IST8210D
Magnetic Angle Sensor

Datasheet

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1 General Description

iSentek IST8210D 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 3.0 × 3.0 × 1.0 mm^3. IST8210D provides an I^2C digital output with fast mode up to 400 kHz. Two sinusoidal output signals (Sin(2θ) and Cos(2θ)) reflecting the angle θ between the sensor and direction of magnetic field are generated for the calculation of absolute angles within 180 degree. IST8210D 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

- I^2C 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
- 3.0 × 3.0 × 1.0 mm^3, LGA-16 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

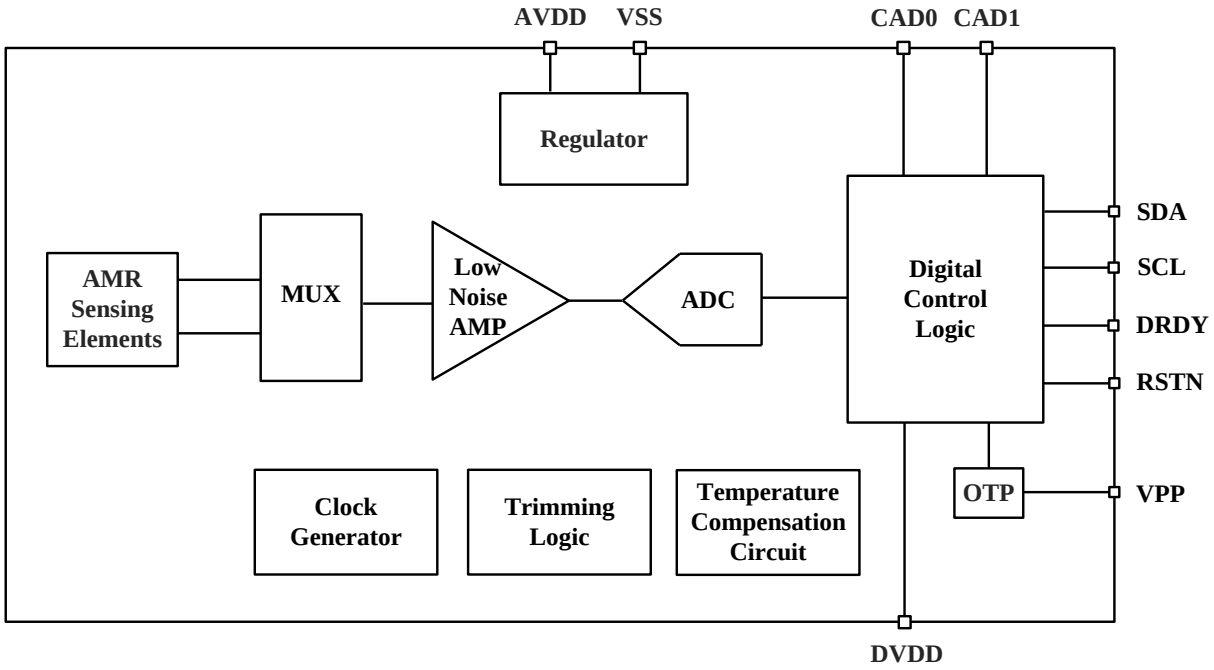


Figure 1. Block Diagram.

2.2 Output Signal

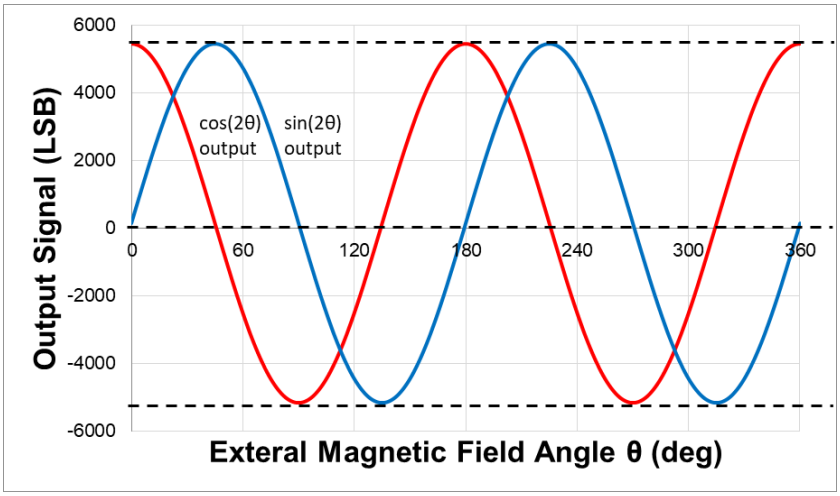
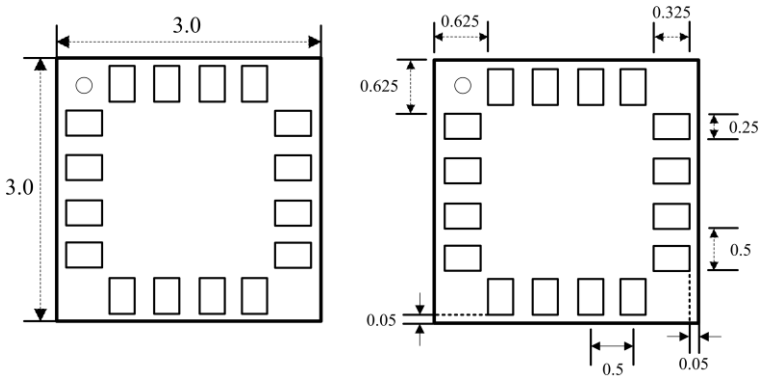


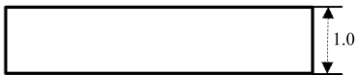
Figure 2. Sensor output as a function of angle θ

2.3 Package Dimensions

IST8210D LGA Top View (Looking Through)



IST8210D LGA Side View



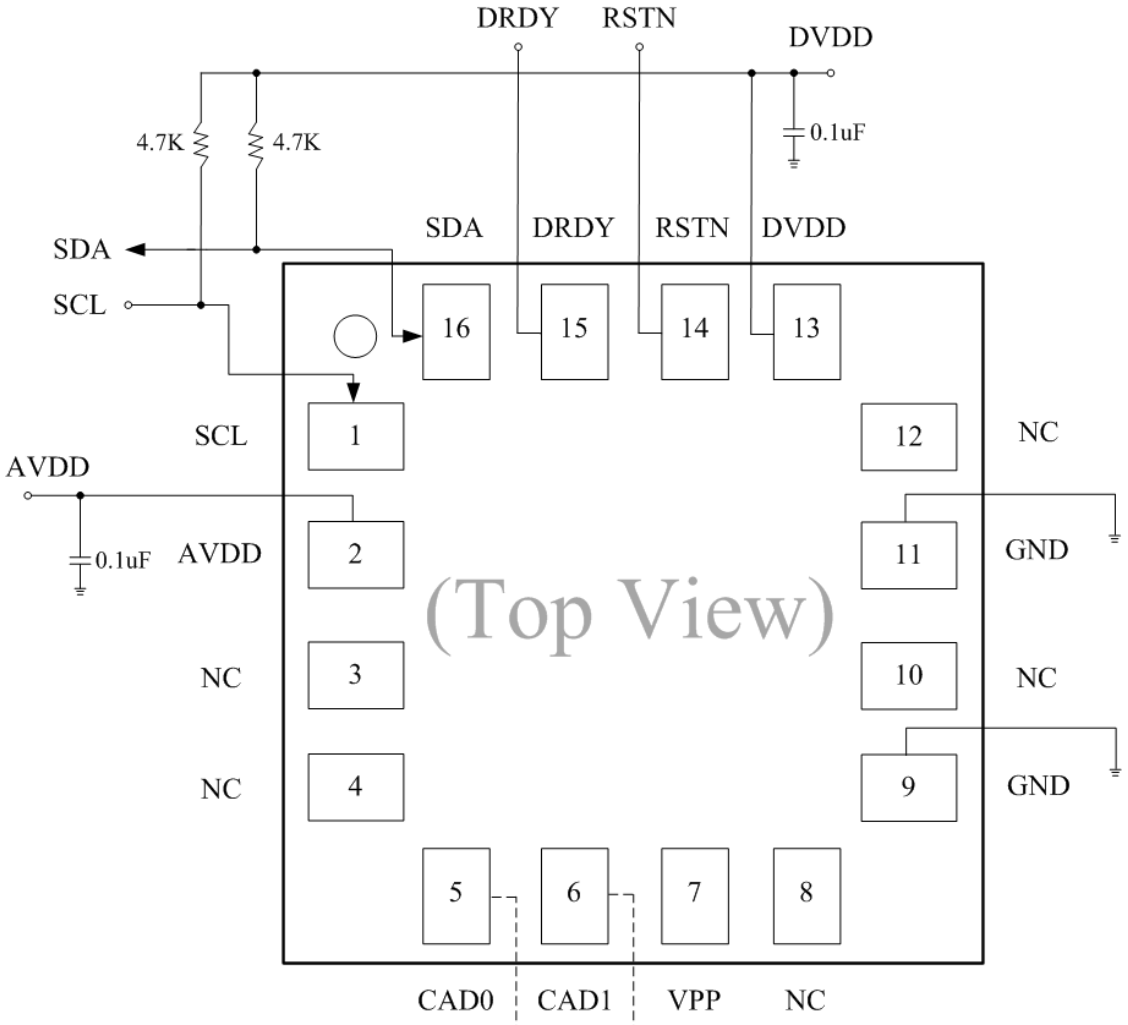
Unit: mm

Tolerance: ±0.1mm

Figure 3. Package dimensions.

2.4 Application Circuit and Pin Description

2.4.1 Application Circuit and Pin Description for 16-pin LGA package



Slave Address Select

CAD1	CAD0	Address (7-bit)	Address (8-bit)
VSS	VSS	0CH	18H
VSS	VDD	0DH	1AH
VDD	VSS	0EH	1CH
VDD	VDD	0FH	1EH

*if CAD1 and CAD0 are floating, I^2C address will be 0CH/18H.
*if CAD1 and CAD0 are NOT floating, extra current may flow into/out of them. (max. ~90uA)

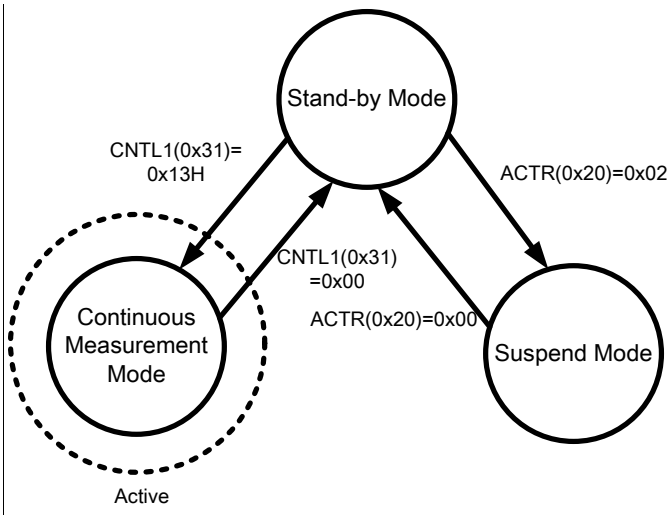
Figure 4. 16-pin LGA Package Application Circuit

Pin	Name	Function
1	SCL	I^2C serial clock
2	AVDD	Analog supply voltage, 2.4~3.6V
3	NC	Not use
4	NC	Not use
5	CAD0	I^2C slave address
6	CAD1	I^2C slave address
7	VPP	Test pin, connection to DVDD is suggested
8	NC	Not use
9	VSS	GND
10	NC	Not use
11	VSS	GND
12	NC	Not use
13	DVDD	Digital supply voltage, 1.72~3.6V
14	RSTN	Reset pin, resets registers by setting it to “Low”. Internally pulled to “High” for floating connection. MCU connection is suggested (but not necessary).
15	DRDY	Data ready indication, output pin only
16	SDA	I^2C serial data

3 Operational Modes and Functional Descriptions

3.1 Operation modes

IST8210D 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	$\Delta\theta_{cal}$	Full temperature range, with iSentek dynamic calibration algorithm		0.25		Degree
Overall Un-calibrated Angle Error	$\Delta\theta_{ucal}$	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. $T_{sen} = 100 \times \frac{S_{(T2)} - S_{(T1)}}{S_{(T1)} \cdot (T_2 - T_1)}$, where T_1 = -40°C, and T_2 = +85°C.

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

5 Ordering Information

Order Number	Package Type	Marking Information
IST8210D	LGA – 16 pin	8210 $X_1X_2X_3$● 8210: Product code of IST8210D X_1: Last number of the year X_2X_3: Week number

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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