

# Automotive Electronics

## Low-g accelerometer for vehicle dynamics control

### SMB225



**BOSCH**  
Invented for life



#### Customer benefit / features:

- ▶ 4.9 g dual-channel low-g accelerometer ( $a_x/a_y$ ) with SPI interface
- ▶ Fully digital signal processing
- ▶ Two output channels per axis with different measurement ranges and sensitivities:
  - 16 bit  $\pm 4.9$  g low-g output (SPI)
  - 8 bit  $\pm 35$  g high-g output (SPI)
- ▶ 35 g measurement capability without clipping effects
- ▶ Multiple internal test functions
- ▶ Temperature sensor output
- ▶ 3.3 V or 5 V supply operation

#### Overview

The SMB225 dual axis low-g acceleration sensor is newly designed for improved accuracy and reliability. The sensor is designed for challenging and safety relevant automotive applications, like vehicle dynamics control (VDC). Other suitable applications are inclination or tilt measurements.

The SMB225 consists of a micromechanical (MEMS) sensor element and a signal processing ASIC mounted in a single SMD package for surface mounting.

#### Product description

The SMB225 is an in-plane accelerometer ( $a_x/a_y$ ) with linear response. Specific design features allow for excellent vibration robustness, high mechanical g-range survivability, and superior protection against external interference.

For each sensing axis the sensor provides two output channels: A high-performance 4.9 g low-g channel with excellent offset stability and 10 bit data resolution. An additional channel provides 35 g high-g acceleration information with 8 bit resolution.

Multiple built in self-test features monitor signals and verify correct sensor function to ensure the highest signal reliability. In addition, the sensor measures and transmits on-chip temperature.

The built in digital Serial Peripheral Interface (SPI) enables bidirectional communication with an external microcontroller ( $\mu C$ ) for data transmissions.

The sensor is suitable for use in applications with a wide temperature range from  $-40$  °C... $+120$  °C and operates with a 3.3 V or 5 V power supply.

**Parameters SMB225****Measurement and functional characteristic**

|  |            |            |
|--|------------|------------|
| Measurement range                      | ±4.915 g   | ±35 g      |
| Nominal sensitivity                    | 6667 LSB/g | 2.65 LSB/g |
| Acceleration data resolution           | 16 bit     | 8 bit      |
| Sensitivity variation <sup>3)</sup>    | ±3 %       | ±20 %      |
| Non-linearity <sup>3)</sup>            | ±40 mg     |            |
| Variation of offset <sup>2)</sup>      | ±100 mg    | ±10.5 g    |
| Cut-off frequency <sup>1)</sup> (-3dB) | 57 Hz      | 180 Hz     |
| Output noise <sup>1)</sup>             | 3.5 mg rms |            |
| Cross axis sensitivity <sup>3)</sup>   | ±2 %       |            |

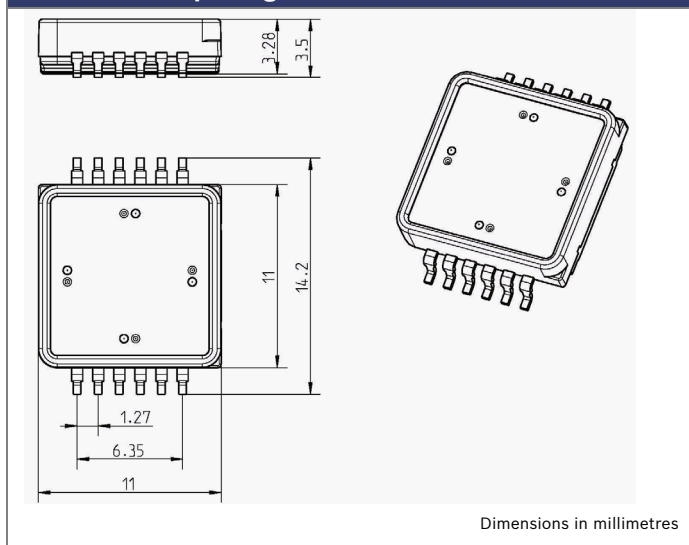
**Operating conditions**

|                                   |                  |
|-----------------------------------|------------------|
| Supply voltage <sup>1)</sup>      | 3.3 V or 5 V     |
| Current consumption <sup>1)</sup> | 7.5 mA           |
| Power-on time                     | < 0.25 s         |
| Operating temperature             | -40 °C...+120 °C |
| Storage temperature               | -40 °C...+85 °C  |
|                                   | JEDEC Level 3    |

<sup>1)</sup> Typical values for main output path (output range ±4.9 g)

<sup>2)</sup> Maximum values at room temperature without ageing

<sup>3)</sup> Maximum values over lifetime

**Outline PM12 package****Working principle**

The accelerometer is manufactured by using surface micromachining technology. The acceleration sensor features suspended free moving comb-like seismic mass elements and fixed counter-electrodes. As a result of external forces acting on the vehicle, deflections of the seismic masses along the sensitive axis generate changes in system capacitance. These changes are detected using a differential measurement principle.

**Interface**

The sensor communicates via a bidirectional digital Serial Peripheral Interface (SPI) with 16 bit for low-g output (±4.9 g) or 8 bit for high-g output (±35 g).

**Package**

The SMB225 is packaged in a pre-molded (PM) 12-pin package for surface mount processes. All parts are RoHS compliant.

**Portfolio**

The SMB225 sensor is part of a larger sensor portfolio. The portfolio consists of acceleration sensors, angular rate sensors, pressure sensors, and combined inertial sensors for occupant safety systems, vehicle dynamics control VDC, active suspension systems, motor management, transmission control systems, and navigation.

Bosch has been active in the field of micro-electro-mechanical systems (MEMS) for more than 20 years, and is established as one of the pioneers of this technology. With more than 1000 MEMS patents, hundreds of engineers in this field, and more than 3 billion MEMS sensors shipped to date, Bosch is the global market leader for MEMS sensors.

For more information about automotive MEMS sensors, visit [www.bosch-sensors.com](http://www.bosch-sensors.com).

**Regional sales contacts**

Europe/Japan [bosch.semiconductors@de.bosch.com](mailto:bosch.semiconductors@de.bosch.com)  
 USA/Canada [bosch.semiconductors@us.bosch.com](mailto:bosch.semiconductors@us.bosch.com)  
 China [bosch.semiconductors@cn.bosch.com](mailto:bosch.semiconductors@cn.bosch.com)  
 Korea [bosch.semiconductors@kr.bosch.com](mailto:bosch.semiconductors@kr.bosch.com)

[www.bosch-semiconductors.com](http://www.bosch-semiconductors.com)  
[www.bosch-sensors.com](http://www.bosch-sensors.com)

**Robert Bosch GmbH**  
 Automotive Electronics  
 AE/SCS  
 Postfach 13 42  
 72703 Reutlingen  
 Germany

[www.bosch.de](http://www.bosch.de)