IST8310
3D Magnetometer

Datasheet

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1. General Description

iSentek IST8310 is a 3-axis digital magnetometer with a 3.0 x 3.0 x 1.0 mm^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^2C digital output with fast mode up to 400 kHz. The high output data rate, ultra-low hysteresis, excellent temperature drift, and low noise performance features make it a perfect candidate for high precision applications.

Features

- High sensitivity of up to 330 LSB/G.
- I^2C slave, Fast Mode up to 400 kHz
- 14 or 16 bits adjustable data output
- Wide dynamic range of ±1600 μT (X, Y-axis) and ±2500 μT (Z-axis)
- High output data rate of maximum 200 Hz
- Ultra-low hysteresis (<0.1%FS)
- Ultra-low sensitivity temperature drift (±0.016 %/°C)
- Ultra-low offset temperature drift (0.024 μT/°C)
- Wide operating temperature range (-40 – 85 °C)
- High precision temperature compensation
- Built-in self-test function
- Software and algorithm support are available (for tilt compensation, cross-axis compensation, soft/hard-iron calibration and noise suppression)
- RoHS, HF and TSCA compliant

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

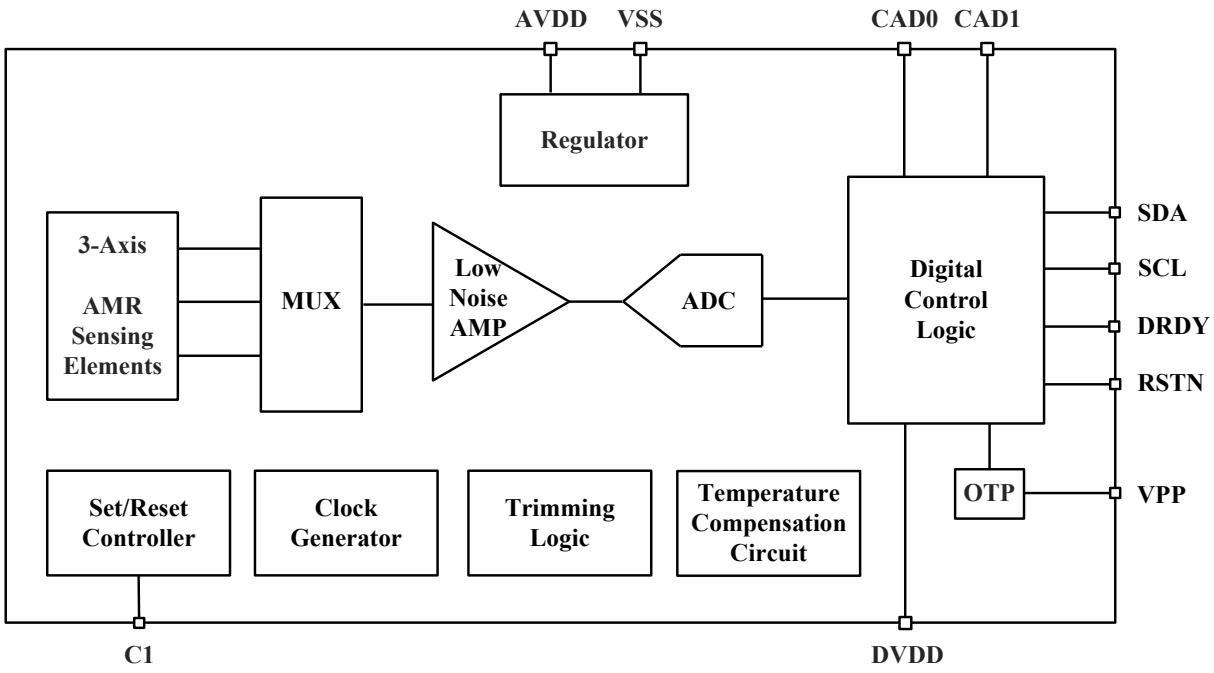
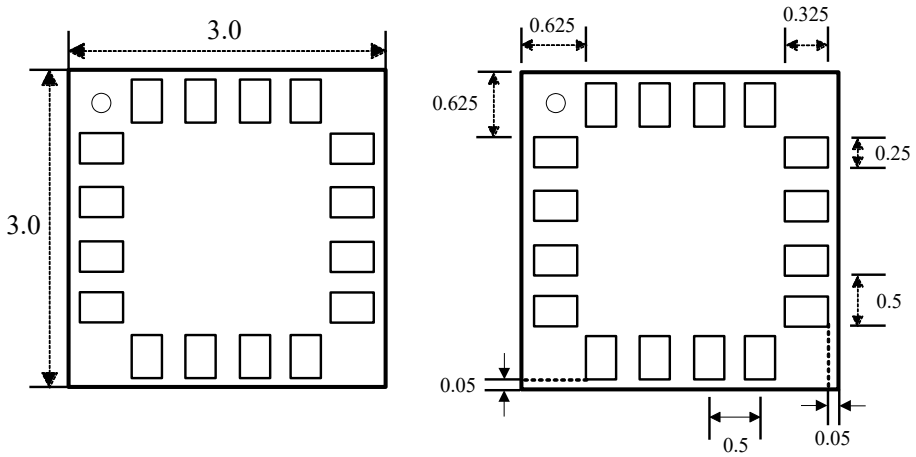


Figure 1. Block Diagram

2.2. Package Dimensions and Pin Description

IST8310 LGA Top View (Looking Through)

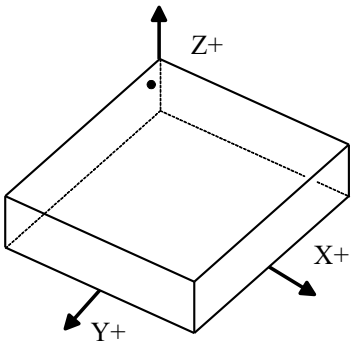


Unit: mm

Tolerance: ±0.1 mm

IST8310 LGA Side View

IST8310 3D Top View



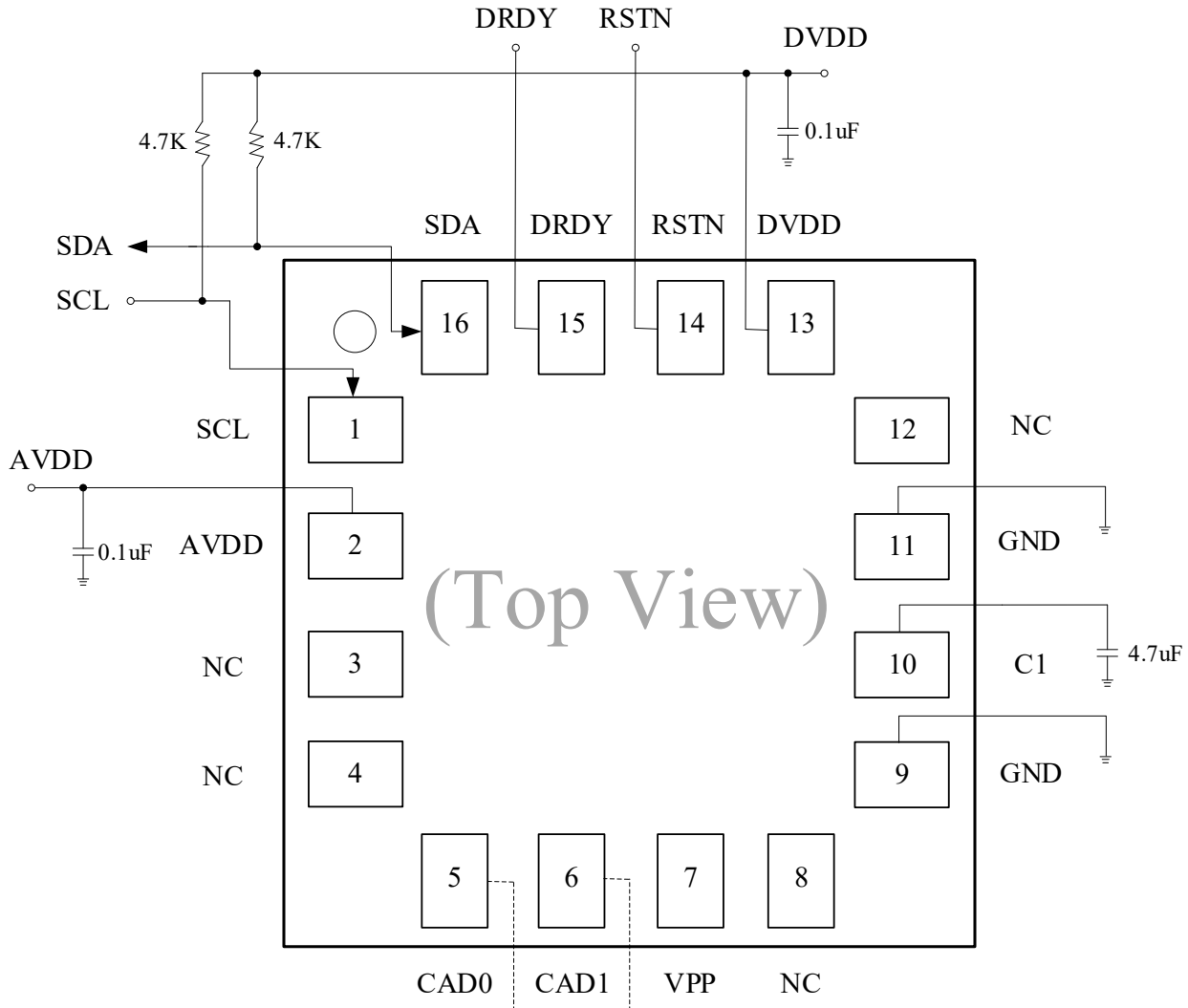
Unit: mm

Tolerance: ±0.1 mm

Pin	Name	Function
1	SCL	I^2C serial clock
2	AVDD	Analog supply voltage, 1.72 – 3.6 V
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, 4.7 μF
11	VSS	GND
12	NC	Not use
13	DVDD	Digital supply voltage, 1.72 – 3.6 V
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

CAD0	CAD1	Address (7-bit)	Address (8-bit)*1	IO leakage
VSS*2	VSS*2	0Ch	18h	0μA
VDD	VSS	0Dh	1Ah	46μA
VSS	VDD	0Eh*1	1Ch*1	46μA
VDD	VDD	0Fh	1Eh	92μA

*1: Potential difference leads to IO leakage
*2: if CAD0 and CAD1 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 = 25ºC; AVDD = 2.8 V; DVDD = 1.8 V; 4.7 µF ceramic capacitors tied to C1 pin with maximum allowed line width and 5 mm distance.)

Parameter	Symbol	Conditions	Min.	Typ.	Max	Unit
Operating Current	IDD3A	Full operation at: 1 sps 8 sps 10 sps 20 sps 50 sps 100 sps 200 sps		 20 72 80 140 320 600 1200		µA
Standby Current	ISTB			10		µA
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 µA (Except SCL and SDA)	DVDD * 80%		DVDD	V

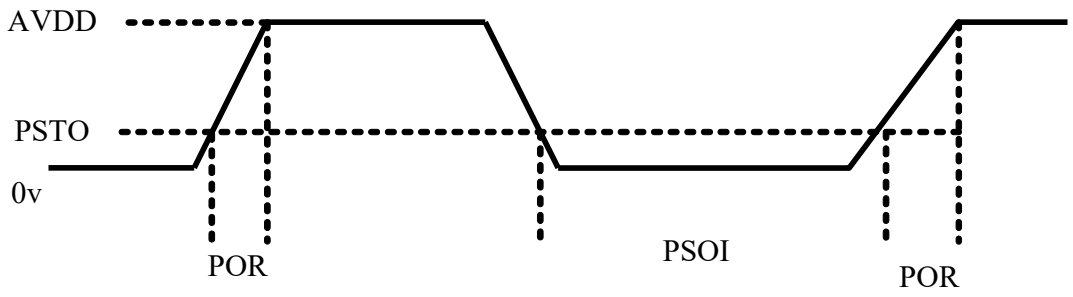
3.4. Magnetic Sensor Specifications

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

Parameter	Symbol	Condition	Min.	Typ.	Max	Unit
Dynamic Range	MDR_XY	TA = 25 °C		±1600		µT
	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		µT/LSB
Sensitivity	SEN			3.3		LSB/µT

Zero Gauss Offset	ZGD	RMS value		±0.3		μT
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		μT/°C

3.5. Power On Reset (POR) Specifications



PSTO: Power Supply Turn Off voltage
PSOI: Power Supply Turn Off Interval
POR: Power On Reset

PSTO: max=0.1volt
PSOI: min=10ms
POR: max:50ms

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

4. Technology Overview

4.1. AMR Technology

IST8310, an iSentek patented magnetometer is designed based on Anisotropy Magnetoresistance (AMR) technology. The output is generated by the resistance change of the AMR resistors as the external magnetic field varies. The sensitivity is approximately 50 to 200 times greater than conventional Hall elements. The high sensitivity allows a higher ODR, lower noise, and lower power consumption.

4.2. High Reliability Planarized Structure Design

IST8310 consists of three full Wheatstone Bridges of AMR resistors. The three bridges detecting magnetic components in three orthogonal directions are wire-bonded to a control ASIC on a single chip. This planarized structure design enables outstanding stability to thermal shock, making our device highly reliable, whereas other known AMR magnetometers with z-axis sensors placed vertically on the substrate using 90° flip-chip packaging suffer from reliability issues.

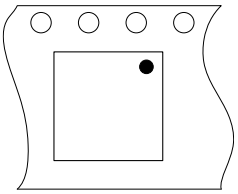
4.3. Ultra-low Hysteresis Design

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 experiencing dynamic offset after encountering a strong external magnetic field impact; that is, the angular accuracy is restored automatically without calibration after the removal of interference field. This feature fulfills the requirements for applications when real-time calibration is unavailable. No calibration is required in general conditions.

4.4. Magnetic Setting Mechanism

AMR sensing resistors consist of permalloy thin film and metallization. Permalloy is a soft magnetic material. Irreversible magnetic rotation may occur when 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 has been 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 IST8310's angular accuracy throughout the operation.



5. Packing Information

Reel tape with round hole facing up, Pin 1 positioned at the top right.
Moisture Sensitivity Level (MSL): 3

6. 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 send an email to sales@isentek.com or visit our website at www.isentek.com.

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

7. Legal Disclaimer

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Revision History

Revision Version	Date	Description
1.4	March 3rd, 2021	Initial release
1.5	April 22nd, 2022	Edited sensitivity to 330 LSB/G in the feature section (Page 4)
1.6	January 3rd , 2025	Added packing information (Page 25); added moisture sensitivity level (MSL): 3 (Page 24)
1.7	April 18th , 2025	Edited 7.3.2. Self-test Mode (Page 24)
1.8	November 25th, 2025	Revised Figure 2: Corrected the I²C address value for floating CAD0 and CAD1 pins to 0Eh/1Ch. (Page 7)