



# L3G3250A

## MEMS motion sensor: three-axis analog gyroscope

Preliminary data

### Features

- Two selectable full scales (625/2500 dps)
- Embedded self-test
- Wide supply voltage range: 2.4 V to 3.6 V
- Embedded power-down and sleep mode
- Embedded low-pass filter
- Integrated high-pass filter reset
- High shock survivability
- Extended operating temperature range (-40 °C to 85 °C)
- ECOPACK® RoHS and “Green” compliant

### Applications

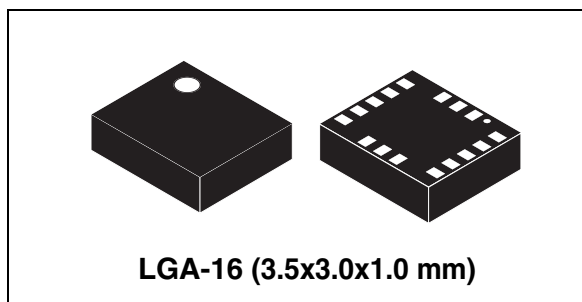
- Gaming and virtual reality input devices
- Motion control with MMI (man-machine interface)
- GPS navigation systems
- Appliances and robotics

### Description

The L3G3250A is a low-power three-axis angular rate sensor.

It includes a sensing element and an IC interface capable of providing the measured angular rate to the external world via three analog outputs.

The sensing element is manufactured using a dedicated micro-machining process developed by STMicroelectronics to produce inertial sensors and actuators on silicon wafers.



The IC interface is manufactured using a CMOS process that allows a high level of integration to design a dedicated circuit which is trimmed to better match the sensing element characteristics.

The L3G3250A is available in a plastic land grid array (LGA) package and can operate within a temperature range from -40 °C to +85 °C.

**Table 1. Device summary**

Order code	Temperature range (°C)	Package	Packing
L3G3250A	-40 to +85	LGA-16 (3.5x3.0x1.0)	Tray
L3G3250ATR	-40 to +85	LGA-16 (3.5x3.0x1.0)	Tape and reel

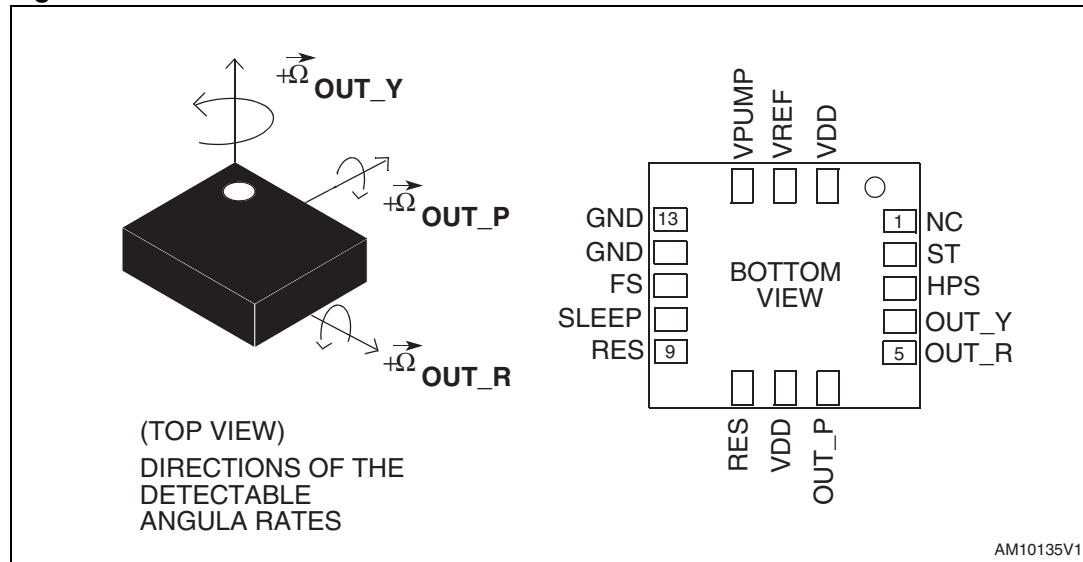
# Contents

<b>1</b>	<b>Pin description</b>	<b>3</b>
1.1	Pin description	3
<b>2</b>	<b>Mechanical and electrical specifications</b>	<b>5</b>
2.1	Mechanical characteristics	5
2.2	Electrical characteristics	6
2.3	Absolute maximum ratings	7
2.4	Terminology	8
2.4.1	Sensitivity	8
2.4.2	Zero-rate level	8
2.4.3	Self-test (ST)	8
2.5	Sleep mode, self-test and power-down	8
2.6	Soldering information	8
<b>3</b>	<b>Application hints</b>	<b>9</b>
3.1	Full scale (FS) pin operation	9
<b>4</b>	<b>Package information</b>	<b>10</b>
<b>5</b>	<b>Revision history</b>	<b>11</b>

# 1 Pin description

## 1.1 Pin description

Figure 1. Pin connection



**Note:** The vibration of the structure is maintained by drive circuitry in a feedback loop. The sensing signal is filtered and appears as an analog output.

Table 2. Pin description

Pin#	Name	Function
1	NC	Internally not connected
2	ST	Self-test pin
3	HPS	High-pass filter reset (‘1’: reset of external high-pass filter; ‘0’: normal mode)
4	OUT_Y	Yaw axis angular rate output
5	OUT_R	Roll axis angular rate output
6	OUT_P	Pitch axis angular rate output
7	VDD	Power supply
8	RES	Reserved, leave unconnected
9	RES	Reserved, leave unconnected
10	SLEEP	Sleep mode selection
11	FS	Full scale selection
12	GND	0 V supply voltage
13	GND	0 V supply voltage
14	VPUMP	Charge pump capacitor connection pin <sup>(1)</sup>

**Table 2. Pin description (continued)**

Pin#	Name	Function
15	VREF	Reference output voltage
16	VDD	Power supply

1. To be connected to GND through 10 nF, 25 V ceramic capacitor. 1 nF min value must be guaranteed under 11 V bias condition.

## 2 Mechanical and electrical specifications

### 2.1 Mechanical characteristics

@ Vdd = 3.0 V, T = 25 °C unless otherwise noted.

**Table 3. Mechanical characteristics <sup>(1)</sup>**

Symbol	Parameter	Test condition	Min.	Typ. <sup>(2)</sup>	Max.	Unit
FS	Measurement range			±625		dps
				±2500		
So	Sensitivity	FS = 625 dps		2		mV/dps
		FS = 2500 dps		0.5		
SoDr	Sensitivity change vs. temperature			±0.017		%/°C
ZRL	Zero-rate level	FS = 625 dps		1.5		V
		FS = 2500 dps		1.5		
Vref	Reference voltage			1.5		V
OffDr	Zero-rate level change vs. temperature			±0.08		dps/°C
NL	Non linearity <sup>(3)</sup>	Best fit straight line			2	% FS
Rn	Rate noise density			0.015		dps/ √Hz
BW	Bandwidth			140		Hz
Top	Operating temperature range		-40		+85	°C

1. The product is factory calibrated at 3.0 V. The operational power supply range is specified in [Table 4](#).

2. Typical specifications are not guaranteed.

3. Guaranteed by design.

## 2.2 Electrical characteristics

@ Vdd = 3.0 V, T = 25 °C unless otherwise noted.

**Table 4. Electrical characteristics <sup>(1)</sup>**

Symbol	Parameter	Test condition	Min.	Typ. <sup>(2)</sup>	Max.	Unit
Vdd	Supply voltage	-	2.4	3.0	3.6	V
Idd	Supply current			6.3		mA
IddSL	Supply current in sleep mode <sup>(3)</sup>			2		mA
IddPdn	Supply current in power-down mode			5		μA
Top	Operating temperature range		-40		+85	°C

1. The product is factory calibrated at 3.0 V.

2. Typical specifications are not guaranteed.

3. Sleep mode introduces a faster turn-on time relative to power-down mode.

## 2.3 Absolute maximum ratings

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.

**Table 5. Absolute maximum ratings**

Symbol	Ratings	Value	Unit
Vdd	Supply voltage	- 0.3 to 4.8	V
Vin	Input voltage on any control pin (SLEEP, FS, ST)	-0.3 to Vdd +0.3	V
T <sub>STG</sub>	Storage temperature range	-40 to +125	°C
Sg	Acceleration <i>g</i> for 0.1 ms	10,000	g
ESD	Electrostatic discharge protection	2 (HBM)	kV

*Note:* Supply voltage on any pin should never exceed 4.8 V.



This is a mechanical shock sensitive device, improper handling can cause permanent damage to the part



This is an ESD sensitive device, improper handling can cause permanent damage to the part

## 2.4 Terminology

### 2.4.1 Sensitivity

An angular rate gyroscope is a device that produces a positive-going digital output for counter-clockwise rotation around the sensitive axis considered. Sensitivity describes the gain of the sensor and can be determined by applying a defined angular velocity to it. This value changes very little over temperature and time.

### 2.4.2 Zero-rate level

Zero-rate level describes the actual output signal if there is no angular rate present. Zero-rate level of precise MEMS sensors is, to some extent, a result of stress to the sensor and therefore zero-rate level can slightly change after mounting the sensor onto a printed circuit board or after exposing it to extensive mechanical stress.

### 2.4.3 Self-test (ST)

Self-test allows the testing of the mechanical and electric parts of the sensor, allowing the seismic mass to be moved by means of an electrostatic test-force. When the ST is activated by the IC, an actuation force is applied to the sensor, emulating a definite Coriolis force. In this case the sensor output will exhibit a change in the output. When ST is active, the device output is given by the algebraic sum of the signals produced by the velocity acting on the sensor and by the electrostatic test-force.

## 2.5 Sleep mode, self-test and power-down

The L3G3250A enables advanced power saving functionality thanks to the different operating modes available. When the device is set in the Sleep mode configuration, the reading chain is completely turned off, allowing lower power consumption. In this condition, the device turn-on time is significantly reduced permitting simpler external power cycling.

The user can select the desired operating mode through two dedicated pins.

**Table 6. Sleep mode, self-test and power-down mode configuration**

Operating mode	ST pin	Sleep pin
Normal mode	0	0
Power-down	0	1
Self-test	1	0
Sleep mode	1	1

## 2.6 Soldering information

The LGA package is compliant with the ECOPACK<sup>®</sup>, RoHS and “Green” standard. It is qualified for soldering heat resistance according to JEDEC J-STD-020.

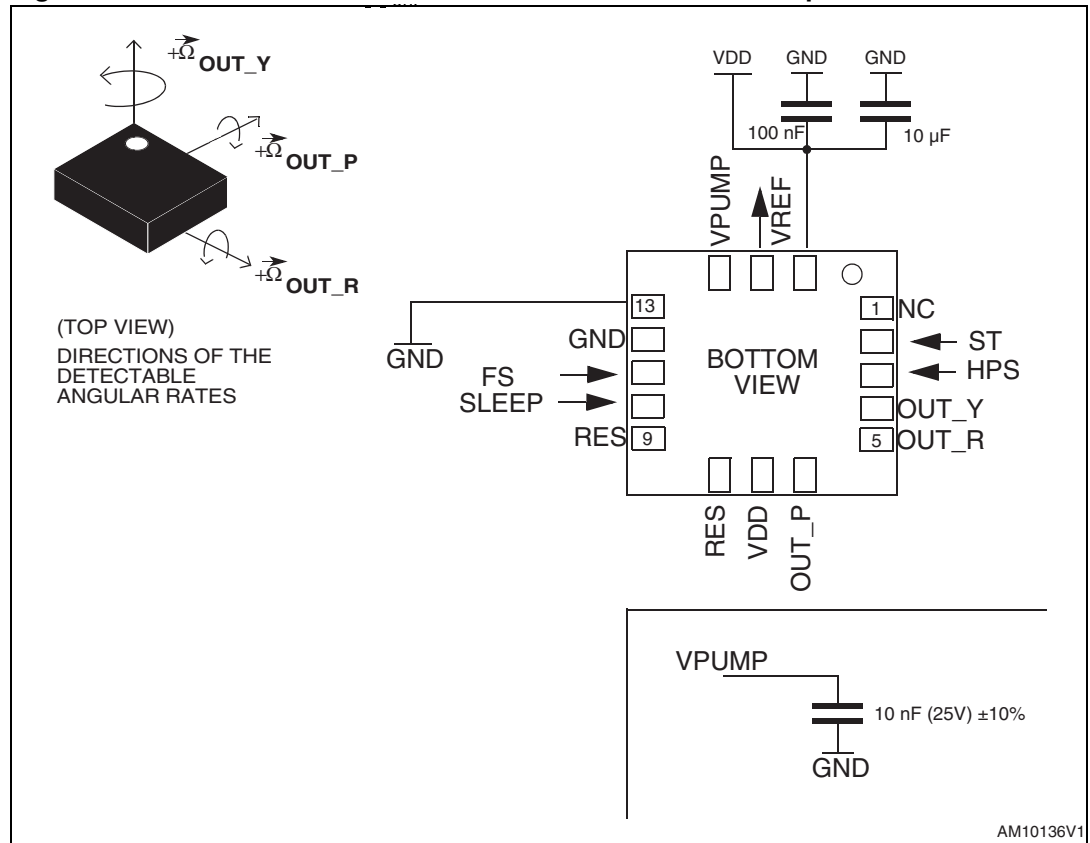
Leave “Pin 1 Indicator” unconnected during soldering.

Land pattern and soldering recommendations are available at [www.st.com/mems](http://www.st.com/mems).



### 3 Application hints

**Figure 2. L3G3250A electrical connections and external component values**



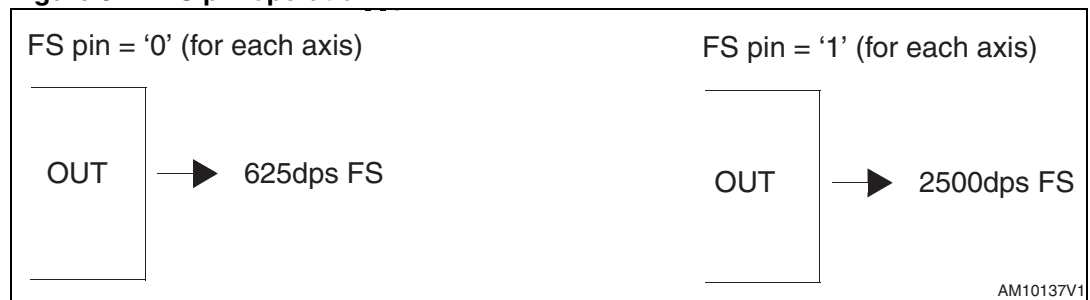
**Note:** The capacitor on pin 14 must guarantee a 1 nF value under 11 V bias condition.

Power supply decoupling capacitors (100 nF ceramic or polyester + 10 μF aluminum) should be placed as near as possible to the device (common design practice).

A 10 nF, 25 V class capacitor connected to pin 14 is required for proper operation of the device.

#### 3.1 Full scale (FS) pin operation

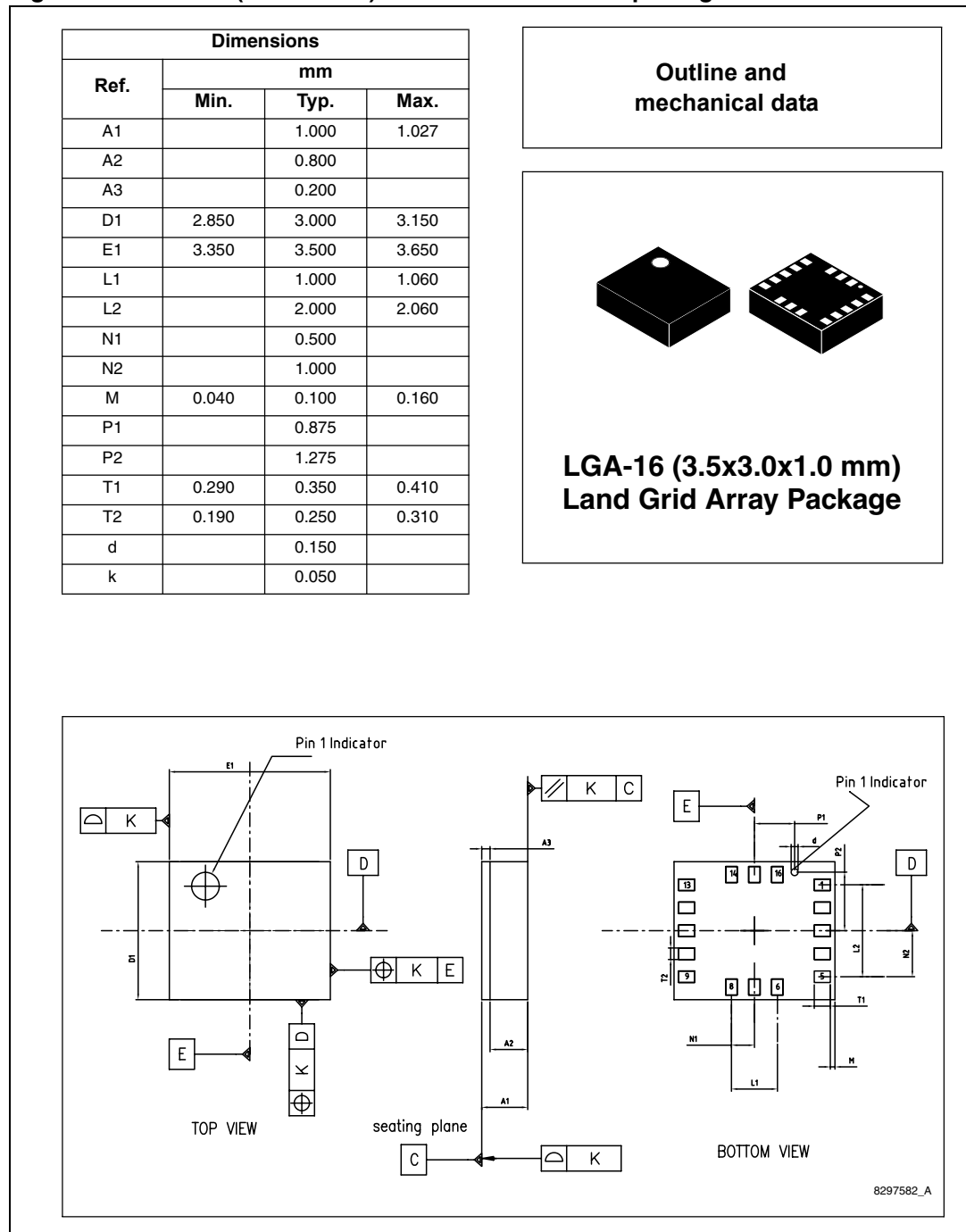
**Figure 3. FS pin operation**



## 4 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

**Figure 4. LGA-16 (3.5x3.0x1.0): mechanical data and package dimensions**



## 5 Revision history

**Table 7. Document revision history**

Date	Revision	Changes
25-Aug-2011	1	Initial release.

**Please Read Carefully:**

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

**UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.**

**UNLESS EXPRESSLY APPROVED IN WRITING BY TWO AUTHORIZED ST REPRESENTATIVES, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.**

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2011 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

[www.st.com](http://www.st.com)