

IST8309

3D Magnetometer

with Programmable

Switch

Datasheet

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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 I²C 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 mm³, 5-pin WLCSP-BGA package
- Operating supply voltage: VDD: 1.7V~3.6V, VID:1.2V~VDD
- I²C bus supports fast mode up to 400 kHz
- Two slave address
- The high dynamic range of a maximum of ± 30 mT
- High resolution of maximum of 2.5 μ T/LSB
- Absolute 360° angle output
- The high output data rate of maximum of 1 KHz
- 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
Joystick and gaming controller

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

2.1. Block Diagram

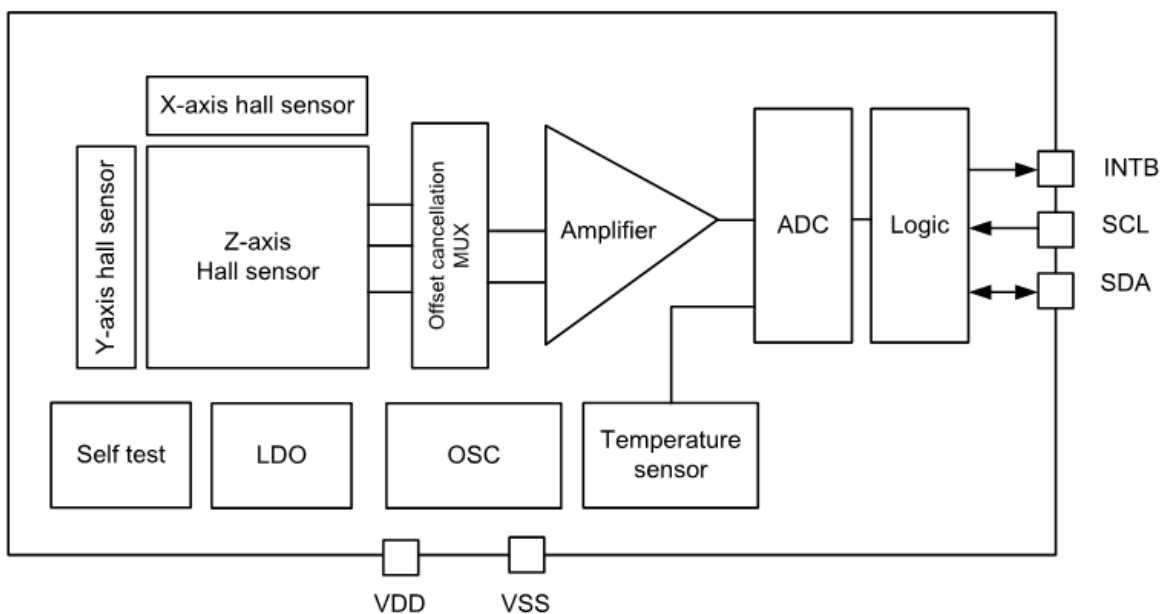


Figure 1. Block Diagram

2.2. Package Dimensions

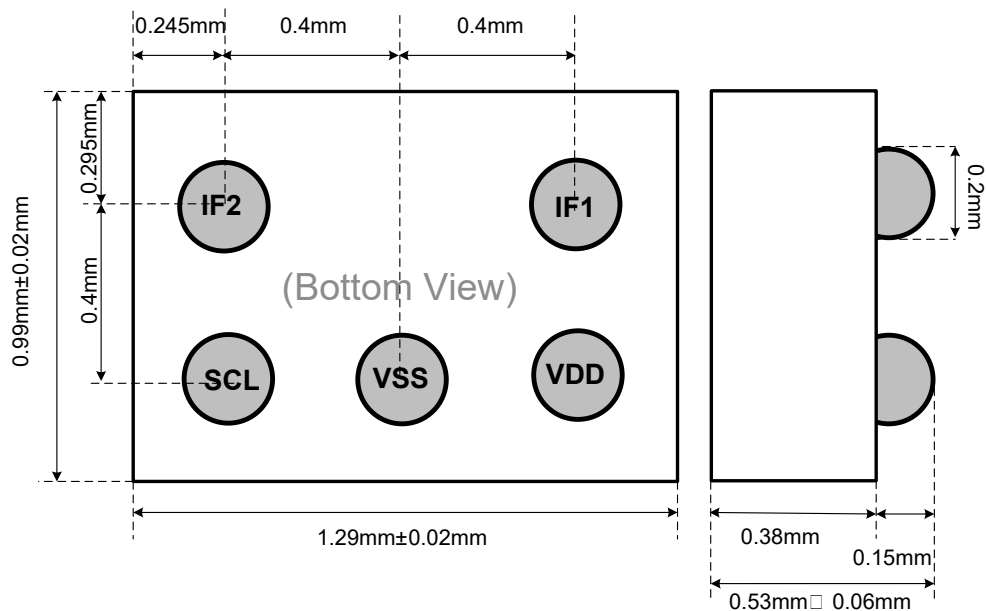
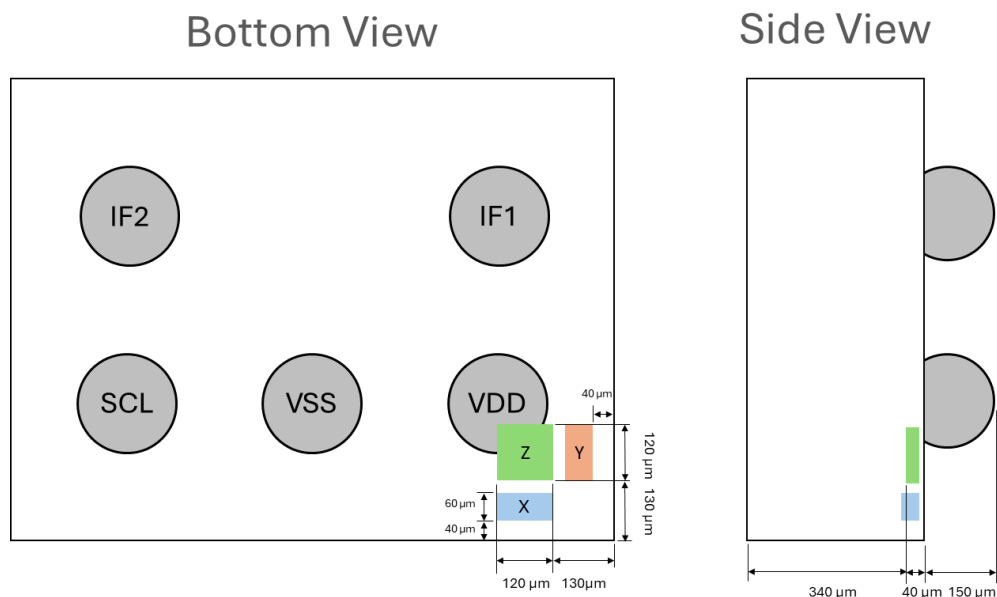


Figure 2. Package Dimensions

2.3. Location of Hall Sensing Elements



2.4. Marking

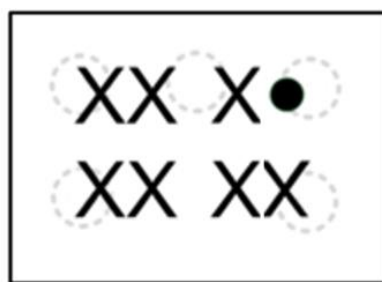
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X_1 : Year

X_2X_3 : Week

$X_4X_5X_6X_7$: Product code



IST8309 TOP View

2.5. Magnetic Field Direction

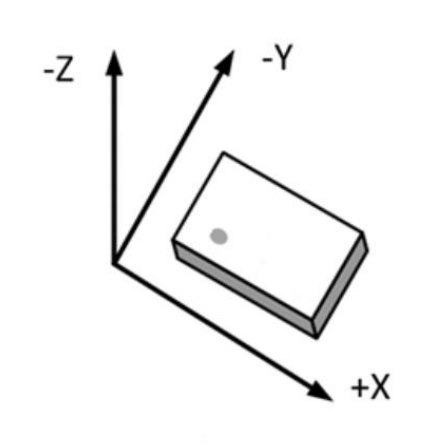
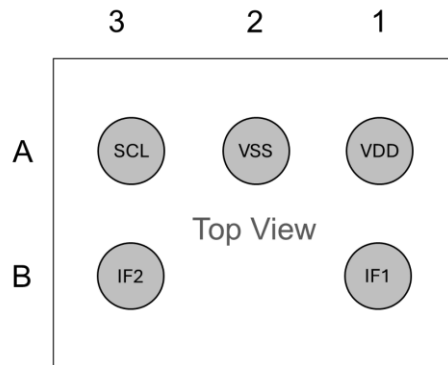


Figure 3. Magnetic Field Direction

2.6. Pin Configurations and Application Circuit



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

	Symbol	Function name	Type	Function
A1	VDD	VDD	Power	Power supply
A2	VSS	VSS	Power	Ground
A3	SCL	SCL	Input	I ² C clock
B1	IF1	INTB	Output	Interrupt output
B3	IF2	SDA	I/O	I ² C data

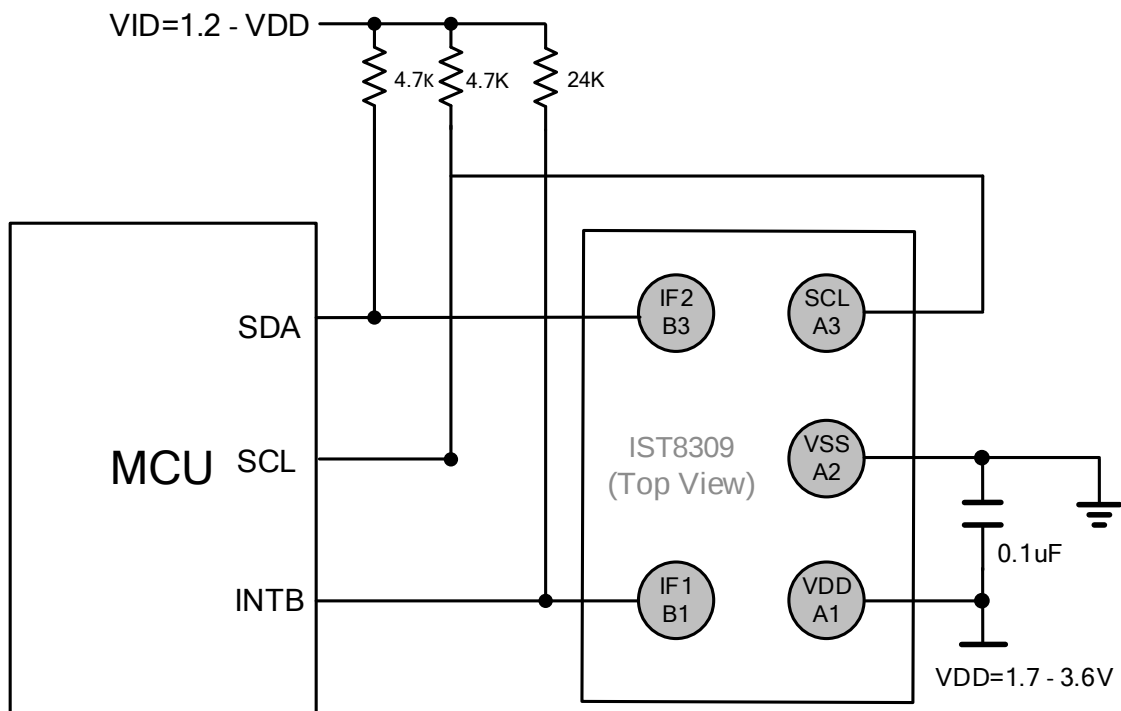


Figure 4. Application Circuit

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

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

	Symbol	Function name	Type	Function
A1	VDD	VDD	Power	Power supply
A2	VSS	VSS	Power	Ground
A3	SCL	SCL	Input	I ² C clock
B1	IF1	SDA	I/O	I ² C data
B3	IF2	INTB	Output	Interrupt output

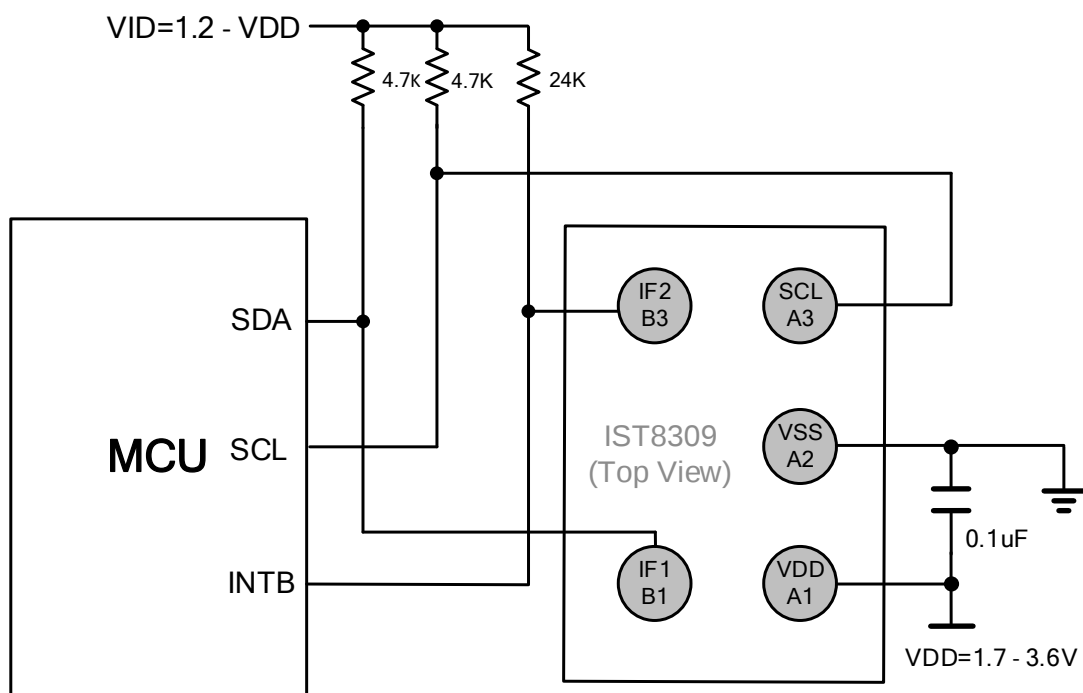


Figure 5. Application Circuit

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

Case 3. Dual IST8309

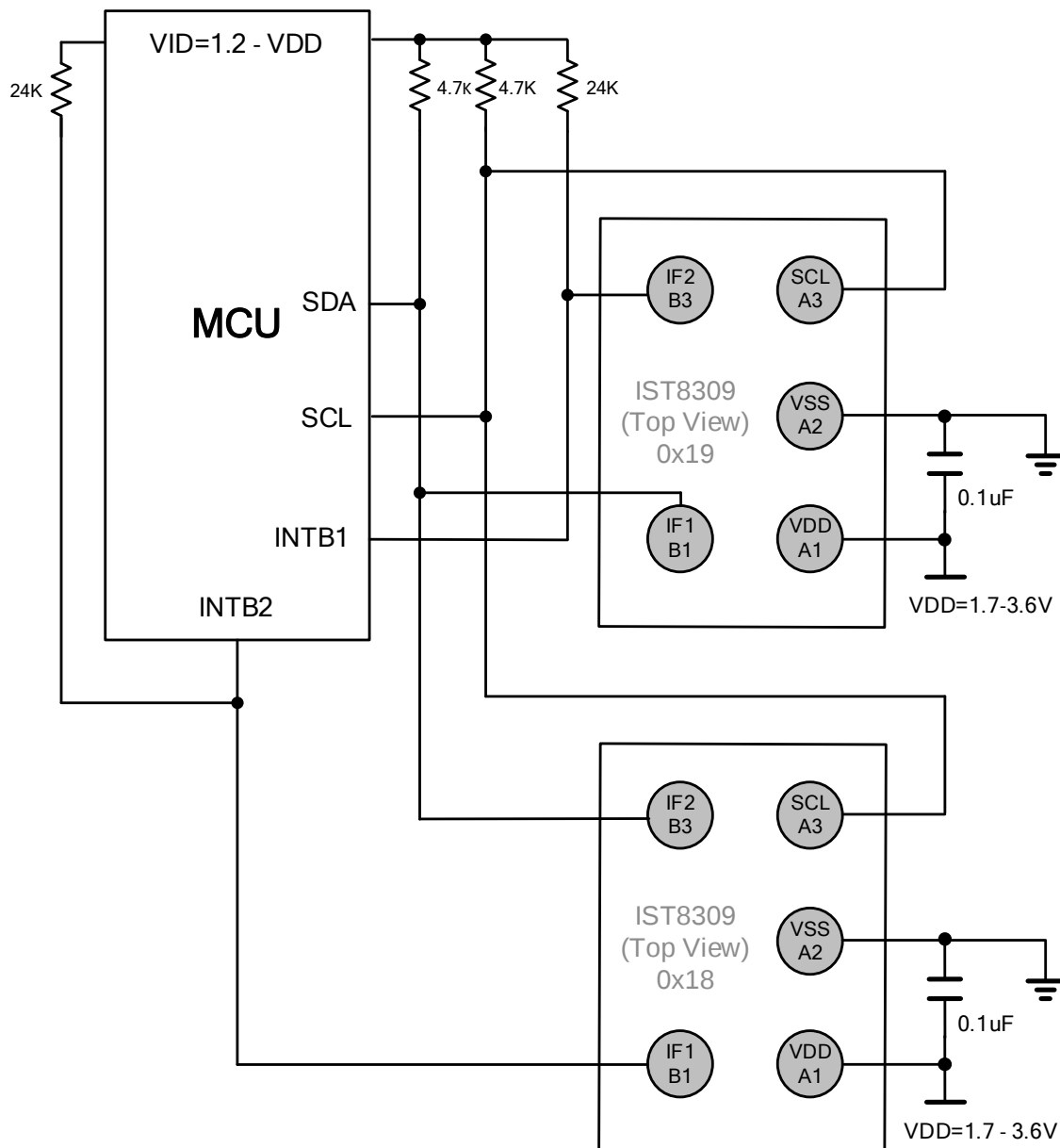


Figure 6. Application Circuit

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**.
 - 24 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** (B3 Pin)

“INT” will be **IF1** (B1 Pin)

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

“SDA” will be **IF1** (B1 Pin)

“INT” will be **IF2** (B3 Pin)

2.8. MCU and Platform Baseband Application

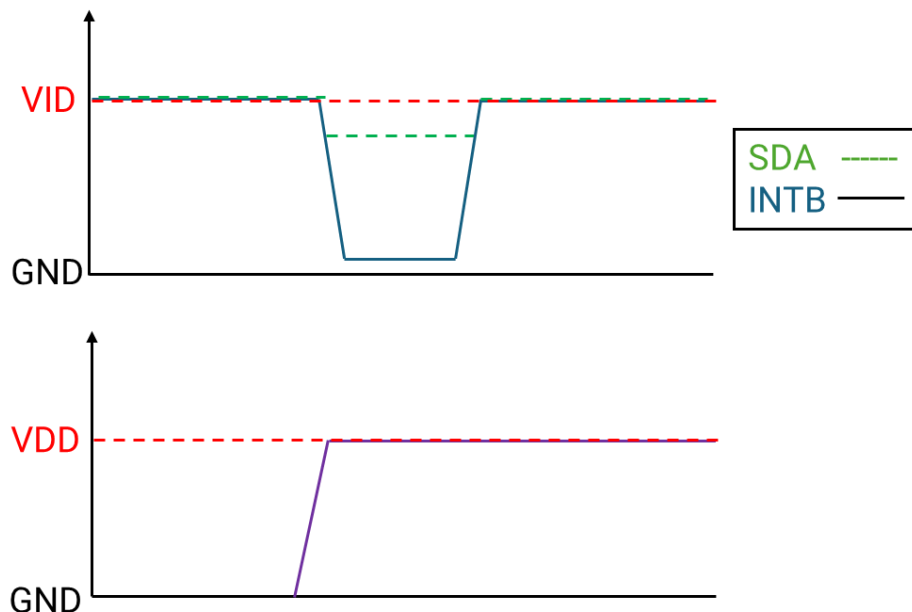
1. External pull-up resistors on SDA, SCL, and INT must be required.
2. Internal pull-up resistors of the MCU and Platform Baseband should be set as disconnected.
3. Mode of GPIO for INT should be set in FLOATING MODE or INPUT MODE when powering on IST8309
4. Mode of I²C IO for SDA and SCL should be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

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

2.9. Startup Sequence and Voltage Requirements

(1) VID is applied before VDD

The power-up of VDD triggers the address detection mechanism. During this process, SDA remains high relative to INTB until the detection is completed.

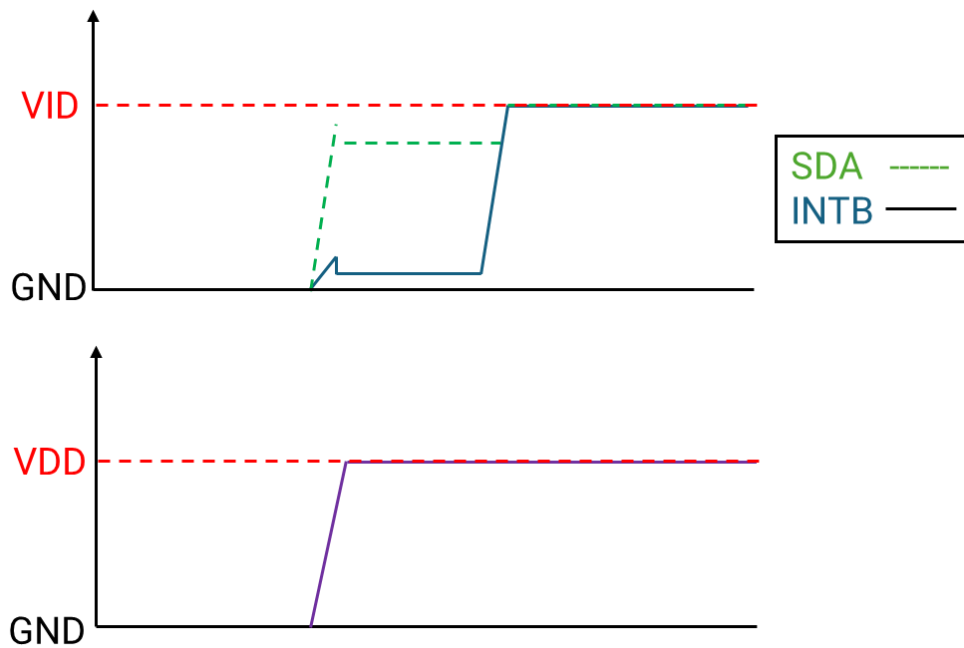


Notes:

- VID voltage must be less than or equal to VDD voltage.
- VID, SDA, SCL, and INTB must all operate at the same VID voltage.

(2) VDD and VID Applied Simultaneously

The power-up of VDD triggers the address detection mechanism. During this process, SDA remains high relative to INTB until the detection is completed.



Notes:

- VID voltage must be less than or equal to VDD voltage.
- VID, SDA, SCL, and INTB must all operate at the same VID voltage.

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* ¹	VESD_HBM	-2000 to 2000	V
Electrostatic Discharge Voltage* ²	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

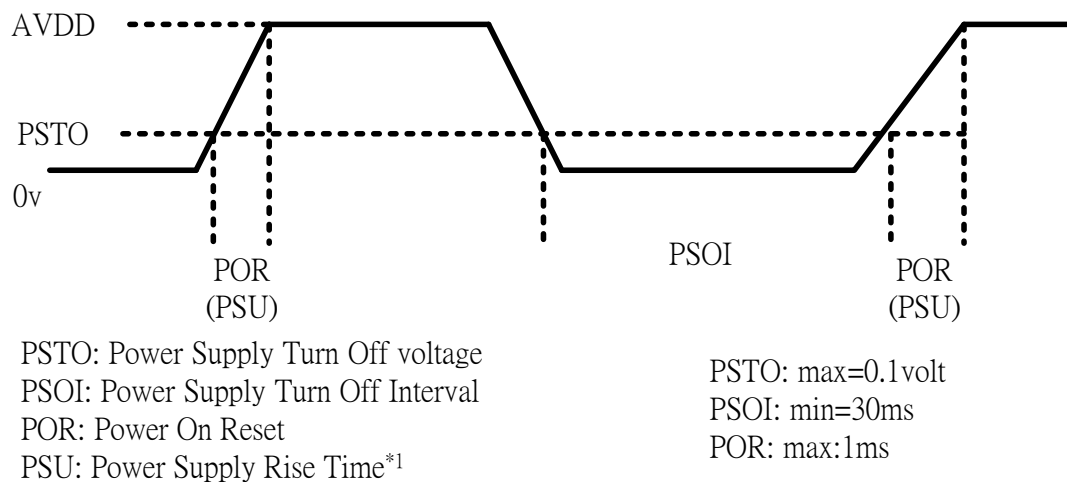
3.4. Magnetic Sensor Specifications

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

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Dynamic Range	DR			±30 ±200 ^{*1}		mT
Resolution	RES	16-bit setting		2.5 20 ^{*1}		uT/LSB

^{*1}High Dynamic Range Mode

3.5. Power-On Reset (POR) Specifications



^{*1} 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 ₁ X ₂ X ₃ ● X ₄ X ₅ X ₆ X ₇ X ₁ : Year X ₂ X ₃ : Week X ₄ X ₅ X ₆ X ₇ : Product code

For further information about iSentek's Magnetic Sensors, please send an email to sales@isentek.com visit our website at www.isentek.com.

5. Legal disclaimer

5.1. Warranty and Liability Disclaimer

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