

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 uT/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

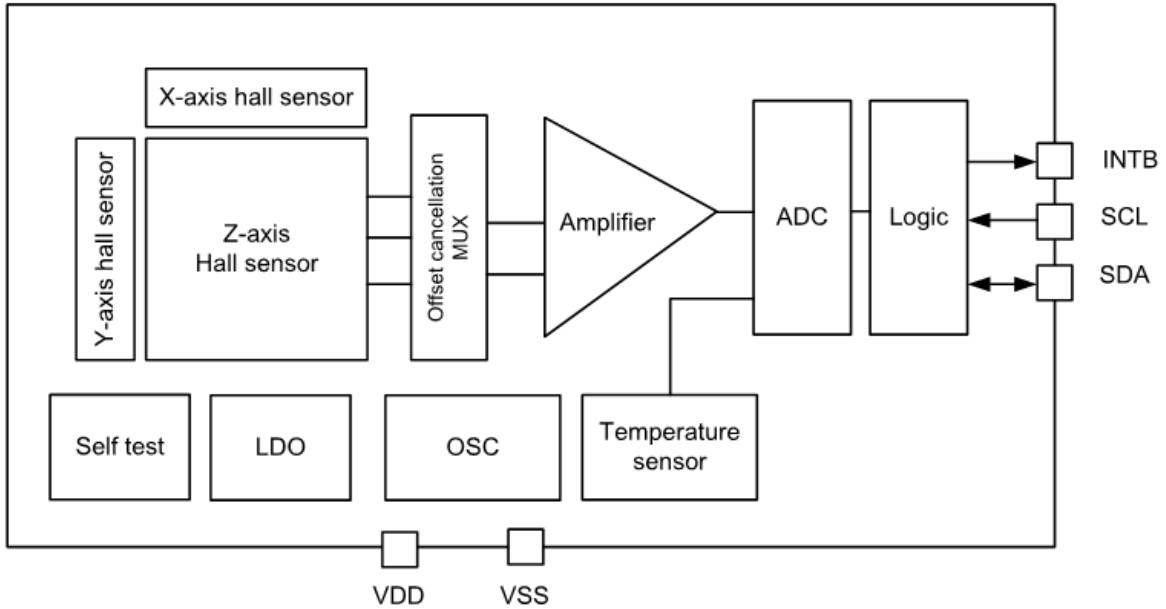


Figure 1. Block Diagram

2.2. Package Dimensions

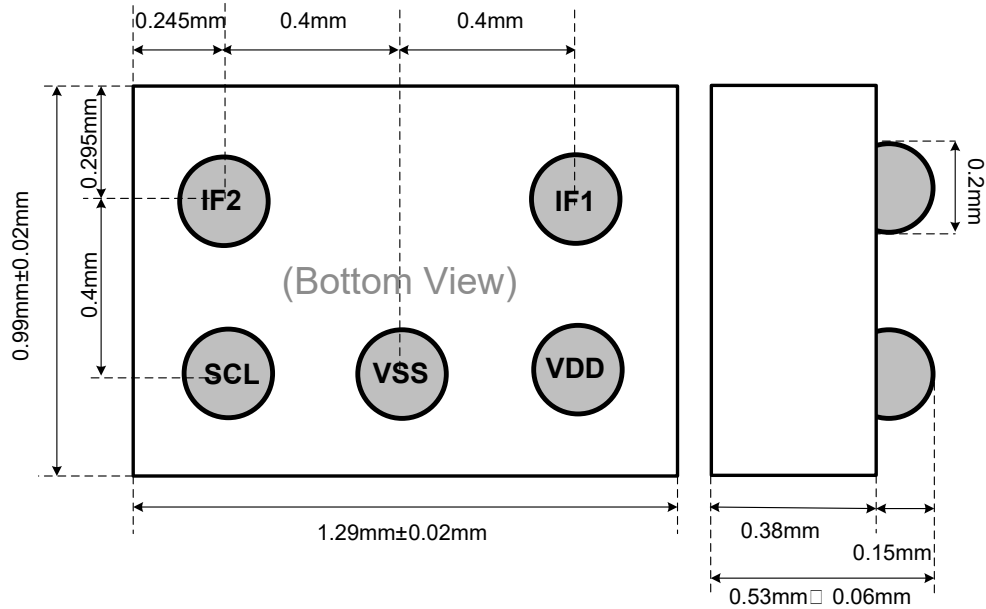
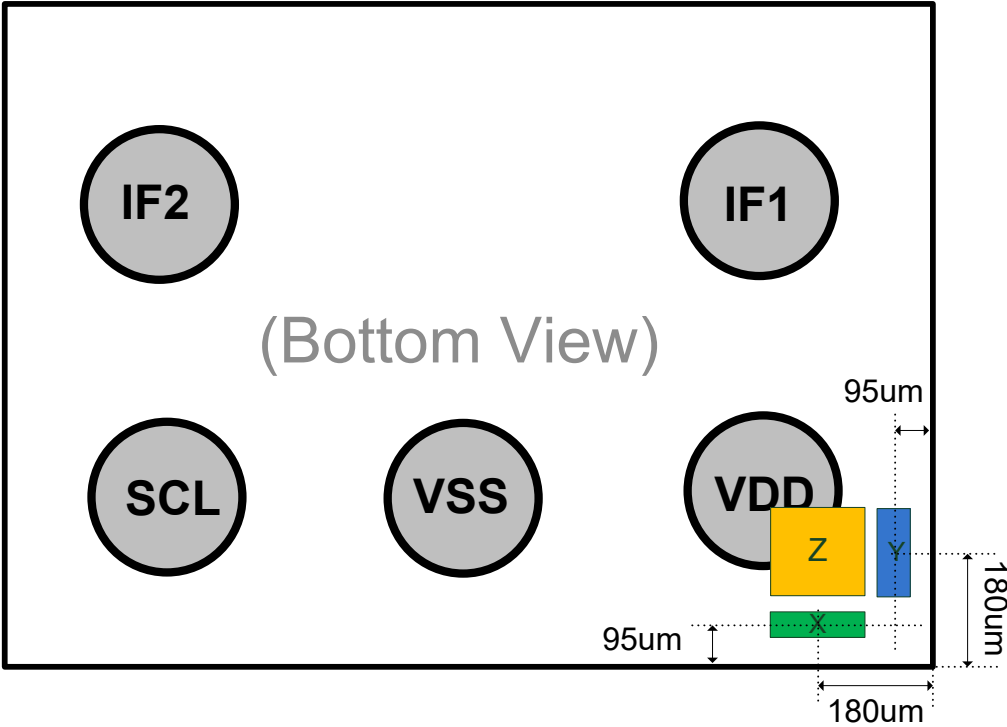


Figure 2. Package Dimensions

2.3. Location of Hall Sensing Elements



2.4. Marking

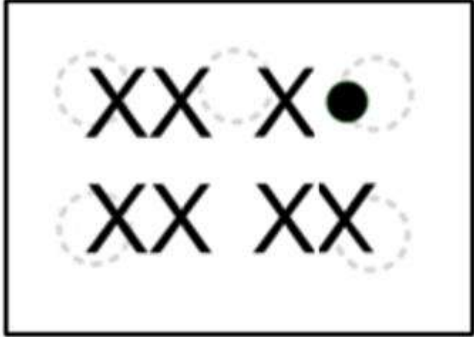
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X₁: Year

X₂X₃: Week

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IST8309 TOP View

2.5. Magnetic Field Direction

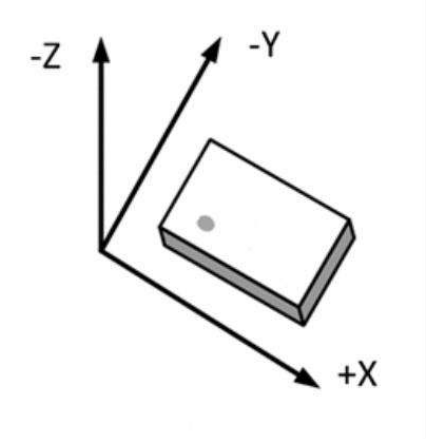
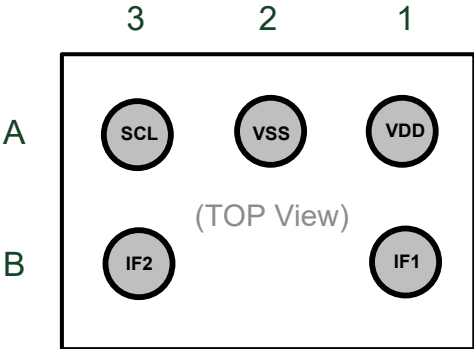


Figure 3. Magnetic Field Direction

2.6. Pin Configurations and Application Circuit



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

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

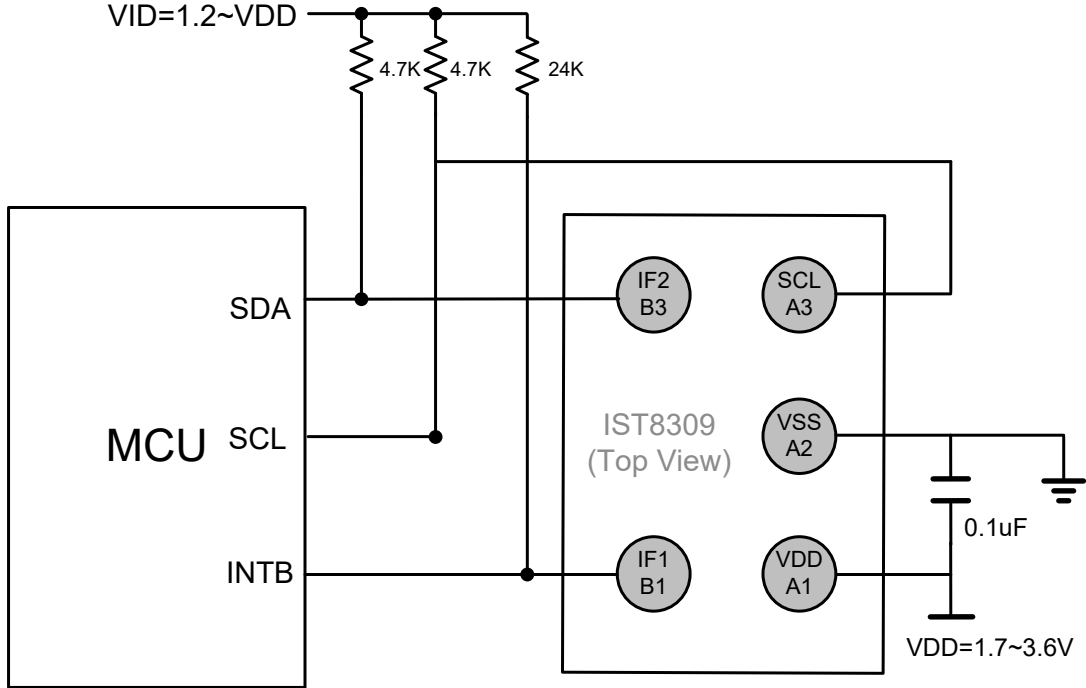


Figure 4. Application Circuit

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

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

	Name	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	INTL	Output	Interrupt output

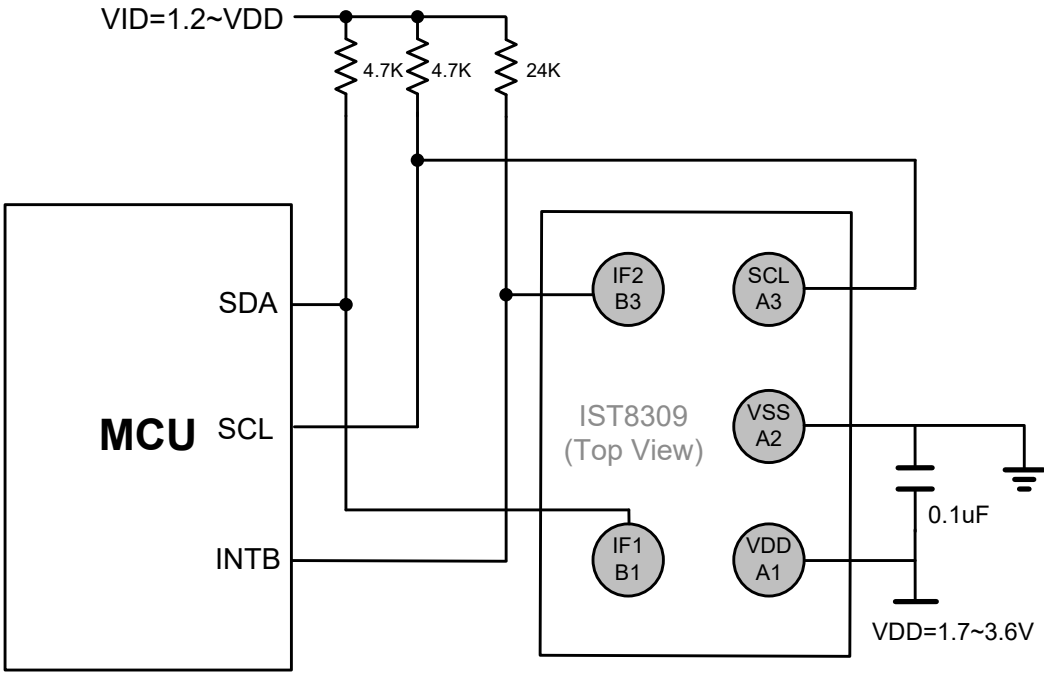


Figure 5. Application Circuit

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

Case 3. Dual IST8309

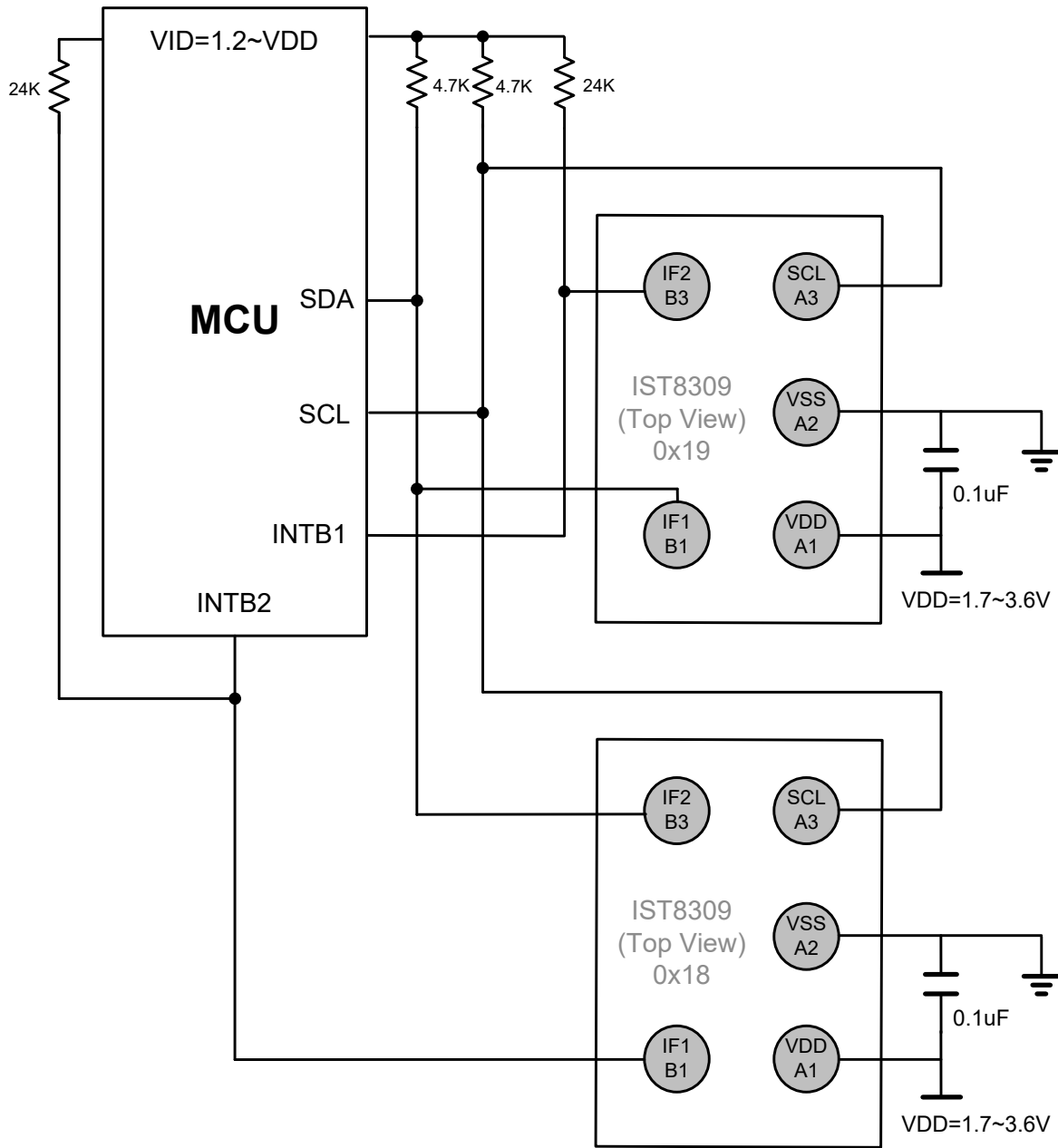


Figure 6. Application Circuit

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

3. Operational Modes and Functional Descriptions

IST8309 has the following operation modes:

- (1) Standby mode
- (2) Single measurement mode
- (3) Continuous measurement mode
- (4) Self-test mode

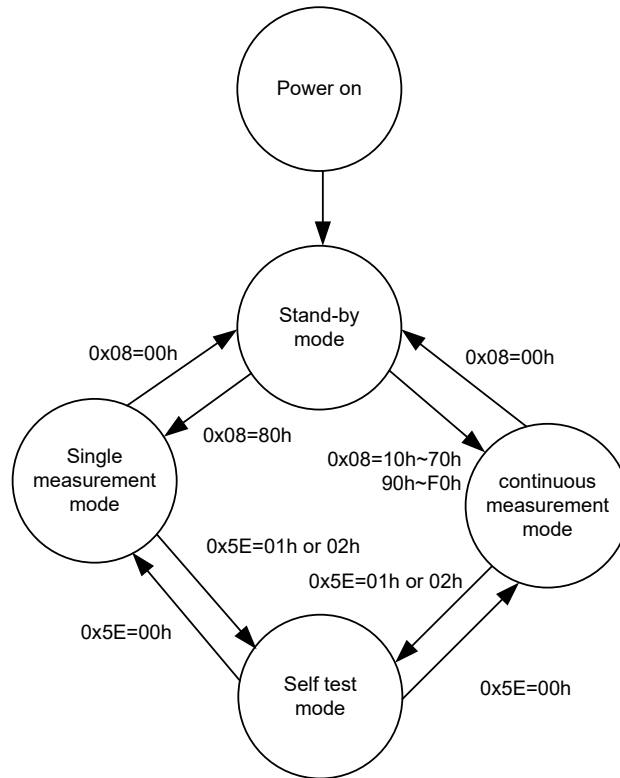


Figure 7. Operation Modes

3.1. Standby Mode

The initial model of the IST8309 (after power on) is Standby Mode. In Standby Mode, internal circuits are deactivated (except the oscillator and regulator). In Standby Mode, you can access all registers. The latest state of data saved in Read/Write registers is maintained. A soft reset can be used to reset registers.

3.2. Single Measurement Mode

In Single Measurement Mode, measured data are recorded in data registers before IST8309 automatically transitions into Standby Mode. On transition to Standby Mode, CNTL1 [7:4] turns to “0000”. Simultaneously, the DRDY bit in the STAT1 register turns to “1”. This is defined as “Data ready”. When any of the measurement data registers are read, the DRDY bit turns to “0”. For the next measurement, the user needs to set CNTL1 [7:4] to “1000” again.

3.3. Continuous Measurement Mode

When the Continuous Measurement Mode is set, the sensor is measured periodically at preset frequencies. The measured data is stored in Output Data Registers. When the next measurement time comes, IST8309 automatically starts to measure again and the Output Data Registers will be updated.

3.4. Self-Test Mode

Self-test mode is utilized to ensure that the magnetic sensor is functioning normally.

When this mode is enabled (0x5E = 0x01 or 0x02), the internal coil is activated to generate a standard magnetic field for testing the magnetic sensing functionality. Users will receive two sets of sensing data for each axis when (0x5E = 0x01) and (0x5E = 0x02) are configured. After calculating the absolute value of the difference between these two data (for each axis), we can determine that the sensor is functioning properly if the result is approximately 1 Gauss.

4. Electrical Specifications

4.1. 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)

4.2. 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

4.3. 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		uA
Standby Consumption	CUP	VDD	Suspend mode		1		uA
Input current	IAN	SCL, IF1, IF2	GND or VDD	-10		10	uA

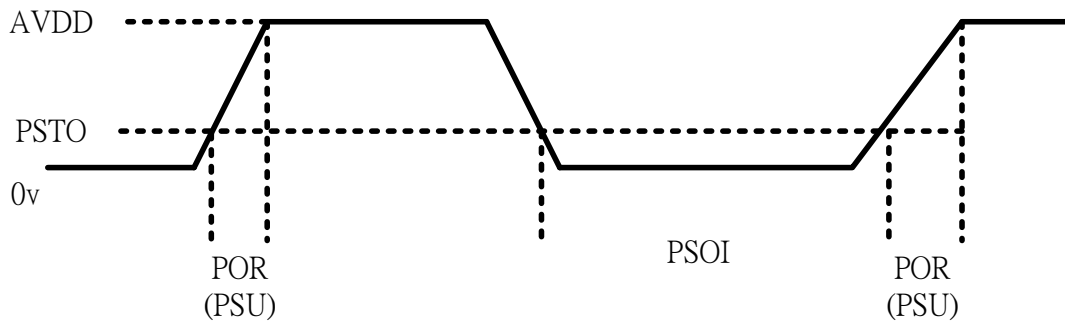
Input Low Voltage	VIL	SCL, IF1, IF2		-0.3		0.42	V
Input High Voltage	VIA	SCL, IF1, IF2		0.89		VDD	V
Output Low Voltage	VOL	IF1, IF2				0.3	V
Hysteresis Input	VHS	SCL, IF1, IF2		0.2			V

4.4. 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

4.5. 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*¹

PSTO: max=0.1volt
 PSOI: min=30ms
 POR: max:1ms

*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.

5. 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.

6. Legal disclaimer

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6.3. Disclaimer Regarding Changes

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