
IST8508

3D Micro Power Omnipolar AMR/Hall-effect Sensor Switch

Datasheet

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1. General Description

The IST8508 is a 3D omni-polar magnetic switch featuring low hysteresis, low power consumption, and adjustable magnetic operating points that can be as low as 15 G. The IST8508 sensor IC is fabricated with mixed-signal CMOS technology. It comprises one AMR sensor, Hall plates, and a CMOS output driver, mainly designed for battery operated applications (such as cellular and cordless phones, PAD). The average operation current is typically 5.7 μ A under a 3.3 V supply.

A sufficient magnetic field intensity triggers the switch (low output voltage). When the magnetic field is eliminated, the switch is turned off (high output voltage). When IST8508 is subjected to a magnetic field B with an absolute value higher than the best operating point (BOP), the output voltage decreases. Otherwise, when B's absolute value is less than the release point (BRP), the output voltage increases.

The IST8508 is available in a SOT23-3L package. The operating temperature range of the iST8508 is from -40 °C to 85 °C.

To minimize the BOM cost, capacitors of the MLCC type are supported, and the application circuit only needs one external component to complete.

Features

- Omni-polar (operating with the magnetic field of either north or south pole)
- Micro power consumption ideal for battery-powered applications
- Input voltage range: 2.5 V to 5.5 V
- Push-pull or open drain output available
- Inverting output mode available
- Chopper stabilized amplifiers
- High sensitivity of Hall/AMR sensor
- SOT23-3L package

Applications

Solid-state switch

Flow sensing in the water meter

Lid/door/position detection

Tamper detection for electricity meter

Contact-less switch for consumer products

Proximity sensor for reed switch replacement

Cellphone, laptop, and other flip cover or slide devices

2. Pin Configuration, Application Circuit, Block Diagram, and Package

Dimension

SOT23-3L(Top View)

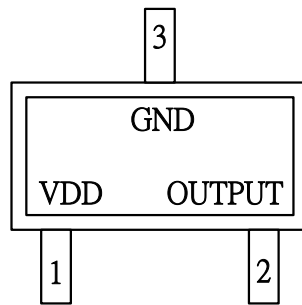


Figure 1. Pin configuration

2.1. Pin Configuration

Pin Name	Pin No.	Pin Function
VDD	1	Power Supply Input
GND	3	Ground
OUTPUT	2	Output Pin

2.2. Application Circuit

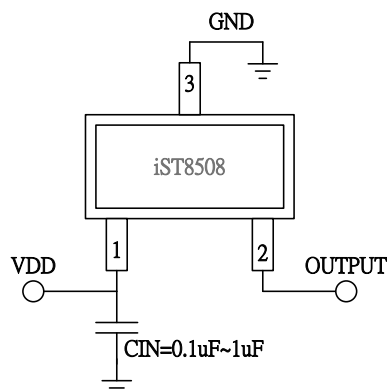


Figure 2. Application circuit

2.3. Block Diagram

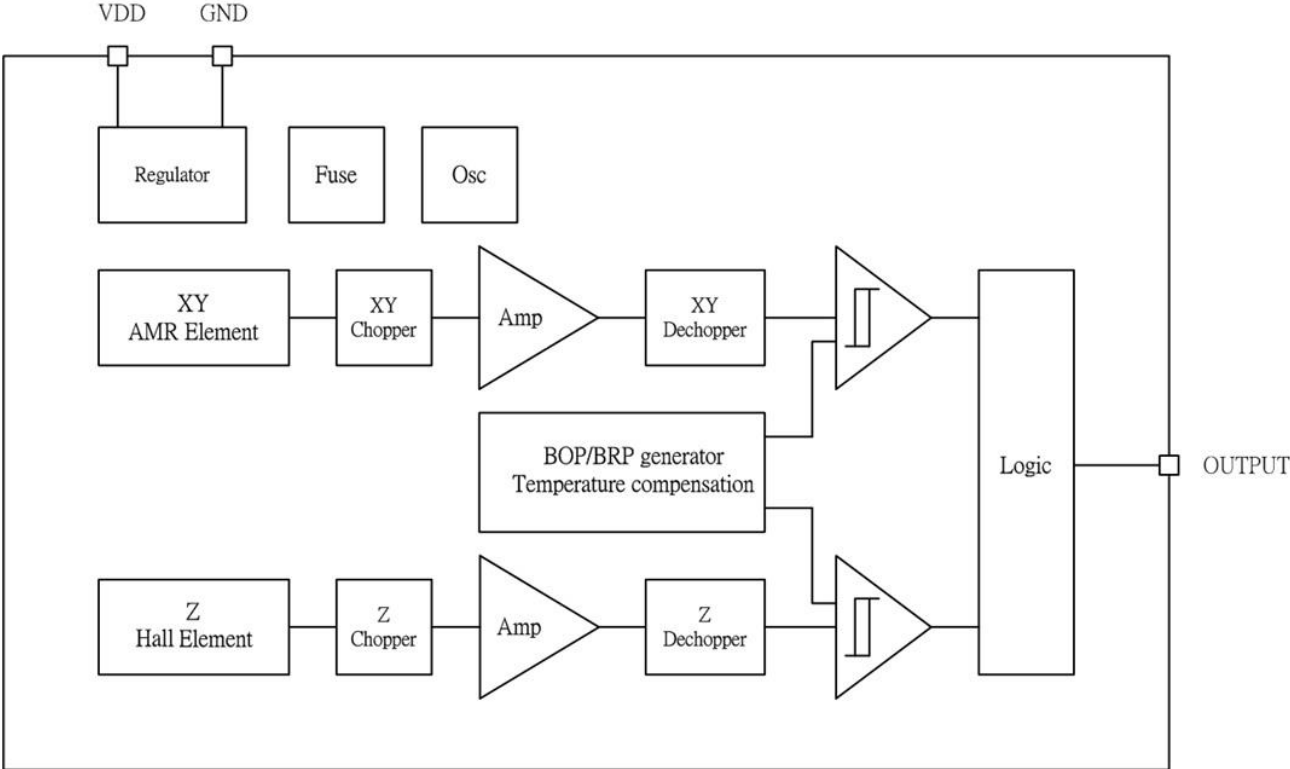


Figure 3. Block Diagram.

2.4. Package Dimensions and Pin Description (SOT23-3L)

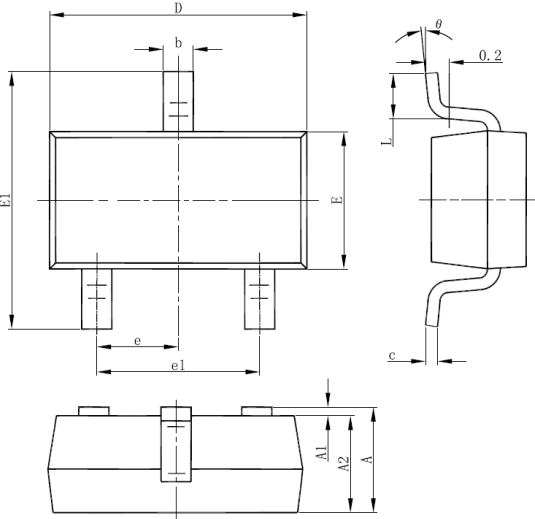


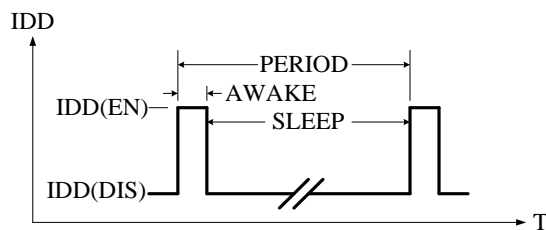
Figure 4. Package Dimensions

Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	1.050	1.15	1.250	0.041	0.045	0.049
A1	0.000	0.050	0.100	0.000	0.002	0.004
A2	1.050	1.100	1.150	0.041	0.043	0.045
b	0.300	0.400	0.500	0.012	0.016	0.020
c	0.100	0.150	0.200	0.004	0.006	0.008
D	2.820	2.920	3.020	0.111	0.115	0.119
E	1.500	1.600	1.700	0.059	0.063	0.067
E1	2.650	2.800	2.950	0.104	0.110	0.116
e1	1.800	1.900	2.000	0.071	0.075	0.079
e	0.950 REF			0.037 REF		
L	0.300	0.450	0.600	0.012	0.018	0.024
θ	0°	4°	8°	0°	4°	8°

3. Functional Descriptions

3.1. Low Average Power

The timing circuitry activates the signal processing circuits for 140 μ s in every 100 ms period and puts the sensor to sleep for the remainder of each period. A short "awake" time allows sensors and signal processing circuits to stabilize prior to the data latching on the falling edge of the timing pulse. The output during the "sleep" time is latched in the latest sampled state.



3.2. Chopper-Stabilization Technique

A chopper-stabilization technique is applied to dynamically remove offset voltages caused by amplifiers and the Hall sensor. When used together with a trimming process, this chopper-stabilization technique produces stable and accurate output voltages for both the AMR sensor and the Hall sensor. This results in the symmetry of the BOP and BRP across temperature and process variations.

3.3. Magnetic Field Detection Mechanism

The IST8508 is capable of detecting magnetic fields in perpendicular and lateral directions. The

AMR sensor detects the magnetic field along the X and Y axes, i.e. the in-plane lateral directions. The Hall sensor is capable of measuring the magnetic field along the Z axis, which is perpendicular to the IC's plane.

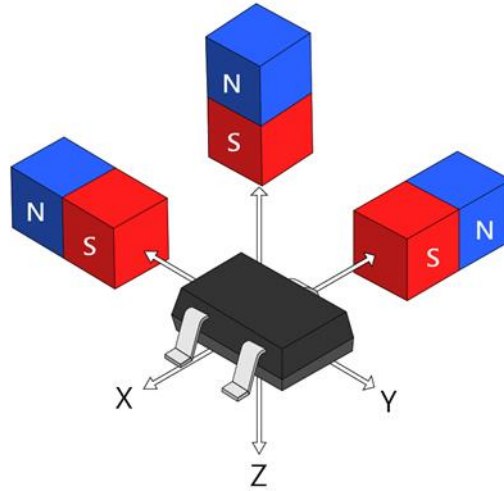


Figure 5. Magnetic field direction

3.4. Operation

The IST8508 is programmable to respond just to a B-field on selected axes — X only, Y only, Z only, X and Y, X and Z, Y and Z, or XYZ all-axes.

The AMR sensor responds to the B field in the XY plane. This response is independent of the B field on the Z axis, to which the Hall sensor responds. If XYZ all-axes mode is selected, the responses from the Hall and AMR sensors are separately digitized into single-bit binary signals, which are then logically ORed together to produce the final output logic level.

The AMR sensor characteristic is affected by field projections on both the X and Y axes simultaneously. The specifications in 4.4. are assuming that the B field aligns either with the X axis or Y axis. The B field projection on X axis reduces sensitivity to B field on Y axis and vice versa.

3.5. Programmability:

For IST8508, besides the axes setting, other parameters of the device can also be permanently programmed, such as the output data rate (ODR), the operate points and release points, the temperature compensation codes, and output modes such as push-pull or open-drain.

4. Electrical Specifications

4.1. Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
VDD to GND	V_{DD}	-0.3 to 6	V
Magnetic Flux Density	B	Unlimited	
Storage Temperature Range	T_S	-55 to +150	°C
Operating Junction Temperature Range	T_J	-40 to 150	°C
Package Power Dissipation	SOT23-3L PD	180	mW

4.2. Recommended Operating Conditions

Parameter	Symbol	Conditions	Rating	Unit
Supply Voltage	V_{DD}	Operating	2.5 ~ 5.5	V
Operating Temperature Range	T_A	Operating	-40 ~ +85	°C

4.3. Electrical Specifications

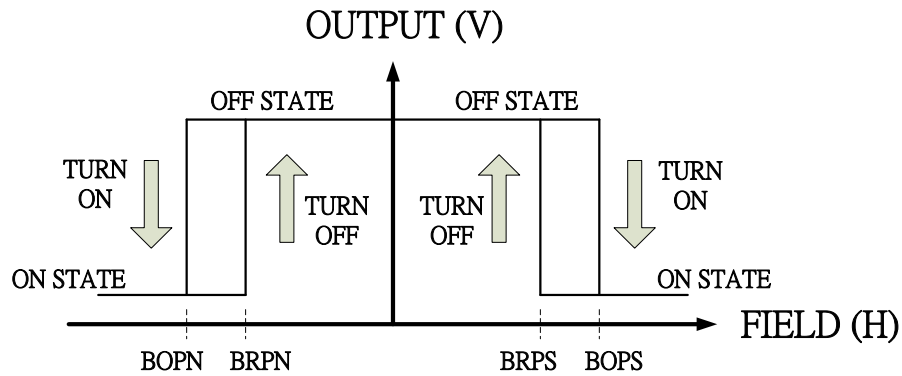
(Unless otherwise noted, typical values are at $T_A = 25\text{ }^\circ\text{C}$, $V_{DD} = 3\text{ V}$)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{OH}	Output Off Voltage (High side)	$I_{OUT} = +1\text{ mA}$	$V_{DD} - 0.3$	$V_{DD} - 0.1$	$V_{DD} + 0.3$	V
V_{OL}	Output Off Voltage (Low side)	$I_{OUT} = -1\text{ mA}$	-0.3	0.1	+0.3	V
I_{OFF}	Output Leakage Current	$V_{OUT} = 4.5\text{ V}$, Output off	-	< 0.1	1.0	uA
$I_{DD}(EN)$	Supply Current (ODR = 10 Hz)	Chip enabled, $T_A = 25\text{ }^\circ\text{C}$, $V_{DD} = 3.3\text{ V}$	-	2.5	3	mA
$I_{DD}(EN)$		Chip enabled, $T_A = -40 \sim 85\text{ }^\circ\text{C}$, $V_{DD} = 2.5 \sim 5.5\text{ V}$	-	2.5	3	mA
$I_{DD}(DIS)$		Chip disable, $T_A = 25\text{ }^\circ\text{C}$, $V_{DD} = 3.3\text{ V}$	-	2.0	2.5	uA
$I_{DD}(DIS)$		Chip disable, $T_A = -40 \sim 85\text{ }^\circ\text{C}$, $V_{DD} = 2.5 \sim 5.5\text{ V}$	-	2.0	9.0	uA
$I_{DD}(AVG)$		Average supply current, $T_A = 25\text{ }^\circ\text{C}$, $V_{DD} = 3.3\text{ V}$	-	5.7	7	uA
$I_{DD}(AVG)$		Average supply current, $T_A = -40 \sim 85\text{ }^\circ\text{C}$, $V_{DD} = 2.5 \sim 5.5\text{ V}$	-	5.7	12	uA

$I_{DD(NS)}$	Supply Current (No Sleep) (ODR = 7 kHz, BW = 2 kHz)	$T_A = 25\text{ }^\circ\text{C}$, $V_{DD} = 3.3\text{ V}$	-	2.5	-	mA
T_{awake}	Awake Time	-	-	140	200	us
T_{period}	Period	-	-	100	150	ms
D.C.	Duty Cycle	-	-	0.14	-	%

4.4. Magnetic Specifications of XY axis

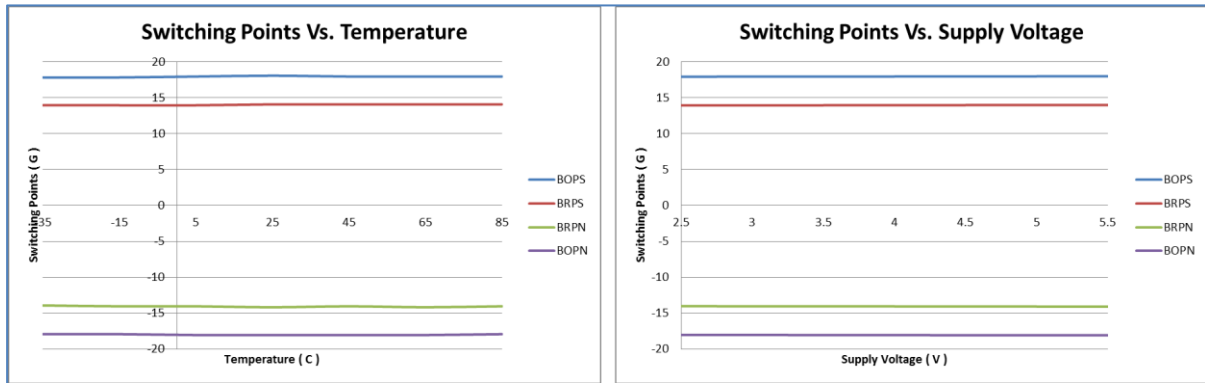
Symbol	Parameter	Min.	Typ.	Max.	Unit
BOPS	Operate Point	13	18	35	Gauss
BOPN		-35	-18	-13	
BRPS	Release Point	8	14	23	
BRPN		-23	-14	-8	
BHY	Hysteresis	-	4	-	



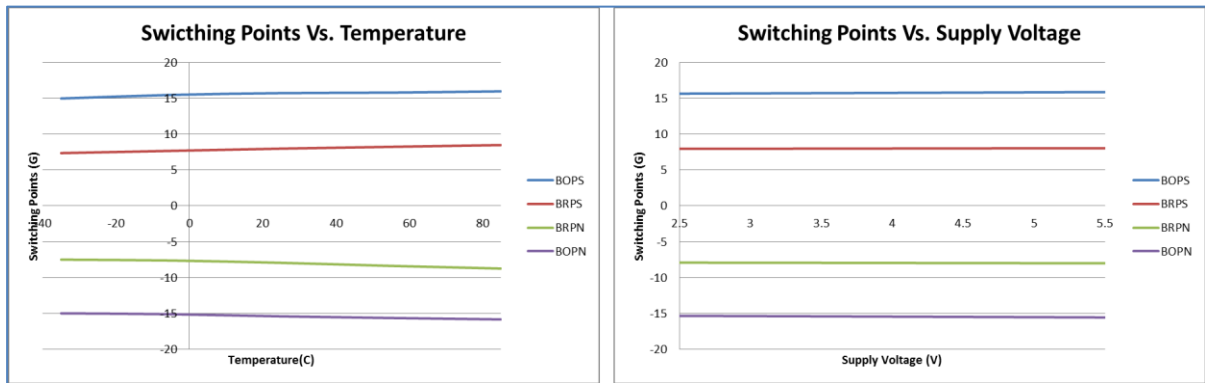
4.5. Magnetic Specifications of Z axis

Symbol	Parameter	Min.	Typ.	Max.	Unit
BOPS (south pole to brand side)	Operate Point	13	16	28	Gauss
BOPN (north pole to brand side)		-28	-16	-13	
BRPS (south pole to brand side)	Release Point	8	12	18	
BRPN (north pole to brand side)		-18	-12	-8	
BHY ((BOPX-BRPX))	Hysteresis	-	4	-	

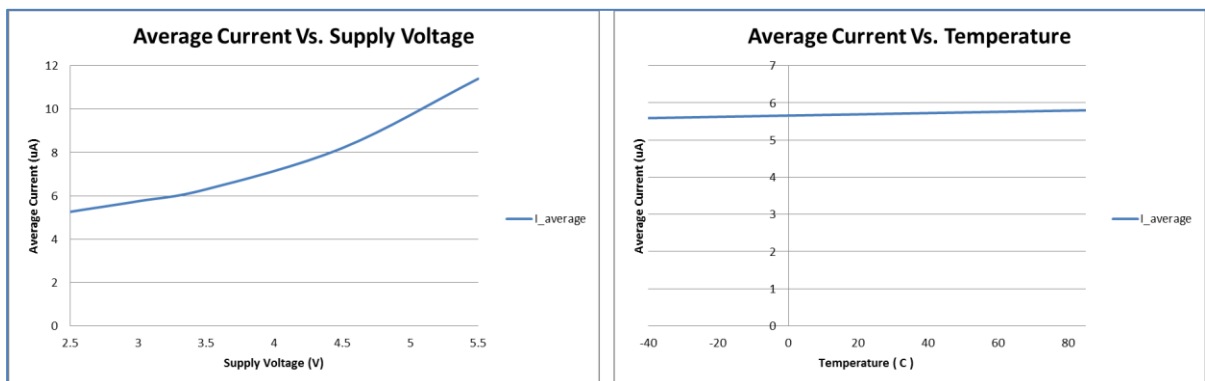
4.6. Typical Characteristics of XY Axes



4.7. Typical Characteristics of Z Axis

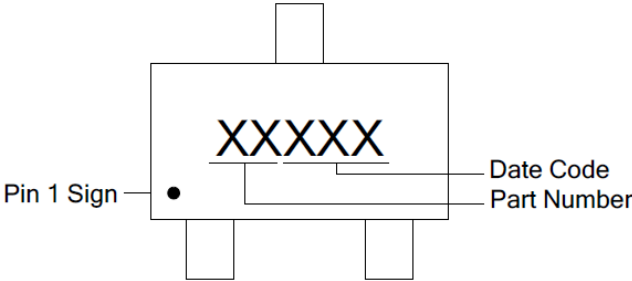


4.8. Typical Characteristics of Average Current

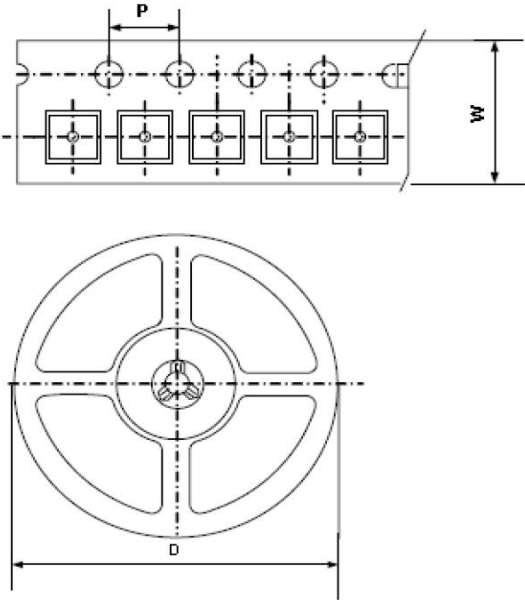


5. Marking Information

SOT23-3L



6. Packing Information



Package Type	Carrier Width (W)	Pitch (P)	Reel Size (D)	Packaging Minimum
SOT23-3L	8.0 ± 0.1 mm	4.0 ± 0.1 mm	180 ± 1 mm	Tape and Reel: 3k pcs per reel

Note: Carrier Tape Dimension, Reel Size and Packing Minimum.

7. Ordering Information

Part Number	Package Type	Packing Quantity	B _{OPS} (Gauss)	B _{RPS} (Gauss)	Temp. (°C)	Eco Plan	Lead
IST8508	SOT23-3L	7-in reel 3000 pcs/reel	±15 ~ ±28	±8 ~ ±18	-40 ~ 85	Green	Cu

For more information on iSentek’s Magnetic Sensors, please contact +86-156-22888- 337 (China) or +886-2-2698-3306 ext: 111 (Taiwan); via e-mail: sales@isentek.com or visit us online at www.isentek.com.

US Patent 9297863, Taiwan Patents I437249, I420128, I463160, and I710215 apply to our magnetic sensor technology described.

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