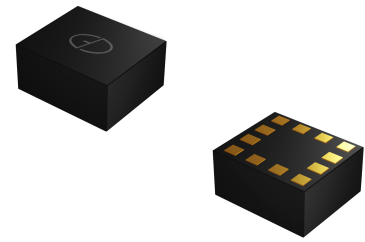


### Key Features and Specifications

- Supply Voltage: 2.2V to 3.6V
- Digital I<sup>2</sup>C Output Interface
- Low Power Consumption
- RoHS Compliant
- Accelerometer
  - User Selectable Range,  $\pm 2g$ ,  $\pm 4g$ ,  $\pm 8g$ ,  $\pm 16g$  for Accelerometer
  - 14-bit Resolution
  - Free-fall Detection
  - User Selectable Data Output Rate
  - One Programmable Interrupt Generator for Motion Detection
  - Factory Programmable Offset and Sensitivity
- Magnetometer
  - Full Scale:  $\pm 48$ Gauss
  - 16-bit Resolution
  - Operation Mode: Power-down Mode/ Burst Mode/Single Measurement Mode
  - One Programmable Interrupt Generator for DRDY or Trig Function
  - Embedded Temperature Sensor to Compensate Sensor Temperature Effect
  - Embedded Self-test to Built-in Internal Magnetic Field Generator



PACKAGE: LGA-12  
 2 x 2 x 1.1 mm  
 (LxWxH max value in mm)

### Applications

- Tilt-compensated Compasses
- Map Rotation
- Position Detection
- Motion-activated Functions
- Free-fall Detection
- Click/Double-click Recognition
- Pedometers
- Intelligent Power Saving for Handheld Devices
- Display Orientation
- Gaming and Virtual Reality Input Devices
- Impact Recognition and Logging

### Description

The GSDC213 is a system-in-package (SiP) featuring a 3D digital linear acceleration sensor and a 3D digital magnetic sensor. The module has linear acceleration full scales of  $\pm 2g$  /  $\pm 4g$  /  $\pm 8g$  /  $\pm 16g$  and a magnetic field full scale of  $\pm 48$  gauss. It also includes an I<sup>2</sup>C serial bus interface that supports standard and fast mode (100 kHz and 400 kHz) . The system can be configured to generate an interrupt signal for free-fall, motion detection and magnetic field detection. Thresholds and timing of interrupt generators are programmable by the end user. Magnetic and accelerometer blocks can be enabled or put into power-down mode separately. Packaged in 2x2x1.1mm land grid array (LGA), the GSDC213 has an outstanding operating temperature range of  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ .

**Mechanical Characteristic of Accelerometer**

Accelerometer specification parameters are specified  $V_{DD} = 2.5\text{ V}$ ,  $V_{DD\_IO} = 2.5\text{ V}$   $T = 25\text{ }^{\circ}\text{C}$  unless otherwise noted (a)

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
A_FS	Measurement Range	FS bit set to 00		±2		g
		FS bit set to 01		±4		g
		FS bit set to 10		±8		g
		FS bit set to 11		±16		g
A_So	Sensitivity	FS bit set to 00		4096		LSB/g
		FS bit set to 01		2048		LSB/g
		FS bit set to 10		1024		LSB/g
		FS bit set to 11		512		LSB/g
A_TCSO	Sensitivity Change vs. Temperature	FS bit set to 00		0.01		%/°C
A_TyOff	Typical Zero-g Level Offset Accuracy After SMT			150		mg
A_TcOff	Zero-g Level Change vs. Temperature	Max delta from 25°C		±1		mg/°C
An	Acceleration Noise Density	FS bit set to 00, Normal Mode		150	200	ug/sqrt(Hz)
Top	Operation Temperature Range		-40		85	°C

a. The product is factory calibrated at 2.5 V. The operational power supply range is from 2.2V to 3.6 V.

**Mechanical Characteristic of Magnetometer**

Magnetometer specification parameters are specified  $V_{DD}=3.0\text{ V}$ ,  $V_{DD\_IO}=3.0\text{ V}$  and  $T=25\text{ }^{\circ}\text{C}$

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
M_FS	Measurement Range			±48		Gauss
M_So	X/Y Axis Sensitivity			667		LSBs/Gauss
	Z Axis Sensitivity			400		LSBs/Gauss
M_NL	Non Linearity			0.1		% of FS
T_CONV	Conversion Time		1		128	ms
T_STBY	From IDLE to STBY			250		us
T_ACTIVE	From STBY to ACTIVE			8		us
T_INTERVAL	Time Between 2 Conversions (burst mode or wake-up on change)		20		5000	ms

### Electrical Characteristics of Accelerometer

The specifications are applicable at 25°C, unless specified otherwise, and for the complete supply voltage range ( $V_{DD}=2.2V$  to  $3.6V$ ,  $V_{DD\_IO}=1.65V$  to  $V_{DD}$ ).

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
$V_{DD}$	Supply Voltage		1.62	2.5	3.6	V
$V_{DD\_IO}$	I/O Pins Supply Voltage		1.62		3.6	V
$I_{DD}$	Current Consumption in Normal Mode	Top=25°C, ODR=1kHz		180		µA
$I_{DD\_LP}$	Current Consumption in Low Power Mode	Top=25°C, ODR=62.5Hz, BW=500Hz		32		µA
$I_{DD\_SM}$	Current Consumption in Suspend Mode	Top=25°C		1		µA
$V_{IH}$	Digital High Level Input Voltage	I <sup>2</sup> C	$0.7 \cdot V_{DD\_IO}$			V
$V_{IL}$	Digital Low Level Input Voltage	I <sup>2</sup> C			$0.3 \cdot V_{DD\_IO}$	V
$V_{OH}$	High Level Output Voltage		$0.9 \cdot V_{DD\_IO}$			V
$V_{OL}$	Low Level Output Voltage				$0.1 \cdot V_{DD\_IO}$	V
BW	System Bandwidth		1.95		500	Hz
ODR	Output Data Rate		1		1000	Hz
Wake-up Time	twu	From Stand-by		1		ms
Start-up Time	tsu	From Power-off		3		ms
PSRR	Power Supply Rejection Rate	Top=25°C			20	mg/V

### Electrical Characteristics of Magnetometer

The specifications are applicable at 25°C, unless specified otherwise, and for the complete supply voltage range ( $V_{DD}=2.2V$  to  $3.6V$ ,  $V_{DD\_IO}=1.65V$  to  $V_{DD}$ ).

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
$V_{DD}$	Analog Supply Voltage		2.2	3	3.6	V
$V_{IO}$	Digital I <sub>O</sub> Supply		1.71	1.8	V <sub>DD</sub>	V
$I_{DD\_CONV}$	Conversion Current			2.35	2.6	mA
$I_{DD\_STBY}$	Standby Current			40		µA
$I_{DD\_IDLE}$	Idle Current			2	3	µA
$I_{DD\_NOM}$	Nominal Current (Data-rate = 10Hz, T <sub>CONV</sub> = 4ms)			280	320	µA

**Absolute Maximum Ratings of Accelerometer**

Parameter	Test conditions	Min	Max	Unit
Storage Temperature		-45	125	°C
Supply Voltage	Supply Pins	-0.3	4.25	V
Supply Voltage	Logic Pins	-0.3	V <sub>DD_I/O</sub> +0.3	V
ESD Rating	HMB,R=1.5k,C=100pF		±2	kV
Mechanical Shock	Duration<200us		10,000	g

**Absolute Maximum Ratings for Magnetometer**

Parameter	Symbol	Min.	Max.	Unit
Power Supply Voltage	V <sub>DD</sub>	2.2	3.6	V
I/O Pins Supply Voltage	V <sub>DD_I/O</sub>	1.71	V <sub>DD</sub>	V
Operating Temperature Range	T <sub>OP</sub>	-40	85	°C
Storage Temperature Range	T <sub>ST</sub>	-50	125	°C
Electrostatic Discharge Protection: Human Body Model	ESD_HBM		2	KV
Electrostatic Discharge Protection: Machine Model	ESD_MM		N/A	V
Electrostatic Discharge Protection: Charged Device Model	ESD_CMD		750	V

Note:

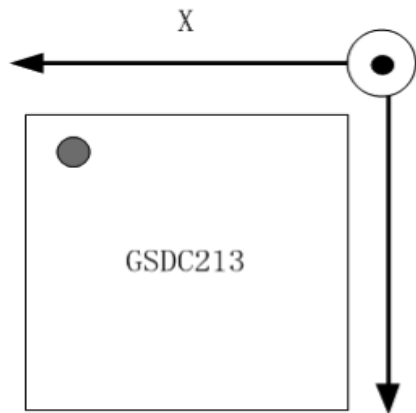
1. Stresses above those listed as “absolute maximum ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device under these conditions is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.
2. Supply voltage on any pin should never exceed 4.25V
3. This is a mechanical shock sensitive device, improper handling can cause permanent damages to the part.



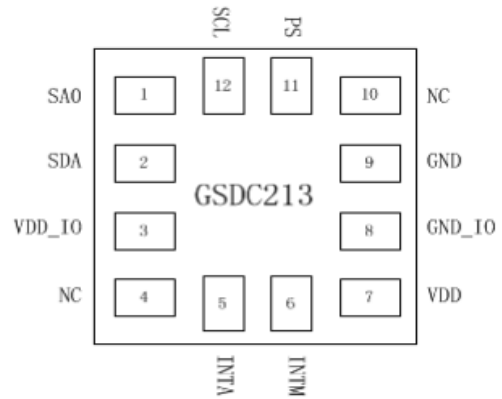
4. This is an ESD sensitive device, improper handling can cause permanent damages to the part.



## Pin Configuration



(Top View)

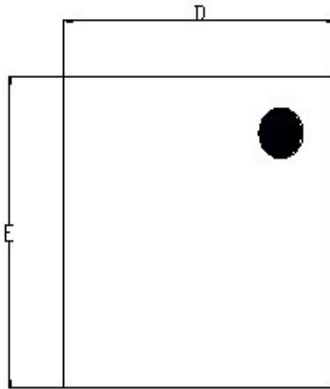


(Bottom View)

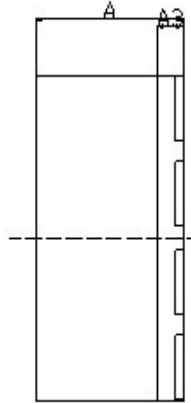
## Pin Description

Pin#	Name	Function
1	SA0	I <sup>2</sup> C Less Significant Bit of The Accelerometer Address (SA0)
2	SDA	I <sup>2</sup> C Serial Data Input/Output (SDA)
3	VDD_IO	Power Supply for I/O Pins
4	NC	Not Connected
5	INTA	Interrupt Pin of Accelerometer
6	INTM	Interrupt Pin of Magnetometer
7	VDD	Power Supply
8	GND_IO	Ground Supply for I/O Pins
9	GND	Ground Supply
10	NC	Not Connected
11	PS	This PIN Must Connect HIGH
12	SCL	I <sup>2</sup> C Serial Clock (SCL)

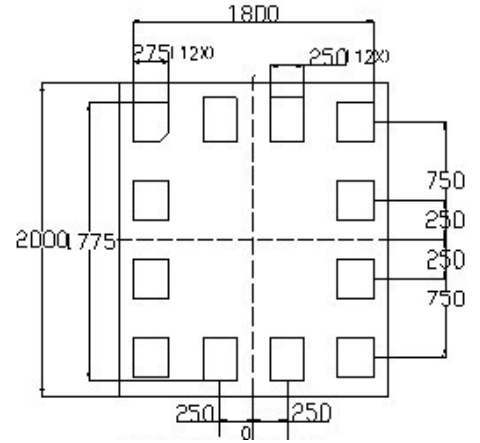
**Mechanical Data and Package Dimensions: 12 Pin LGA**



(Top View)



(Side View)



(Bottom View)

COMMON DIMENSIONS (MM)			
PACKAGE	LGA-12 PIN		
REF.	MIN.	NOM.	MAX.
A	1.00	1.10	1.20
A3	0.20 REF.		
D	1.90	2.00	2.10
E	1.90	2.00	2.10