Automotive Electronics

Combined inertial sensor for Vehicle Dynamics Control SMI510

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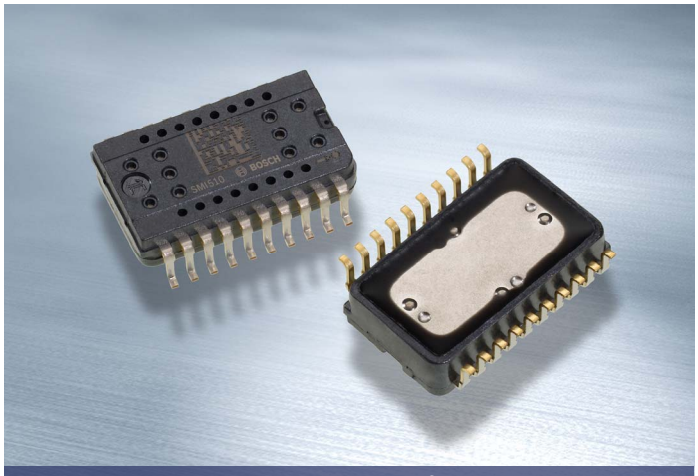


Combined inertial sensor SMI510 for VDC

Customer benefit / features:

Integration of angular rate and two-axis acceleration sensors in one standard PM20 premold package allowing cost-efficient system integration on PCB:

- High precision angular rate response (Ω_x)
- High precision in-plane linear accelerometer (a_y/a_z)
- Small standard SMD package for ease of mounting
- RoHS compliant

Superior signal performance and implemented self-tests enabling advanced system concepts for reliable safety relevant applications:

- Fully digital signal processing
- Closed loop architecture
- 16 bit digital output via Serial Peripheral Interface (SPI) or 12 bit digital output via CAN
- Excellent stability over temperature and lifetime
- On-chip self-monitoring based on Bosch VDC component experience
- Temperature sensor output

Overview

The inertial sensor SMI510 is a compact inertial sensor with high accuracy and reliability, especially designed for Vehicle Dynamics Control (VDC) systems like Roll Stability Control (RSC) or rollover sensing.

The sensor consists of two micro-machined sensor elements and a signal processing ASIC packaged together in a premold housing for surface mounting. The concept of combining acceleration sensors and an angular rate sensor in one premold package aims to provide a cost-efficient solution for high-performance VDC applications.

Product description

The SMI510 contains a Ω_x angular rate sensor and a two-axis acceleration sensor (a_y/a_z), both with linear response to external stimulations. Additionally, a temperature signal is available.

Excellent durability with respect to mechanical and electrical interference is guaranteed by a fully digital signal processing of all sensor signals combined with a closed loop operation of the angular rate sensor. The digital output via SPI (Serial Peripheral Interface) ensures an optimal signal quality to the electronic control unit. Additionally a CAN interface is integrated for sensorcluster applications.

In combination with a multitude of customer specific signal monitoring options and an advanced safety concept, the sensor is particularly suitable for safety relevant applications.

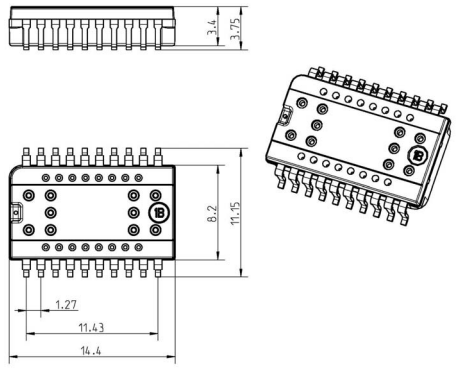
The sensor accepts 3.3 V or 5 V supply voltage and can be operated in a broad temperature range between -40 °C and +125 °C. It is RoHS compliant and qualified according to AEC-Q100.

Parameters SMI510		
Measurement and functional characteristics[1)]		
Measurement axis	Ω_x	a_y, a_z
Measurement range	±240 °/s	±4.9 g
Sensitivity (nominal)	136 LSB/°/s	6667 LSB/g
Sensitivity variation [2)]	±5 %	±5 %
Non-linearity [2)]	±2.4 °/s	±40 mg
Offset variation [2)]	±3 °/s	a_y: ±90 mg a_z: ±100 mg
Noise (rms @ 57 Hz)	0.3 °/s	a_y: 4 mg a_z: 8.5 mg
Bandwidth (-3dB)	13 Hz or 57 Hz	
Start up time	350 ms	
Operating conditions		
Supply voltage (digital)	3.3 V / 5 V	
Supply current	< 25 mA	
Ambient temperature	-40 °C ... +125 °C	

[1)] in SPI-mode

[2)] Over lifetime and temperature

Outline PM20 package



Package

The SMI510 is packaged in a small and easy mountable standard RoHS compliant premold package.

Interface

The SMI510 communicates via a 16 bit digital Serial Peripheral Interface (SPI) or via a 12 bit CAN interface.

Working principle

The sensor elements of the SMI510 are manufactured utilizing state-of-the-art Bosch surface micro-machining technology. The angular sensor is based on the Coriolis vibratory gyroscope principle: High frequency electrostatic forces generate a 15 kHz out-of-phase oscillation of two seismic masses controlled by a closed loop drive system. When rotating around the nominal axis, the Coriolis forces acting on the oscillators can be measured by capacity changes in the detection system. To guarantee the highest performance the layout of the detection circuit also makes use of the closed loop principle.

The acceleration sensor consists of free movable comb-like (a_y) and rocker-like (a_z) seismic masses suspended from silicon spring bars 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 the capacity of the system. These changes are detected using a differential measurement principle. Most of the signal evaluation is performed digitally allowing a sophisticated supervisory concept and highest reliability.

Portfolio

The SMI510 sensor is part of a larger sensor portfolio. The portfolio consists of acceleration sensors, angular rate sensors, pressure sensors, torque sensors, and CO_2 sensors for occupant safety systems, Vehicle Dynamics Control VDC, active suspension systems, motor management, steering systems, or A/C systems.

Bosch has been active in the field of micromechanics (MEMS) since more than 20 years, being one of the pioneers. With more than 900 MEMS patents, hundreds of engineers in this field, and far more than 1 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.

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