

Feature

- Dual channel output
- 1.4mm hall element spacing
- Self adjust magnetic range
- Two digital output signal
- High speed operation frequency
- Zero speed detection
- No direction of rotation concern
- Short circuit protection
- RoHs Compliant 2011/65/EU

Application

- Cam shaft speed and direction sensing
- Gear tooth speed and direction sensing

Product Description

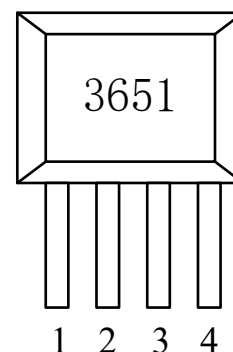
The MT3651 is gear tooth sensor IC for use in automotive camshaft sensing. MT3651 is used with a bias magnet south facing the back (no mark) side of the IC. The technology used for the IC is Hall-effect based. The Chip incorporate two hall-effect plate located 1.4mm apart an A/D converter with self-calibrates the internal gain of the device to adjust the air-gap variations. And digital sample and hold circuit, Schmitt trigger and two digital output (OUTA and OUTB) open drain output with short circuit protected for speed and direction processing.

As the gear tooth rotate, the chip samples an increasing or decreasing flux density. When the flux has reached its minimum value and increased hysteresis flux, the output will turn on (B_{OP}). When the flux has reached its maximum value and decreased hysteresis flux, the output will turn off (B_{RP}).

The MT3651 is ideal for use in gather speed, position and direction detection to those gear-tooth based configurations. Particularly suited to those applications that require accurate duty cycle or accurate edge detection, such as automotive camshaft sensing.

Pin definition

Name	Number	Description
V_{DD}	1	Power Supply
OUTA	2	Signal A Output
OUTB	3	Signal B Output
GND	4	Ground

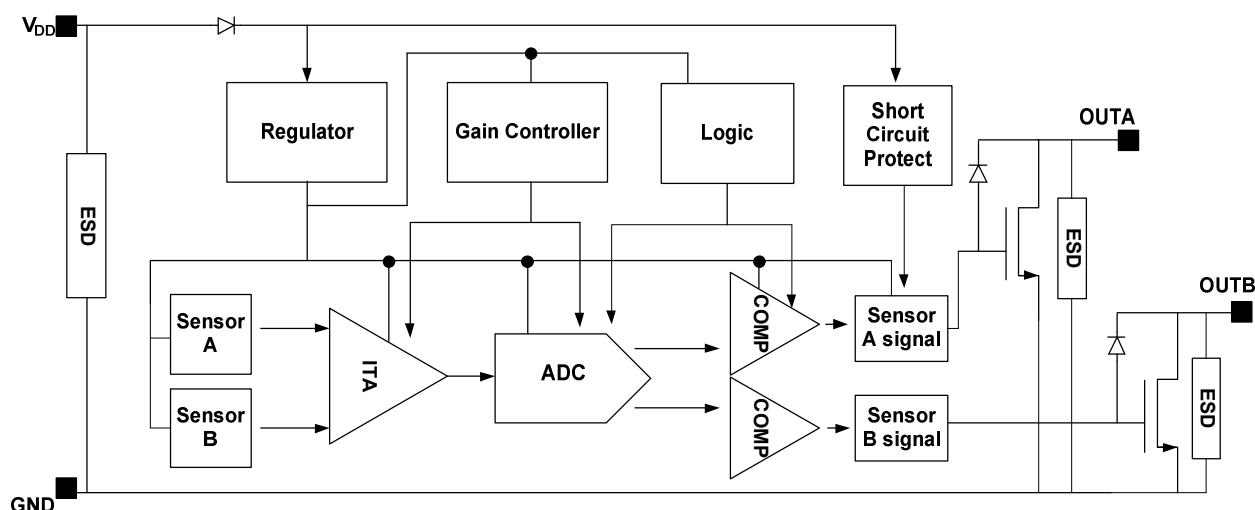


Family members

Part Number	Description
MT3651A	Flat TO-94 package ,bulk packaging(1000pcs/bag)

The MT3651 is provided in a 4-pin Flat TO-94 that is Pb(lead) free with 100% matt tin plated leadframe

Block Diagram



Electrical and Magnetic Characteristics

Absolute Maximum Rating

Absolute maximum ratings are limiting values to be applied individually, and beyond which the serviceability of the circuit may be impaired. Functional operability is not necessarily implied. Exposure to absolute maximum rating conditions for an extended period of time may affect device reliability.

Absolute maximum ratings: all voltages listed are referenced to GND

Symbol	Parameters	Min	Max	Unit
V_{DD}	Supply Voltage	-0.5	28	V
I_{OUT}	Continuous Output Current	--	40	mA
V_{OUT}	Output voltage	-0.5	28	V
T_A	Operating Temperature Range	-40	+150	°C
T_S	Storage Temperature Range	-65	+170	°C

Magnetic Characteristics

At $T_A = -40^{\circ}\text{C}$ to 150°C , $V_{DD} = 4.0\text{V}$ to 24V (Unless other specified)

Symbol	Parameters	Test Conditions	Min	Typ	Max	Units
B_{BIAS}	Back bias range		10	--	500	mT
B_{LIN}	Linear region		50	--	400	mT
B_{HYST}	Hysteresis window		2	4	6	mT

Note: 1mT=10Gauss.

Electrical CharacteristicsAt $T_A = -40^{\circ}\text{C}$ to 150°C , $V_{DD} = 4.0\text{V}$ to 24V (Unless other specified)

Symbol	Parameters	Test Conditions	Min	Typ	Max	Units
V_{DD}	Supply voltage		4.0	--	24	V
I_{DD}	Supply current	$V_{DD} = 12\text{V}$	6.0	7.0	9.0	mA
V_{SON}	Output saturation voltage	$I_{OUT} = 25\text{mA}$	--	--	0.4	V
I_{OFF}	Output leakage current	$V_{OUT} = 24\text{V}$	--	--	10	μA
T_R	Output rise time	$V_{DD} = 12\text{V}, R_L = 1\text{Kohm}, C_L = 20\text{pF}$	--	--	1.5	μs
T_F	Output rise time	$V_{DD} = 12\text{V}, R_L = 1\text{Kohm}, C_L = 20\text{pF}$	--	--	1.5	μs
F_{SW}	Maximum switching frequency		15	--	--	KHz
I_{SH}	Output short circuit current		50	100	150	mA
T_{SH}	Output short circuit shutdown		10	-	20	μs
D_{IS}	Distance of hall elements		1.39	1.4	1.41	mm
T_{SH}	Output short circuit shutdown		50	100	150	μs
RTH	TO-92 package thermal resistance		--	230	--	$^{\circ}\text{C/W}$
PUS	Power up state	$V_{DD} > 4.0\text{V}$	$V_{OUTA} = V_{OUTB} = \text{High level}$			

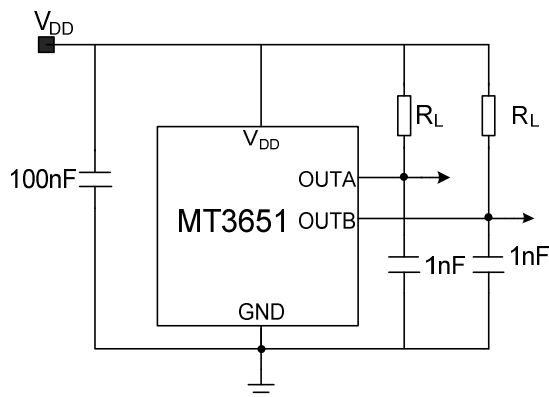
Device Evaluation Standard: EMC (Electromagnetic Compatibility)

Test name	Reference Specification
ESD-Human Body Model	JEDEC EIA /JESD22-A114F
ESD-Machine Model	JEDEC EIA /JESD22-A115
Conducted Transients	ISO 7637-1
Direct RF Injection	ISO11452-7
TEM Cell	ISO11452-3

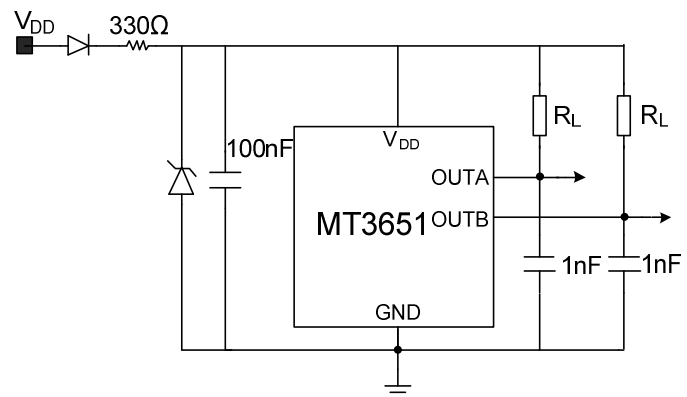
Application Information

Application Circuit

Note: R_L recommend 1Kohm to 10Kohm

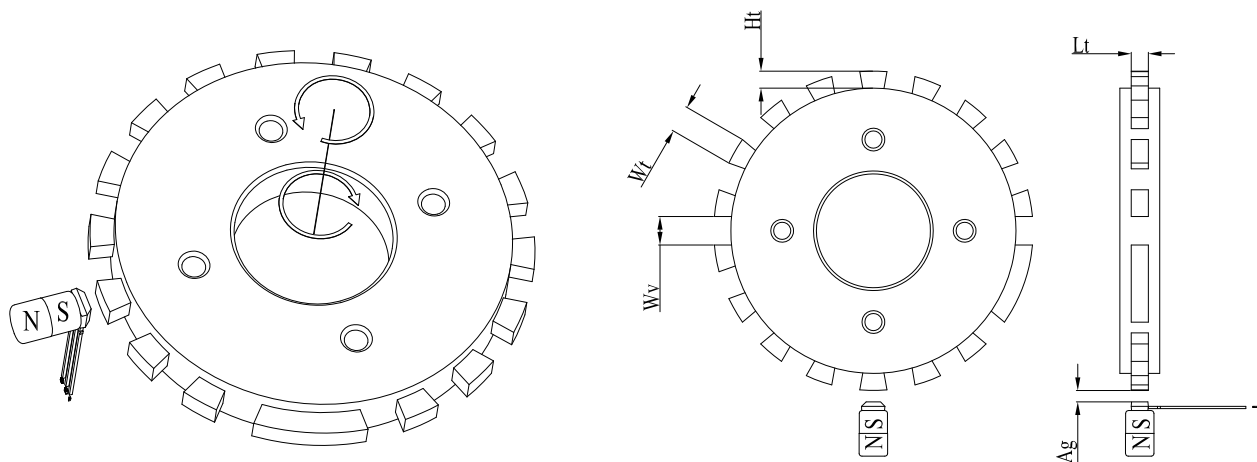


Typical application



Harsh, noisy environments and automotive application

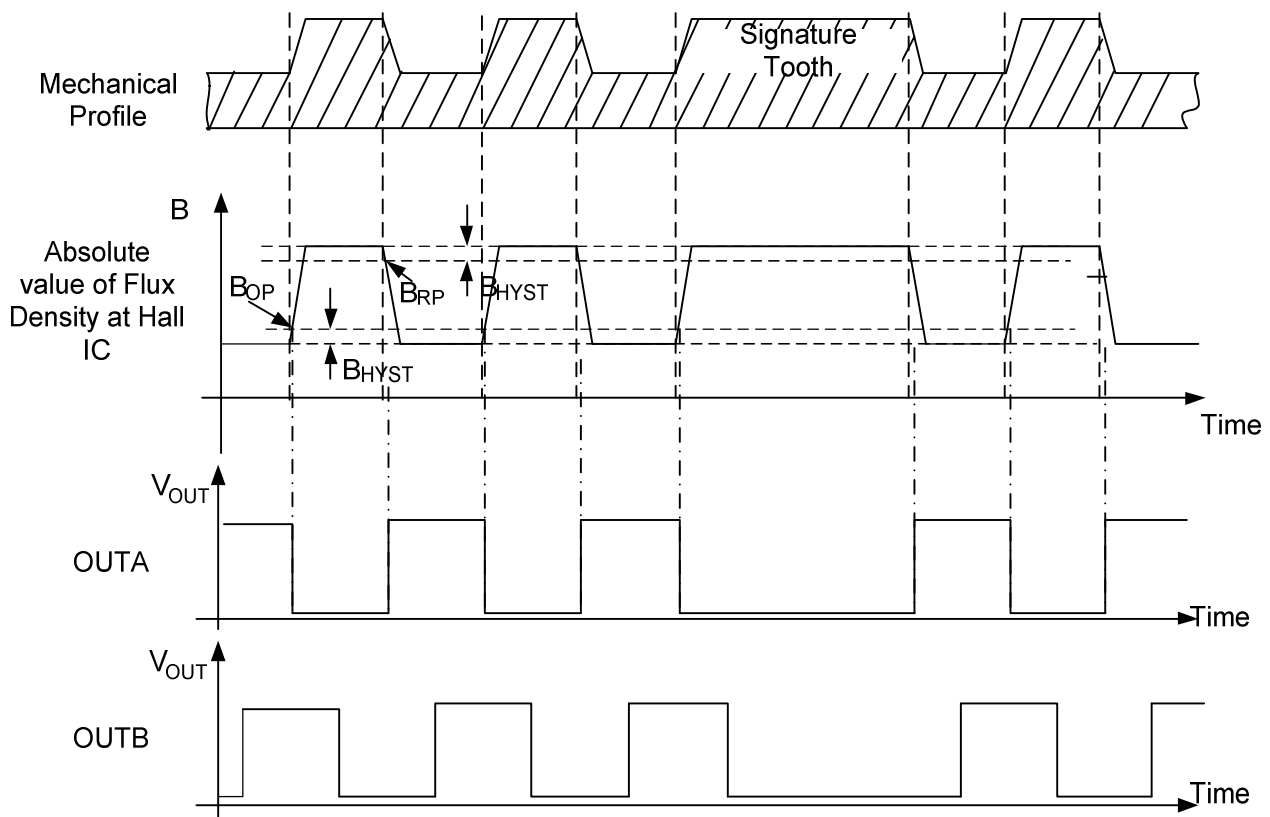
Configuration with Radial-Tooth



For the generation of adequate magnetic field level, the following recommendations should be followed in the design and specification of targets:

Symbol	Parameters	Min	Typ	Max	Units
AG	Distance of air gap	0.5	--	2.5	mm
H_T	Height of tooth	3.0	--	--	mm
L_T	Length of tooth	3.0	--	--	mm
W_T	Width of tooth	2.0	--	--	mm
W_V	Width of valley	2.0	--	--	mm
Material	Low carbon steel				

Operating Waveform



B_{OP} : Operate point, switches the output ON (V_{OUT} =Low)

B_{RP} : Release point, switches the output OFF (V_{OUT} =High)

Application Note:

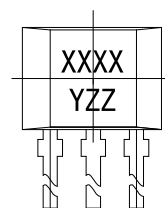
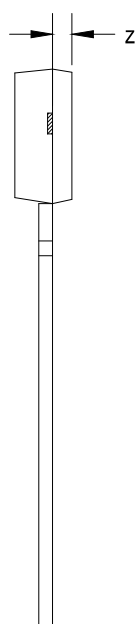
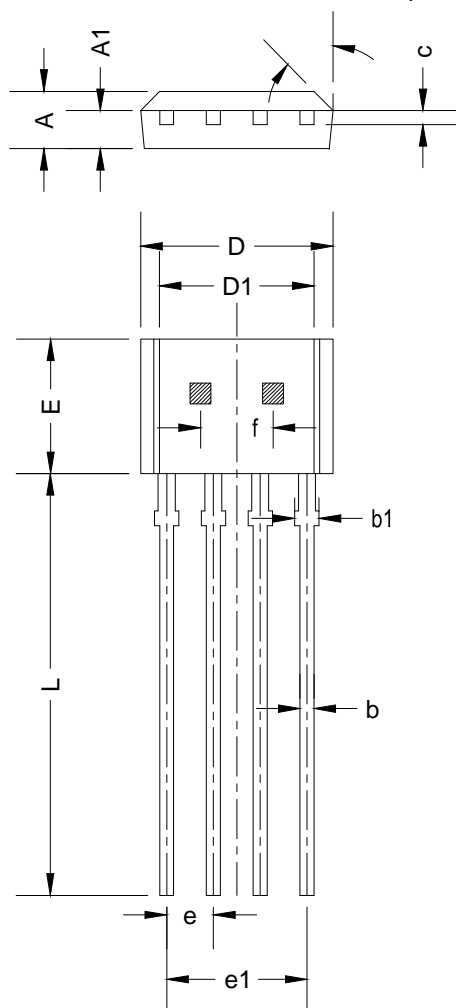
Maximum dynamic range is 500 mT, linear dynamic range is 400mT. The hysteresis is fixed at 4mT. When the magnetic loop provides peak magnetic flux at the chip near the high end of the linear range of 400mT, best angular accuracy will be get.

The output is reset to the high level (output driver is off) at chip power on whatever the magnetic field is. The output only changes after the first min is detected.

If the power supply of the chip is raised slowly, the reset state will be not stable,

The bias magnet must be glued to the back surface (unbranded side) of the IC, the south pole face the unbranded side of the device.

PACKAGE DESIGNATOR (MT3651A) Flat TO-94



XXXX Product ID
 YZZ DateCode: Y ZZ
 year week
 (0~9) (01~55)

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	1.420	1.660	0.056	0.065
A1	0.660	0.860	0.026	0.034
b	0.350	0.480	0.014	0.019
b1	0.400	0.650	0.016	0.026
c	0.360	0.510	0.014	0.020
D	5.100	5.320	0.201	0.210
D1	4.100	4.300	0.161	0.169
E	3.550	3.750	0.140	0.147
e	1.267	1.273	0.050	0.050
e1	3.780	3.840	0.149	0.151
L	13.500	15.500	0.531	0.610
f	1.390	1.410	0.055	0.056
z	0.500TYP		0.020TYP	
θ	10°	12°	10°	12°