

**IST8309**  
**3D Magnetometer with**  
**Programmable Switch**  
  
**Datasheet**

**Table of Contents**

- 1. GENERAL DESCRIPTION.....3**
- 2. BLOCK DIAGRAM, PACKAGE DIMENSIONS, MAGNETIC FIELD DIRECTION, PIN CONFIGURATIONS, AND APPLICATION CIRCUIT .....4**
  - 2.1. Block diagram.....4
  - 2.2. Package Dimensions .....4
  - 2.3. Location of Hall Sensing Elements .....5
  - 2.4. Marking.....5
  - 2.5. Magnetic Field Direction.....6
  - 2.6. Pin Configurations and Application Circuit.....6
  - 2.7. Slave address detection.....9
  - 2.8. MCU and Platform Baseband Application ..... 11
  - 2.9. Startup Sequence ..... 11
- 3. ELECTRICAL SPECIFICATIONS .....12**
  - 3.1. Absolute Maximum Ratings ..... 12
  - 3.2. Recommended Operating Conditions ..... 12
  - 3.3. Electrical Specifications ..... 12
  - 3.4. Magnetic Sensor Specifications..... 13
  - 3.5. Power-On Reset (POR) Specifications ..... 13
- 4. ORDERING INFORMATION.....14**
- 5. LEGAL DISCLAIMER .....14**
  - 5.1. Warranty and Liability Disclaimer..... 14
  - 5.2. Application Disclaimer ..... 14
  - 5.3. Disclaimer Regarding Changes ..... 14

## 1. General Description

iSentek IST8309 is a 3D digital linear hall sensor to measure magnetic flux intensity. It is an IC device that contains magnetic sensors and control ASIC with a 16-bit ADC output. IST8309 provides an I<sup>2</sup>C digital output with a fast mode up to 400 kHz. Wide dynamic range operation, high resolution, and compact form factor features make it the best candidate for smartphone, wearable, and IoT devices.

### Features

- Single-chip 3-axis linear hall sensor with digital output
- 3-axis programmable magnetic switch function
- INTB pin for event notification (magnetic switch, DRDY, overflow)
- Compact form factor, 1.29 x 0.99 x 0.53 mm<sup>3</sup>, 5-pin WLCSP-BGA package
- Operating supply voltage: VDD:1.7V~3.6V, VID:1.2V~VDD
- I<sup>2</sup>C bus supports fast mode up to 400 kHz
- Two slave address
- The high dynamic range of a maximum of  $\pm 30$  mT
- High resolution of maximum of 2.5  $\mu$ T/LSB
- Absolute 360° angle output
- The high output data rate of maximum of 500 Hz
- Operation temperature -30~85 °C
- Built-in oscillator for internal clock source
- Power-on reset circuit
- RoHS, HF and TSCA compliant

### Applications

Magnetometer for external magnetic detection

Displacement detection

Foldable device angle detection

Angle sensor application

## 2. Block Diagram, Package Dimensions, Magnetic Field Direction, Pin Configurations, and Application Circuit

### 2.1. Block diagram

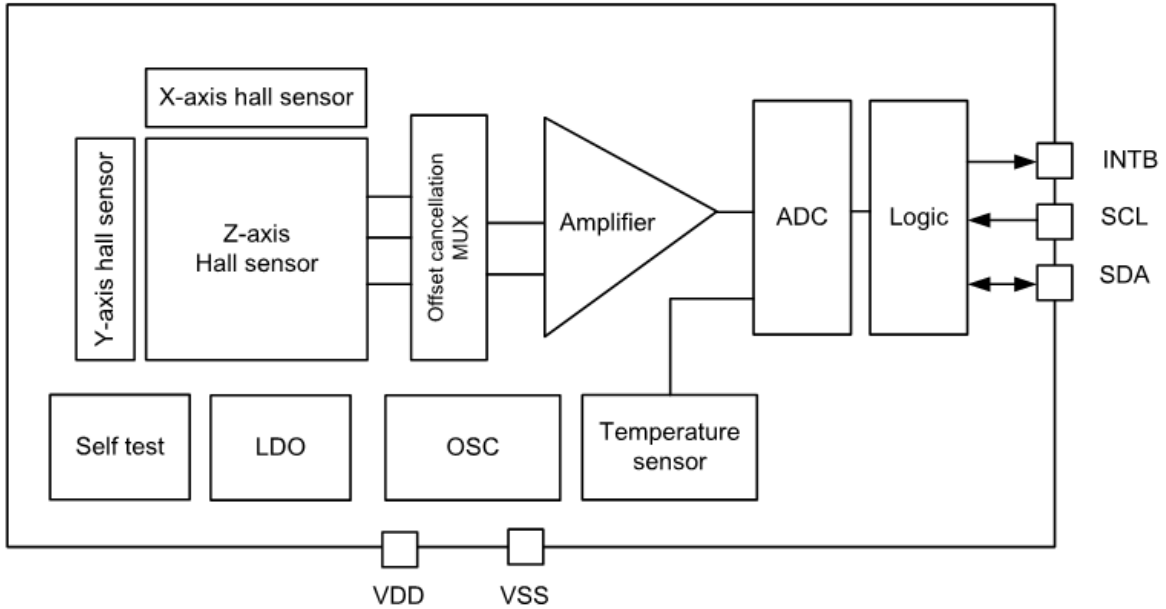


Figure 1. Block Diagram

### 2.2. Package Dimensions

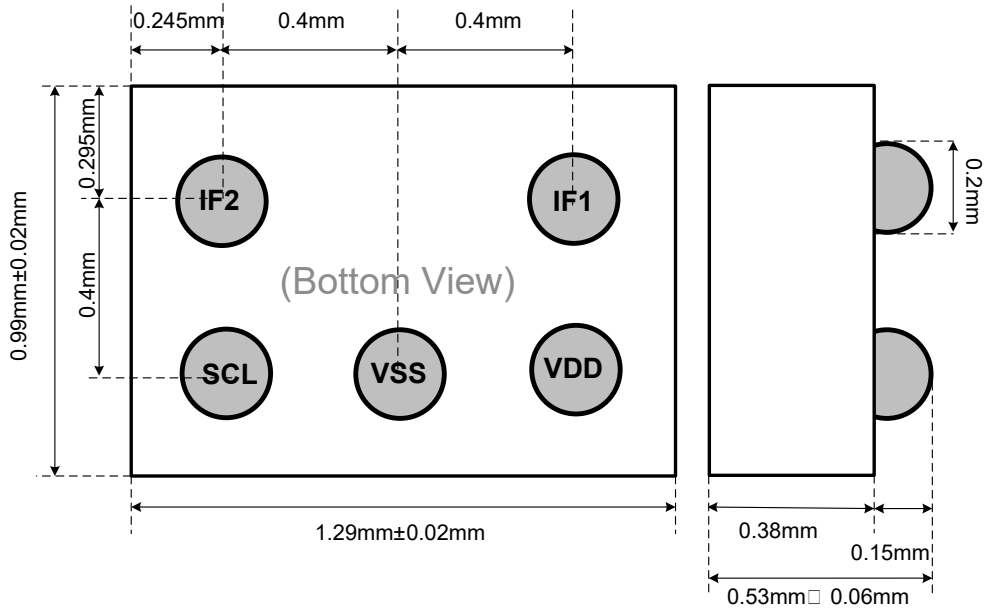
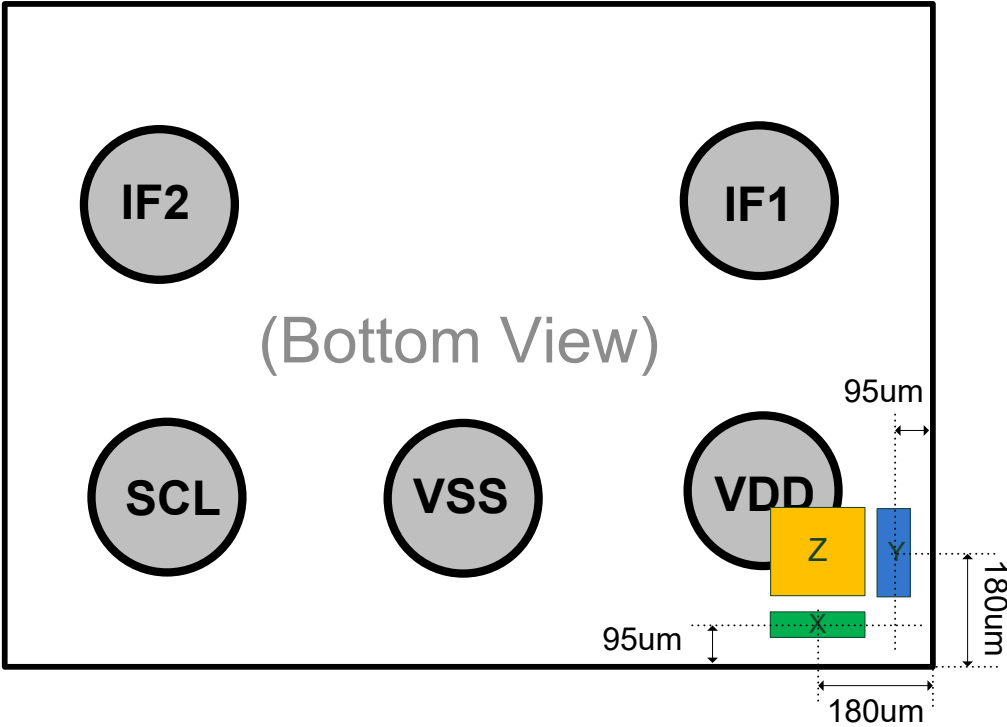


Figure 2. Package Dimensions

2.3. Location of Hall Sensing Elements



2.4. Marking

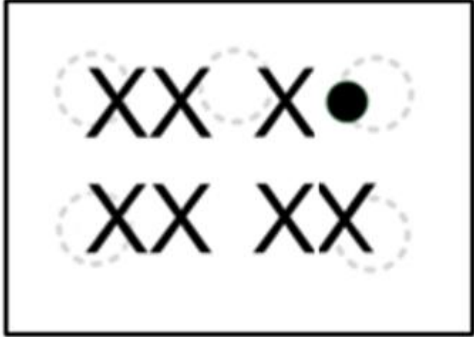
Date code X<sub>1</sub>X<sub>2</sub>X<sub>3</sub>●

Product code X<sub>4</sub>X<sub>5</sub>X<sub>6</sub>X<sub>7</sub>

X<sub>1</sub>: Year

X<sub>2</sub>X<sub>3</sub>: Week

X<sub>4</sub>X<sub>5</sub>X<sub>6</sub>X<sub>7</sub>: Product code



IST8309 TOP View

**2.5. Magnetic Field Direction**

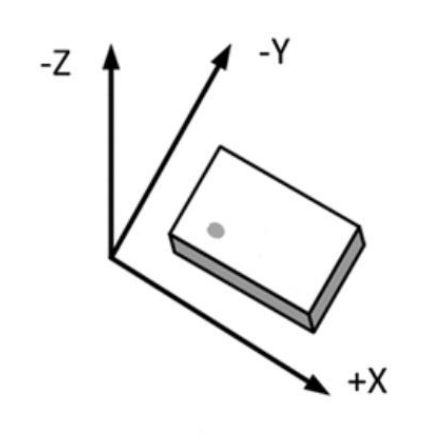
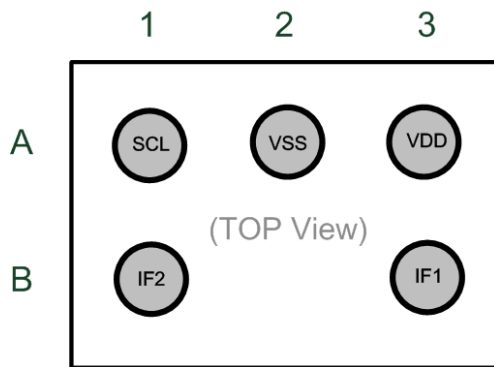


Figure 3. Magnetic Field Direction

**2.6. Pin Configurations and Application Circuit**



Case 1. Slave Address = 0, (0x18)

	Name	Function name	Type	Function
A1	SCL	SCL	Input	I <sup>2</sup> C clock
A2	VSS	VSS	Power	Ground
A3	VDD	VDD	Power	Power Supply
B1	IF2	SDA	I/O	I <sup>2</sup> C data
B3	IF1	INTL	Output	Interrupt output

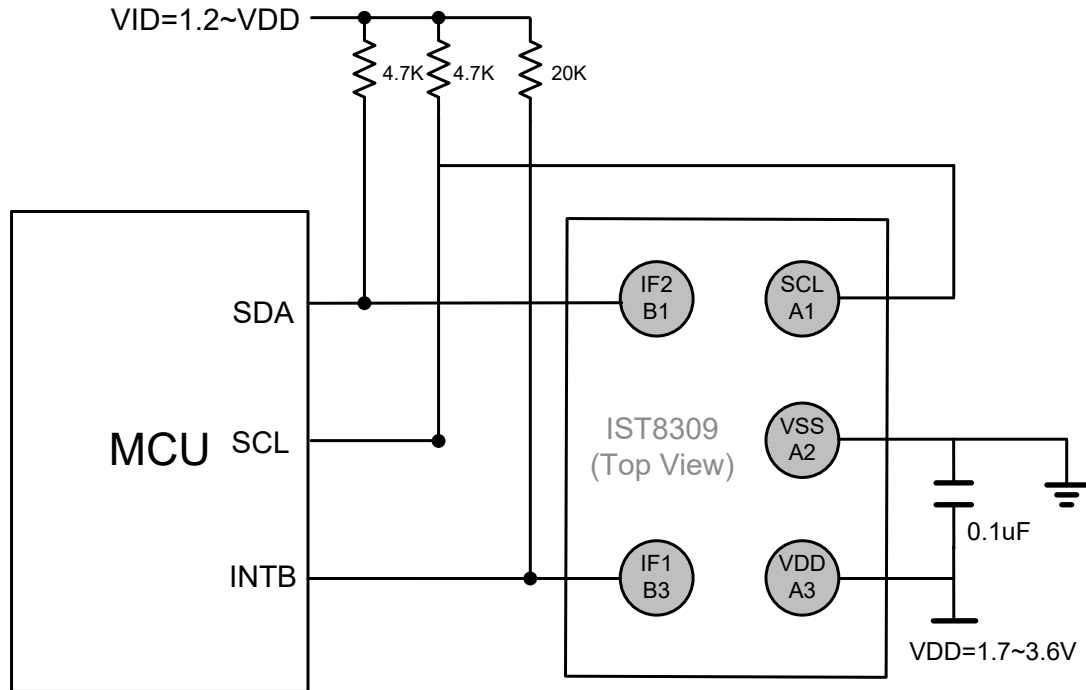


Figure 4. Application Circuit

Note: VID must be powered up no later than VDD.

Case 2. Slave Address = 1, (0x19)

	Name	Function name	Type	Function
A1	SCL	SCL	Input	I <sup>2</sup> C clock
A2	VSS	VSS	Power	Ground
A3	VDD	VDD	Power	Power Supply
B1	IF2	INTL	Output	Interrupt output
B3	IF1	SDA	I/O	I <sup>2</sup> C data

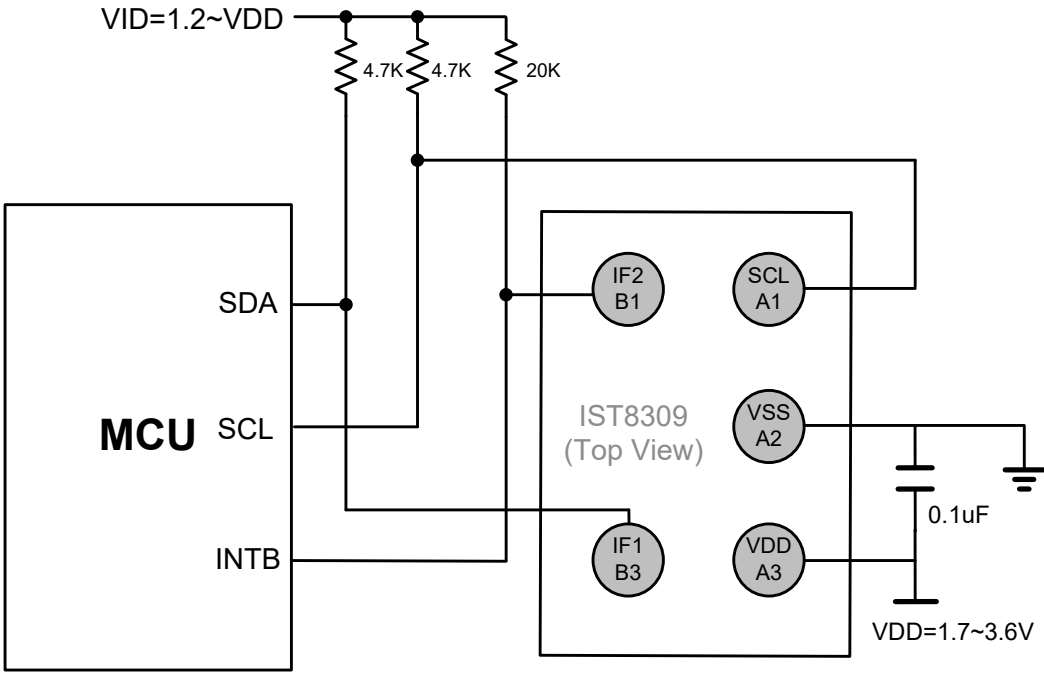


Figure 5. Application Circuit

Note: VID must be powered up no later than VDD.



## Case 3. Dual IST8309

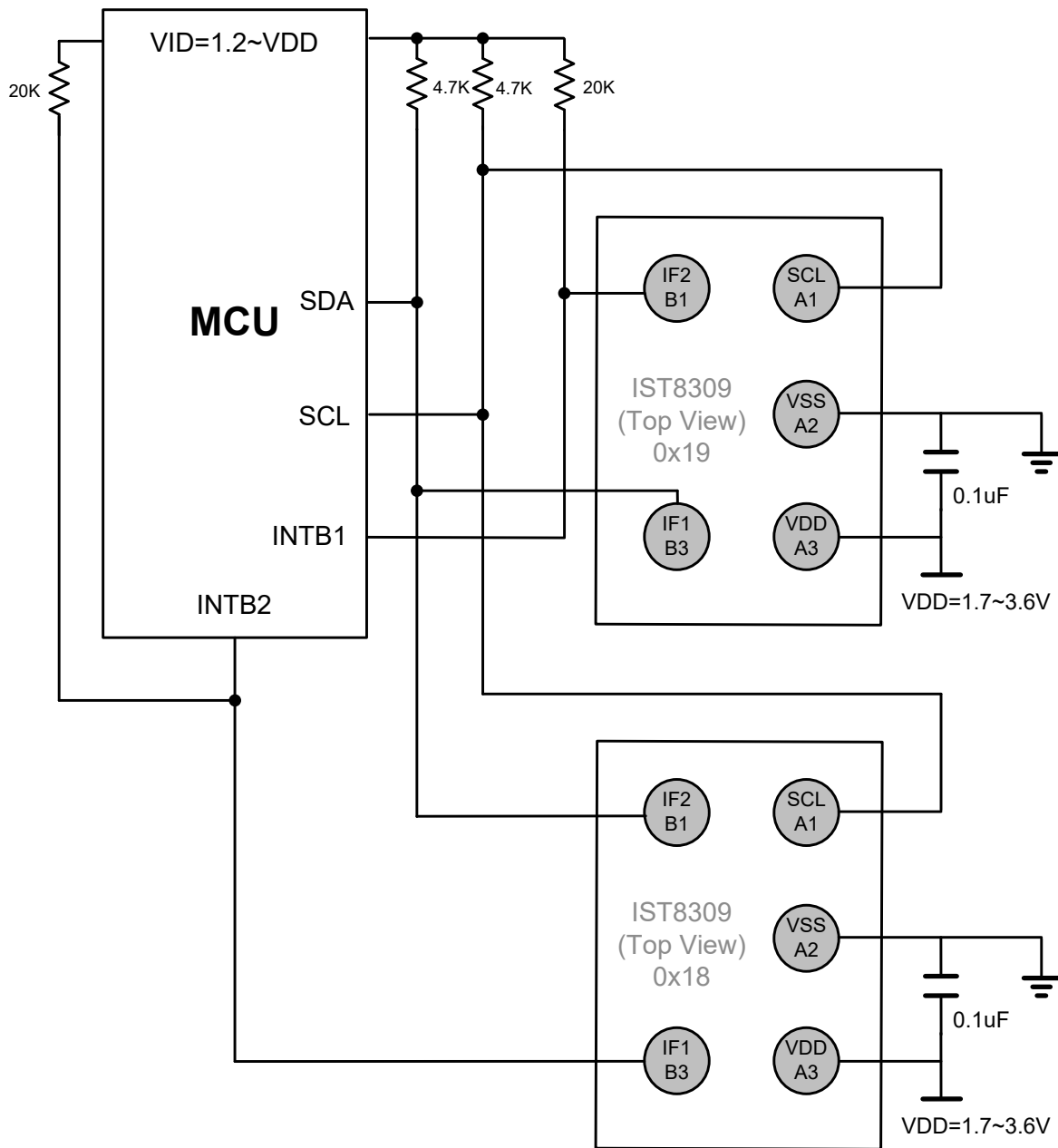


Figure 6. Application Circuit

Note: VID must be powered up no later than VDD.

### 2.7. Slave address detection

1. The slave address, either **0x18** or **0x19**, is determined by the pull-up resistors of SDA, SCL, and INT.
2. Pull-up resistor **MUST** be:
  - 4.7 kΩ on SDA and SCL;
  - 20 kΩ on INT
3. The I2C “SDA” and interrupt “INT” schematics are **different** between 0x18 and 0x19.

- When the slave address is set to **0x18**:

- “SDA” will be **IF2** (B1 Pin)
- “INT” will be **IF1** (B3 Pin)

- When the slave address is set to **0x19**:

- “SDA” will be **IF1** (B3 Pin)
- “INT” will be **IF2** (B1 Pin)

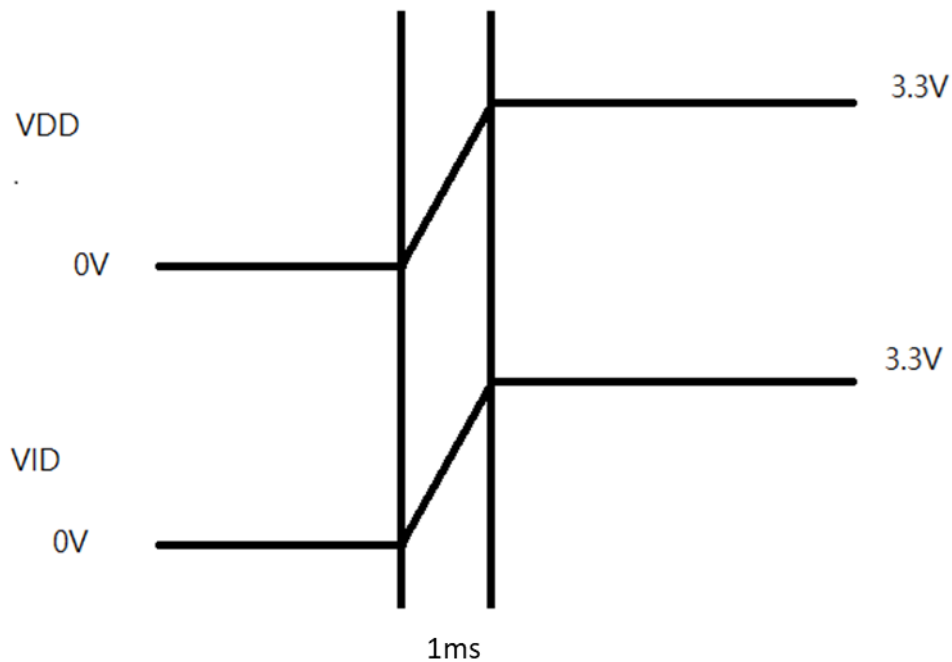
## 2.8. MCU and Platform Baseband Application

1. External pull-up resistors on SDA, SCL, and INT must be required.
2. Internal pull-up resistors of the MCU and Platform Baseband should be set as disconnected.
3. Mode of GPIO for INT should be set in FLOATING MODE or INPUT MODE when powering on IST8309
4. Mode of I2C IO for SDA and SCL should be set to OPEN DRAIN MODE

**\*\*\*DO NOT ACCESS SDA, SCL, AND INT WHILE POWER-ON\*\*\***

## 2.9. Startup Sequence

1. VDD = 3.3 V is the IST8309's supply voltage, and VID = 3.3 V is the pull-up voltage of SDA, SCL, and INT.
2. VDD and VID commence simultaneously within 1 ms slope.



### 3. Electrical Specifications

#### 3.1. Absolute Maximum Ratings

Parameter	Symbol	Limits	Unit
Storage Temperature	TCG	-40 to +125	°C
Power Supply Voltage (VDD)	VDD	-0.3 to +4.0	V
Electrostatic Discharge Voltage* <sup>1</sup>	VESD HBM	-2000 to 2000	V
Electrostatic Discharge Voltage* <sup>2</sup>	VESD CDM	-1000 to 1000	V
Reflow Classification	JESD22-A113 with 260°C Peak Temperature		

If the device is used in conditions exceeding these limits, it may malfunction permanently. Performance cannot be assured when these limits are exceeded.

1. Human Body Model (HBM)
2. Charge Device Model (CDM)

#### 3.2. Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operating Temperature	TA	-30		+85	°C
Power Supply Voltage (VDD)	VDD	1.7	3.3	3.6	V

#### 3.3. Electrical Specifications

Operating conditions: TA = +25 °C; VDD = 3.3 V.

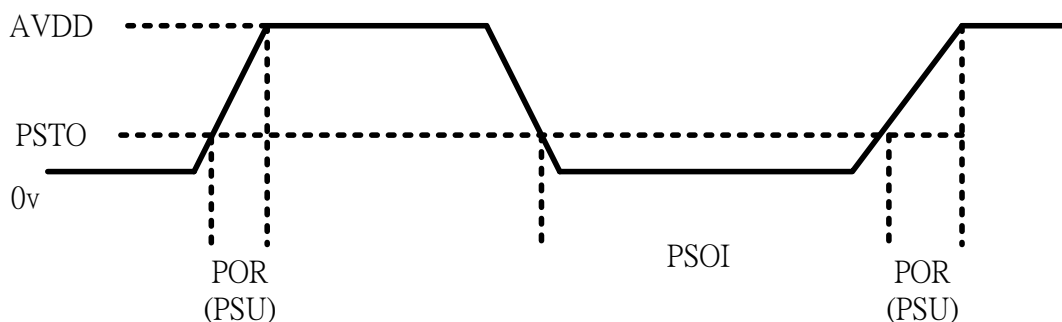
Parameter	Symbol	Pin	Conditions	Min.	Typ.	Max.	Unit
Current Consumption	IDD	VDD	10 Hz sampling		50		µA
Standby Consumption	CUP	VDD	Suspend mode		1		µA
Input current	IAN	SCL, IF1, IF2	GND or VDD	-10		10	µA
Input Low Voltage	VIL	SCL, IF1, IF2		-0.3		0.42	V
Input High Voltage	VIA	SCL, IF1, IF2		0.89		VDD	V
Output Low Voltage	VOL	IF1, IF2				0.3	V
Hysteresis Input	VHS	SCL, IF1, IF2		0.2			V

### 3.4. Magnetic Sensor Specifications

Operating conditions: TA = +25 °C; VDD = 3.3 V.

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Dynamic Range	DR			±30		mT
Resolution	RES	16-bit setting		2.5		uT/LSB

### 3.5. Power-On Reset (POR) Specifications



PSTO: Power Supply Turn Off voltage

PSOI: Power Supply Turn Off Interval

POR: Power On Reset

PSU: Power Supply Rise Time\*<sup>1</sup>

PSTO: max=0.1volt

PSOI: min=30ms

POR: max:1ms

\*<sup>1</sup> The power on reset time is equal to the power supply rise time (max:1ms).

When the POR circuit detects an increase in VDD value, it resets all internal circuits and initializes all registers. After being reset, IST8309 transits to Standby Mode.

## 4. Ordering Information

Order Number	Package Type	Packaging	Temperature Range	Marking Information
IST8309	WLCSP – 5 pins	Tape and Reel: 5k pieces per reel	-30 to +85°C	X <sub>1</sub> X <sub>2</sub> X <sub>3</sub> ● X <sub>4</sub> X <sub>5</sub> X <sub>6</sub> X <sub>7</sub> X <sub>1</sub> : Year X <sub>2</sub> X <sub>3</sub> : Week X <sub>4</sub> X <sub>5</sub> X <sub>6</sub> X <sub>7</sub> : Product code

For further information about iSentek's Magnetic Sensors, please send an email to [sales@isentek.com](mailto:sales@isentek.com) visit our website at [www.isentek.com](http://www.isentek.com).

## 5. Legal Disclaimer

### 5.1. Warranty and Liability Disclaimer

iSentek Inc. warrants the information in this datasheet. It is assumed that the specification is accurate and reliable. However, iSentek Inc. makes no warranties or claims regarding the accuracy or completeness of this information and takes no responsibility for the use of the information, nor does it convey any license under its patent rights or the rights of third parties.

iSentek Inc. shall not be liable for any consequential, incidental, indirect, or punitive damages (including, but not limited to, profit loss, business interruption, and further expenses related to the removal, replacement, or rework of any products).

### 5.2. Application Disclaimer

iSentek's products are unsuitable for life-critical and safety-critical applications. No liability is claimed by iSentek for the use of its products in such applications. The customer agrees to indemnify and hold iSentek harmless from and against any and all liabilities and losses.

### 5.3. Disclaimer Regarding Changes

iSentek reserves the right to modify the contents of this datasheet, including specifications and descriptions, at any time and without prior notice. This document supersedes all previously issued information.