IST8801
Digital Linear Hall Sensor

Datasheet

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1. General Description

iSentek IST8801 is a digital linear hall sensor to measure magnetic flux intensity. It is an integrated chip with magnetic sensors and a control ASIC with a 16-bit ADC output. IST8801 provides an I^2C 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 handheld, wearable, and IoT devices.

Features

- Single chip linear hall sensor with digital output
- Compact form factor, 1.33 x 1.33 x 0.53 mm^3, 9-pin WLCSP-BGA package
- I^2C slave, Fast Mode up to 400 kHz
- High dynamic range of maximum ±40.96 mT
- High resolution of maximum 0.3125 μT/LSB (16-bit setting with 10.24 mT dynamic range)
- High output data rate of maximum 500 Hz
- 8~16-bit adjustable data output
- Operation Temperature -40 ~ 85 °C
- Built-in oscillator for internal clock source
- Power on Reset circuit
- RoHS, HF and TSCA compliant

Applications

Magnetometer for external magnet detection

Lid opening angle detection

Displacement detection

VCM modules

2. Block Diagram, Package Dimension, Magnetic Field Direction and

Application Circuit

2.1. Block diagram

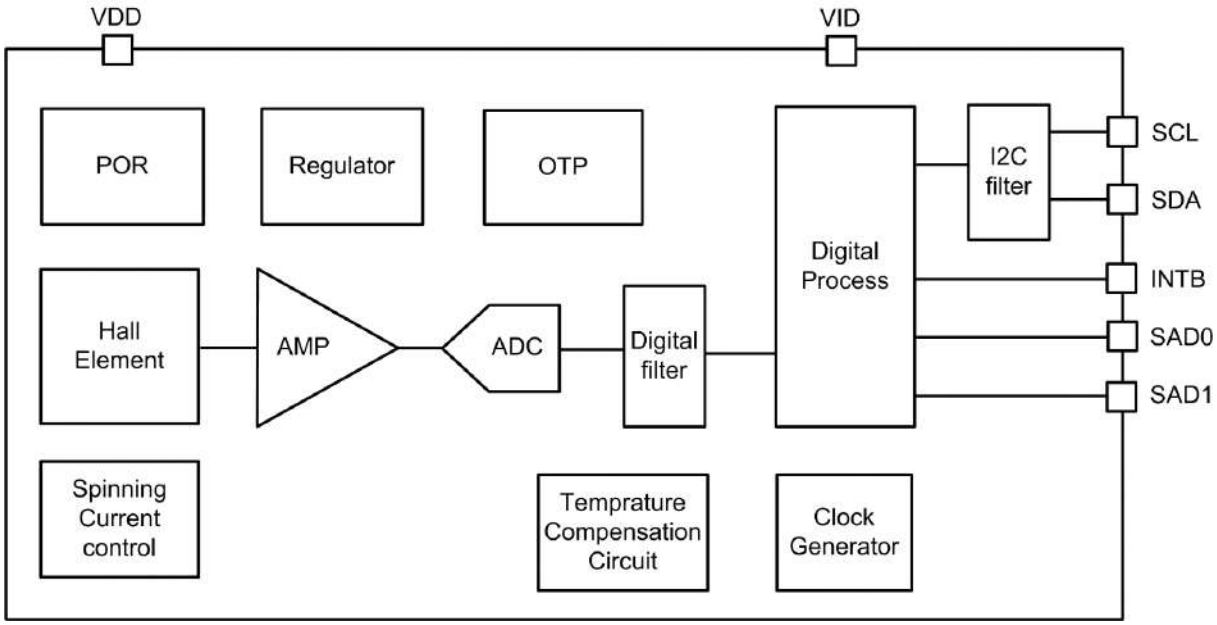


Figure 1. Block Diagram

2.2. Package Dimensions and Hall Element Locations

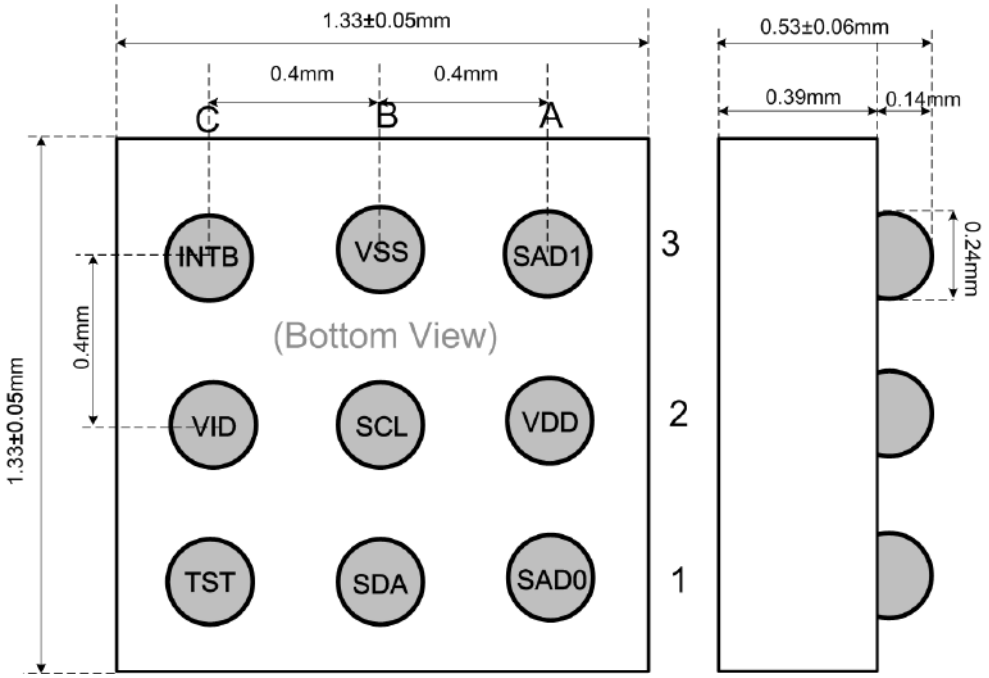
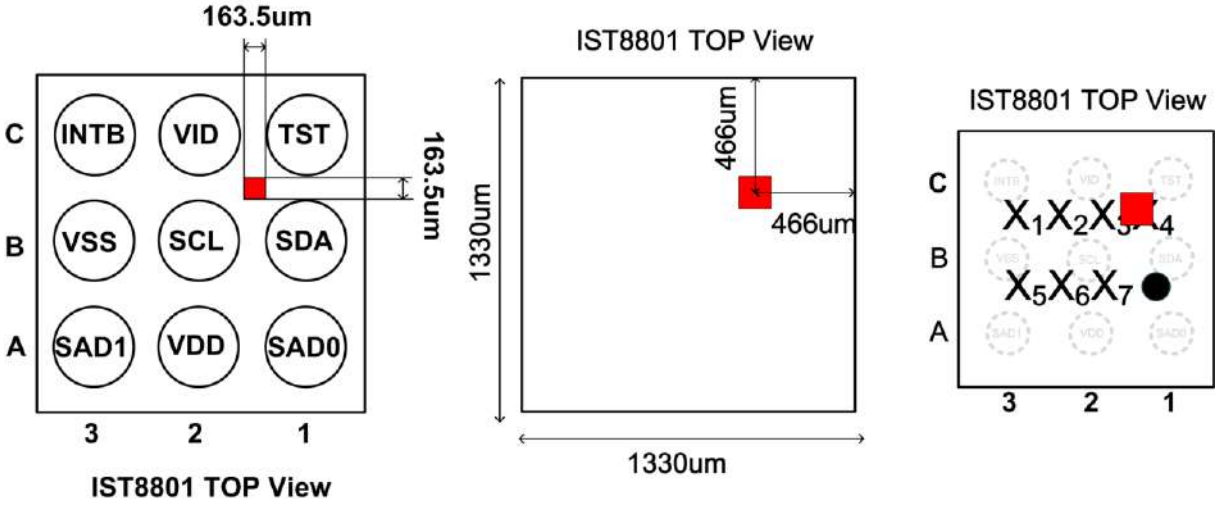


Figure 2. Package Dimensions

Figure 3. Hall Element Locations



2.3. Pin Configurations and Functions

Product code $X_1X_2\ X_3X_4$

Date code $X_5X_6\ X_7$●

$X_1X_2X_3X_4$: Product code

X_5: Year

X_6X_7: Week

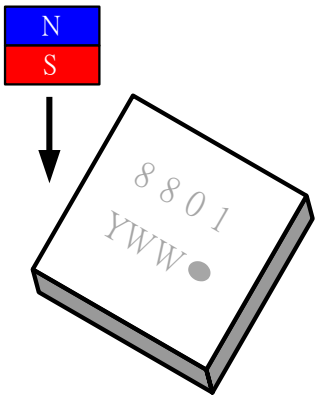
Pin No	Pin Name	I/O type	Function
A1	SAD0	I	I^2C slave address selection, connect to GND or VDD. Internally pull-low when floating
A2	VDD	Supply	Power supply voltage: 1.8 ~ 3.6 V
A3	SAD1	I	I^2C slave address selection, connect to GND or VDD. Internally pull-low when floating.
B1	SDA	I/O	I^2C data, should be connected to VID with 1.5 kΩ resistor
B2	SCL	I	I^2C clock, should be connected to VID with 1.5 kΩ resistor
B3	VSS	Supply	Should be connected to Ground
C1	TST	I/O	Keep it floating or connect it to VDD/GND[*1]
C2	VID	Supply	Digital power supply voltage: 1.65~VDD.
C3	INTB	O	When detected magnetic flux density meets specific

			threshold level, INTB become low level unless user clear it manually via PERSINT[0]. Internally pull-high when floating.

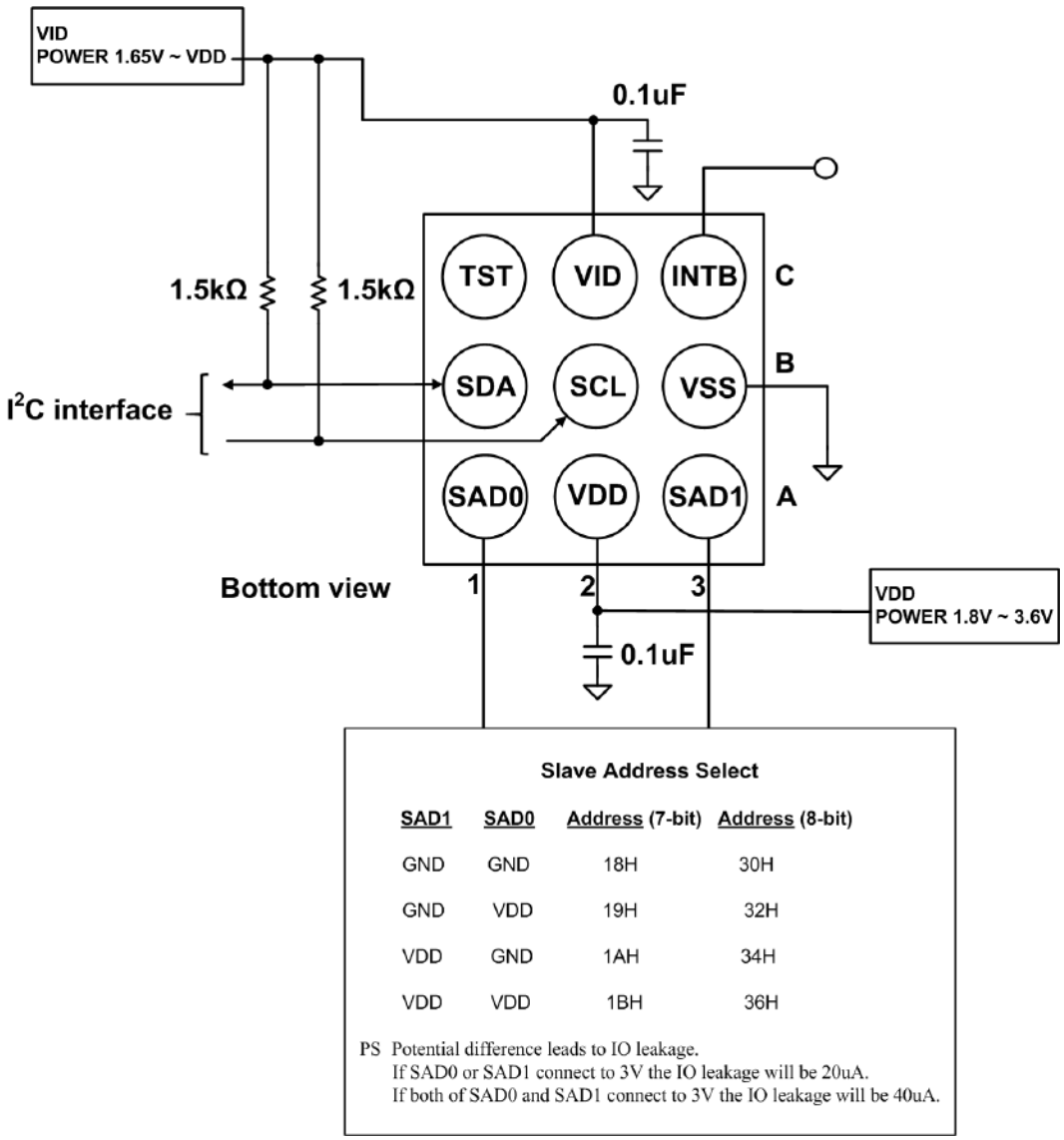
*1 TSTCNTL register (0x76H) need to be set to 0x04H when TST pin is connected to VDD/GND.

2.4. Magnetic Field Direction

The measurement data increases as the magnetic flux density increases in the arrow directions



2.5. Application Circuit



Slave Address Select

SAD1	SAD0	Address (7-bit)	Address (8-bit)
GND	GND	18H	30H
GND	VDD	19H	32H
VDD	GND	1AH	34H
VDD	VDD	1BH	36H

PS Potential difference leads to IO leakage.
If SAD0 or SAD1 connect to 3V the IO leakage will be 20uA.
If both of SAD0 and SAD1 connect to 3V the IO leakage will be 40uA.

Figure 4. Application Circuit

3. Operational Modes and Functional Descriptions

3.1. Operation Modes

IST8801 has the following operation modes:

(1) Standby Mode

(2) Single Measurement Mode

(3) Continuous Measurement Mode

(4) Suspend Mode

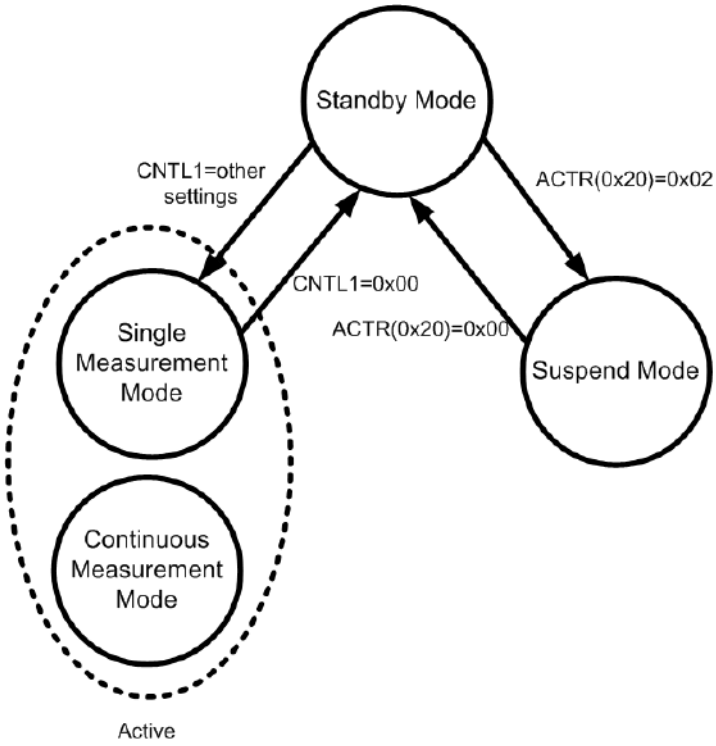


Figure 5. Operation Modes

3.1.1. Standby Mode

The initial mode of the IST8801 (after power on) is Standby Mode. In Standby Mode, all internal circuits are deactivated (except oscillator and regulator) and all registers are accessible. The latest state of data saved in Read/Write registers is maintained. Soft reset can be used to reset registers.

As shown in Figure 4, Standby Mode can be entered via ACTR(0x20) or CNTL1(0x08) registers. Please note that after entering Standby Mode via these two registers, IFCNTL(0x40) must be set to 0×04H before entering any active modes (Single Measurement Mode or Continuous Measurement Mode).

In addition, when the Standby Mode is entered from Suspend Mode, please wait 5 ms (for the system to wake up) before entering any active modes (Single Measurement Mode or Continuous Measurement Mode).

Any register setting of IST8801 must be set in Standby Mode.

3.1.2. Single Measurement Mode

In Single Measurement Mode, measured data are saved in data registers before IST8801 automatically transitions to Standby Mode. When entering Standby Mode, CNTL1[7:4] becomes "0000." Simultaneously, the DRDY bit in the STAT1 register is set to 1. This is called “data ready”. When any of the measurement data registers is read, DRDY bit turns to “0”. For the next measurement, user must set CNTL1[7:4] to “1000” again.

3.1.3. Continuous Measurement Mode

When 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, IST8801 automatically resumes measuring and the Output Data Registers will be updated.

If user wants to switch between different ODR modes in Continuous Measurement Mode by using CNTL1[7:4], they must switch to Standby Mode first (by setting CNTL1[7:4] to “0000”) and write 0x04H into IFCNTL(0x40), and finally set CNTL1[7:4] to desired ODR setting.

3.1.4. Suspend Mode

This is a mode with lower power consumption. When Suspend Mode is set through ACTR(0x20), most of the circuits are turned off, the only allowed command is ACTR(0x20) = 0x02H (return to Standby Mode). Users are advised to use this mode when the system does not require sensor data. If the user decides to retake a measurement, the IST8801 must first enter Standby Mode.

Note that software reset through the SRST (0x07) register is NOT supported in this mode. In this mode, the sole allowed command is ACTR(0x20) = 0x02H. (go back to Standby Mode).

3.2. IST8801 Read Process

(1)Read STAT1 register:

-Polling STAT1 register

-DRDY: indicates whether or not the hall sensor data is ready

0: no data ready

1: data ready

-DOR: indicates whether any data was skipped prior to the current data

0: no skipped data

1: data skipped.

(2) Read Measurement Data:

Read Register 0x11h~0x12h for sensor data. When data reading starts, DRDY and DOR bits turn to “0”.

4. Electrical Specifications

4.1. Absolute Maximum Ratings

Parameter	Symbol	Limits	Unit
Storage Temperature	TSTG	-40 to +150	°C
Power Supply Voltage (VDD)	VDD	-0.3 to +3.8	V
Power Supply Voltage (VID)	VID	-0.3 to +3.8	V
Digital Input Voltage	VIN	-0.3 to VDD + 0.3	V
Electrostatic Discharge Voltage*[1]	VESD_HBM	-2000 to 2000	V
Electrostatic Discharge Voltage*[3]	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	-40		+85	°C
Power Supply Voltage (VDD)	VDD	1.8	3.3	3.6	V
Power Supply Voltage (VID)	VID	1.65	1.8	3.6	V

4.3. Electrical Specifications

Operating conditions: TA = +25 ℃; VDD = 3.0 V; VID = 3.0 V or 1.8 V; CAD0 = GND; CAD1 = GND

Parameter	Symbol	Conditions	Min.	Typ.	Max	Unit
Current Consumption	IDD	50 sample per second*[1] 500 sample per second*[1] 50 sample per second*[2] 500 sample per second*[2]		180 600 450 3300		uA
Suspend Current	ISUP			2		uA
Standby Mode Current	ISTB			100		uA

Output Data Rate	ODR				500	Hz
Input Low Voltage (For SCL, SDA)	VIL		0		VID *30%	V
Input High Voltage (For SCL, SDA)	VIH		VID *70%			V
Output Low Voltage	VOL	IOL= +4mA	0		VID *20%	V
Output High Voltage	VOH	IOH= -100uA (Except SCL and SDA)	VID *80%		VID	V

*1 Current consumption in Continuous Measurement Mode, OSR = 4

*1 Current consumption in Continuous Measurement Mode, OSR = 32

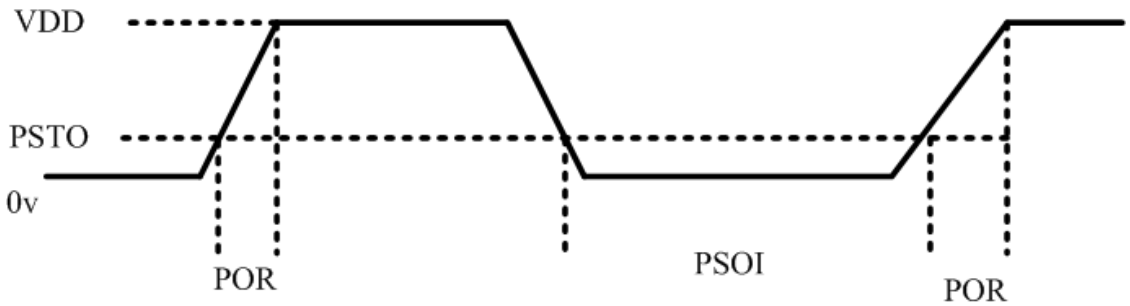
4.4. Magnetic Sensor Specifications

Operating conditions: TA = +25 ℃; VDD = 3.0 V; VID = 1.8 V.

Parameter	Symbol	Condition	Low	Mid.	High	Unit
Dynamic Range*1	DR		±10.24	±20.48	±40.96	mT
Resolution*1	RES	16-bit setting*1	0.3125	0.625	1.25	uT/LSB

*1CNTL2(0x0D) controls dynamic range setting and resolution setting.

4.5. 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=30ms
POR: max:50ms

When POR circuit detects a rise of VDD voltage, it resets all internal circuits and initializes all registers. After reset, IST8801 transits to Standby Mode.

5. Ordering Information

Order Number	Package Type	Packaging	Temperature Range	Marking Information
IST8801	WLCSP – 9 pins	Tape and Reel: 3k pieces per reel	-40 to +85°C	$X_1X_2X_3X_4$ $X_5X_6X_7$● $X_1X_2X_3X_4$: Product code X_5: Year X_6X_7: Week

For more information on iSentek's magnetic sensors, please send an email to sales@isentek.com or visit our website at www.isentek.com.

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