IST8310
3D Magnetometer

Brief Datasheet

Table of Contents

1 General Description

iSentek IST8310 is a 3-axis digital magnetometer with 3.0x3.0x1.0mm^3, 16-pin LGA package. It is an integrated chip with 3-axis magnetic sensors, digital control logic, built-in temperature compensation circuit and self-test function. IST8310 provides an I^{2}C digital output with fast mode up to 400kHz. The high output data rate, ultra-low hysteresis, excellent temperature drift and low noise performance features make it a perfect candidate for high accuracy applications.

Features

- Single chip 3-axis magnetic sensor
- 3.0x3.0x1.0mm^3, 16-pin LGA package
- I^{2}C slave, Fast Mode up to 400kHz
- 14 or 16 bits adjustable data output
- Wide dynamic range of ±1600uT (x, y-axis) and ±2500uT (z-axis)
- High output data rate of maximum 200Hz
- High sensitivity of maximum 1320 LSB/Gauss.
- Ultra-low hysteresis (<0.1%FS)
- Ultra-low sensitivity temperature drift (±0.016 %/ ^{o}C)
- Ultra-low offset temperature drift (0.024uT/ ^{o}C)
- Wide operating temperature range (-40 ~ 85 ^{o}C)
- High precision temperature compensation
- Built-in self-test function
- Software and algorithm support available (For tilt compensation, cross-axis compensation, soft/hard-iron calibration and noise suppression)

Applications

Quadcopter/Drone Applications
Augmented Reality Applications
Virtual Reality Applications
Location Based Services
Navigation Applications
Industrial Applications
Magnetometry
IOT devices
Heading
Gaming

2 Block Diagram, Package Dimension and Application Circuit

2.1 Block diagram

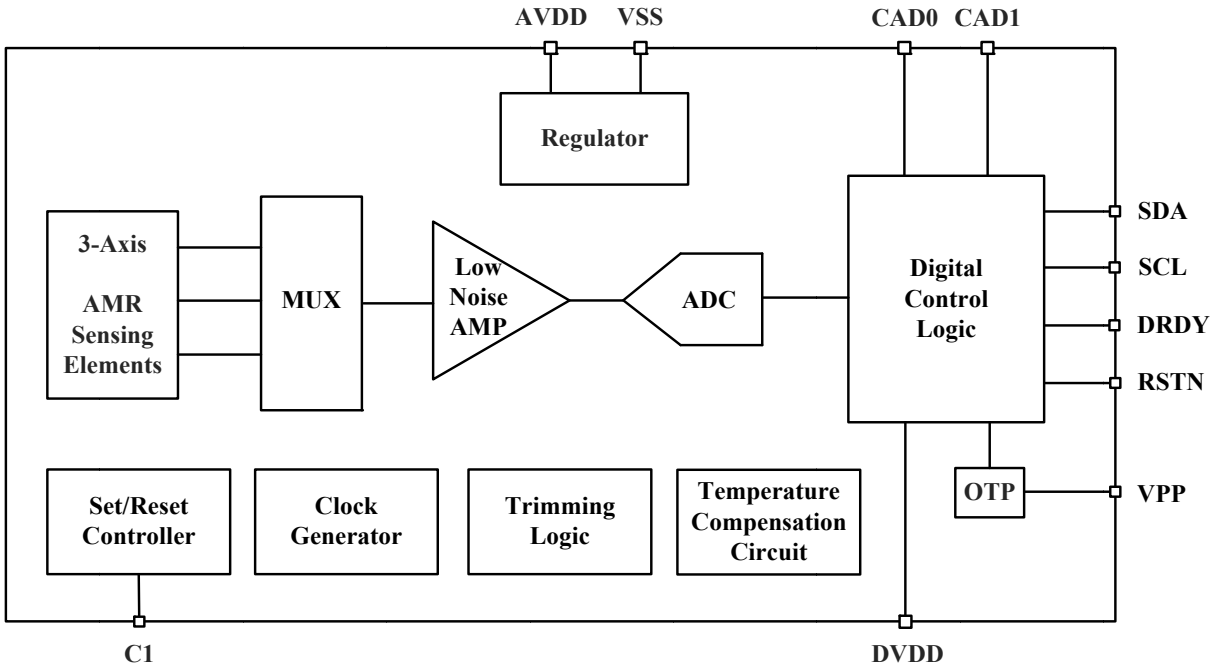
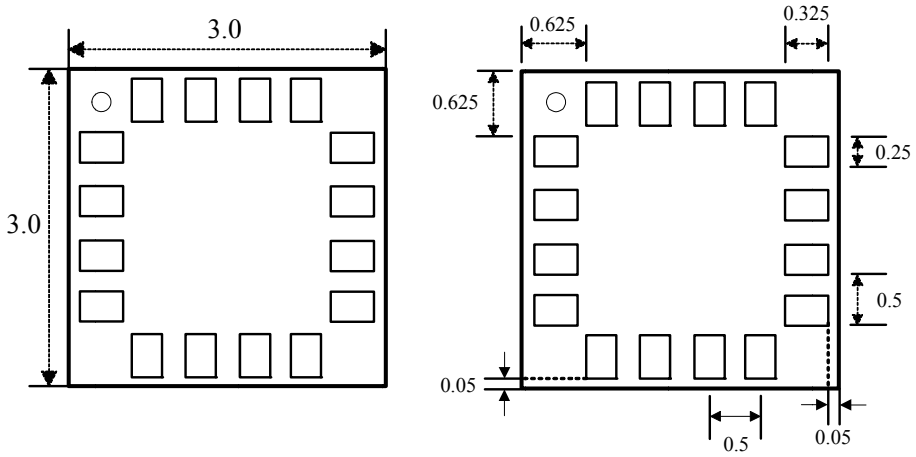


Figure 1. Block Diagram

2.2 Package Dimensions and Pin Description

IST8310 LGA Top View (Looking Through)

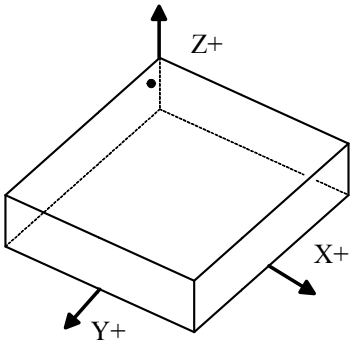


Unit: mm

Tolerance: ±0.1mm

IST8310 LGA Side View

IST8310 3D Top View



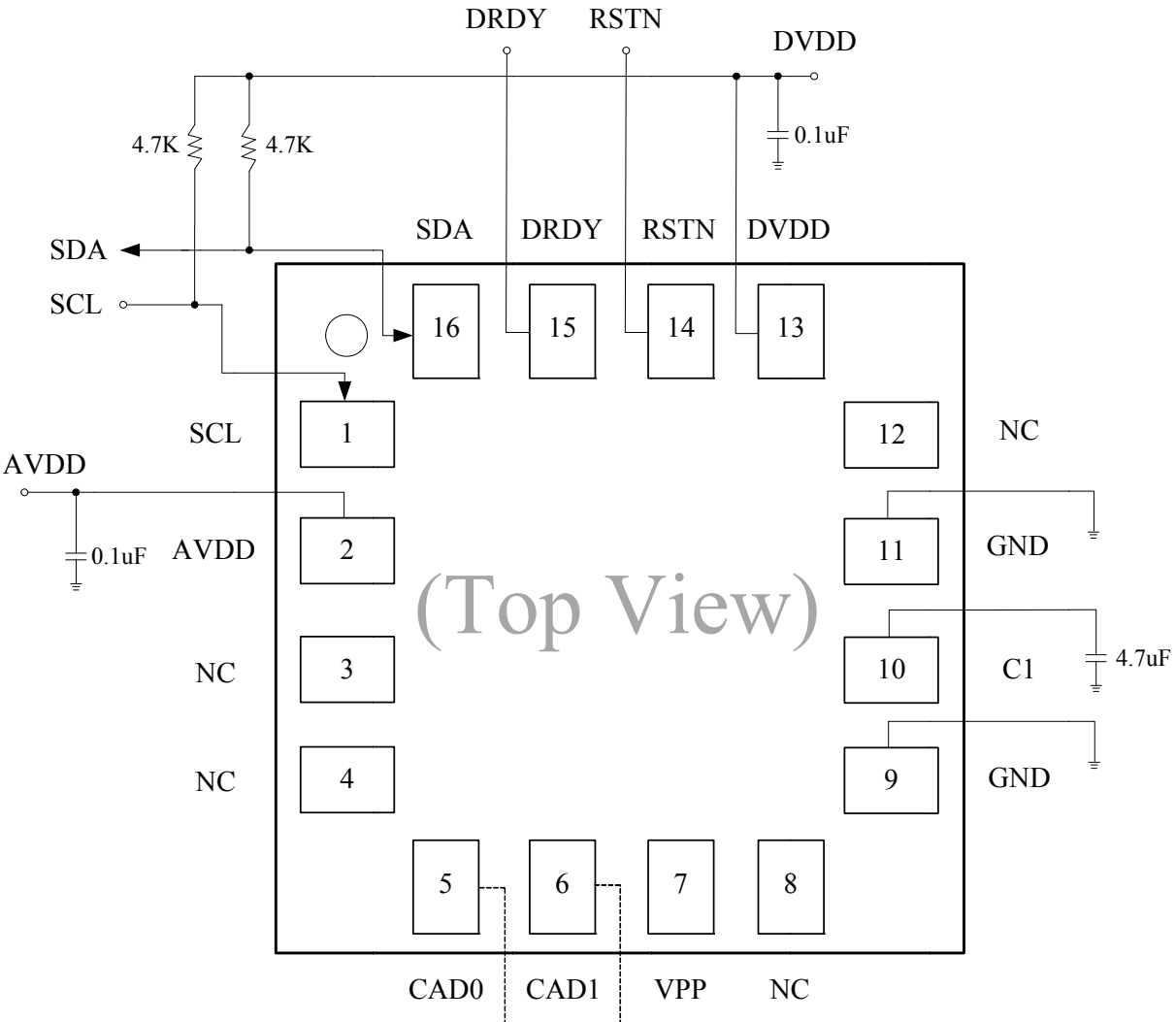
Unit: mm

Tolerance: ±0.1mm

Pin	Name	Function
1	SCL	I^2C serial clock
2	AVDD	Analog supply voltage, 1.72~3.6V
3	NC	Not use
4	NC	Not use
5	CAD0	I^2C slave address
6	CAD1	I^2C slave address
7	VPP	Test pin, connection to DVDD is suggested, Otherwise can be floating.
8	NC	Not use
9	VSS	GND
10	C1	Set/Reset function, 4.7uF
11	VSS	GND
12	NC	Not use
13	DVDD	Digital supply voltage, 1.72~3.6V
14	RSTN	Reset pin, resets registers by setting it to “Low”. Internally pulled to “High” for floating connection. MCU connection is suggested.
15	DRDY	Data ready indication, output pin only
16	SDA	I^2C serial data

*please refer to Figure 2.

2.3 Application Circuit



Slave Address Select

CAD1	CAD0	Address (7-bit)	Address (8-bit)
VSS	VSS	0CH	18H
VSS	VDD	0DH	1AH
VDD	VSS	0EH	1CH
VDD	VDD	0FH	1EH

*if CAD1 and CAD0 are floating, I^2C address will be 0EH/1CH.

Figure 2. Application Circuit

3 Electrical Specifications

3.1 Absolute Maximum Ratings

Parameter	Symbol	Limits	Unit
Storage Temperature	TSTG	-40 to +150	°C
Analog Supply Voltage	AVDD	-0.5 to +3.6	V
Digital Supply Voltage	DVDD	-0.5 to +3.6	V
Digital Input Voltage	VIN	-0.3 to DVDD+0.3	V
Electrostatic Discharge Voltage*[1]	VESD_HBM	-4000 to 4000	V
Electrostatic Discharge Voltage*[2]	VESD_MM	-350 to 350	V
Reflow Classification	JESD22-A113 with 260 °C Peak Temperature		

1. Human Body Model (HBM)
2. Machine Model (MM)

3.2 Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operating Temperature	TA	-40		+85	°C
Analog Supply Voltage	AVDD	1.72	2.8	3.6	V
Digital Supply Voltage	DVDD	1.72	1.8	3.6	V

3.3 Electrical Specifications

(Operating conditions: TA=+25℃; AVDD=2.8V; DVDD=1.8V; 4.7μF ceramic capacitors tied to C1 pin with maximum allowed line width and 5mm distance.)

Parameter	Symbol	Conditions	Min.	Typ.	Max	Unit
Operating Current	IDD3A	Full operation, at				uA
		1 sps		20		
		8 sps		72		
		10 sps		80		
		20 sps		140		
		50 sps		320		
		100 sps		600		
		200 sps		1200		
Standby Current	ISTB			10		uA

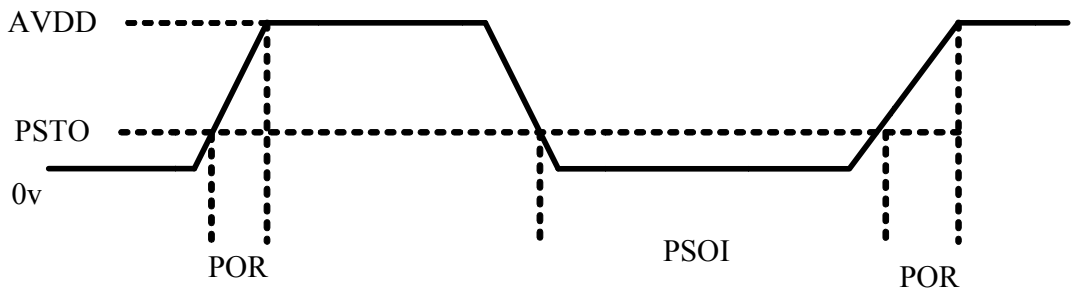
Output Data Rate (ODR)	ODR		1		200	Hz
Input Low Voltage	VIL		0		DVDD *30%	V
Input High Voltage	VIH		DVDD *70%		DVDD	V
Output Low Voltage	VOL	IOL= +4 mA	0		DVDD *20%	V
Output High Voltage	VOH	IOH= -100 uA (Except SCL and SDA)	DVDD *80%		DVDD	V

3.4 Magnetic Sensor Specifications

(Operating conditions: Ta=+25℃; AVDD=2.8V; DVDD=1.8V; 4.7μF ceramic capacitors tied to C1 pin with maximum allowed line width and 5mm distance.)

Parameter	Symbol	Condition	Min.	Typ.	Max	Unit
Dynamic Range	MDR_XY	TA=25 °C		±1600		uT
	MDR_Z	TA=25 °C		±2500		
Linearity	LIN	X-axis		1	1.5	%FS
		Y, Z-axis		0.1	0.5	
Resolution	RESO			0.3		uT/LSB
Sensitivity	SEN			3.3		LSB/uT
Zero Gauss Offset	ZGD	RMS value		±0.3		uT
Hysteresis	HS			0.1		%FS
Sensitivity Temperature Drift	TD_S	-40 ~ 85 °C		±0.016		%/ °C
Zero-B Offset Temperature Drift	TD_O	-40 ~ 85 °C		0.024		uT/ °C

3.5 Power On Reset (POR) Specifications



PSTO: Power Supply Turn Off voltage	PSTO: max=0.1volt
PSOI: Power Supply Turn Off Interval	PSOI: min=10ms
POR: Power On Reset	POR: max:50ms

When POR circuit detects the rise of AVDD voltage, it resets all internal circuits and initializes all registers. After reset, IST8310 transits to Stand-By mode.

4 Technology Overview

4.1 AMR Technology

IST8310, an iSentek patented magnetometer is designed based on Anisotropy Magneto-Resistance (AMR) technology. The output is generated from the resistance change of the AMR resistors while external magnetic field changes. The sensitivity is about 50 to 200 times larger than traditional Hall element. The high sensitivity allows higher output data rate (ODR), lower noise and lower power consumption.

4.2 High Reliability Planarized Structure Design

IST8310 consists of three full Wheatstone Bridge of AMR resistors. The three bridges detecting magnetic component in three directions orthogonal to each other are located on one chip, wire-bonded to a control ASIC. This planarized structure design enables outstanding stability to thermal shock, making our device highly reliable, while other known AMR magnetometers place z-axis sensor vertical to the substrate using 90-degree flip-chip packaging, suffer from reliability issues.

4.3 Ultra-low Hysteresis Design

iSentek has developed a specialized high permeability (μ) material for magnetic field detection. This high-μ material has ultra-low residual magnetization below 0.1 %FS in the field range as large as +/- 500 G. The ultra-low hysteresis design prevents the magnetometer from dynamic offset after encountering a strong external magnetic field impact; that is, the angular accuracy restores automatically without calibration after the removal of interference field. This feature fulfills the requirements for applications when real time calibration is not available. No calibration is required in general conditions.

4.4 Magnetic Setting Mechanism

AMR sensing resistors consist of permalloy thin film and metallization. Permalloy is soft magnetic, irreversible magnetic rotation may occur after the strength of external magnetic field exceeds half of the anisotropy field of the sensing resistor, resulting in angular error induced by offset. To solve this issue, a magnetic setting mechanism is introduced in IST8310. A magnetic field is generated within IST8310 to align the magnetization of AMR sensing resistors before every measurement. This auto-zeroing mechanism ensures the stability of angular accuracy of IST8310 during whole operation.

5 Ordering Information

Order Number	Package Type	Packaging	Marking Information
IST8310	LGA – 16 pin	Tape and Reel: 5k pieces per reel	$X_1X_2X_30$ 010● X_1: Last number of the year X_2X_3: Week number 010: Product code of IST8310

For more information on iSentek's Magnetic Sensors, please contact us by phone at +86-132-6706-8686 (China), +86-755-2991-0201 (China) or +886-2-2698-3306 ext:110 (Taiwan); via e-mail: sales@isentek.com or visit us online at www.isentek.com.

The application circuits herein constitute typical usage and interface of iSentek's product. iSentek does not warranty or assume liability of customer-designed circuits derived from this description or depiction.

iSentek reserves the right to make changes to improve reliability, function or design. iSentek does not assume any liability arising out of the application or use of any product or circuit described herein; neither does it convey any license under its patent rights nor the rights of others.

US Patent 9,297,863, Taiwanese Patents I437249, I420128 and I463160 apply to our magnetic sensor technology described.