

IST8210S

Magnetic Angle Sensor

Datasheet

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1 General Description

iSentek IST8210S is a anisotropic magneto-resistance (AMR) digital magnetic angle sensor which detects the orientation of a magnetic field. It is an integrated chip with magnetic sensors and control ASIC with 14-bit ADC output in $1.6 \times 1.6 \times 1.2 \text{ mm}^3$, 12-pin BGA package. IST8210S provides an I²C digital output with fast mode up to 400 kHz. Two sinusoidal output signals (Sin(2 θ) and Cos(2 θ)) reflecting the angle θ between the sensor and direction of magnetic field are generated for the calculation of absolute angles within 180 degree. IST8210S operates in saturation region therefore has high tolerance to process and temperature variation of magnet and the alignment error of PCB mounting. Both end-of-shaft and side-shaft mounting configurations are supported. iSentek dynamic calibration algorithms are provided for the users to obtain an angle error of 0.25°.

Features

- I²C digital output with fast mode of 400KHz.
- 14-bit resolution for absolute 180° angle detection
- 0.25° angle error with iSentek dynamic calibration algorithm
- Low current consumption of 1.3mA
- Low suspend current consumption of 2.5uA
- 1000Hz output data rate
- -40 to +85°C Operating Temperature
- $1.6 \times 1.6 \times 1.2 \text{ mm}^3$, 12-pin BGA package

Advantages

- Non-contact and wear-free angle measurement
- Insensitive to dust, water, oil, or other contaminations
- Excellent robustness against shocks and vibrations
- Constant sensitivity at operation field higher than 320 Gauss
- High sensitivity
- Negligible hysteresis effect

Applications

- General purpose angle measurement (180° absolute)
- Incremental or absolute position detection for linear or rotational motion
- Rotational speed measurement
- Motor communication
- Industrial robotics
- Valve control
- Power tools
- Automatic applications

2 Block Diagram, Output Signal, Package Dimension and Pin Descriptions

2.1 Block Diagram

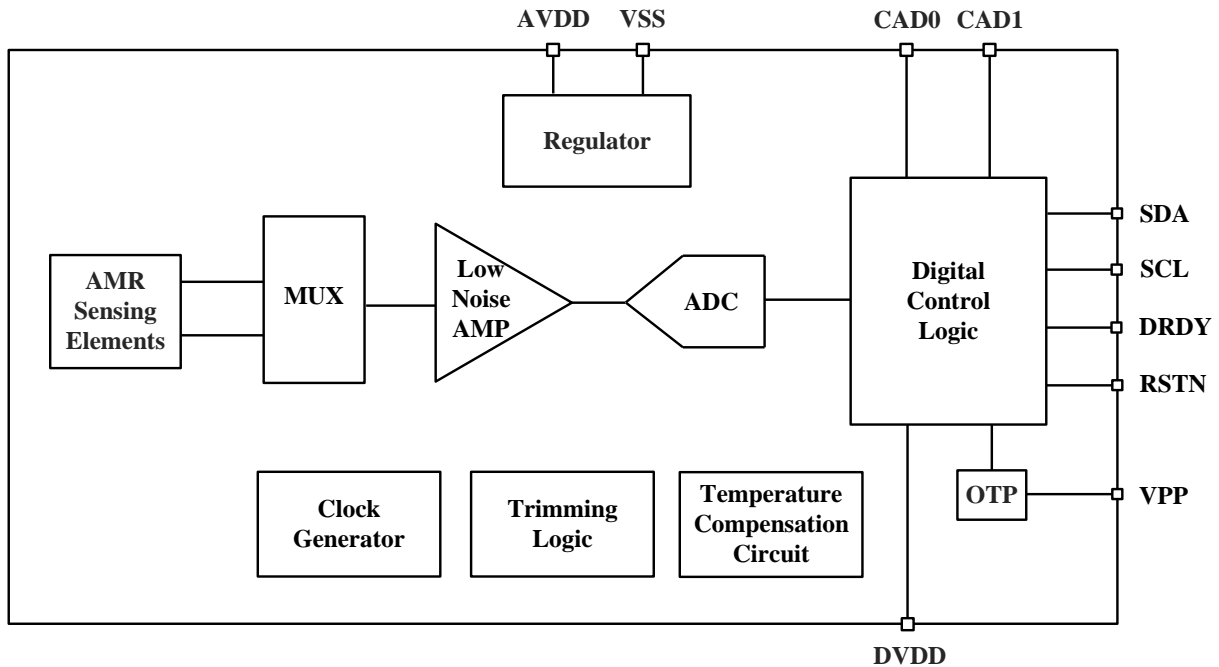


Figure 1. Block Diagram.

2.2 Output Signal

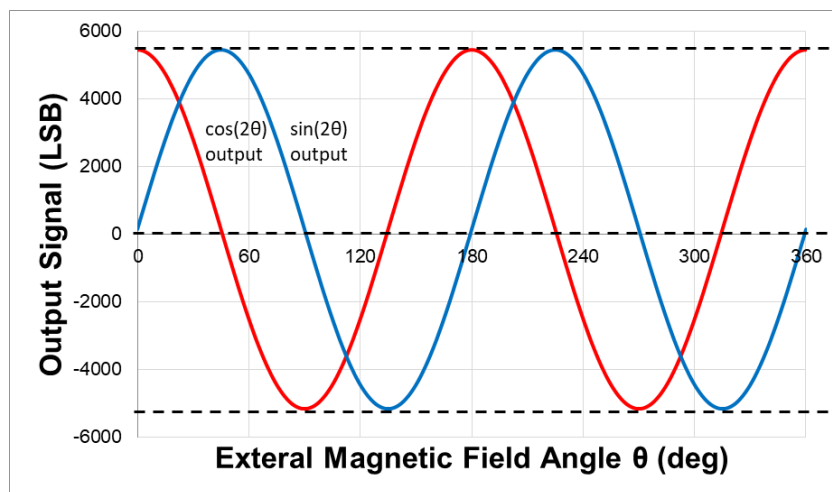
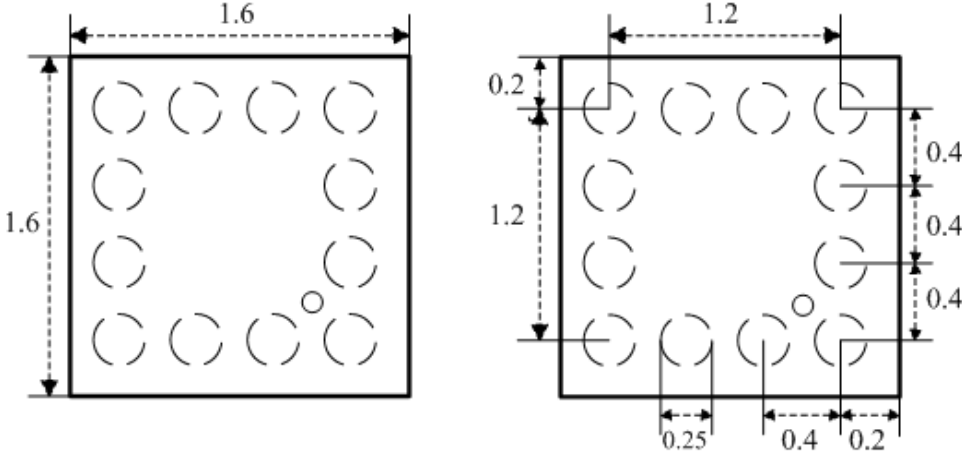


Figure 2. Sensor output as a function of angle θ

2.3 Package Dimensions

IST8210S BGA Top View (Looking Through)



IST8210S BGA Side View



Unit: mm
Tolerance: ±0.1mm

Figure 3. Package dimensions.

Pin ^{*1}	Name	Function
1	DRDY	Data ready
2	NC	Not use
3	SCL	I ² C serial clock
4	SDA	I ² C serial data
5	VPP	Test pin, connect to DVDD or keep floating ^{*2}
6	DVDD	Digital supply voltage, 1.72~3.6V
7	RSTN	Reset pin, resets registers by setting it to “Low”. Internally pulled to “High” for floating connection. MCU connection is suggested (but not necessary).
8	C1	Set/Reset function
9	CAD1	I ² C slave address select, internally pulled to “high” by default
10	CAD0	I ² C slave address select, internally pulled to “low” by default
11	VSS	GND
12	AVDD	Analog supply voltage, 2.4~3.6V

^{*1} Please refer to Figure 4. on page 6.

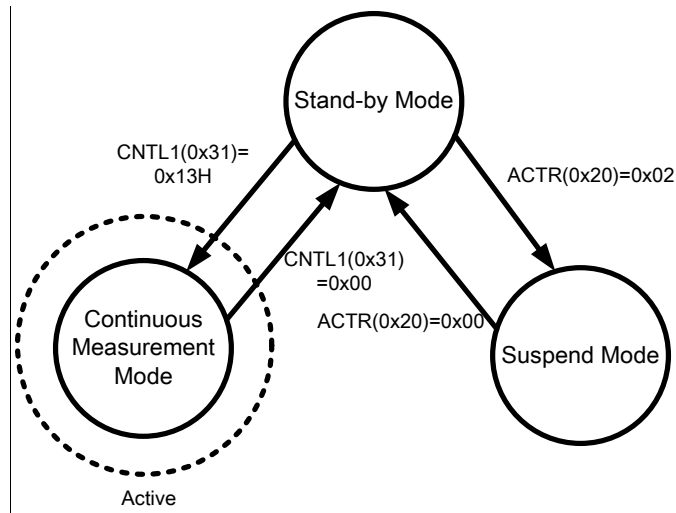
^{*2} Please keep CAD1 floating if VPP is floating.

3 Operational Modes and Functional Descriptions

3.1 Operation modes

IST8210S has following operation modes:

- (1) Stand-By Mode
- (2) Suspend Mode
- (3) Continuous Measurement Mode



4 Electrical and Magnetic Specifications

4.1 Absolute Maximum Ratings

Parameter	Symbol	Limits	Unit
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 VDD+0.3	V
Electrostatic Discharge ^{*1}	VESD_HBM	-4000 to 4000	V
Electrostatic Discharge ^{*2}	VESD_MM	-300 to 300	V
Electrostatic Discharge ^{*3}	VESD_CDM	-700 to 700	V
Storage Temperature		-40 to +150	°C
Reflow Classification	JESD22-A113 with 260°C Peak Temperature		

If the device is used in conditions exceeding these limits, it may be permanently failed. Device’s performance cannot be guaranteed when exceeding these limits.

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

4.2 Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max	Unit
Analog Supply Voltage	AVDD		2.4	3.3	3.6	V
Digital Supply Voltage	DVDD		1.72	1.8	3.6	V
Operating Magnetic Field Strength	H _{OP}	At IC's surface (middle), no upper limit.	320			Gauss
Operating temperature	T _{OP}		-40		85	°C

4.3 General Specifications

(Operating conditions: T_{OP} = +25 °C; H_{op} = 320 G; AVDD = 2.5 V; DVDD = 1.8 V; unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max	Unit
Operating Current	I _o	Operating at 1000 Hz		1.30		mA
Suspend Current	I _{suspend}			2.5		uA
Resolution	RES			14		Bit
X,Y Output Range					±5300	LSB
Output Data Rate	ODR			1000	1300	Hz
Overall Calibrated Angle error	Δθ _{cal}	Full temperature range, with iSentek dynamic calibration algorithm		0.25		Degree
Overall Un-calibrated Angle Error	Δθ _{ucal}	T=25°C, without iSentek dynamic calibration algorithm		1		Degree
Output Noise	Noise	RMS value		0.075		Degree
Offset		Without iSentek dynamic calibration algorithm	-115		+115	LSB
Sensitivity Temperature Coefficient	T _{sen}	Without iSentek dynamic calibration algorithm		-0.40		%/°C
Offset Temperature Coefficient	T _{off}	Without iSentek dynamic calibration algorithm		±0.015		Degree/°C

1. $T_{sen} = 100 \times \frac{S(T_2) - S(T_1)}{S(T_1)(T_2 - T_1)}$, where T₁ = -40°C, and T₂ = +85°C.

2. $T_{OFF} = \frac{O(T_2) - O(T_1)}{(T_2 - T_1)}$, where T₁ = -40°C, and T₂ = +85°C.

5 Ordering Information

Order Number	Package Type	Packaging	Marking Information
IST8210S	BGA – 12 pin	Tape and Reel: 3k pieces per reel	<p>X₁X₂X₃ 10● X₁: Last number of the year X₂X₃: Week number 10: Product code of IST8210S</p>

For more information on iSentek’s Magnetic Sensors, please contact us by phone at +86-132-6706-8686 (China), +86-755-2991-0201 (China) or +886-2-2698-3306 ext:110 (Taiwan); via e-mail: sales@isentek.com or visit us online at www.isentek.com.

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