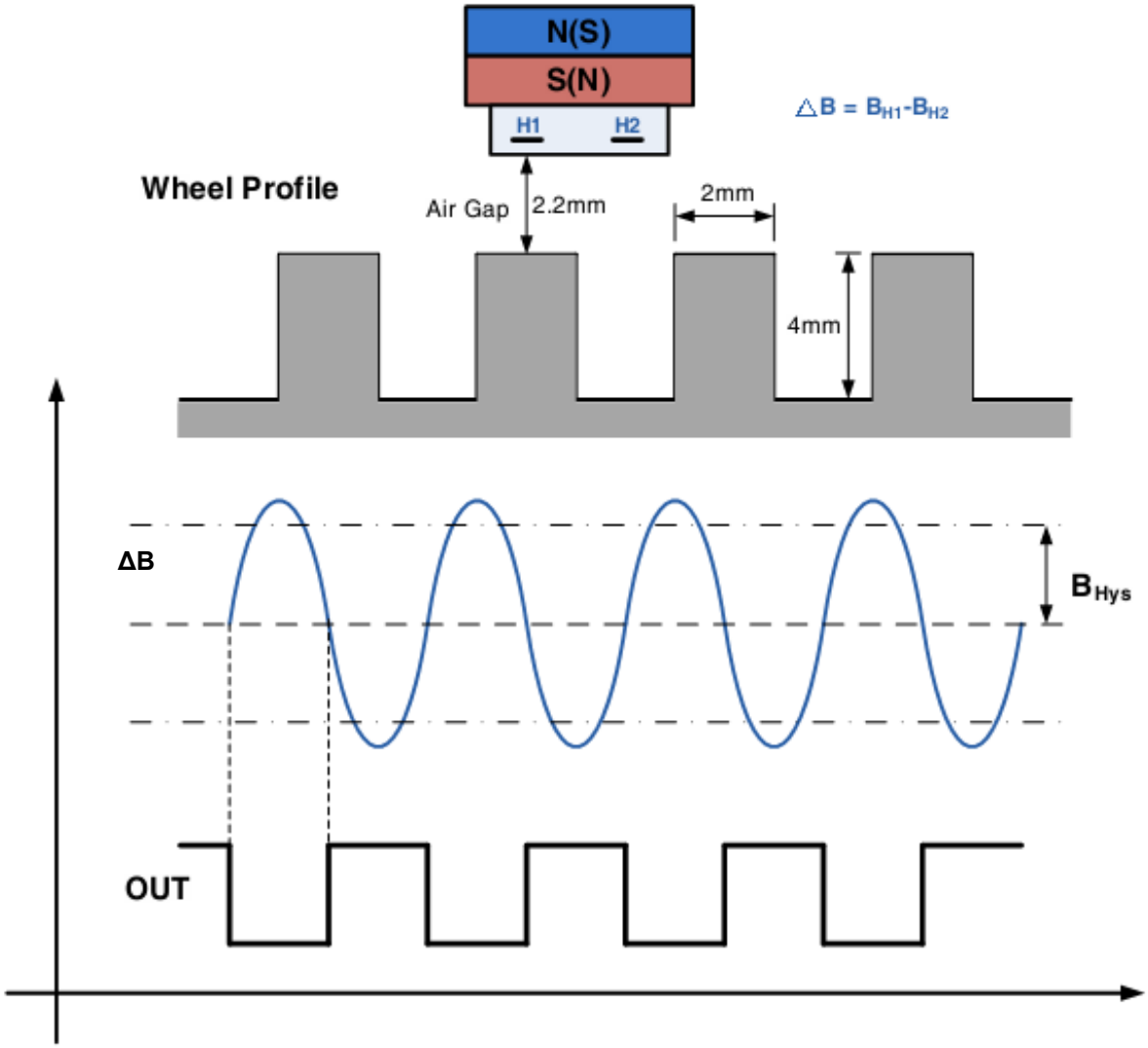
Gear Tooth Sensing

In the case of ferromagnetic toothed wheel application the IC has to be biased by the South or North Pole of a permanent magnet which should cover both Hall probes

The maximum air gap depends on

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



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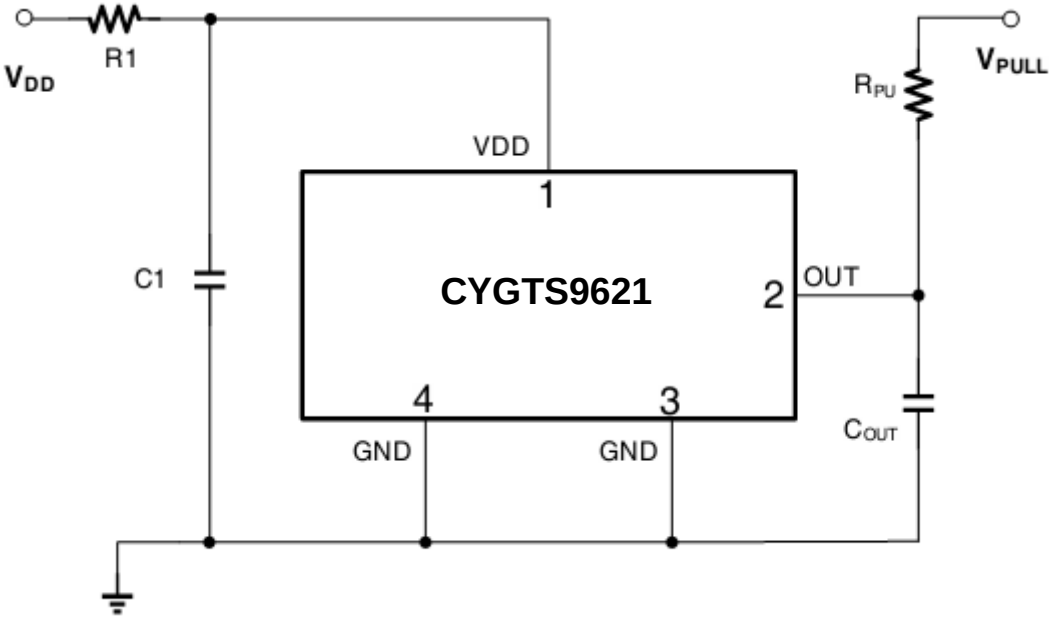
Recommended Application

The CYGTS9621 contains an on-chip voltage regulator and can operate over a wide supply voltage range. In applications that operate the device from an unregulated power supply, transient protection must be added externally. For applications using a regulated line, EMI/RFI protection may still be required.

Three-Wire Connection



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Component	Value	Units
R_{PU}	1.2	kΩ
R1	200	Ω
C1	0.1	µF
C_{OUT}	1.0	µF

1. Pull-up resistor not required for protection but for normal operation

2. R1 is for improved CI performance

3. C_{OUT} is for improved BCI performance

Thermal Characteristics

Symbol	Parameter	Test Conditions	Rating	Units
R_{QJA}	VB Package thermal resistance	Single-layer PCB, with copper limited to solder pads	177	°C/W

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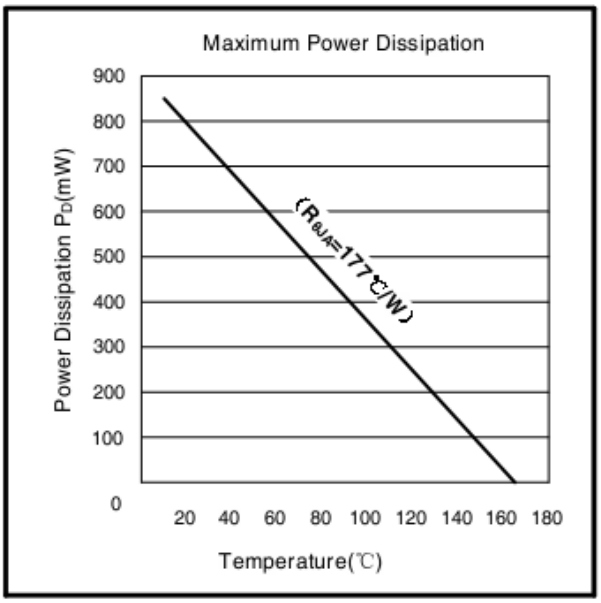

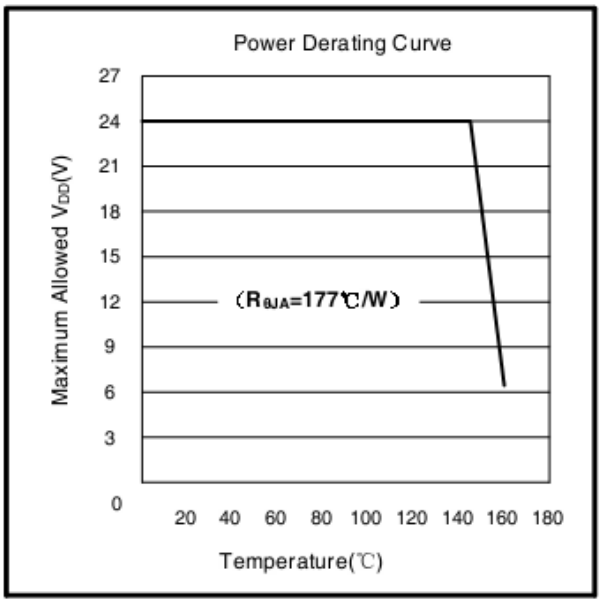

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Power Derating Description

The device must be operated below the maximum junction temperature of the device, $T_{J(max.)}$. Under certain combinations of peak condition, reliable operation may require derating supplied power or improving the heat dissipation properties of the application. The package Thermal Resistance, $R_{\theta JA}$, is figure of merit summarizing the ability of the application and device to dissipate heat from the junction, through all paths to the ambient air. Its primary component is an Effective Thermal Conductivity, K, of the printed circuit board, including adjacent devices and traces. Radiation from the die through the device case, $R_{\theta JC}$, is relatively small component of $R_{\theta JA}$. Ambient air temperature, T_A, and air motion are significant external factors, damped by over molding.

The effect of varying power levels (Power Dissipation, P_D), can be estimated. The following formulas represent the fundamental relationships used to estimate T_J, at P_D.

$P_D = V_{DD} \times I_{DD}$ (1)

$\triangle T = P_D \times R_{\theta JA}$ (2)

$T_J = T_A + \triangle T$ (3)

For example $T_A = 25$℃, $V_{DD} = 12V$, $I_{DD} = 3.5mA$, $R_{\theta JA} = 177$ ℃/W, we get

$P_D = V_{DD} \times I_{DD} = 12V \times 3.5mA = 42mW$

$\triangle T = P_D \times R_{\theta JA} = 42mW \times 177$ ℃/W $= 7.5$℃

$T_J = T_A + \triangle T = 25$℃$+ 7.5$℃$ = 32.5$℃

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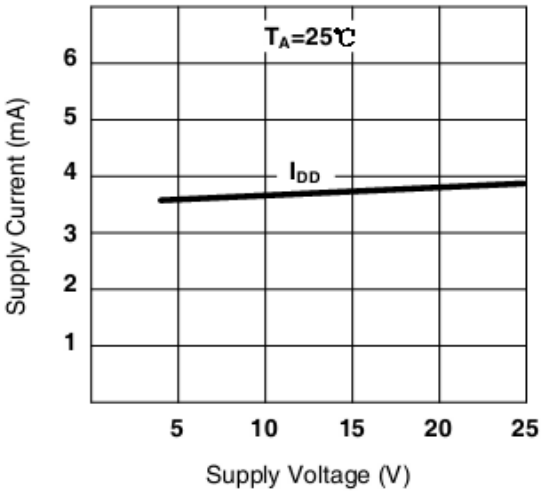
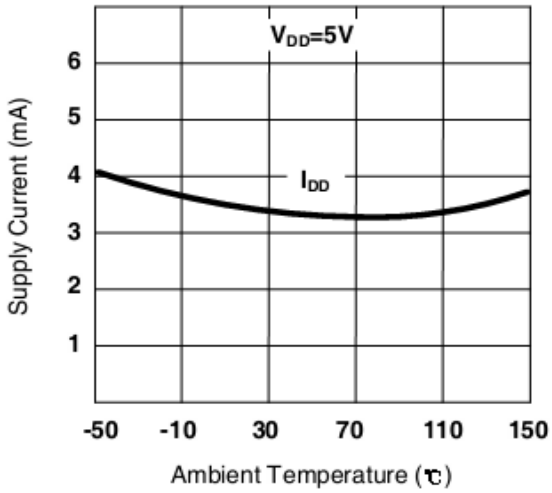
Empirical Result

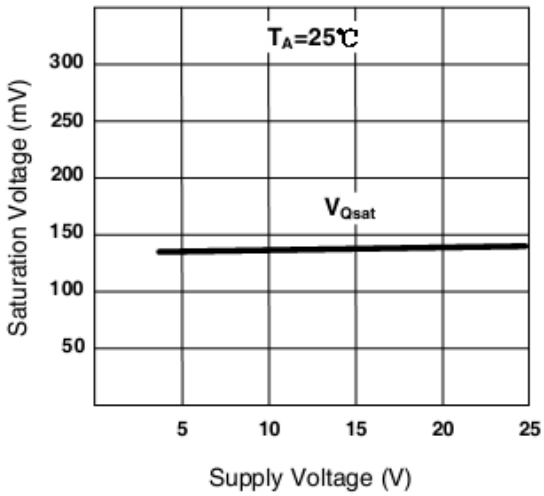
I_{DD} vs V_{DD}



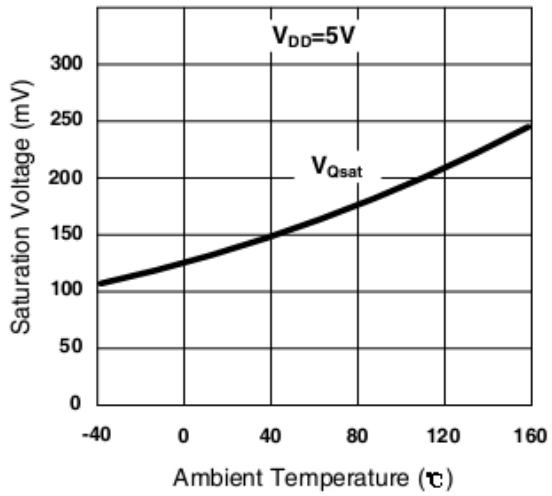
I_{DD} vs T_A



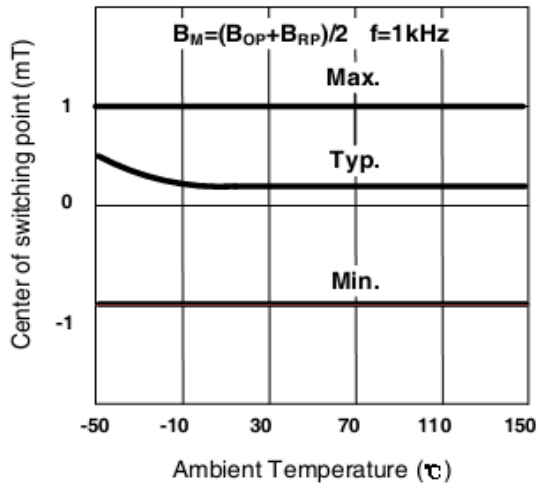
$V_{Q(sat)}$ vs V_{DD}



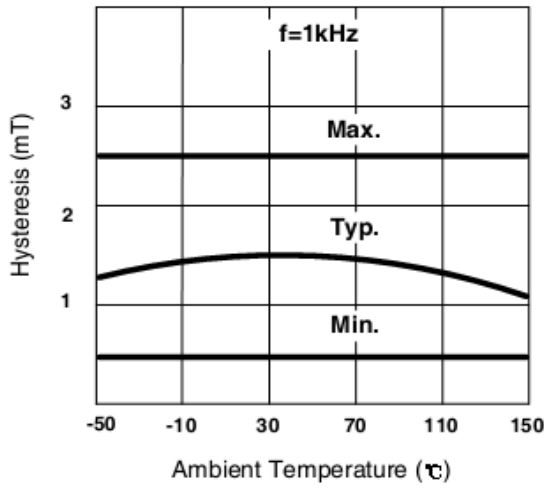
$V_{Q(sat)}$ vs T_A



$\triangle B_M$ vs T_A



V_{HYS} vs T_A



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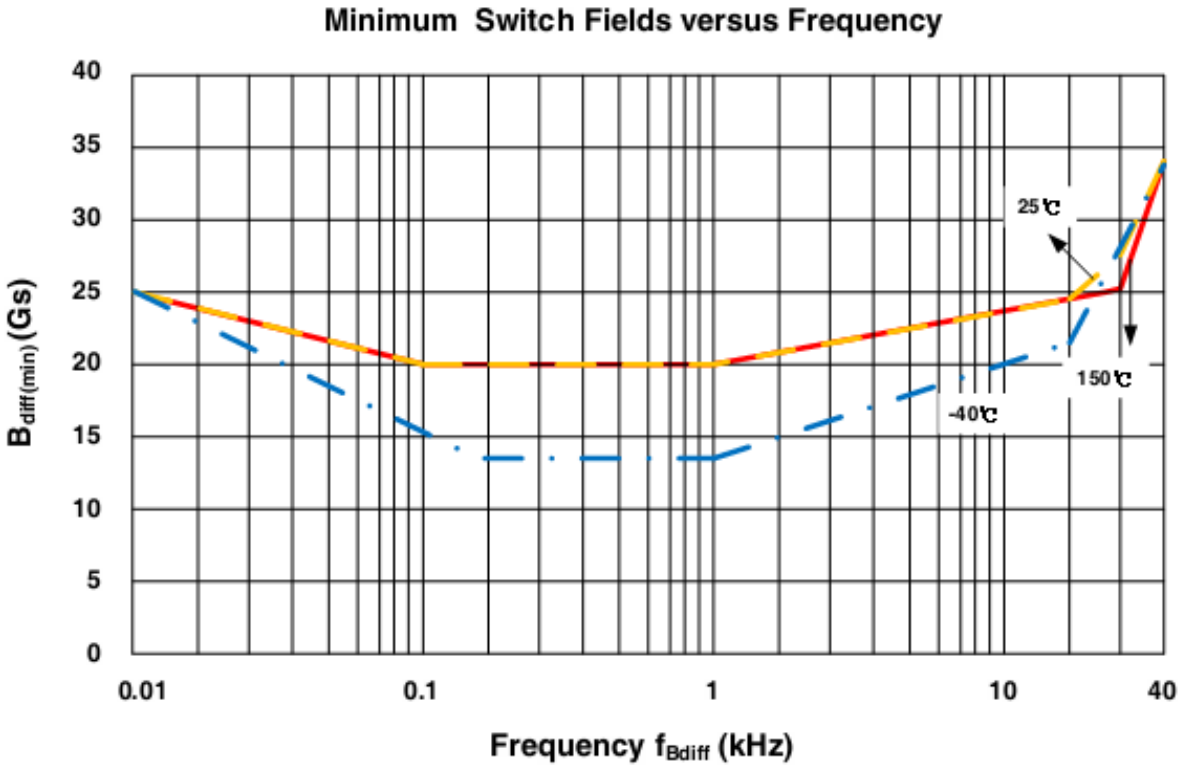
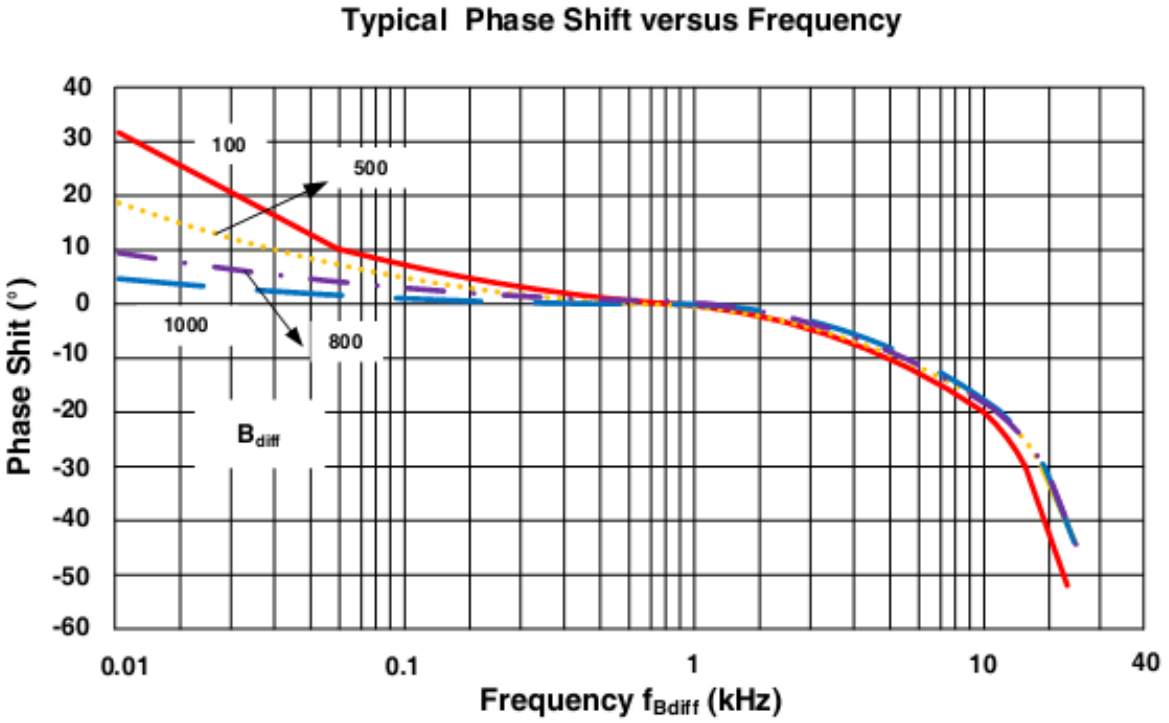
Simulation Result





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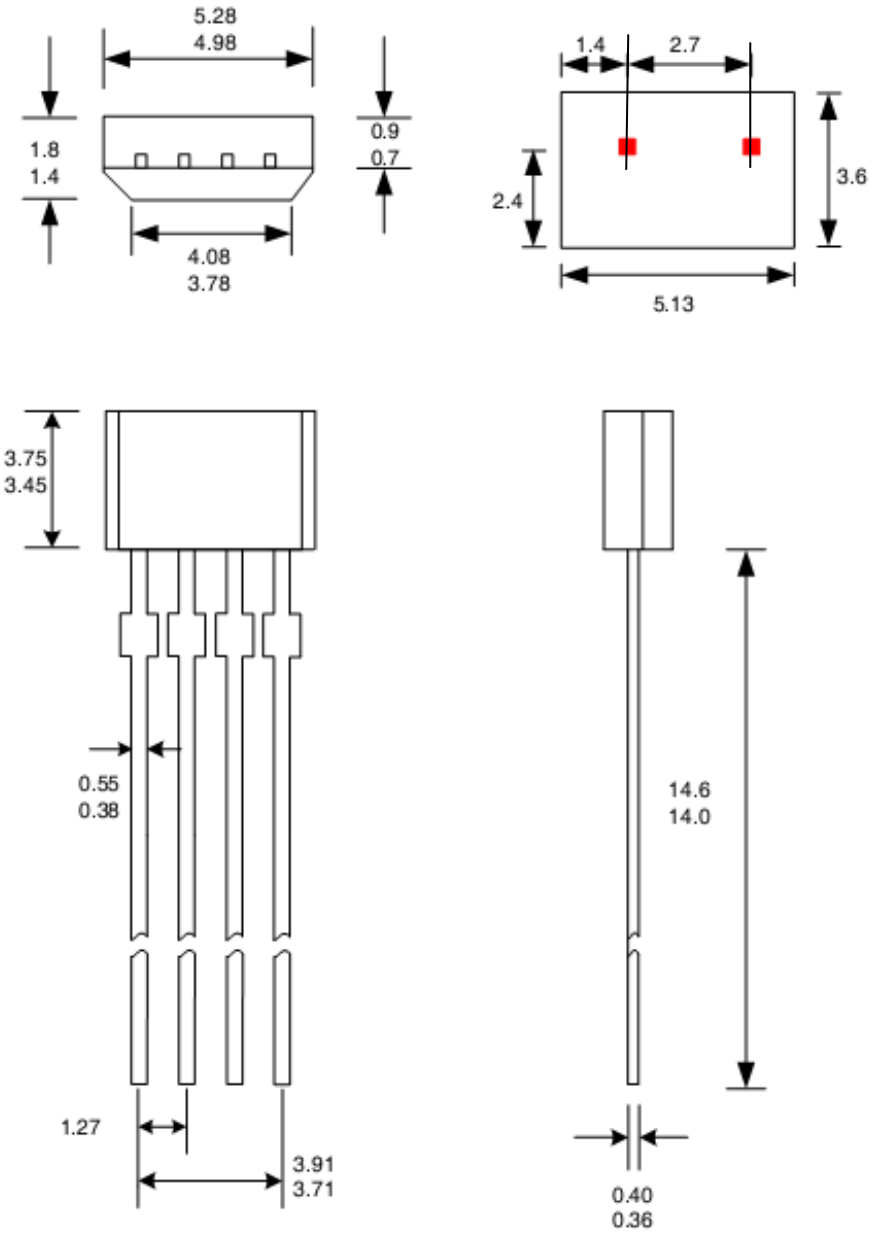
Package Designator

4-Terminal
VB Package

Dimension:mm



Notes:

1. Exact body and lead configuration at vendor's option within limits shown.
2. Height does not include mold gate flash.

   Where no tolerance is specified, dimension is nominal.

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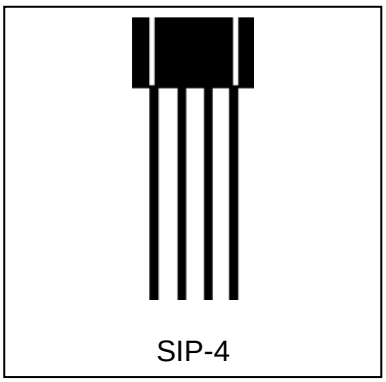
CYGTS9625 High Sensitivity Differential Speed Sensor IC

The differential Hall Effect Gear Tooth sensor CYGTS9625 provides a high sensitivity and a superior stability over temperature and symmetrical thresholds in order to achieve a stable duty cycle. CYGTS9625 is particularly suitable for rotational speed detection and timing applications of ferromagnetic toothed wheels such as anti-lock braking systems, transmissions, crankshafts, etc. The integrated circuit, which is based on Hall Effect principle, is response to changing differential magnetic fields created by rotating ring magnets and by ferrous targets when coupled with a magnet and provides a digital signal output with frequency proportional to the rotational speed. The device is packaged in a 4-pin plastic SIP. It is lead (Pb) free, with 100% matte tin plated lead frame.

Features

- Integrated filter capacitor
- South and North pole pre-induction possible
- Large air gap
- 3.8V to 24V supply operating range
- Wide operating temperature range -40°C ~150°C
- Output compatible with both TTL and CMOS logic families
- Protection against over-voltage in all PIN
- Reverse-current protection in power supply V_{DD} PIN
- Output protection against electrical disturbances



SIP-4

Applications

Automotive and Heavy Duty Vehicles	Industrial Areas:
• Camshaft and crankshaft speed and position • Transmission speed • Tachometers • Anti-skid/traction control	• Sprocket speed • Chain link conveyor speed/distance • Stop motion detector • High speed low cost proximity • Tachometers, counters.

Device Information

Part number	Packing	Mounting	Temperature range	Marking
CYGTS9625VB	Bulk, 500pcs/bag	4-pin SIP	-40°C~150°C	9625

Operating Range

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Back Bias Range	B_{Bias}	Operating	-500	--	500	mT
Differential Magnetic Field	ΔB	f=1kHz	-100	--	100	mT
Supply Voltage	V_{DD}	Operating	3.8	12	24	V
Operating Temperature	T_A		-40	~	150	°C
Storage Temperature	T_S		-65	~	175	°C

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Electrical and Magnetic Specifications

Operating Parameters T_A = -40°C to 150°C, V_{DD} = 12V (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ.	Max	Unit
Supply Voltage	V_{DD}	Operating	3.8	12	24	V
Supply Current	I_{DD}	VDD=3.8 to 24 V	2.5	3.5	4.5	mA
Output Saturation Voltage	V_{sat}	I_{out}=20mA, T_A=25°C	--	150	400	mV
Output Leakage Current	I_{Leak}	V_{out} =24V	--	--	10	µA
Overvoltage protection at supply voltage	V_{SP}	I_{DD} = 10mA	30	35	40	V
Overvoltage protection at output terminal	V_{OP}	I_{out} =1mA, V_{out}=High	30	35	40	V
Over current protection	OCP[1]	T_A=25°C	40	- -	- -	mA
Power on time	t_{po}[2]	V_{DD} >3.8V	- -	3.8	9.0	ms
Settling time	t_{settle}[3]	V_{DD}>3.8V, f=1kHz	0	--	50	ms
Response time	$t_{response}$[4]	V_{DD}>3.8V, f=1kHz	3.8	--	59	ms
Output Rise Time	T_R[5]	R1=1kΩ C=20pF	--	--	0.2	µs
Output Fall Time	T_F	R1=1kΩ C=20pF	--	--	0.2	µs
Upper corner frequency	fcu	-3dB, single pole	20	--		kHz
Lower corner frequency	fcl	-3dB, single pole	--	--	10	Hz
Back Bias Range	B_{Bias}	Operating	-500		500	mT
Differential Magnetic Field	ΔB[6]	f=1kHz	-100		100	mT
Output on switch point	Bop	f=1kHz, ΔB=5mT	--	--	0	mT
Output off switch point	Boff	f=1kHz, ΔB=5mT	0	--	--	mT
Positive and negative hysteresis	B_{HYS}	f=1kHz, ΔB=5mT	0.4	1.2	2.0	mT

1 I_{OUT} does not change state when I_{OUT}=OCP.
2 Time required initializing device.
3 Time required for the output switch points to be within specification.
4 Equal to t_{po} + t_{settle}.
5 Output Rise Time will be dominated by the RC time constant.
6 Exceeding this limit might result in decreased duty cycle performance and the phase accuracy.

Absolute Maximum Ratings

Parameter	Symbol	Minimal value	Maximal value	Unit
Power supply voltage	V_{DD}	-30	30	V
Power output current	I_{DD}	-10	25	mA
Output terminal voltage	V_{OUT}	-0.5	30	V
Output terminal current sink	I_{SINK}	0	40	mA
Operating ambient temperature	T_A	-40	150	°C
Maximum junction temperature	T_J	-55	165	°C
Storage temperature	T_{STG}	-65	175	°C

Note: Stresses above those listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

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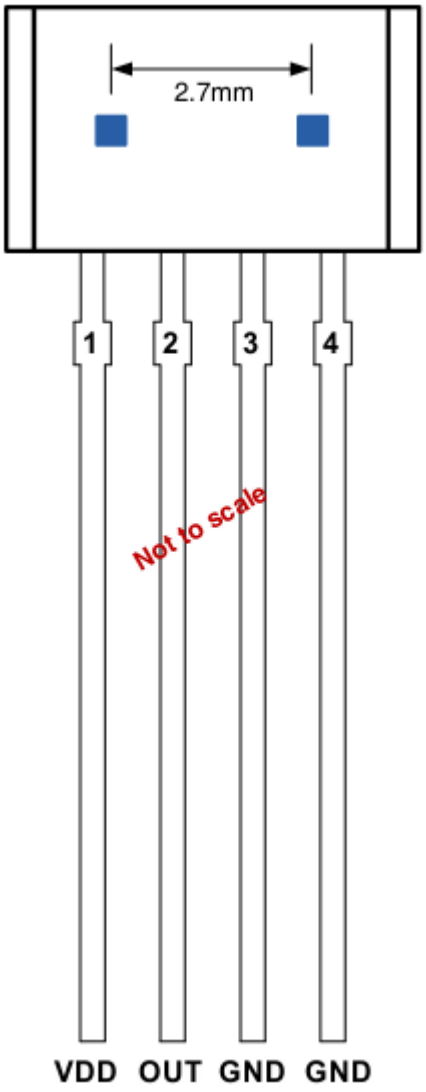
ESD (Emergency Shutdown System) Protection

Human Body Model (HBM) Tests

Parameter	Symbol	Max.	Unit	Note
ESD	V_{ESD}	±4.0	kV	According to Standard EIA/JESD22-A114-B-HBM

Pin Configuration

4-Terminal SIP VB package (Top View)



Pin No.	Symbol	Type	Description
1	V_{DD}	Supply voltage	3.8V to 24V power supply
2	OUT	Output	Open-drain output required a pull-up resistor
3	GND	Ground	Ground terminal
4	GND	Ground	Ground terminal

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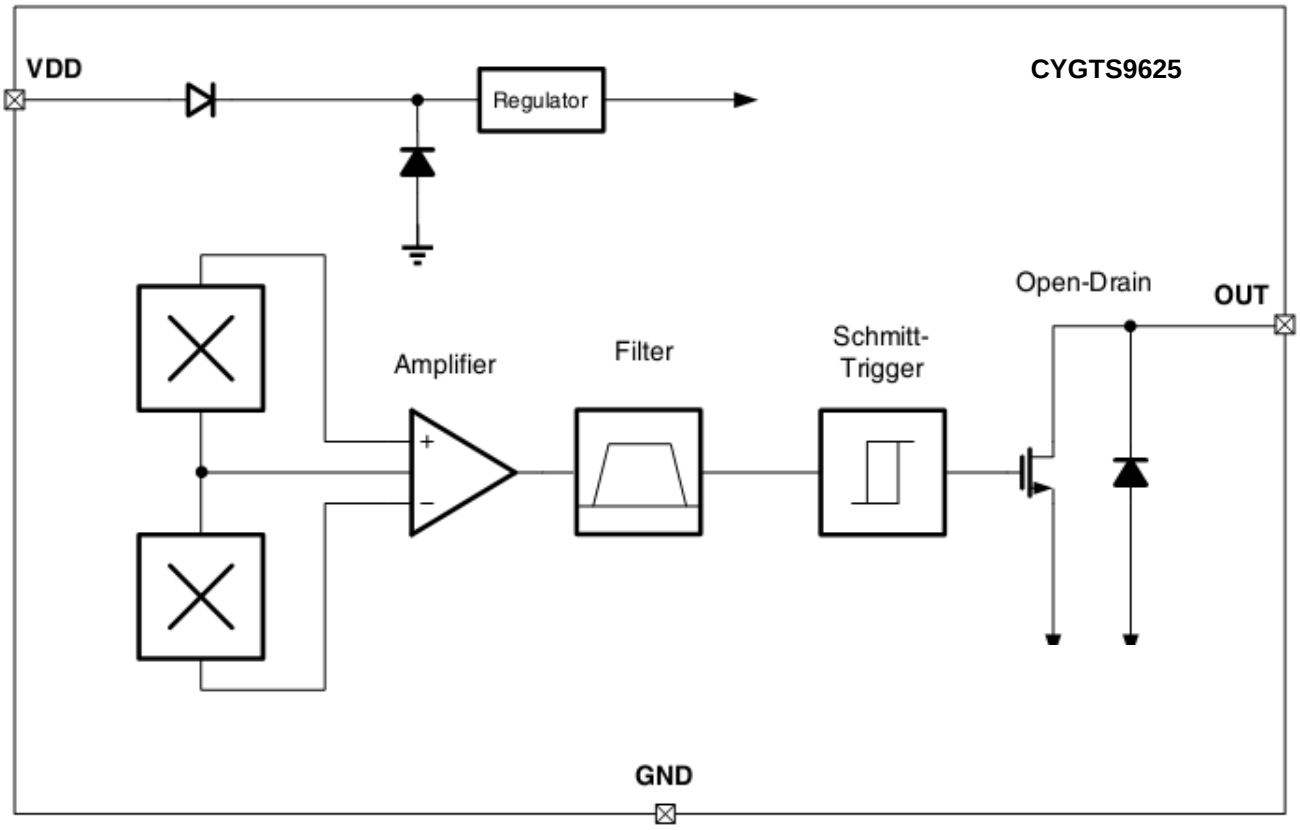
Functional Block Diagram



Functional Description

The Differential Hall Sensor IC detects the motion and position of ferromagnetic and permanent magnet structures by measuring the differential flux density of the magnetic field. Changes in field strength at the device face, which are induced by a moving target, are sensed by the two integrated Hall probes. The probes generate signals that are differentially amplified by on-chip electronics. This differential design provides immunity to radial vibration within the operating air gap range of the CYGTS9625, by rejection of the common mode signal. Steady-state magnet and system offsets are eliminated using an on-chip differential band-pass filter. This filter also provides relative immunity to interference from electromagnetic sources.

The device utilizes advanced temperature compensation for the band-pass filter, sensitivity, and Schmitt trigger switch-points to guarantee optimal operation over a wide range of air gaps and temperatures even at lower frequency.

The CYGTS9625 can be exploited to detect toothed wheel rotation in a rough environment. Jolts against the toothed wheel and ripple have no influence on the output signal. Furthermore, the device can be operated in a two-wire as well as in a three wire-configuration.

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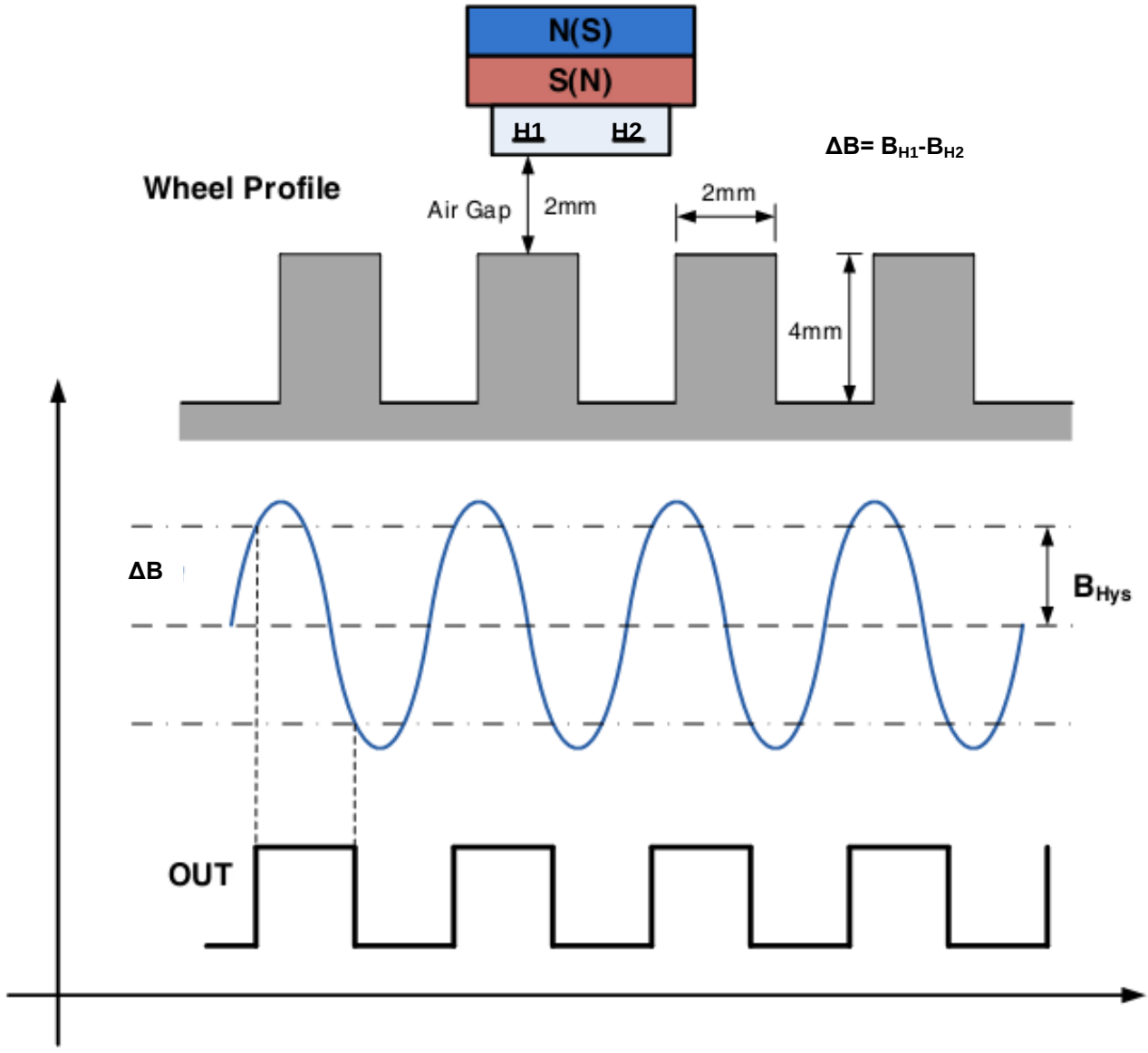
Gear Tooth Sensing

In the case of ferromagnetic toothed wheel application the IC has to be biased by the South or North Pole of a permanent magnet which should cover both Hall probes

The maximum air gap depends on

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



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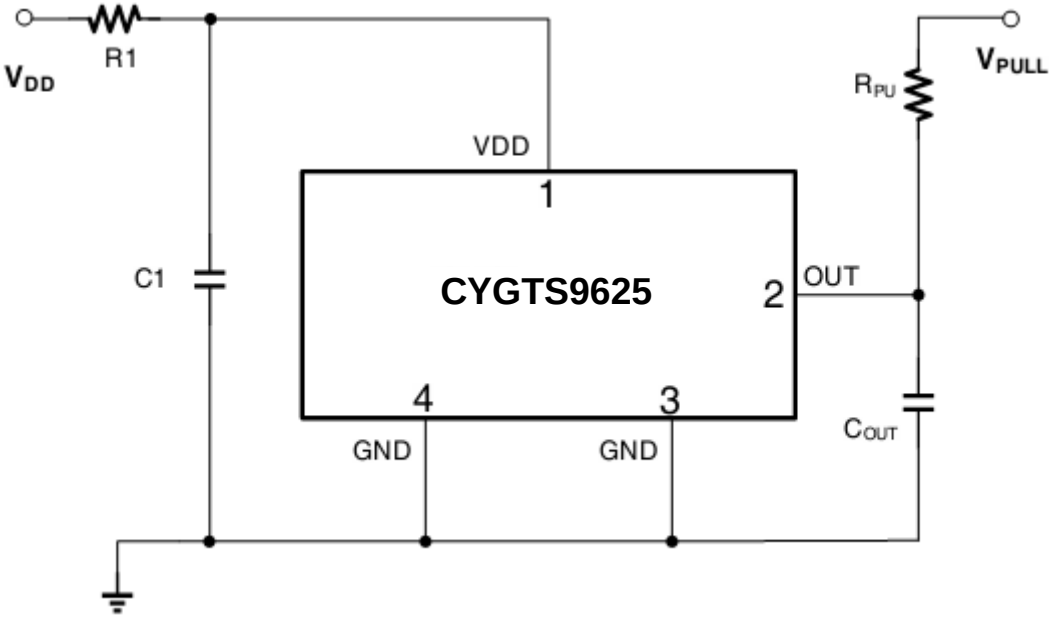
Recommended Application

The CYGTS9625 contains an on-chip voltage regulator and can operate over a wide supply voltage range. In applications that operate the device from an unregulated power supply, transient protection must be added externally. For applications using a regulated line, EMI/RFI protection may still be required.

Three-Wire Connection



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Component	Value	Units
R_{PU}	1.2	kΩ
R1	200	Ω
C1	0.1	µF
C_{OUT}	1.0	µF

1. Pull-up resistor not required for protection but for normal operation

2. R1 is for improved CI performance

3. C_{OUT} is for improved BCI performance

Thermal Characteristics

Symbol	Parameter	Test Conditions	Rating	Units
R_{QJA}	VB Package thermal resistance	Single-layer PCB, with copper limited to solder pads	177	°C/W

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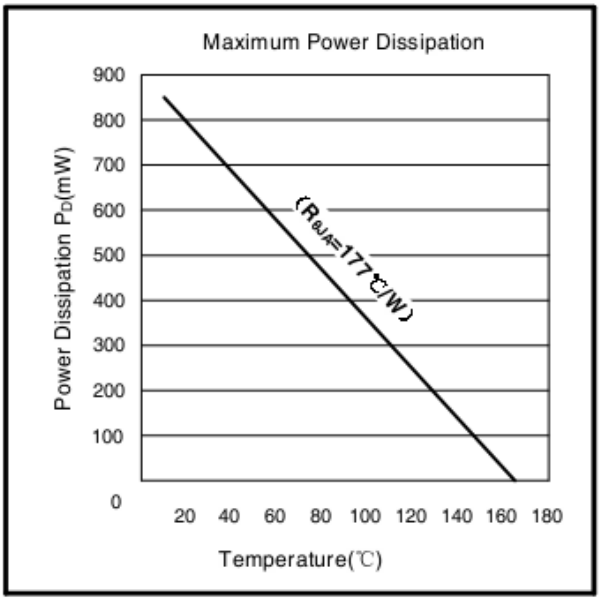

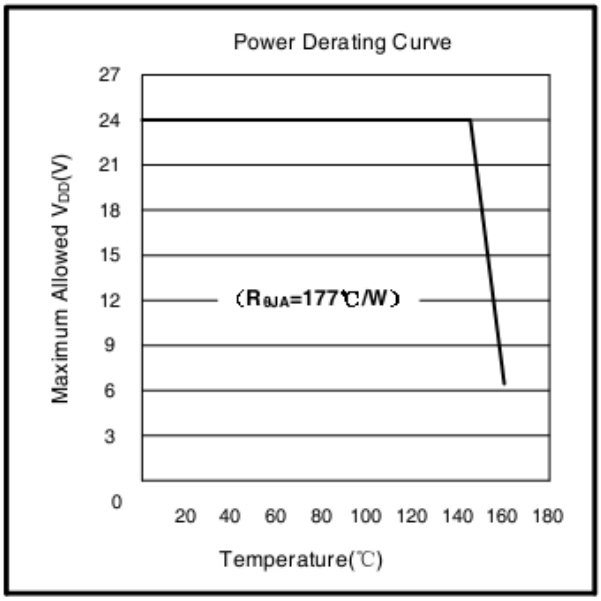

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Power Derating Description

The device must be operated below the maximum junction temperature of the device, $T_{J(max.)}$. Under certain combinations of peak condition, reliable operation may require derating supplied power or improving the heat dissipation properties of the application. The package Thermal Resistance, $R_{\theta JA}$, is figure of merit summarizing the ability of the application and device to dissipate heat from the junction, through all paths to the ambient air. Its primary component is an Effective Thermal Conductivity, K, of the printed circuit board, including adjacent devices and traces. Radiation from the die through the device case, $R_{\theta JC}$, is relatively small component of $R_{\theta JA}$. Ambient air temperature, T_A, and air motion are significant external factors, damped by over molding.

The effect of varying power levels (Power Dissipation, P_D), can be estimated. The following formulas represent the fundamental relationships used to estimate T_J, at P_D.

$$P_D=V_{DD} \times I_{DD} \quad (1)$$
$$\triangle T=P_D \times R_{\theta JA} \quad (2)$$
$$T_J=T_A + \triangle T \quad (3)$$

For example $T_A=25$℃, $V_{DD}=12V$, $I_{DD}=3.5mA$, $R_{\theta JA}=177$ ℃/W, we get

$$P_D=V_{DD} \times I_{DD}=12V \times 3.5mA=42mW$$
$$\triangle T=P_D \times R_{\theta JA}=42mW \times 177\ ℃/W=7.5℃$$
$$T_J=T_A +\triangle T=25℃+7.5℃=32.5℃$$

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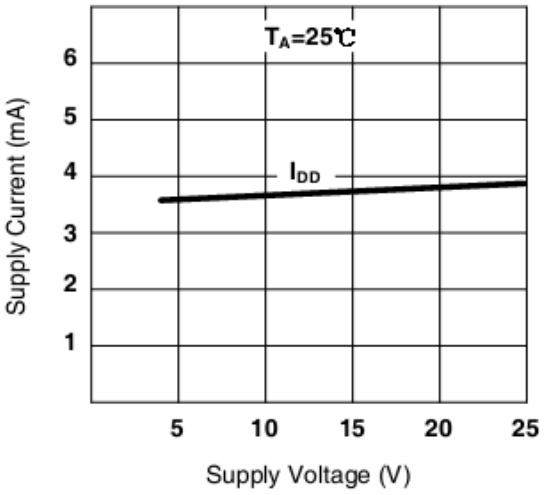
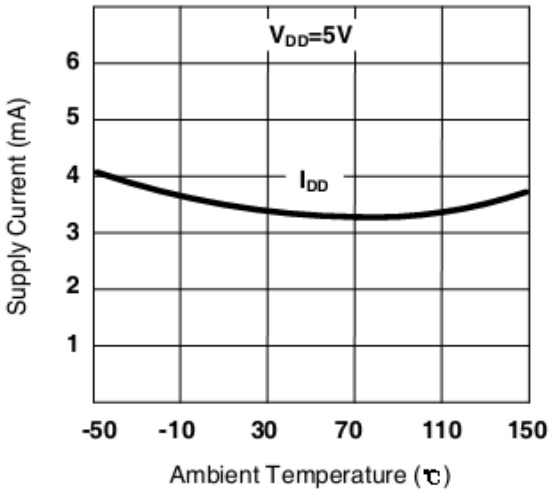
Empirical Result

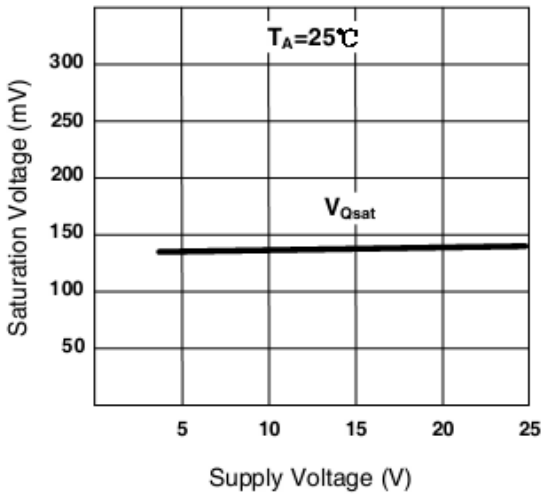
I_{DD} vs V_{DD}



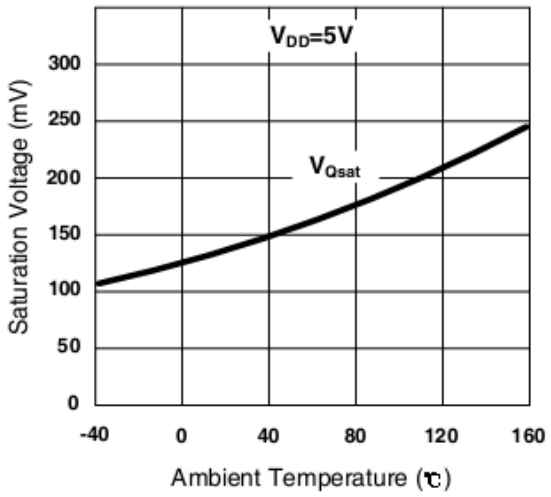
I_{DD} vs T_A



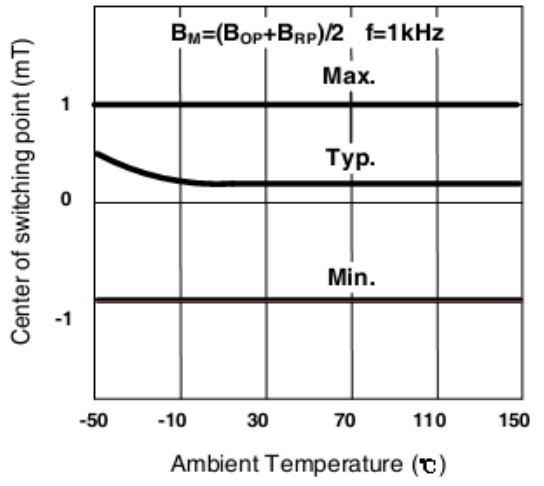
$V_{Q(sat)}$ vs V_{DD}



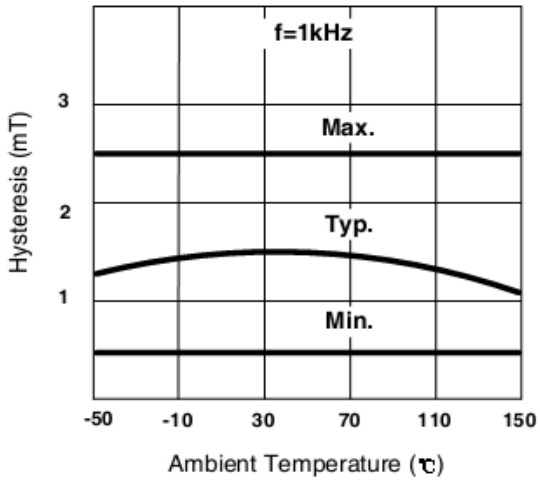
$V_{Q(sat)}$ vs T_A



$\triangle B_M$ vs T_A



V_{HYS} vs T_A



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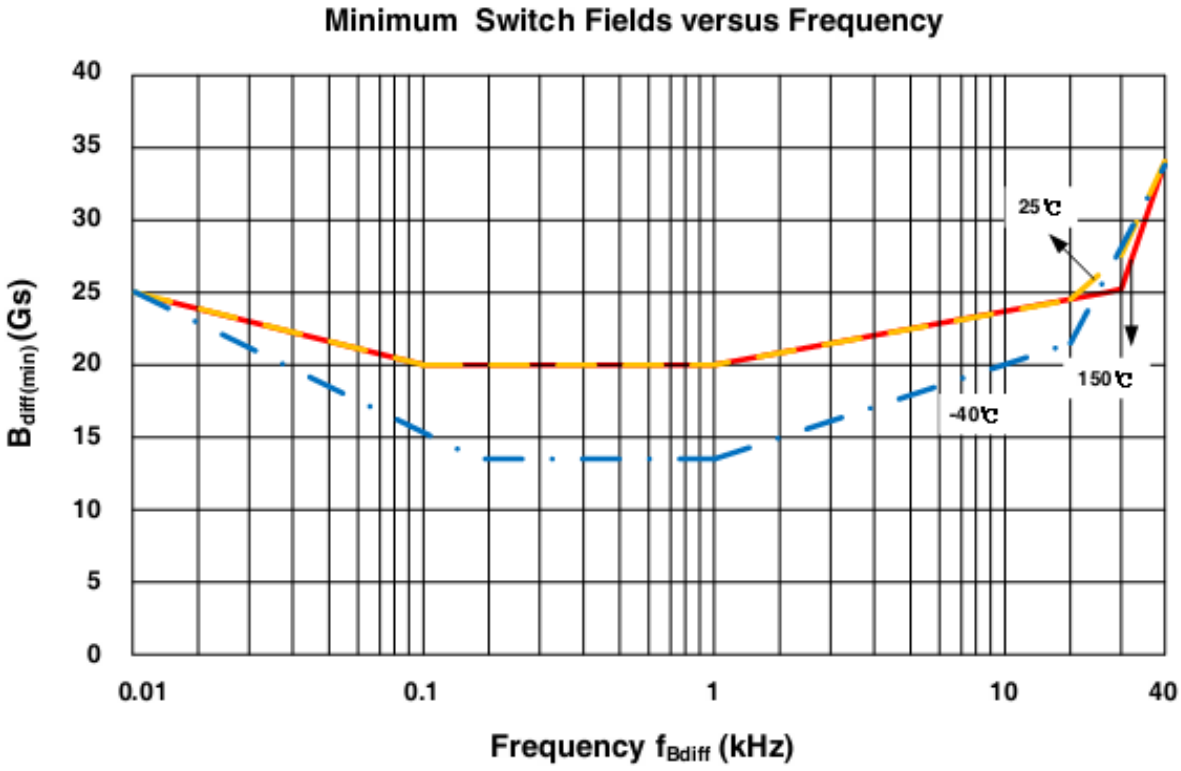
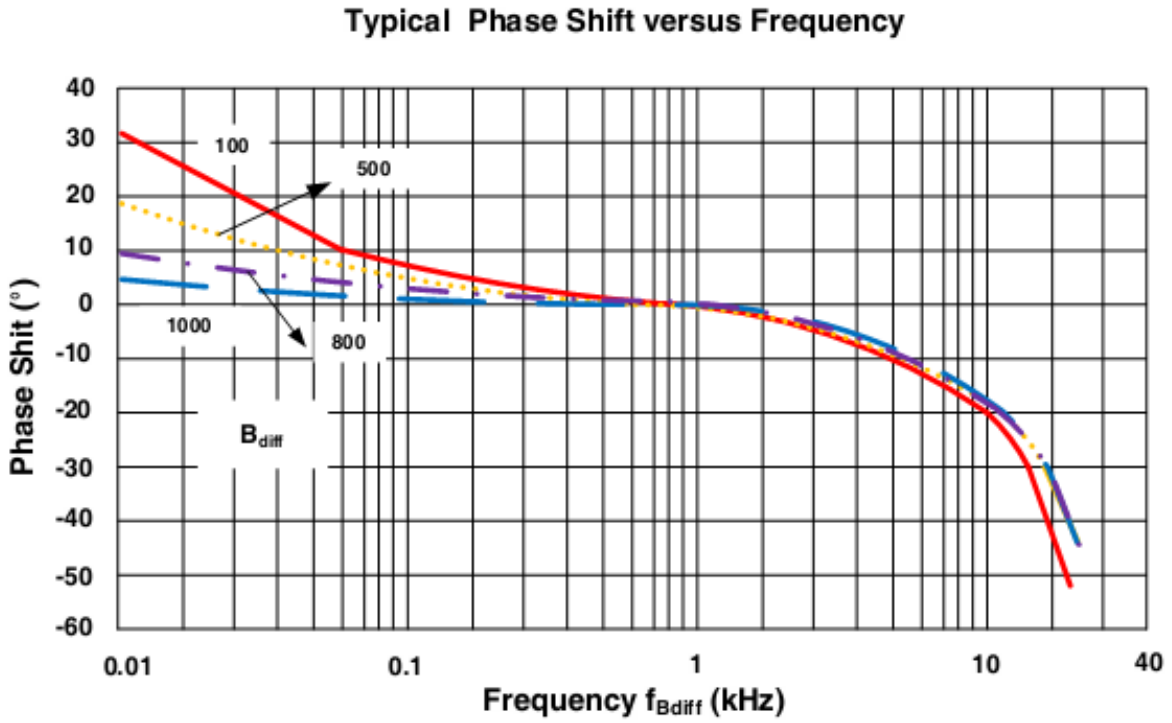
Simulation Result





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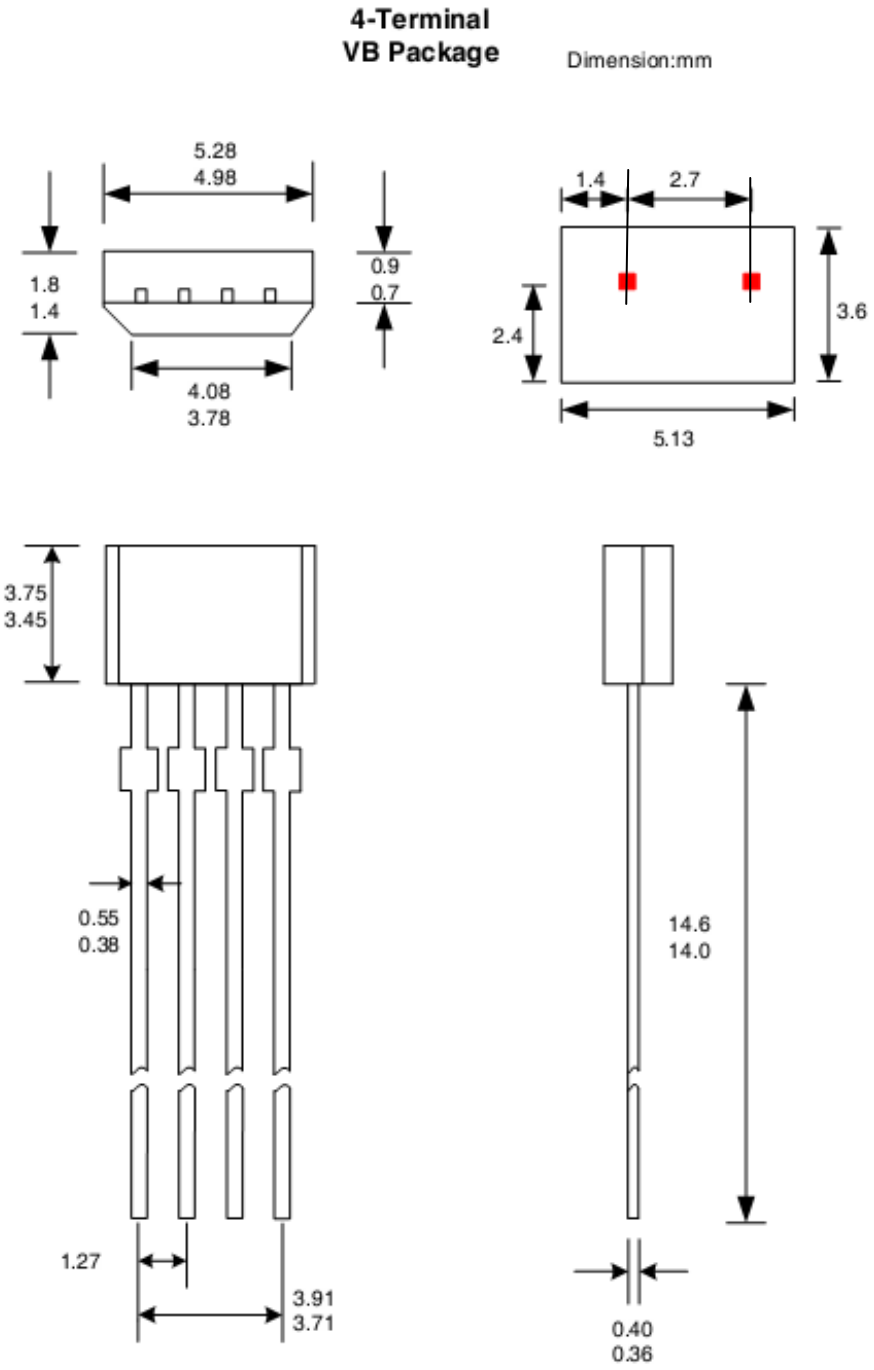
Package Designator



Notes:

1. Exact body and lead configuration at vendor's option within limits shown.
2. Height does not include mold gate flash.

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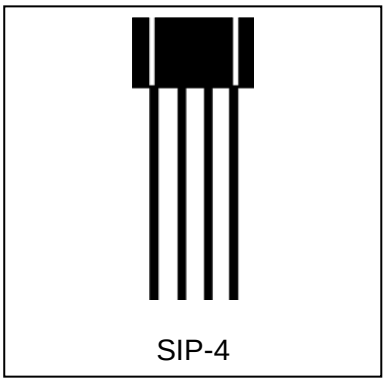
CYGTS9632 High Sensitivity Speed Sensor IC with Dual Quadrature Outputs

CYGTS9632 is a differential Hall Effect sensor IC with two independent channels providing quadrature outputs. The device provides a high sensitivity and a superior stability over temperature and symmetrical thresholds in order to achieve a stable duty cycle. The integrated circuit is response to changing differential magnetic fields created by rotating ring magnets and by ferrous targets when coupled with a magnet. By use of the A and B quadrature outputs, the device is particularly suitable for speed and direction of magnetic ring or ferromagnetic toothed wheels.
The device is packaged in a 4-pin plastic SIP. It is lead (Pb) free, with 100% matte tin plated lead frame.

Features

- Two independent digital quadrature A/B outputs
- Accurate true zero-crossing switch-point
- South and North pole pre-induction possible
- Large air gap
- 3.8V to 24V supply operating range
- Low power consumption 6.5mA (typ.)
- Wide operating temperature range -40°C ~150°C
- Protection against over-voltage in all PIN
- Reverse-current protection in power supply V_{DD} PIN
- Output protection against electrical disturbances


SIP-4

Applications

Automotive and Heavy Duty Vehicles	Industrial Areas:
• Camshaft and crankshaft speed and position • Transmission speed • Tachometers • Anti-skid/traction control	• Sprocket speed • Chain link conveyor speed/distance • Stop motion detector • High speed low cost proximity • Tachometers, counters.

Device Information

Part number	Packing	Mounting	Temperature range	Marking
CYGTS9632VB	Bulk, 500pcs/bag	4-pin SIP	-40°C~150°C	9632

Operating Range

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Back Bias Range	B_{Bias}	Operating	-500	--	500	mT
Supply Voltage	V_{DD}	Operating	3.8	12	24	V
Operating Temperature	T_A		-40	~	150	°C
Storage Temperature	T_S		-65	~	175	°C

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Electrical and Magnetic Specifications

Operating Parameters T_A = -40°C to 150°C, V_{DD} = 5V (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ.	Max	Unit
Supply Voltage	V_{DD}	Operating	3.8	12	24	V
Supply Current	I_{DD}	VDD=3.8 to 24 V	4.5	6.5	8.5	mA
Output Saturation Voltage	V_{sat}	I_{out}=20mA, T_A=25°C	--	150	400	mV
Output Leakage Current	I_{Leak}	V_{out} =24V	--	--	10	µA
Overvoltage protection at supply voltage	V_{SP}	I_{DD} = 10mA	30	35	40	V
Overvoltage protection at output terminal	V_{OP}	I_{out} =1mA, V_{out}=High	30	35	40	V
Over current protection	OCP[1]	T_A=25°C	40	- -	- -	mA
Power on time	t_{po}[2]	V_{DD} >3.8V	- -	3.8	9.0	ms
Settling time	t_{settle}[3]	V_{DD}>3.8V, f=1kHz	0	--	50	ms
Response time	$t_{response}$[4]	V_{DD}>3.8V, f=1kHz	3.8	--	59	ms
Output Rise Time	T_R[5]	R1=1kΩ C=20pF	--	0.4	1.0	µs
Output Fall Time	T_F	R1=1kΩ C=20pF	--	0.35	1.0	µs
Upper corner frequency	fcu	-3dB, single pole	20	--		kHz
Lower corner frequency	fcl	-3dB, single pole	--	--	5	Hz
Back Bias Range	B_{Bias}	Operating	-500	--	500	mT
Operating point of channel 1	ΔB_{OP1}	f=1kHz, B_{diff}=5mT	--	--	0	mT
Release point of channel 1	ΔB_{RP1}	f=1kHz, B_{diff}=5mT	0	--	--	mT
Hysteresis of Channel 1	B_{HYS1}	f=1kHz, ΔB=5mT	0.5	1.5	2.5	mT
Switching point center of channel 1	ΔB_{M1}	$(B_{OP} + B_{RP})/2$	-2.0	0	2.0	mT
Operating point of channel 2	ΔB_{OP2}	f=1kHz, B_{diff}=5mT	--	--	0	mT
Release point of channel 2	ΔB_{RP2}	f=1kHz, B_{diff}=5mT	0	--	--	mT
Hysteresis of Channel 2	B_{HYS2}	f=1kHz, ΔB=5mT	0.5	1.5	2.5	mT
Switching point center of channel 2	ΔB_{M2}	$(B_{OP} + B_{RP})/2$	-2.0	0	2.0	mT

1 I_{OUT} does not change state when I_{OUT}=OCP.
2 Time required initializing device.
3 Time required for the output switch points to be within specification.
4 Equal to t_{po} + t_{settle}.
5 Output Rise Time will be dominated by the RC time constant.

Absolute Maximum Ratings

Parameter	Symbol	Minimal value	Maximal value	Unit
Power supply voltage	V_{DD}	-30	30	V
Power output current	I_{DD}	-10	25	mA
Output terminal voltage	V_{OUT}	-0.5	30	V
Output terminal current sink	I_{SINK}	0	40	mA
Operating ambient temperature	T_A	-40	150	°C
Maximum junction temperature	T_J	-40	165	°C
Storage temperature	T_{STG}	-65	175	°C

Note: Stresses above those listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

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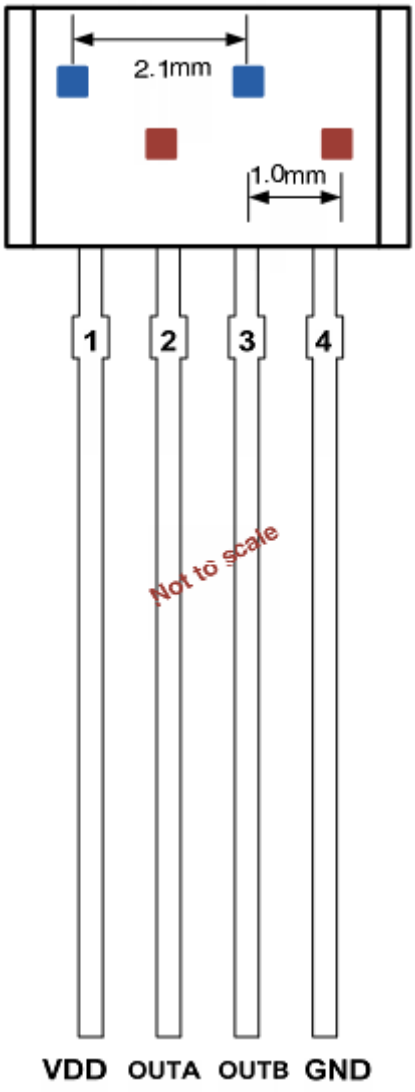
ESD (Emergency Shutdown System) Protection

Human Body Model (HBM) Tests

Parameter	Symbol	Max.	Unit	Note
ESD	V_{ESD}	±4.0	kV	According to Standard AEC-Q100-002

Pin Configuration

4-Terminal SIP VB package (Top View)



Pin No.	Symbol	Type	Description
1	V_{DD}	Supply voltage	3.8V to 24V power supply
2	OUTA	Output	Open-drain output required a pull-up resistor
3	OUTB	Output	Open-drain output required a pull-up resistor
4	GND	Ground	Ground terminal

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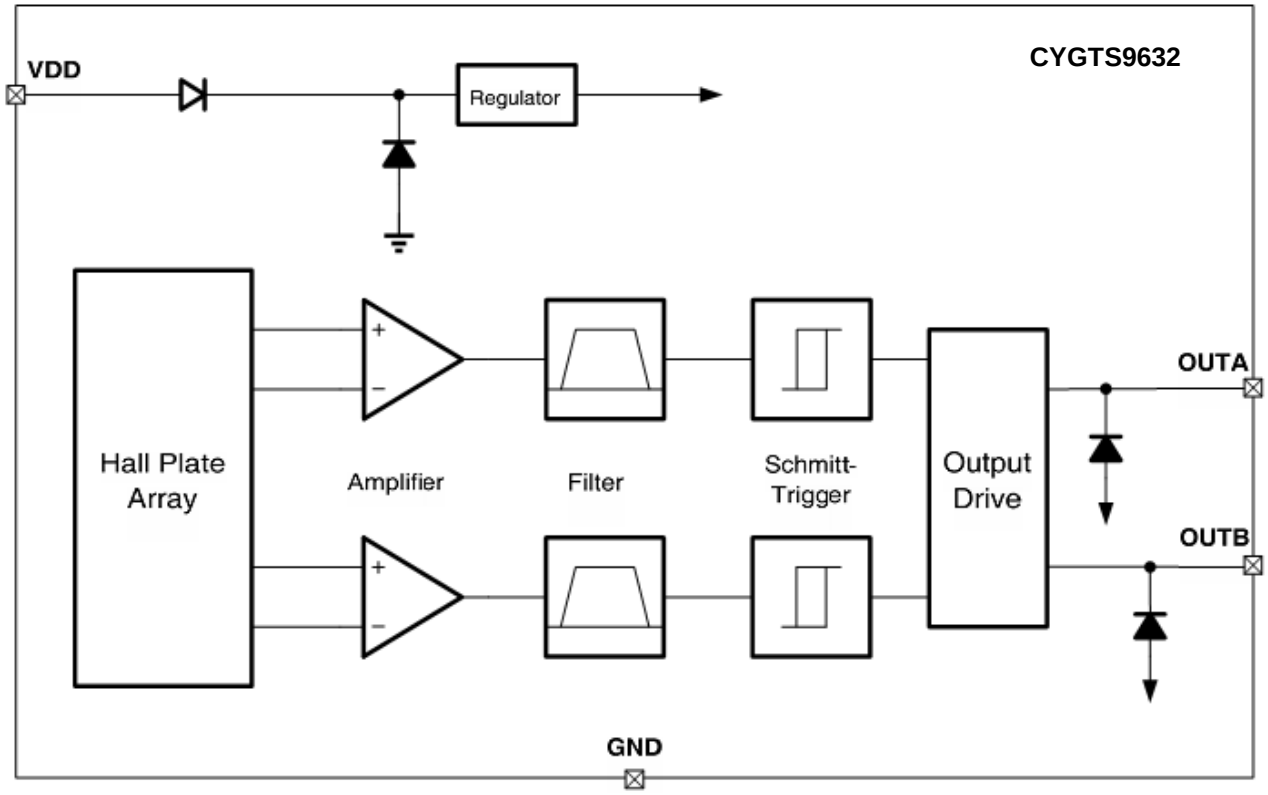
Functional Block Diagram



Functional Description

The CYGTS9632 integrates two independent differential Hall-effect sensor IC. The Hall IC supports four Hall elements, with magnet back-biased, which sense the magnetic profile of the ferrous gear target simultaneously, but at different points, generating two differential internal analog voltages, that is processed for precise switching of the digital output signals.

For each of two independent channels, the device detects the motion and position of ferromagnetic or permanent magnet structures by measuring the differential flux density of the magnetic field. Changes in field strength at the device face, which are induced by a moving target, are sensed by the two integrated Hall elements. The Hall elements generate signals that are differentially amplified by on-chip electronics. This differential design provides immunity to radial vibration within the operating air gap range of the CYGTS9632, by rejection of the common mode signal. Steady-state magnet and system offsets are eliminated using an on-chip differential band-pass filter. This filter also provides relative immunity to interference from electromagnetic sources.

The Hall IC is self-calibrating with a temperature compensated amplifier and offset cancellation circuitry. Its internal voltage regulator provides supply noise rejection throughout the operating voltage range. Changes in temperature do not greatly affect this device due to the stable amplifier design and the offset rejection circuitry. The Hall elements and signal processing electronics are integrated on the same silicon substrate, using a proprietary BiCMOS process.
The CYGTS9632 is offered in a lead (Pb) free 4-pin SIP package with a 100% matte tin plated Lead frame.

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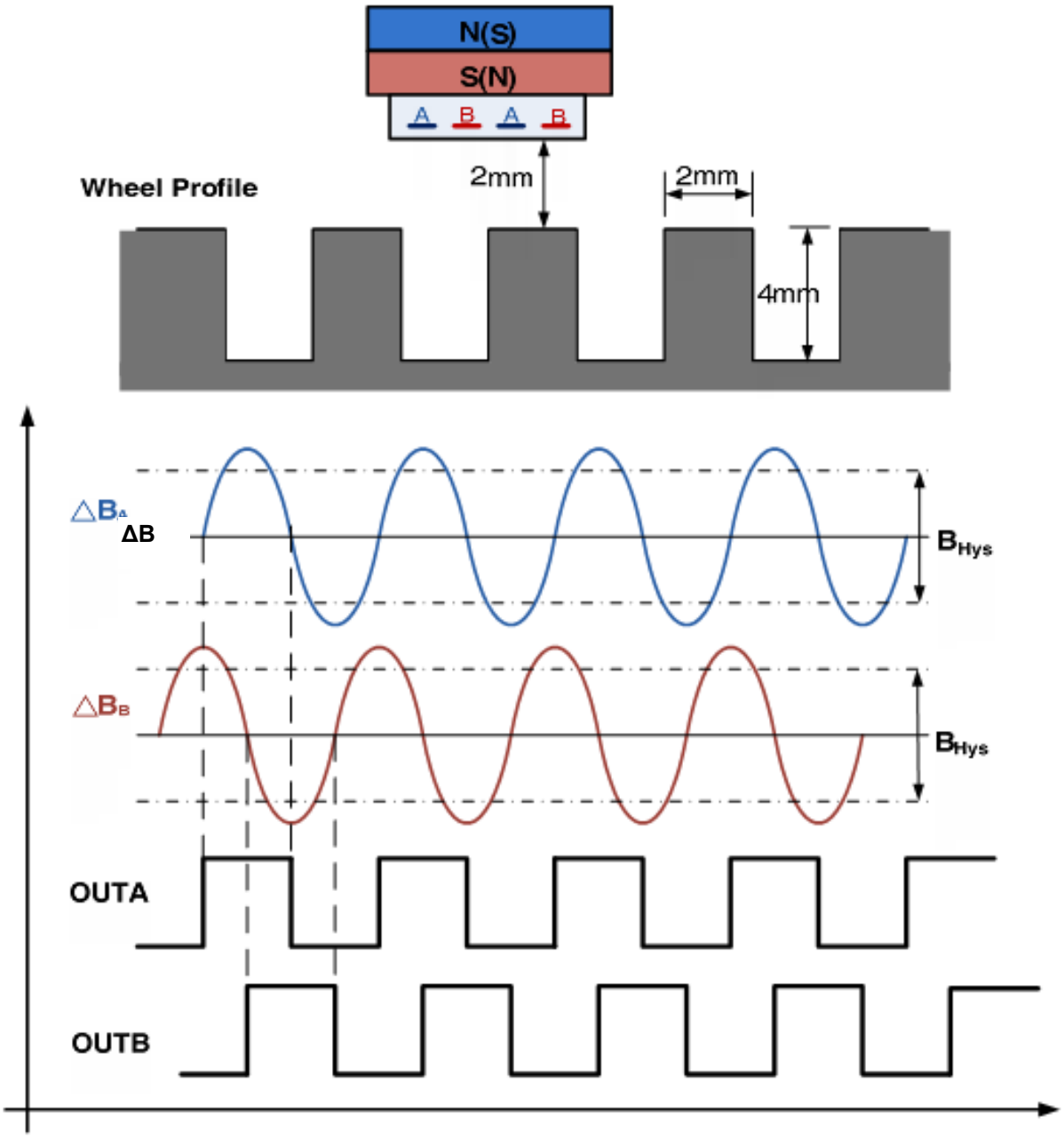
Gear Tooth Sensing

In the case of ferromagnetic toothed wheel application the IC has to be biased by the South or North Pole of a permanent magnet which should cover both Hall probes

The maximum air gap depends on

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



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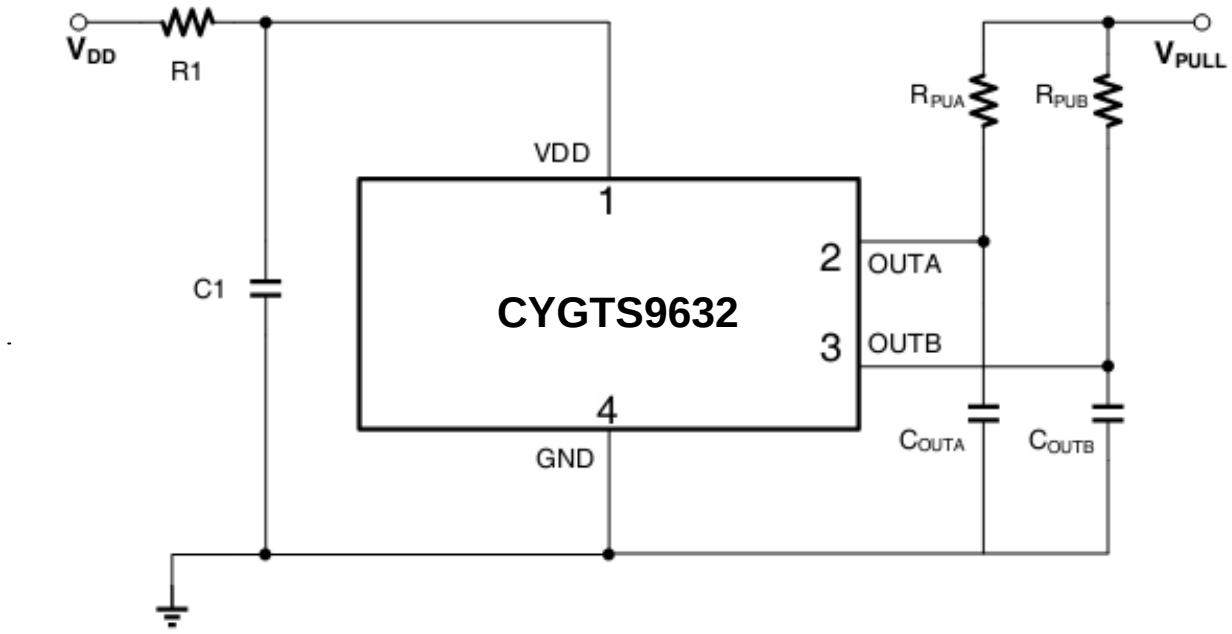
Recommended Application

The CYGTS9632 contains an on-chip voltage regulator and can operate over a wide supply voltage range. In applications that operate the device from an unregulated power supply, transient protection must be added externally. For applications using a regulated line, EMI/RFI protection may still be required.

Three-Wire Connection



Component	Value	Units
R_{PUA} / R_{PUB}	1.2	kΩ
R1	200	Ω
C1	0.1	µF
C_{OUTA} / C_{OUTB}	1.0	µF

1. Pull-up resistor not required for protection but for normal operation

2. R1 is for improved CI performance

3. C_{OUT} is for improved BCI performance

Thermal Characteristics

Symbol	Parameter	Test Conditions	Rating	Units
R_{QJA}	VB Package thermal resistance	Single-layer PCB, with copper limited to solder pads	177	°C/W

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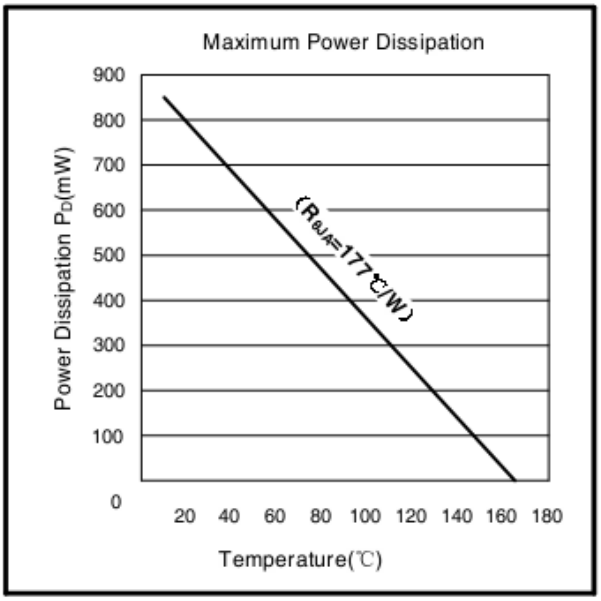

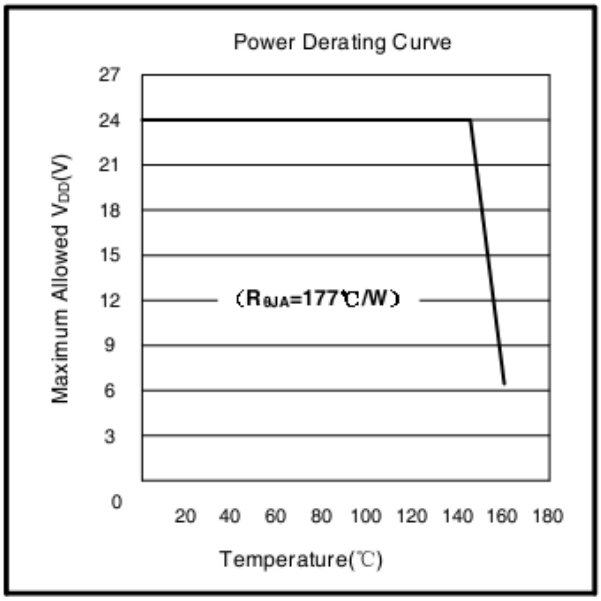

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Power Derating Description

The device must be operated below the maximum junction temperature of the device, $T_{J(max.)}$. Under certain combinations of peak condition, reliable operation may require derating supplied power or improving the heat dissipation properties of the application. The package Thermal Resistance, $R_{\theta JA}$, is figure of merit summarizing the ability of the application and device to dissipate heat from the junction, through all paths to the ambient air. Its primary component is an Effective Thermal Conductivity, K, of the printed circuit board, including adjacent devices and traces. Radiation from the die through the device case, $R_{\theta JC}$, is relatively small component of $R_{\theta JA}$. Ambient air temperature, T_A, and air motion are significant external factors, damped by over molding.

The effect of varying power levels (Power Dissipation, P_D), can be estimated. The following formulas represent the fundamental relationships used to estimate T_J, at P_D.

$$P_D=V_{DD} \times I_{DD} \quad (1)$$
$$\triangle T=P_D \times R_{\theta JA} \quad (2)$$
$$T_J=T_A + \triangle T \quad (3)$$

For example $T_A=25$℃, $V_{DD}=12V$, $I_{DD}=3.5mA$, $R_{\theta JA}=177$ ℃/W, we get

$$P_D=V_{DD} \times I_{DD}=12V \times 3.5mA=42mW$$
$$\triangle T=P_D \times R_{\theta JA}=42mW \times 177\ ℃/W=7.5℃$$
$$T_J=T_A +\triangle T=25℃+7.5℃=32.5℃$$

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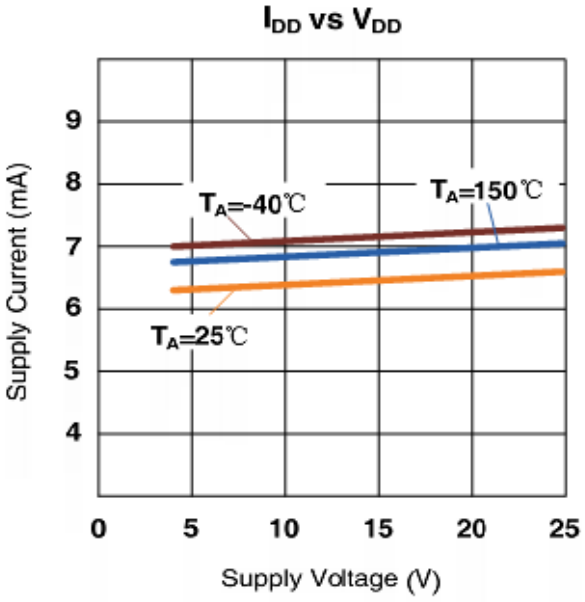
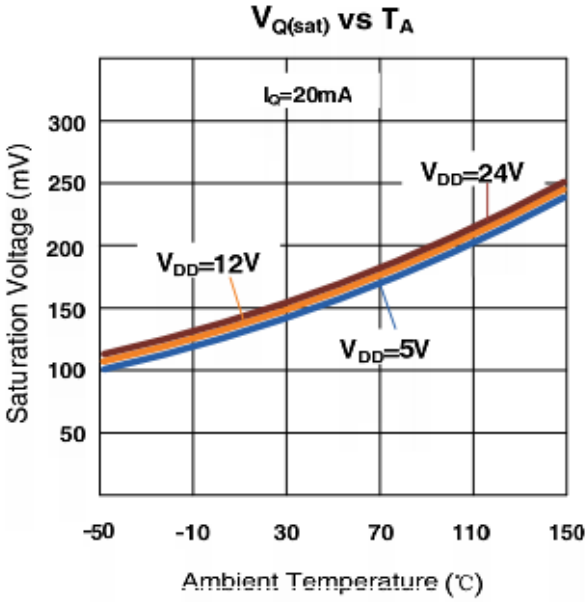
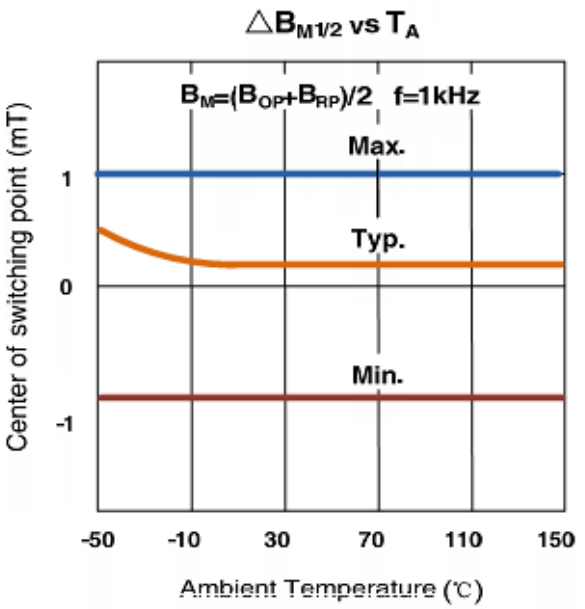
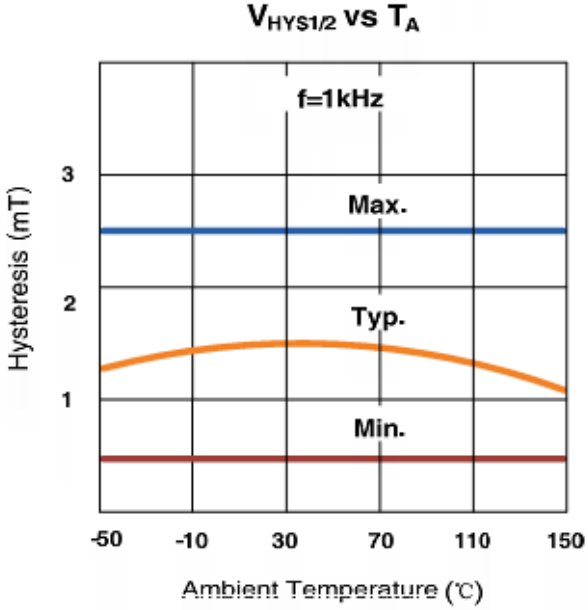
Empirical Result









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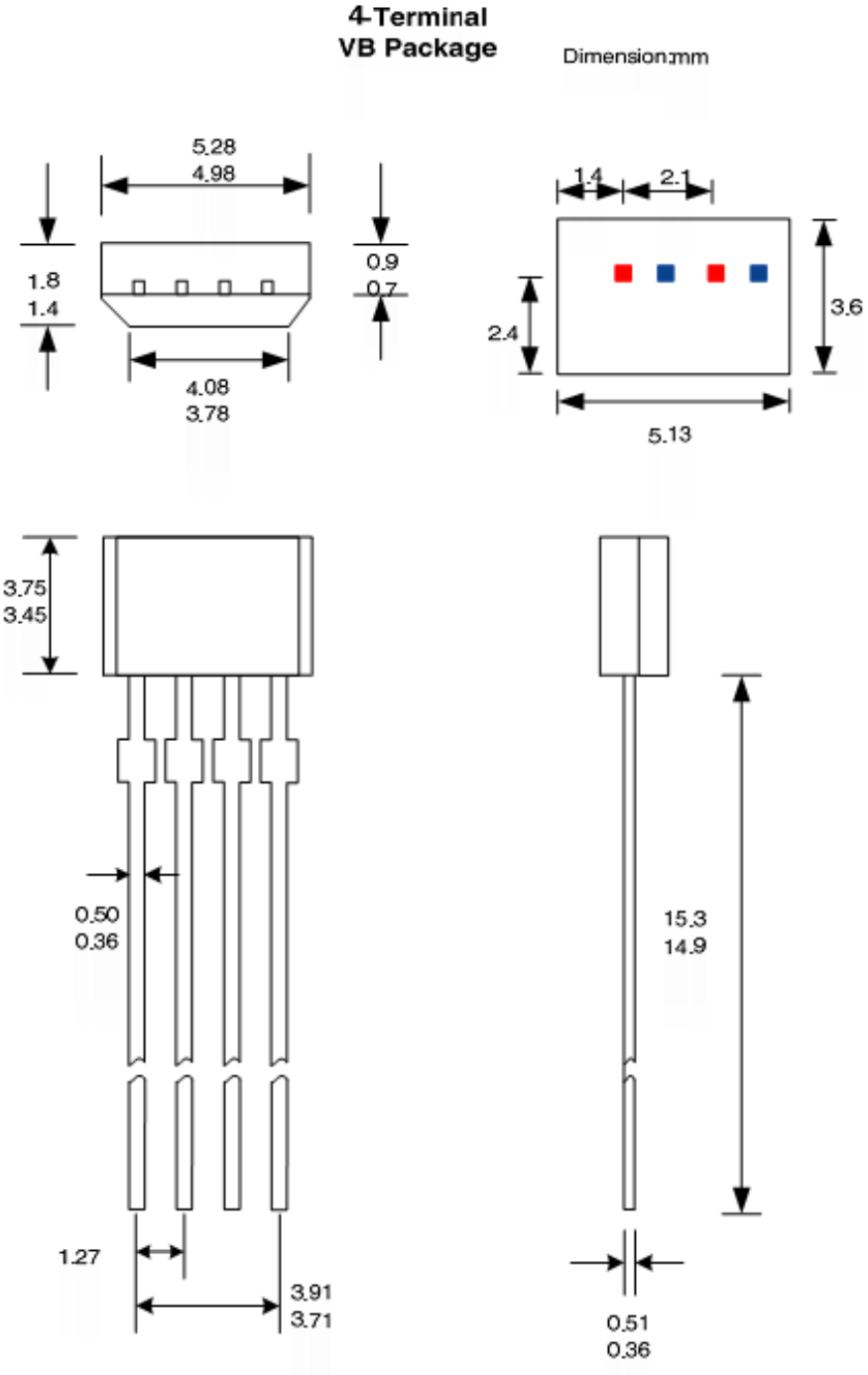
Package Designator



Notes:

1. Exact body and lead configuration at vendor's option within limits shown.
2. Height does not include mold gate flash.

   Where no tolerance is specified, dimension is nominal.

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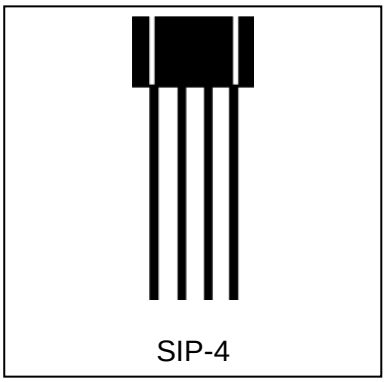
CYGTS9633 High Sensitivity Speed Sensor IC with Dual Quadrature Outputs

CYGTS9633 is a differential Hall Effect sensor IC with two independent channels providing quadrature outputs. The device provides a high sensitivity and a superior stability over temperature and symmetrical thresholds in order to achieve a stable duty cycle. The integrated circuit is response to changing differential magnetic fields created by rotating ring magnets and by ferrous targets when coupled with a magnet. By use of the A and B quadrature outputs, the device is particularly suitable for speed and direction of magnetic ring or ferromagnetic toothed wheels.
The device is packaged in a 4-pin plastic SIP. It is lead (Pb) free, with 100% matte tin plated lead frame.

Features

- Two independent digital quadrature A/B outputs
- Accurate true zero-crossing switch-point
- South and North pole pre-induction possible
- Large air gap
- 3.8V to 24V supply operating range
- Low power consumption 6.5mA (typ.)
- Wide operating temperature range -40°C ~150°C
- Protection against over-voltage in all PIN
- Reverse-current protection in power supply V_{DD} PIN
- Output protection against electrical disturbances



SIP-4

Applications

Automotive and Heavy Duty Vehicles	Industrial Areas:
• Camshaft and crankshaft speed and position • Transmission speed • Tachometers • Anti-skid/traction control	• Sprocket speed • Chain link conveyor speed/distance • Stop motion detector • High speed low cost proximity • Tachometers, counters.

Device Information

Part number	Packing	Mounting	Temperature range	Marking
CYGTS9633VB	Bulk, 500pcs/bag	4-pin SIP	-40°C~150°C	9633

Operating Range

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Back Bias Range	B_{Bias}	Operating	-500	--	500	mT
Supply Voltage	V_{DD}	Operating	3.8	12	24	V
Operating Temperature	T_A		-40	~	150	°C
Storage Temperature	T_S		-65	~	175	°C

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Electrical and Magnetic Specifications

Operating Parameters T_A = -40°C to 150°C, V_{DD} = 5V (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ.	Max	Unit
Supply Voltage	V_{DD}	Operating	3.8	12	24	V
Supply Current	I_{DD}	VDD=3.8 to 24 V	4.5	6.5	8.5	mA
Output Saturation Voltage	V_{sat}	I_{out}=30mA, T_A=25°C	--	210	400	mV
Output Leakage Current	I_{Leak}	V_{out} =24V	--	--	10	µA
Overvoltage protection at supply voltage	V_{SP}	I_{DD} = 10mA	30	35	40	V
Overvoltage protection at output terminal	V_{OP}	I_{out} =1mA, V_{out}=High	30	35	40	V
Over current protection	OCP[1]	T_A=25°C	40	- -	- -	mA
Power on time	t_{po}[2]	V_{DD} >3.8V	- -	3.8	9.0	ms
Settling time	t_{settle}[3]	V_{DD}>3.8V, f=1kHz	0	--	50	ms
Response time	$t_{response}$[4]	V_{DD}>3.8V, f=1kHz	3.8	--	59	ms
Output Rise Time	T_R[5]	R1=1kΩ C=20pF	--	0.4	1.0	µs
Output Fall Time	T_F	R1=1kΩ C=20pF	--	0.35	1.0	µs
Upper corner frequency	fcu	-3dB, single pole	20	--		kHz
Lower corner frequency	fcl	-3dB, single pole	--	--	5	Hz
Back Bias Range	B_{Bias}	Operating	-500	--	500	mT
Operating point of channel 1	ΔB_{OP1}	f=1kHz, B_{diff}=5mT	--	--	0	mT
Release point of channel 1	ΔB_{RP1}	f=1kHz, B_{diff}=5mT	0	--	--	mT
Hysteresis of Channel 1	B_{HYS1}	f=1kHz, ΔB=5mT	0.5	1.5	2.5	mT
Switching point center of channel 1	ΔB_{M1}	$(B_{OP} + B_{RP})/2$	-2.0	0	2.0	mT
Operating point of channel 2	ΔB_{OP2}	f=1kHz, B_{diff}=5mT	--	--	0	mT
Release point of channel 2	ΔB_{RP2}	f=1kHz, B_{diff}=5mT	0	--	--	mT
Hysteresis of Channel 2	B_{HYS2}	f=1kHz, ΔB=5mT	0.5	1.5	2.5	mT
Switching point center of channel 2	ΔB_{M2}	$(B_{OP} + B_{RP})/2$	-2.0	0	2.0	mT

1 I_{OUT} does not change state when I_{OUT}=OCP.
2 Time required initializing device.
3 Time required for the output switch points to be within specification.
4 Equal to t_{po} + t_{settle}.
5 Output Rise Time will be dominated by the RC time constant.

Absolute Maximum Ratings

Parameter	Symbol	Minimal value	Maximal value	Unit
Power supply voltage	V_{DD}	-30	30	V
Power output current	I_{DD}	-10	25	mA
Output terminal voltage	V_{OUT}	-0.5	30	V
Output terminal current sink	I_{SINK}	0	40	mA
Operating ambient temperature	T_A	-40	150	°C
Maximum junction temperature	T_J	-40	165	°C
Storage temperature	T_{STG}	-65	175	°C

Note: Stresses above those listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

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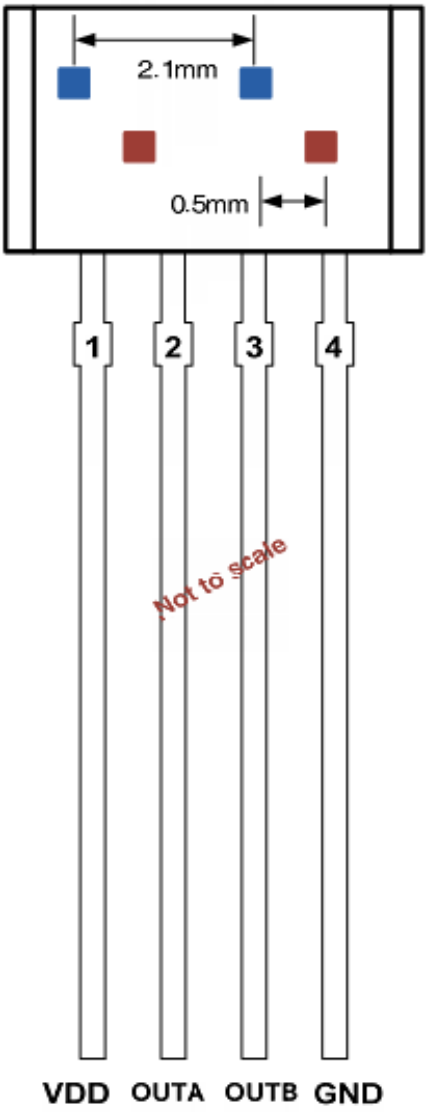
ESD (Emergency Shutdown System) Protection

Human Body Model (HBM) Tests

Parameter	Symbol	Max.	Unit	Note
ESD	V_{ESD}	±4.0	kV	According to Standard AEC-Q100-002

Pin Configuration

4-Terminal SIP VB package (Top View)



Pin No.	Symbol	Type	Description
1	V_{DD}	Supply voltage	3.8V to 24V power supply
2	OUTA	Output	Open-drain output required a pull-up resistor
3	OUTB	Output	Open-drain output required a pull-up resistor
4	GND	Ground	Ground terminal

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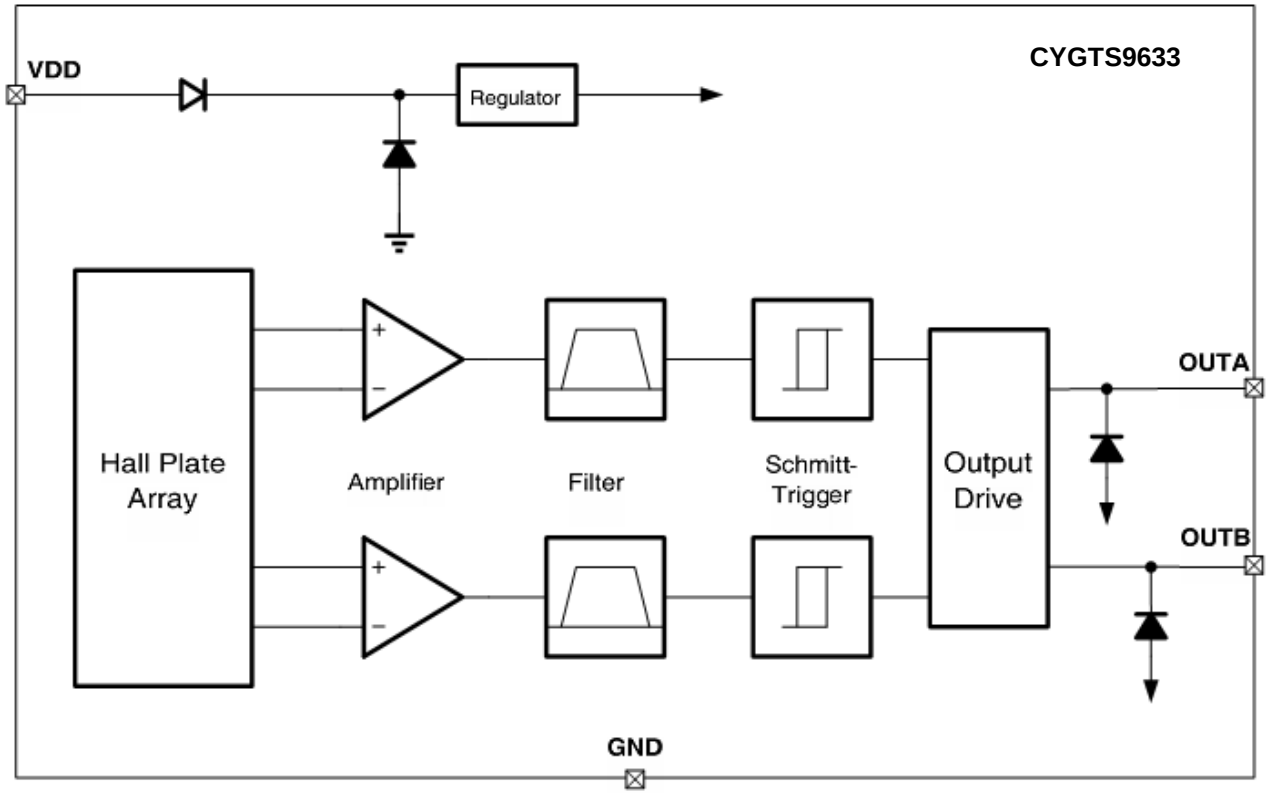
Functional Block Diagram



Functional Description

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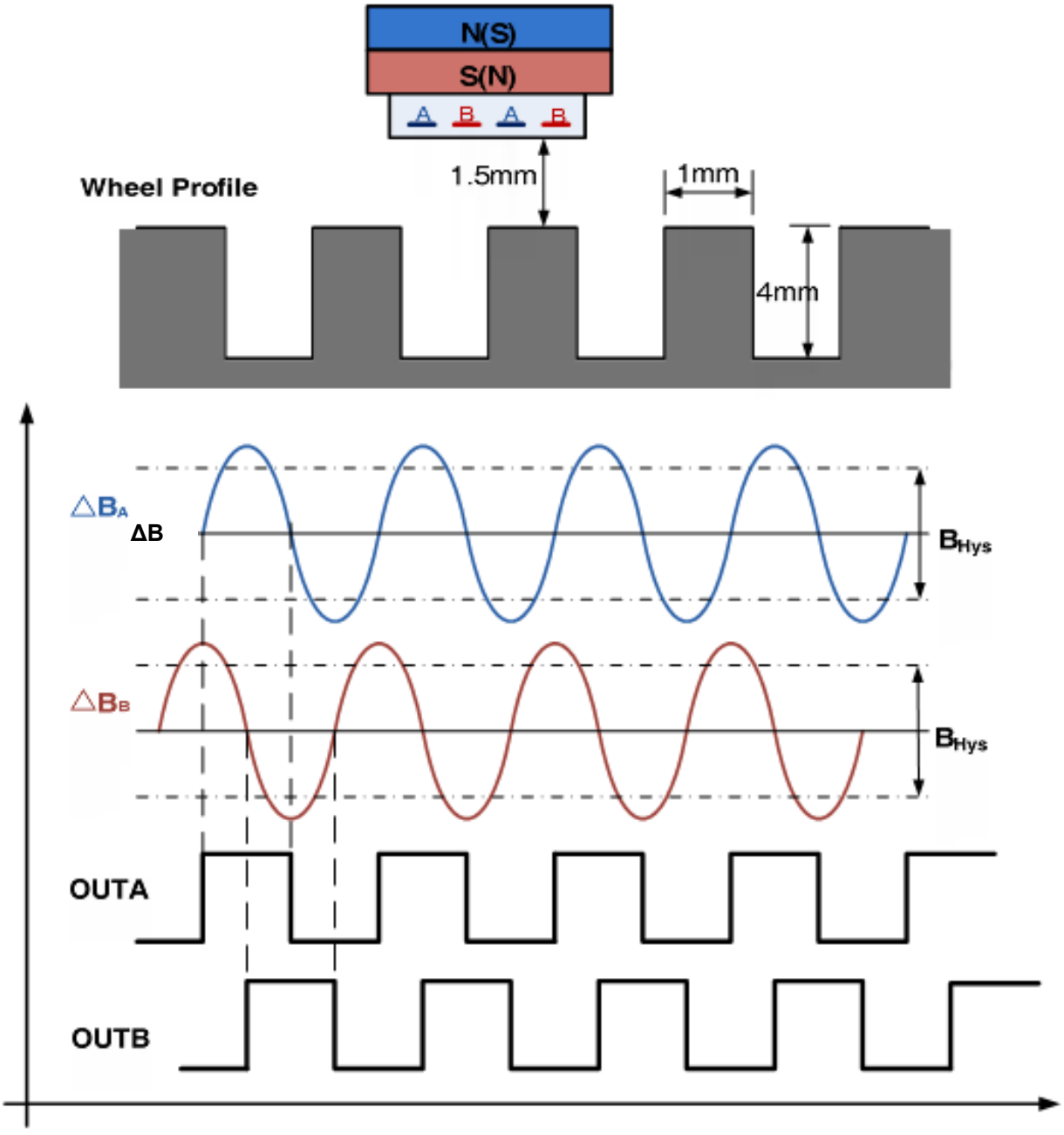

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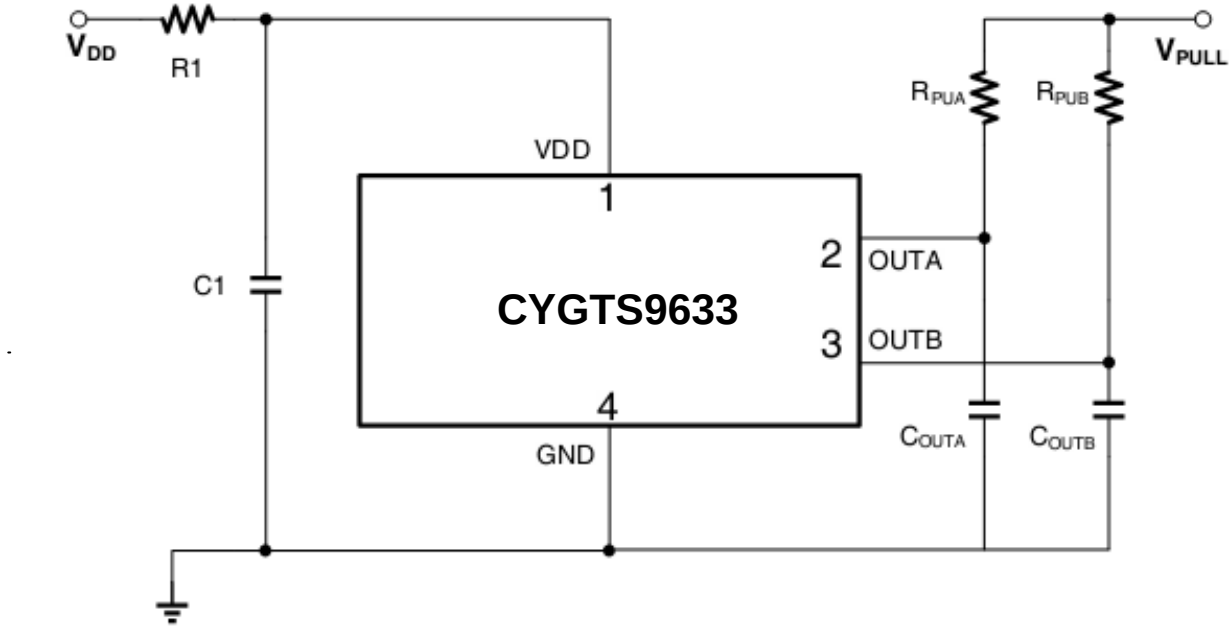
Three-Wire Connection



Component	Value	Units
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R1	200	Ω
C1	0.1	µF
C_{OUTA} / C_{OUTB}	1.0	µF

1. Pull-up resistor not required for protection but for normal operation

2. R1 is for improved CI performance

3. C_{OUT} is for improved BCI performance

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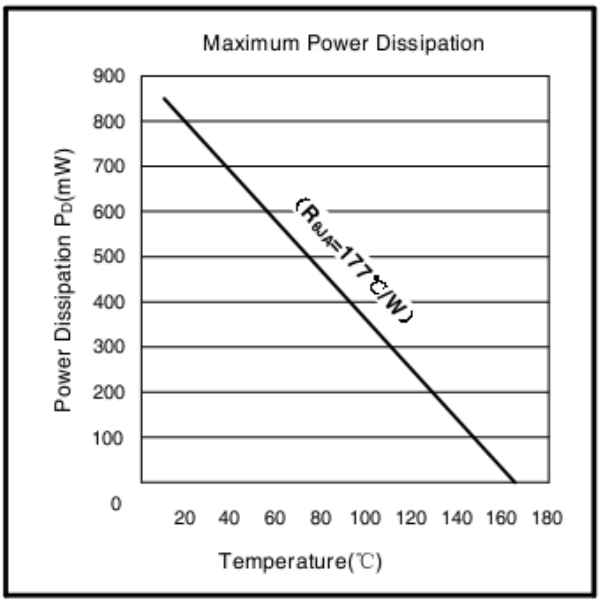
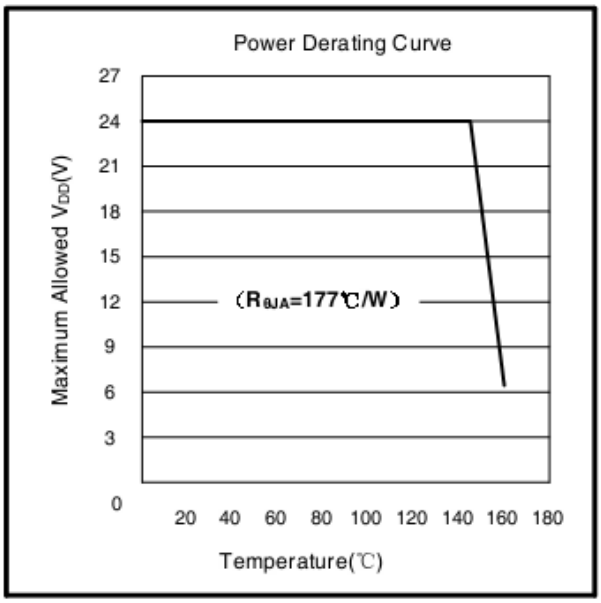
Thermal Characteristics

Symbol	Parameter	Test Conditions	Rating	Units
R_{QJA}	VB Package thermal resistance	Single-layer PCB, with copper limited to solder pads	177	℃/W





Power Derating Description

The device must be operated below the maximum junction temperature of the device, $T_{J(max.)}$. Under certain combinations of peak condition, reliable operation may require derating supplied power or improving the heat dissipation properties of the application. The package Thermal Resistance, $R_{\theta JA}$, is figure of merit summarizing the ability of the application and device to dissipate heat from the junction, through all paths to the ambient air. Its primary component is an Effective Thermal Conductivity, K, of the printed circuit board, including adjacent devices and traces. Radiation from the die through the device case, $R_{\theta JC}$, is relatively small component of $R_{\theta JA}$. Ambient air temperature, T_A, and air motion are significant external factors, damped by over molding.

The effect of varying power levels (Power Dissipation, P_D), can be estimated. The following formulas represent the fundamental relationships used to estimate T_J, at P_D.

$$P_D=V_{DD} \times I_{DD} \quad (1)$$

$$\triangle T=P_D \times R_{\theta JA} \quad (2)$$

$$T_J=T_A + \triangle T \quad (3)$$

For example $T_A=25$℃, $V_{DD}=12V$, $I_{DD}=3.5mA$, $R_{\theta JA}=177$ ℃/W, we get

$$P_D=V_{DD} \times I_{DD}=12V \times 3.5mA=42mW$$

$$\triangle T=P_D \times R_{\theta JA}=42mW \times 177\ ℃/W=7.5℃$$

$$T_J=T_A +\triangle T=25℃+7.5℃=32.5℃$$

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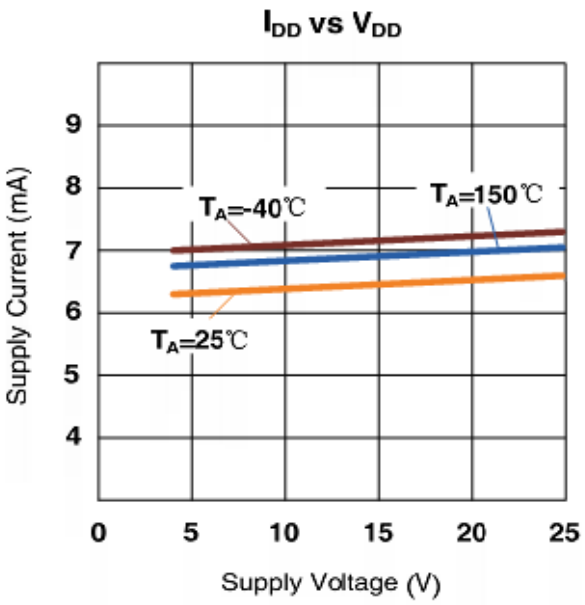
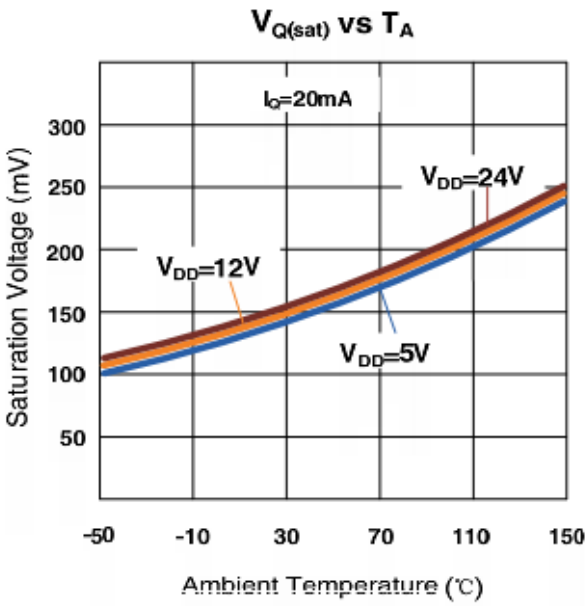
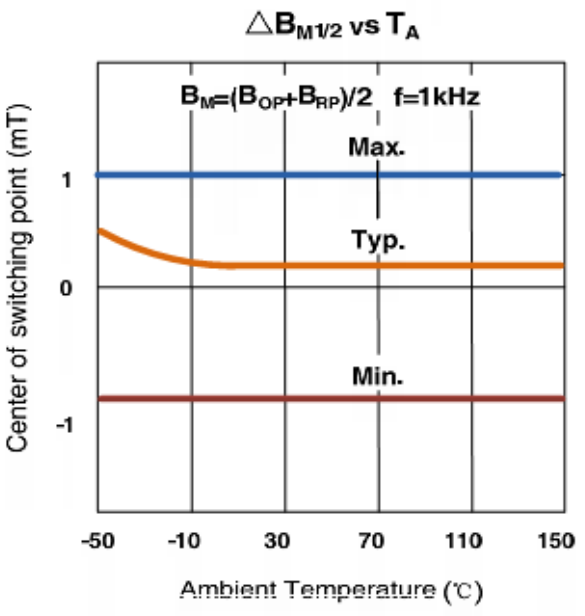
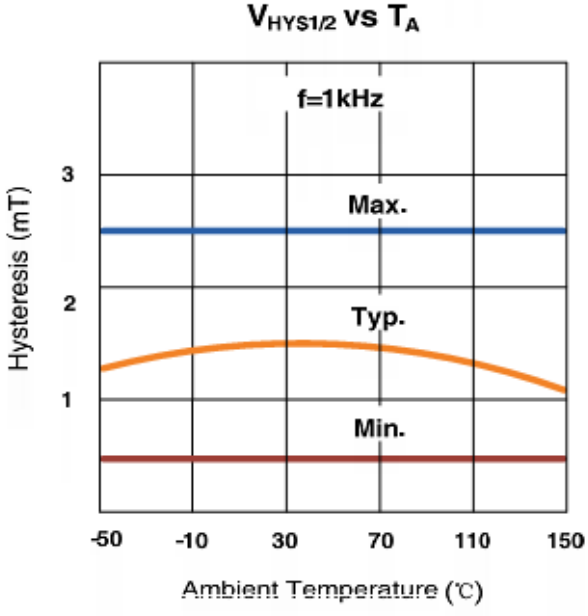
Empirical Result









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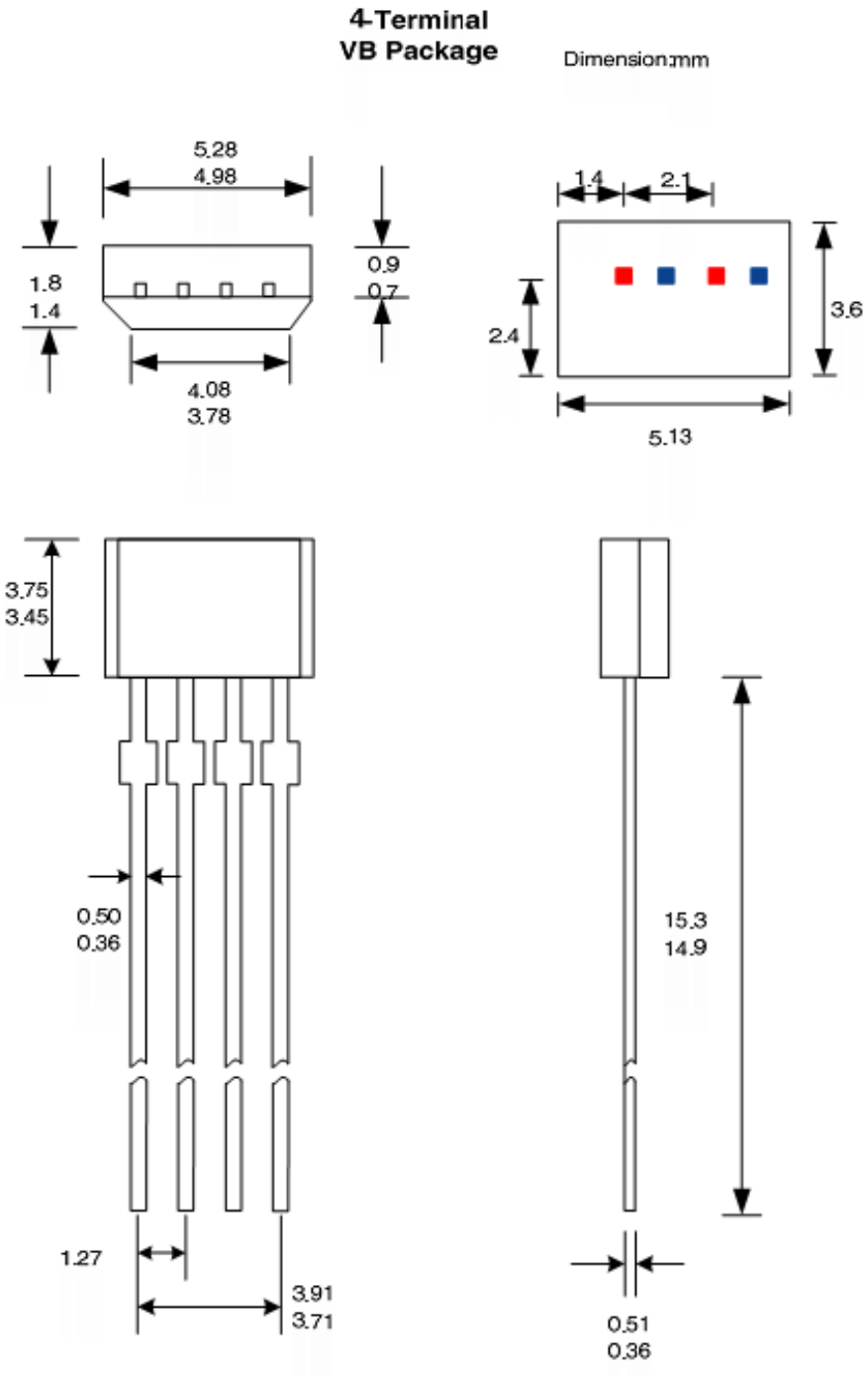
Package Designator



Notes:

1. Exact body and lead configuration at vendor's option within limits shown.
2. Height does not include mold gate flash.

   Where no tolerance is specified, dimension is nominal.

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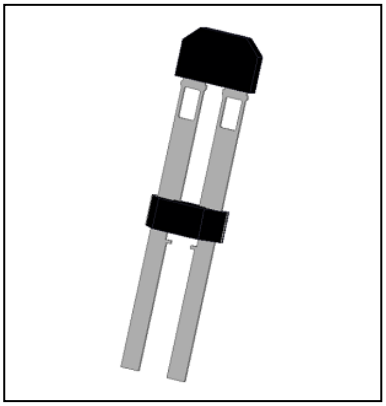
CYGTS9641 Two-Wire High Accuracy Differential Speed Sensor IC with Continuous Calibration

The differential Hall Effect sensor CYGTS9641 is designed to provide information about rotational speed to modern vehicle dynamics control systems and ABS. The output has been designed as a two wire current interface. Excellent accuracy and sensitivity are specified for harsh automotive requirements with a wide temperature range, high ESD and EMC robustness.

The regulated current output is configured for two-wire applications and the 2.0mm spacing between the dual Hall elements is optimized for fine pitch ring-magnet-based configurations.
The device is packaged in a 2-pin plastic SIP. It is lead (Pb) free, with 100% matte tin plated lead frame.

Features

- Two-wire current interface
- High sensitivity
- South and North pole pre-induction possible
- Large air gap
- 4.5V to 24V supply operating range
- Wide operating temperature range -40°C ~150°C



Applications

Automotive and Heavy Duty Vehicles	Industrial Areas:
• Camshaft and crankshaft speed and position • Transmission speed • Tachometers • Anti-skid/traction control	• Sprocket speed • Chain link conveyor speed/distance • Stop motion detector • High speed low cost proximity • Tachometers, counters.

Device Information

Part number	Packing	Mounting	Temperature range	Marking
CYGTS9641TS	Bulk, 500pcs/bag	2-pin SIP	-40°C~150°C	9641

Operating Range

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Back Bias Range	B_{Bias}	Operating	-500	--	500	mT
Supply Voltage	V_{DD}	Operating	4.5	12	24	V
Operating Temperature	T_A		-40	~	150	°C
Storage Temperature	T_S		-65	~	175	°C

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Electrical and Magnetic Specifications

Operating Parameters T_A = -40°C to 150°C, V_{DD} = 5V (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ.	Max	Unit
Operating Supply Voltage	V_{DD}	Operating	4.5	12	24	V
Operating Supply Current	$I_{DD(Low)}$	V_{DD}=4.5V to 24 V	5.9	7.0	8.4	mA
Operating Supply Current	$I_{DD(High)}$	V_{DD}=4.5V to 24 V	12.0	14.0	16.0	mA
Supply current ratio	R_{CUR}	$I_{DD(High)}$ / $I_{DD(Low)}$	1.8	2	2.4	--
Power on time	t_{po} [1]	V_{DD} >4.5V	- -	3.8	9.0	ms
Settling time	t_{settle} [2]	V_{DD}>4.5V, f=1kHz	0	--	50	ms
Response time	$t_{response}$ [3]	V_{DD}>4.5V, f=1kHz	3.8	--	59	ms
Output Rise Time	T_R [5]	R1=1kΩ C=20pF	--	0.4	1.0	µs
Output Fall Time	T_F	R1=1kΩ C=20pF	--	0.35	1.0	µs
Upper corner frequency	fcu	-3dB, single pole	15	--		kHz
Lower corner frequency	fcl	-3dB, single pole	--	--	5	Hz
Back Bias Range	B_{Bias}	Operating	-500	--	500	mT
Operating point	ΔB_{OP1}	f=1kHz, B_{diff}=5mT	--	--	0	mT
Release point	ΔB_{RP1}	f=1kHz, B_{diff}=5mT	0	--	--	mT
Hysteresis	B_{HYS1}	f=1kHz, ΔB=5mT	0.7	1.3	2.8	mT
Center of switching points	ΔB_{M1}	$(B_{OP} + B_{RP})/2$	-2.0	0	2.0	mT

1 Time required initializing device.
2 Time required for the output switch points to be within specification.
3 Equal to t_{po} + t_{settle}.

Absolute Maximum Ratings

Parameter	Symbol	Minimal value	Maximal value	Unit
Power supply voltage	V_{DD}	-0.5	30	V
Operating ambient temperature	T_A	-40	150	°C
Maximum junction temperature	T_J	-55	165	°C
Storage temperature	T_{STG}	-65	175	°C

Note: Stresses above those listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ESD (Emergency Shutdown System) Protection

Human Body Model (HBM) Tests

Parameter	Symbol	Max.	Unit	Note
ESD	V_{ESD}	±8.0	kV	According to Standard AEC-Q100-002

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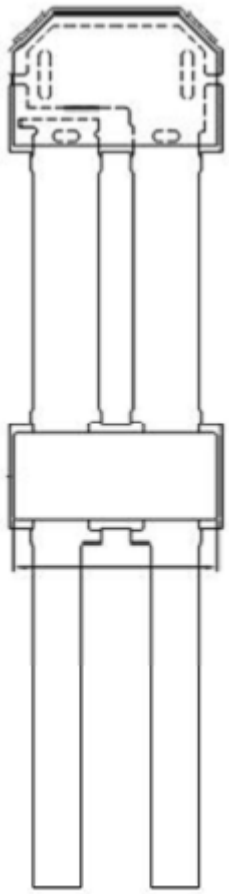
Pin Configuration

2-Terminal SIP TS package

(Top View)



Pin No.	Symbol	Type	Description
1	V_{DD}	Supply voltage	3.8V to 24V power supply
2	GND	Ground	Ground terminal

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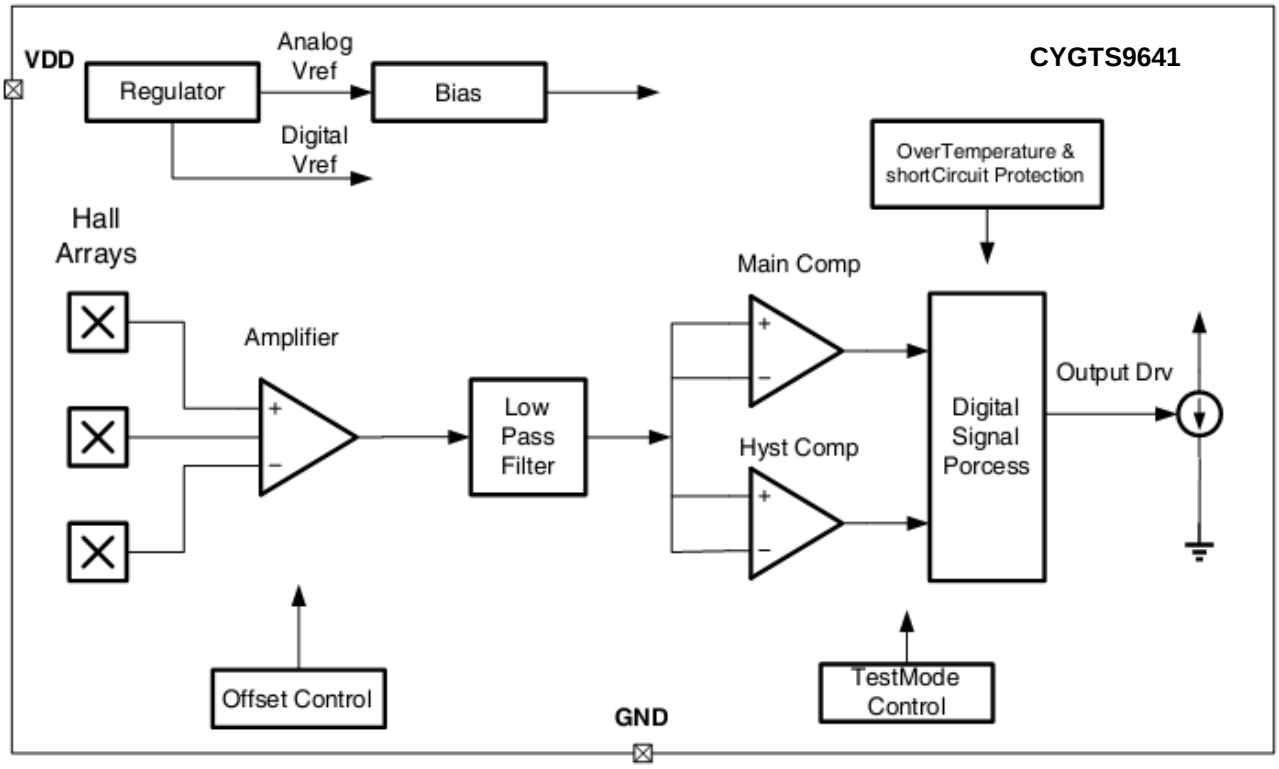
Functional Block Diagram



Functional Description

The CYGTS9641 is an optimized Hall Effect sensing integrated circuit that provides a user-friendly solution for ring-magnet sensing in two-wire applications. This small package can be easily assembled used in conjunction with a wide variety of target shapes and sizes.

The integrated circuit incorporates a dual-element Hall Effect sensor and signal processing that switches to differential magnetic signals created by ring magnet poles. The circuitry contains a sophisticated digital circuit to reduce system offsets and to calibrate the gain for air-gap-independent switch points.

The regulated current output is configured for two-wire applications and the sensor is ideally suited for obtaining speed and duty cycle information in ABS (antilock braking systems). The 2.0 mm spacing between the dual Hall elements is optimized for fine pitch ring-magnet-based configurations. The package is lead (Pb) free, with 100% matte tin lead frame plating.

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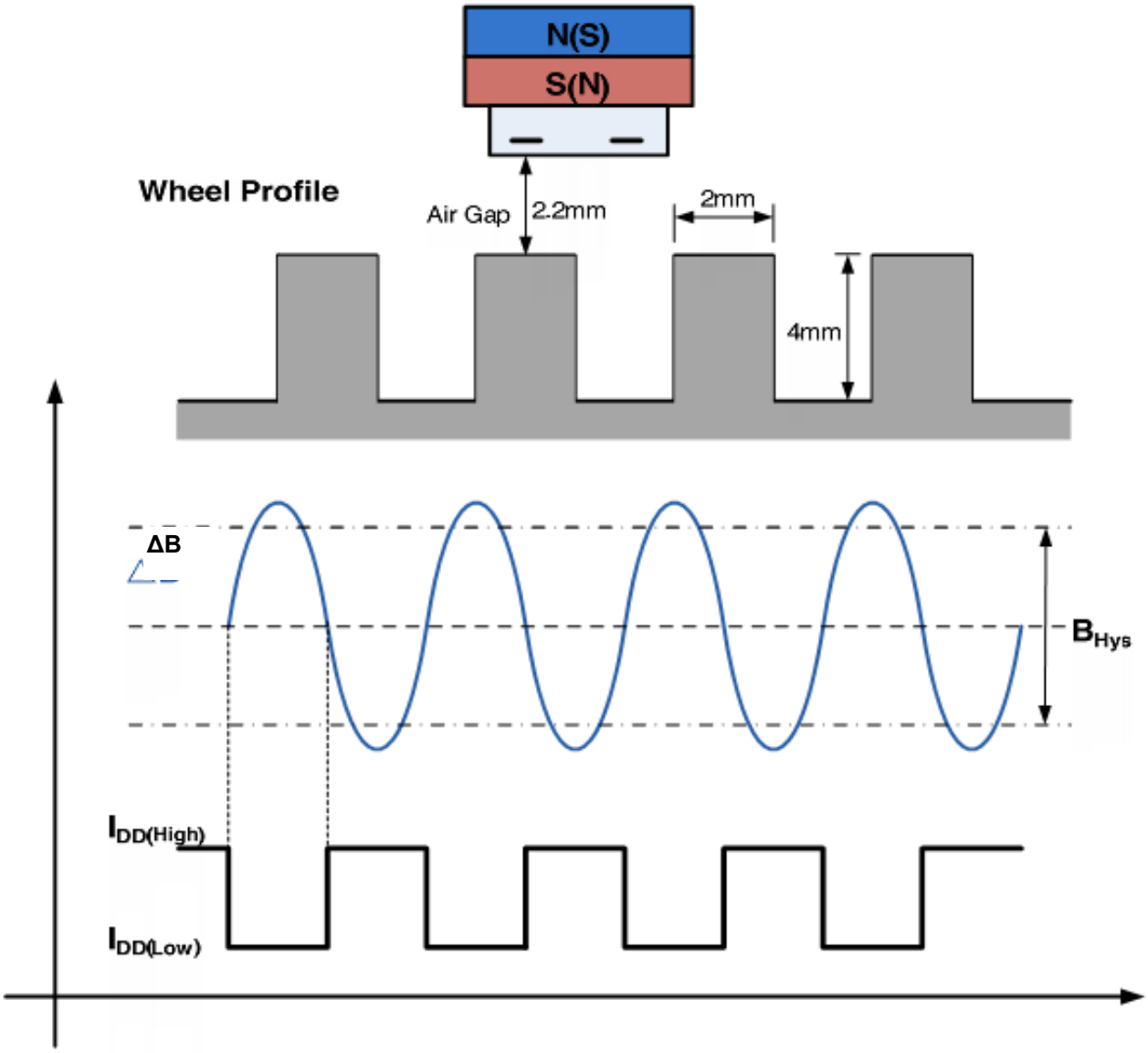
Gear Tooth Sensing

In the case of ferromagnetic toothed wheel application the IC has to be biased by the South or North Pole of a permanent magnet which should cover both Hall probes

The maximum air gap depends on

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



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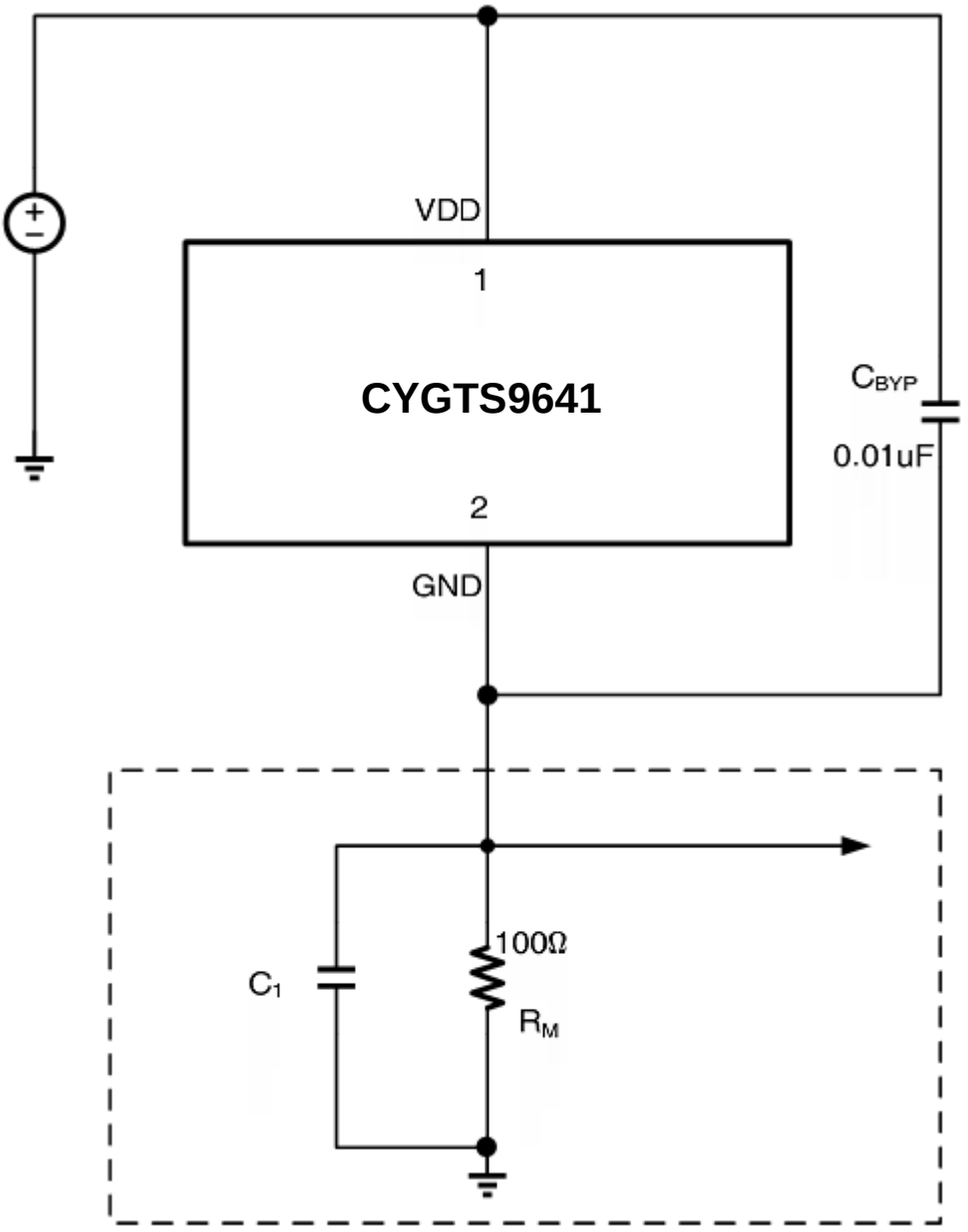
Recommended Application

The CYGTS9641 contains an on-chip voltage regulator and can operate over a wide supply voltage range.

Two-Wire Connection



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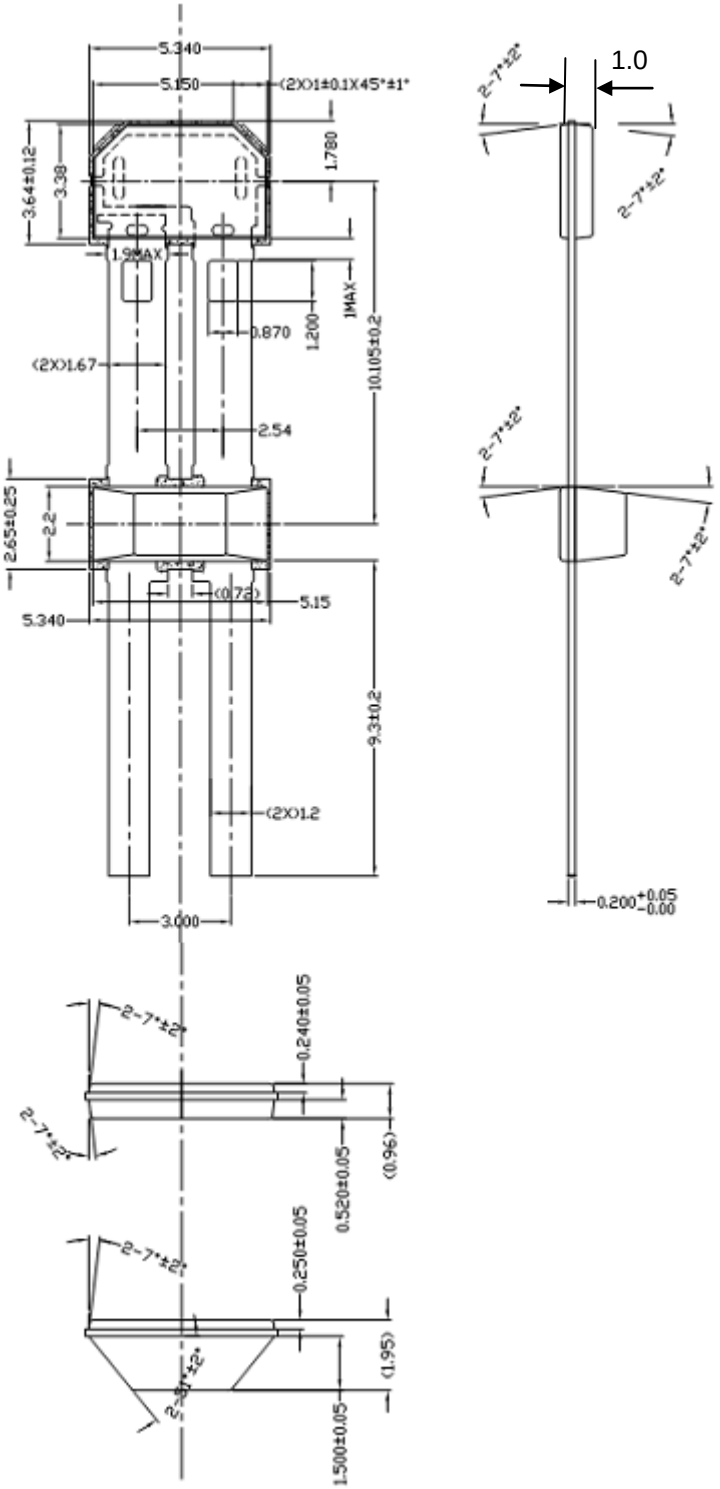
Package Designator



Notes:

1. Exact body and lead configuration at vendor's option within limits shown.
2. Height does not include mold gate flash.

   Where no tolerance is specified, dimension is nominal.

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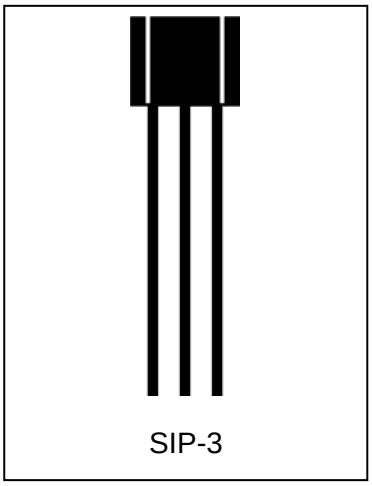
CYGTS9801 Self-Adjusting Hall Effect Gear Tooth Sensor IC

The CYGTS9801 is a sophisticated Hall Effect Gear Tooth 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 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
- Wide voltage working range
- Self-adjusting magnetic range
- On-chip 12 bit A/D converter
- High speed operation
- No chopper delay applications
- 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
- 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	1.5	3.0	4.5	mA
Power-Up State	POS	$V_{DD} > V_{DD(min)}$	H	H	H	
Supply Current	I_{DD}	V_{DD} = 4.0V to 30V	1.0	--	6.0	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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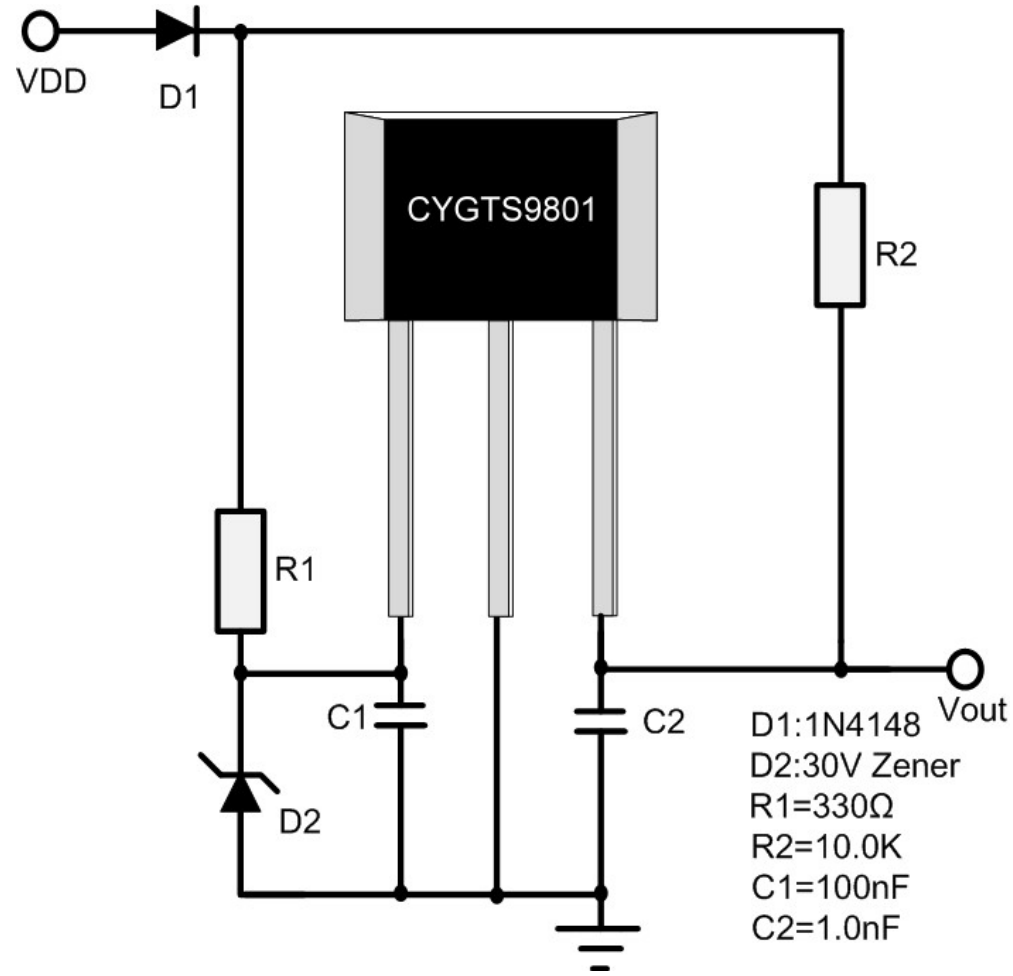
ESD (Emergency Shutdown System) Protection

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	GND	Ground terminal
3	Vout	Signal Output

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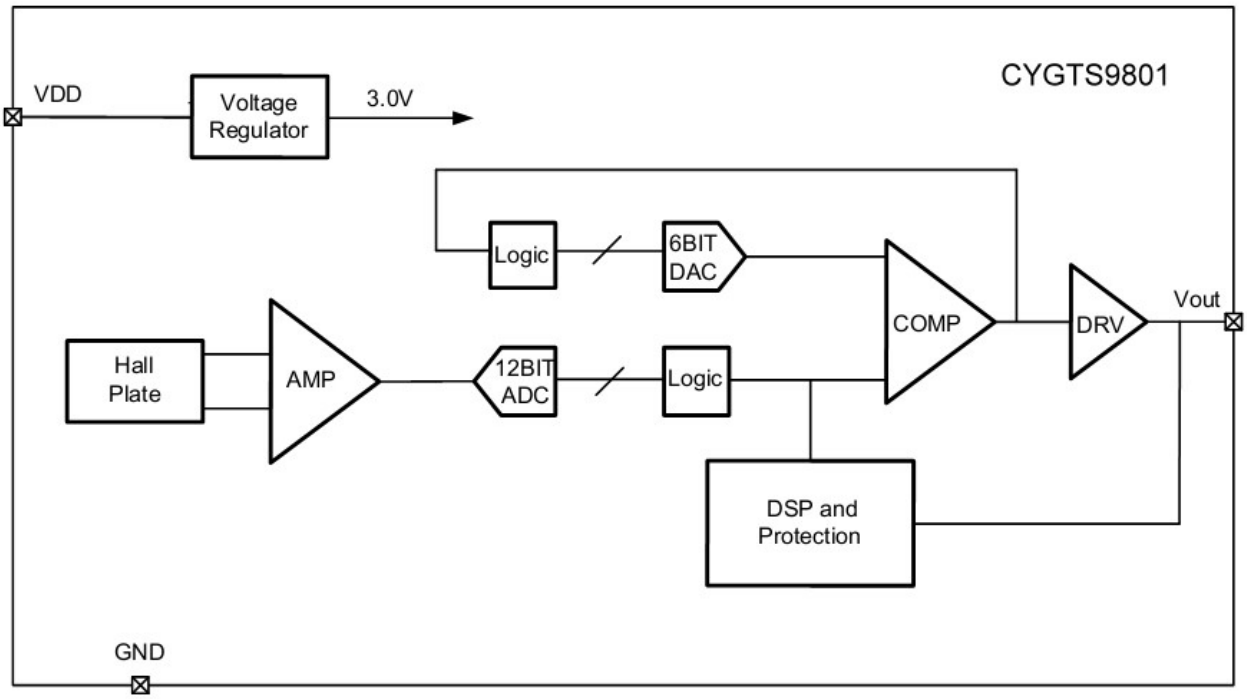
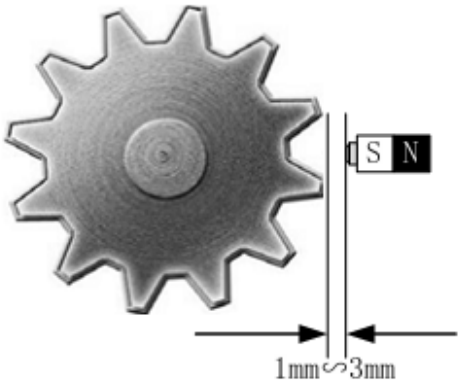
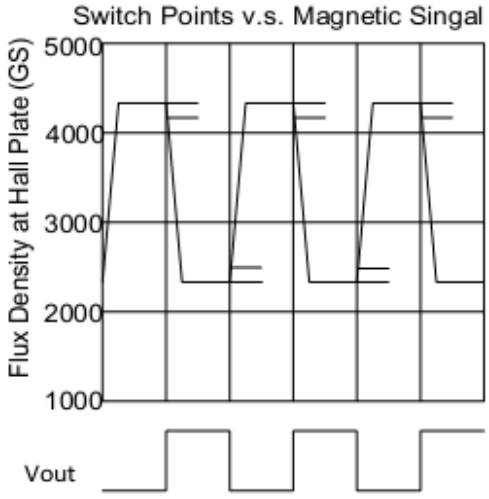
Block Diagram



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

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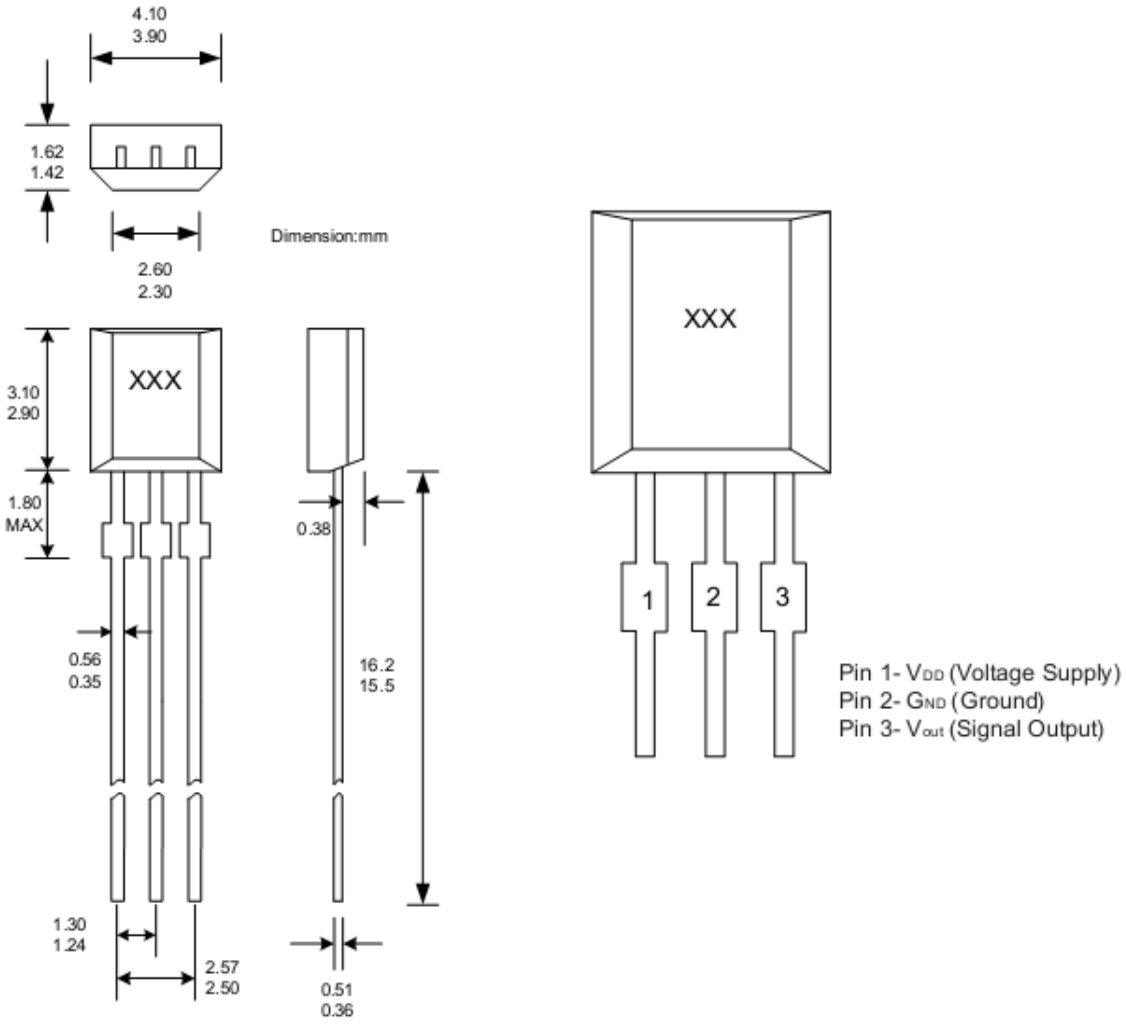
high state. The maximum air gap depends on

- 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.

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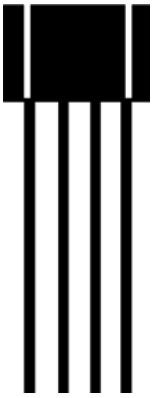
CYGTS9802 Self-Adjusting Hall Effect Gear Tooth Sensor IC with Complementary Output

The CYGTS9802 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 OUT will turn on (BOP) after the flux has reached its peak and decreased by an amount equal to the hysteresis. Similarly the OUT will turn off (BRP) after the flux has reached its minimum value and increased by an amount equal to the hysteresis. The complementary outputs (OUT and OUTB) are provided in this sensor. The OUTB will turn off after the flux has reached its peak and decreased by an amount equal to the hysteresis. Similarly the OUTB will turn on after the flux has reached its minimum value and increased by an amount equal to the hysteresis.

Features

- High sensitivity
- Complementary output signal
- True 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



SIP-4

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	1.5	3.0	4.5	mA
Power-Up State	$POS_{(OUT)}$	$V_{DD} > V_{DD(min)}$	H	H	H	
	$POS_{(OUTB)}$		L	L	L	
Supply Current	I_{DD}	V_{DD} = 4.0V to 30V	1.0	--	6.0	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_O	-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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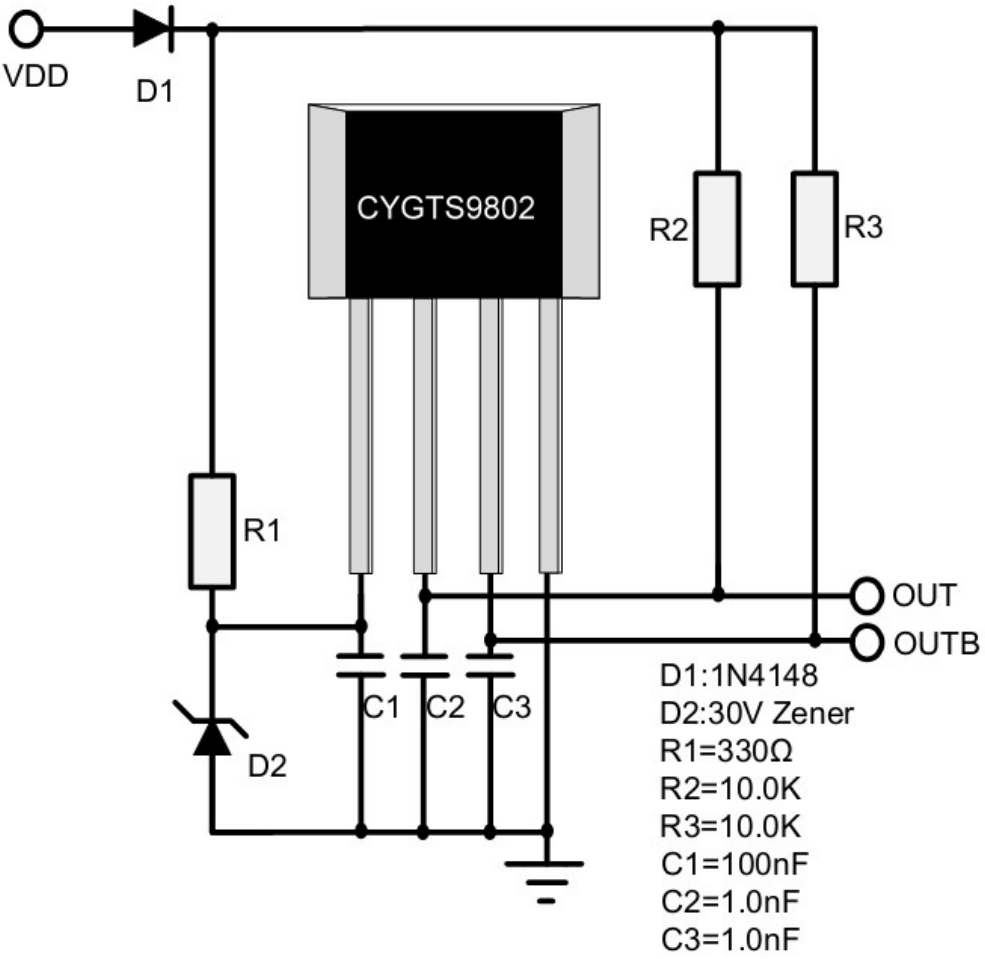
ESD (Emergency Shutdown System) Protection

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	OUT	Signal Output
3	OUTB	Complementary Signal Output
4	GND	Ground terminal

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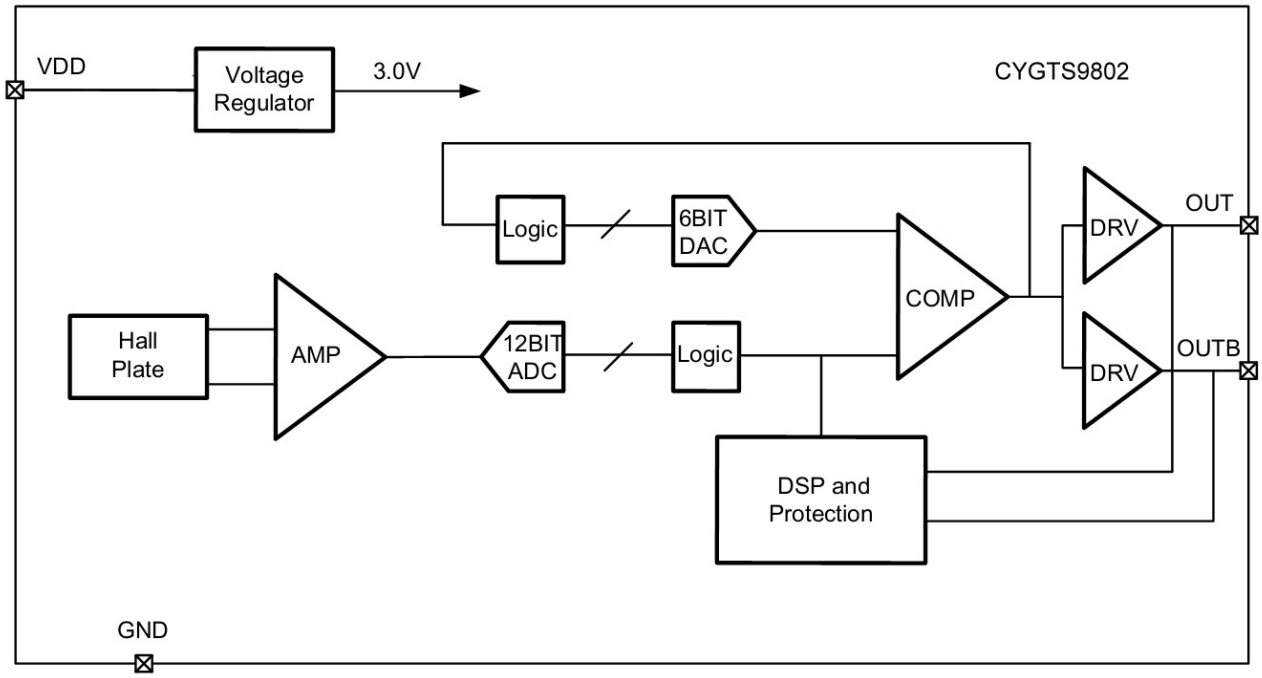
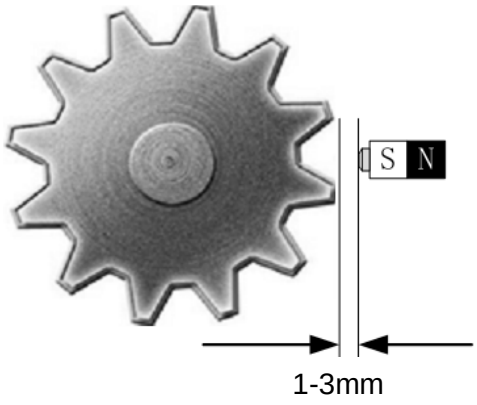
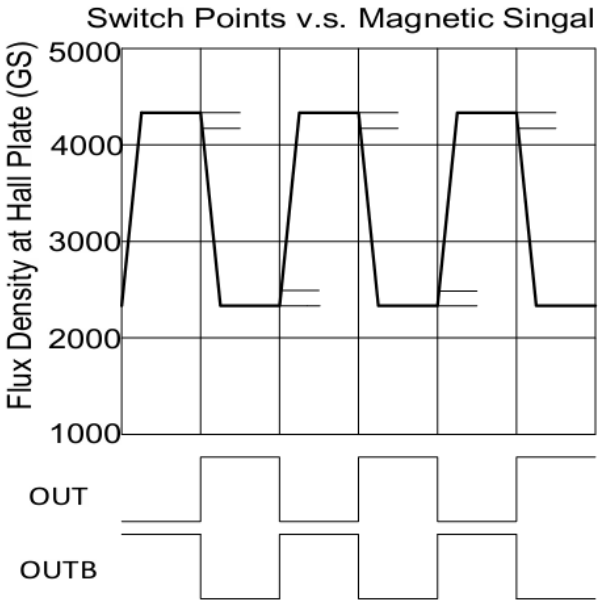
Block Diagram



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 a adhesive or suitable epoxy. The sensor CYGTS9802 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

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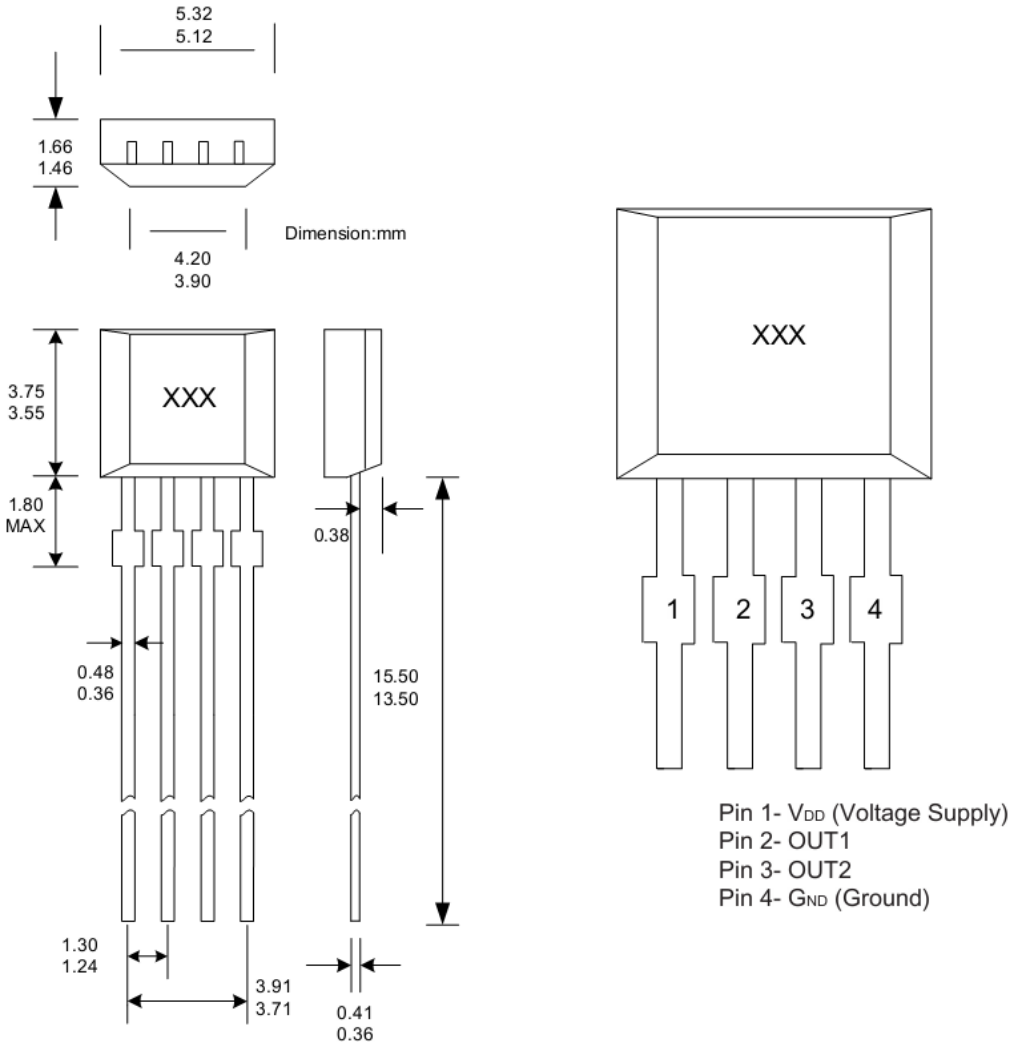
after the first min is detected. The reset state holds no information about the field. If the supply of the chip is raised slowly, the reset state is not stable; the output maybe can't set to the high state. The maximum air gap depends on

- 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.

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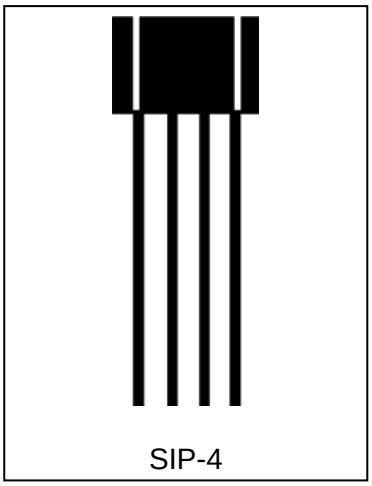
CYGTS9803 Self-Adjusting Hall Effect Gear Tooth Sensor IC with Dual-Channel Outputs

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



SIP-4

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_O	-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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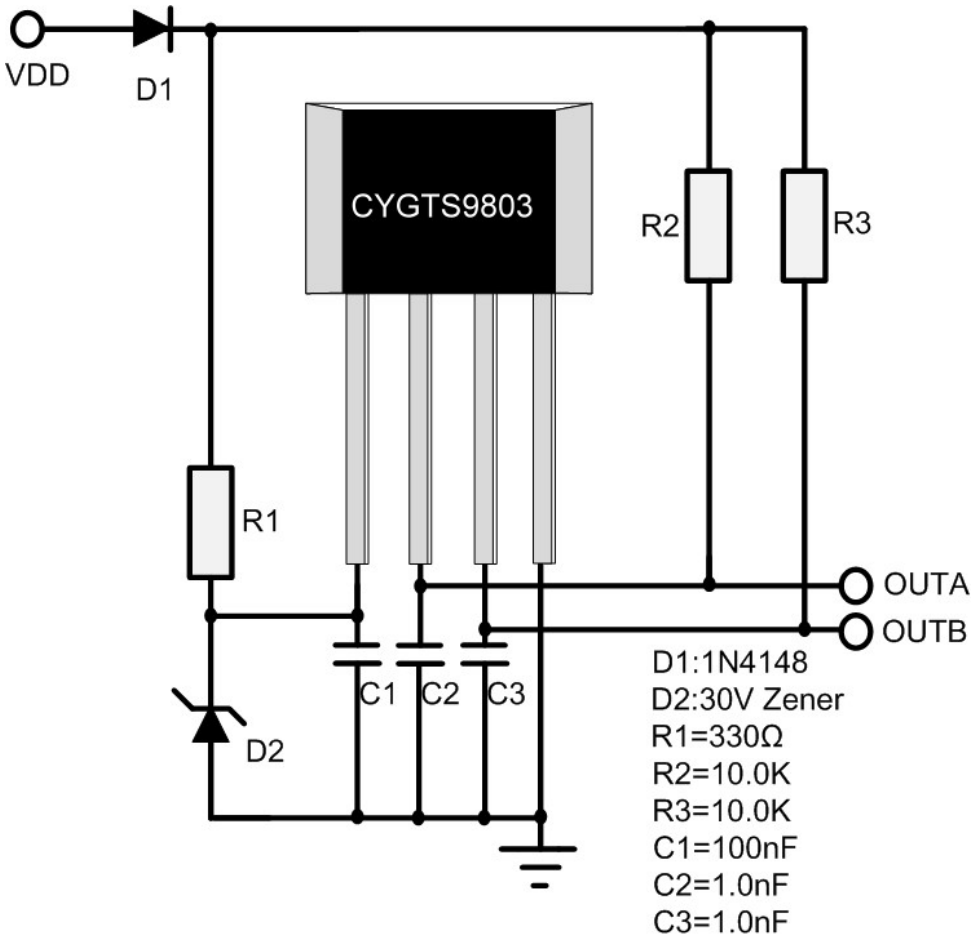
ESD (Emergency Shutdown System) Protection

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

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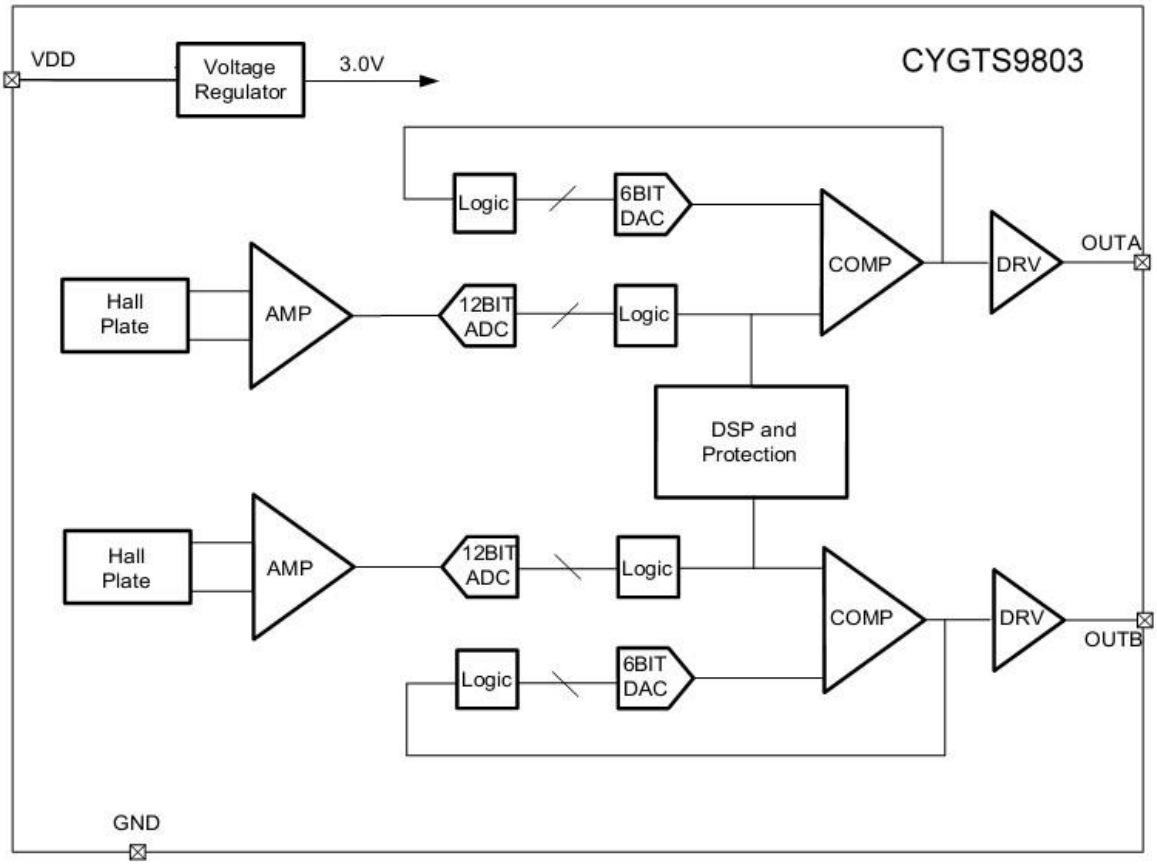
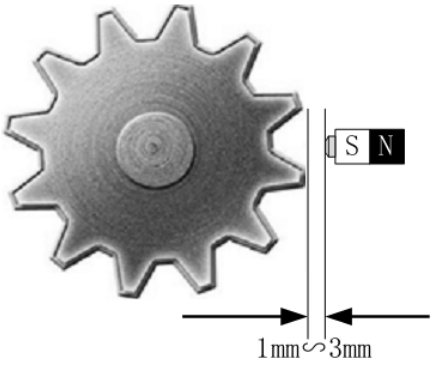
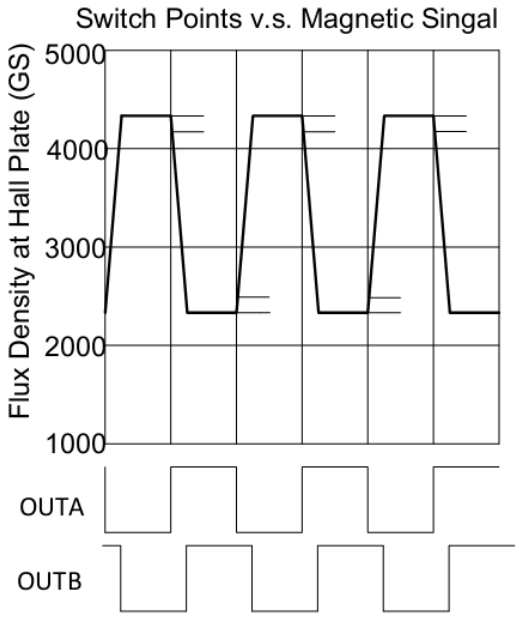
Block Diagram



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

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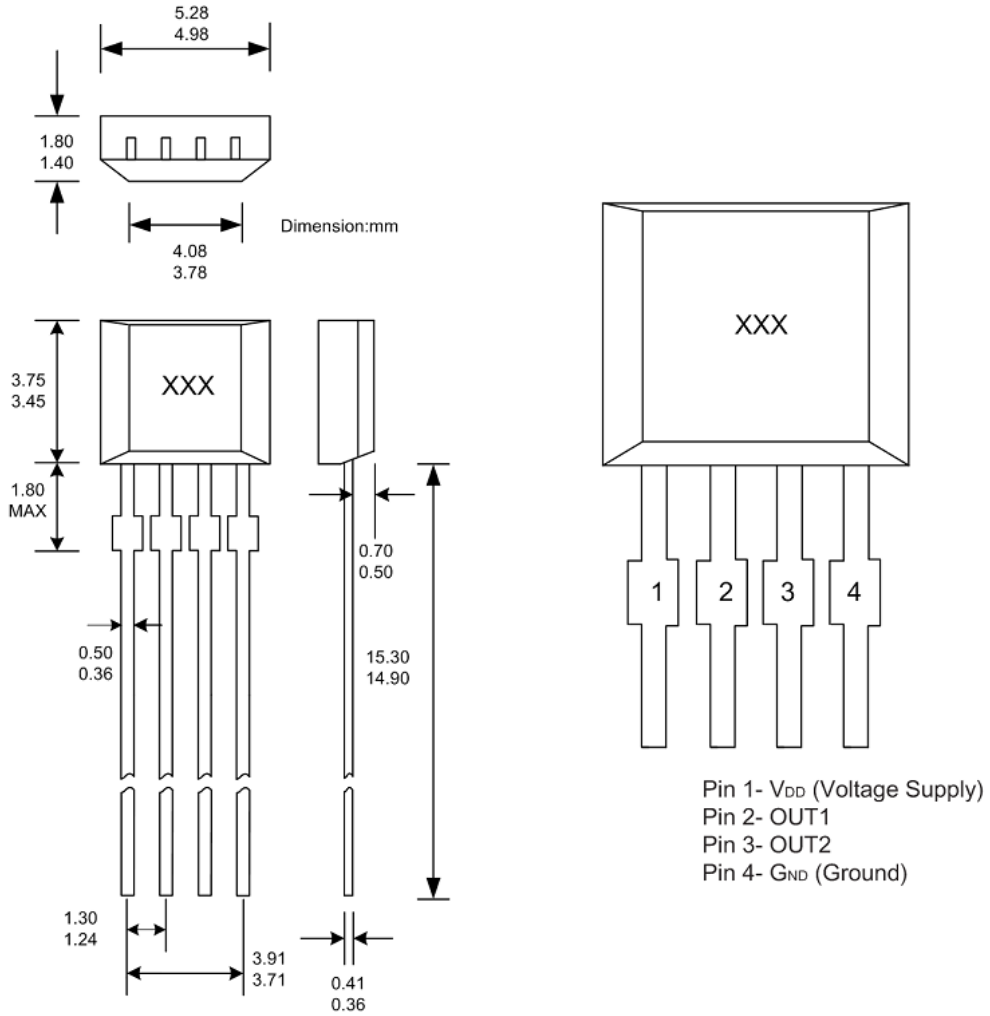
faces the unbranded side of the IC. The magnet should be glued to the back surface (non branded side) of the IC using an adhesive or suitable epoxy. The sensor SC9003 is “Self adjusting” over a wide range of back bias flux eliminating the need for any trimming in the application. At the chip power on 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.

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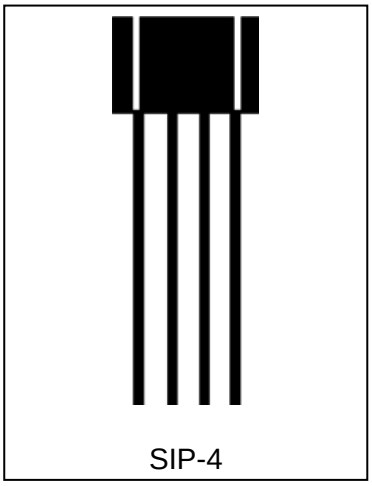
CYGTS9804 Self-Adjusting Two-Wire Hall Effect Gear Tooth Sensor IC

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



SIP-4

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_O	-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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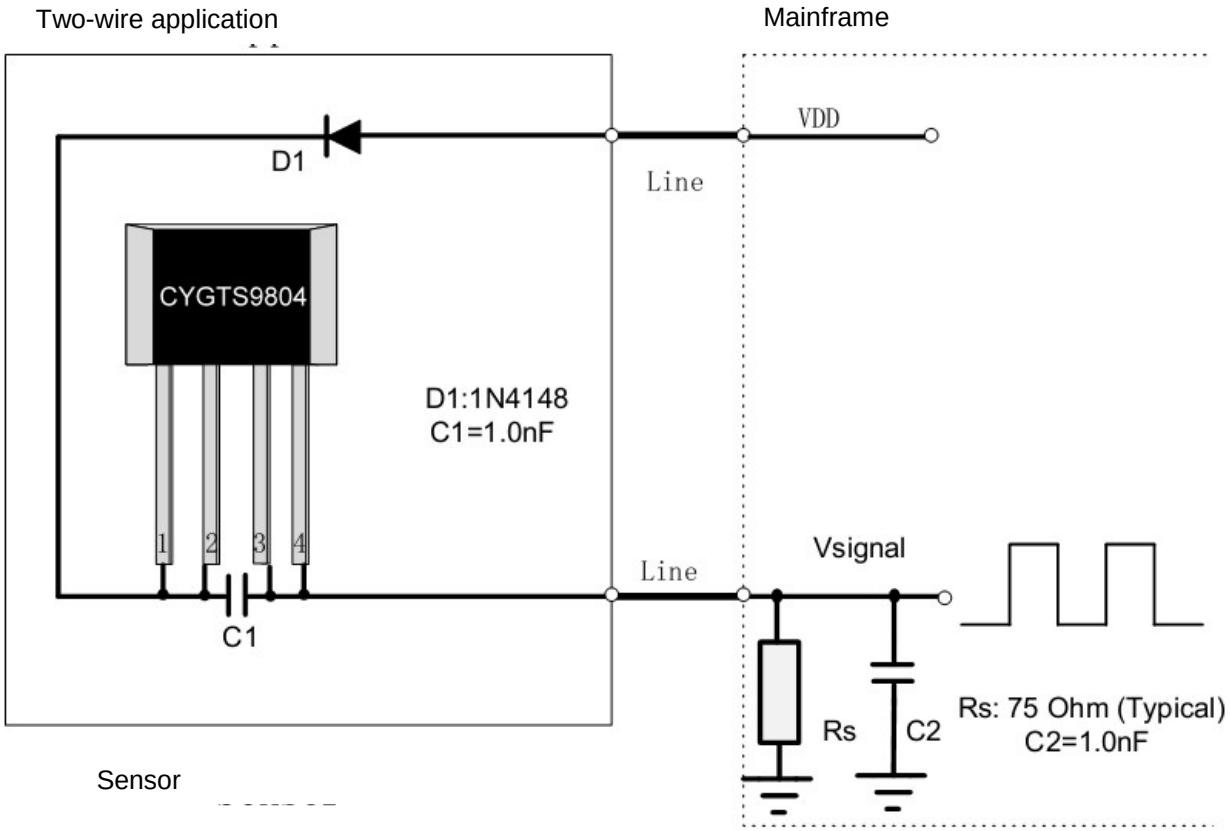
ESD Protection

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

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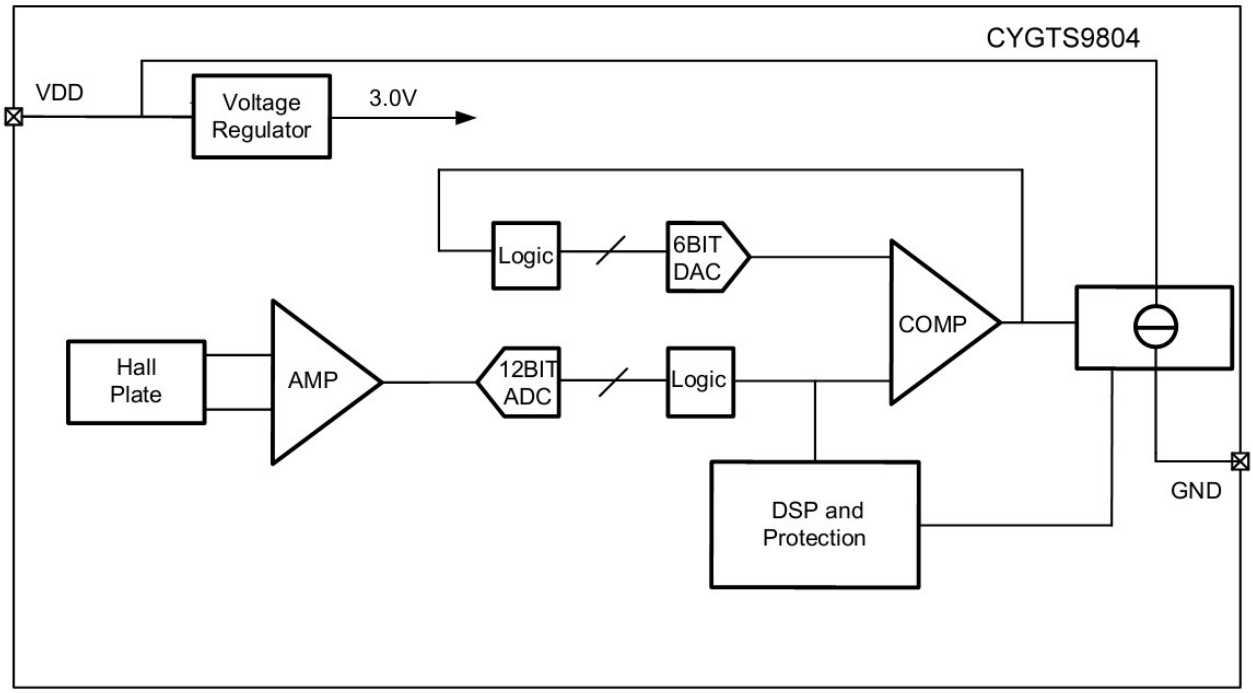
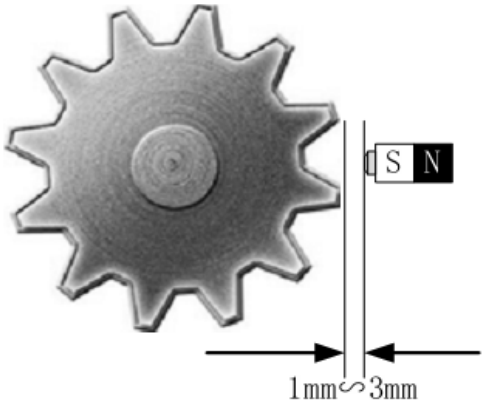
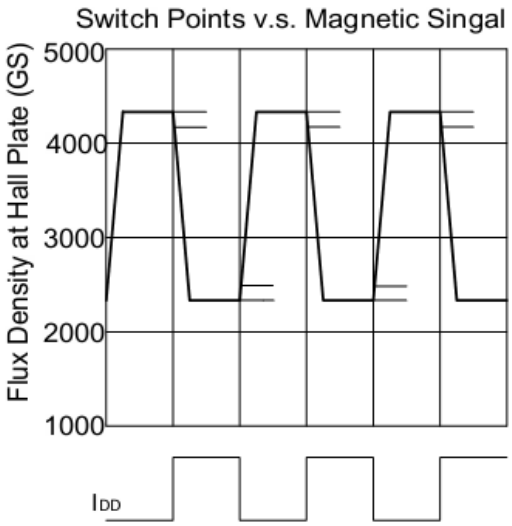
Block Diagram



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 CYGTS9804 is “Self adjusting” over a wide range of back bias flux eliminating the need for any trimming in the application. At the

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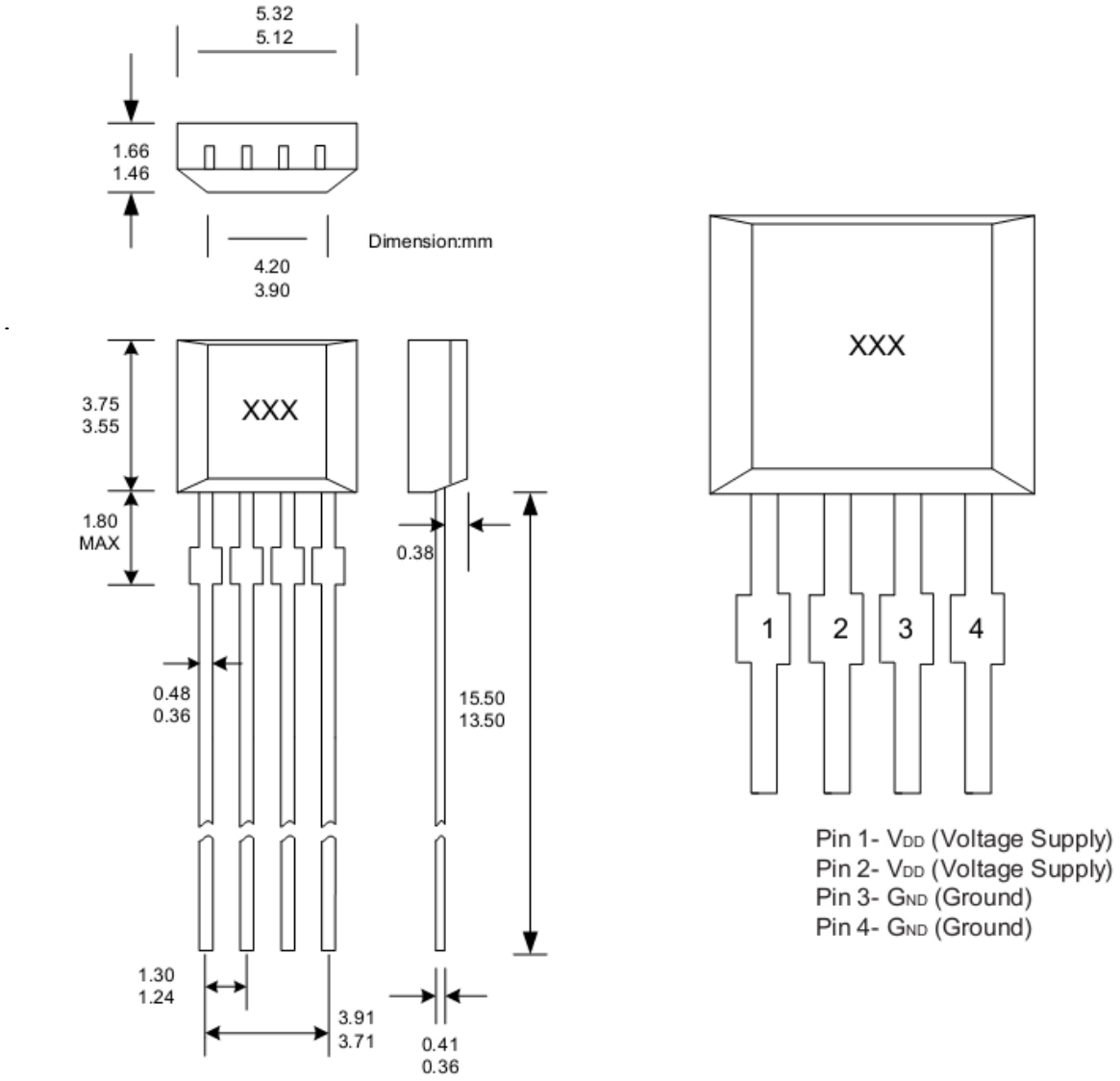
chip power on state, the output is reset to the high state whatever the field is. The output only changes after the first min is detected. The reset state holds no information about the field. If the supply of the chip is raised slowly, the reset state is not stable; the output maybe can't set to the 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



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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