Automotive Electronics

Combined inertial sensor for vehicle dynamics control SMI540

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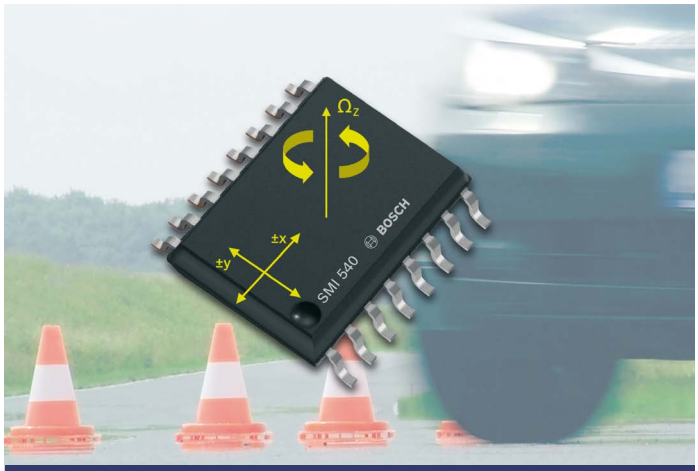


Combined inertial sensor SMI540 for VDC

Customer benefits / features:

- Integration of angular rate and two-axis acceleration sensors in one small standard mold package allowing cost-efficient system integration on PCB:
- High precision angular rate response (Ω_z)
- High precision in-plane linear accelerometer (a_x/a_y)
- 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:

- Pure digital signal processing
- Closed loop architecture
- 16 bit digital output via serial peripheral interface (SPI)
- Excellent stability over temperature and lifetime
- On-chip self-monitoring based on Bosch VDC component experience
- Temperature sensor output

Overview

The inertial sensor SMI540 is a compact inertial sensor with high accuracy and reliability, especially designed for automotive vehicle dynamics control (VDC) systems.
The sensor consists of two micro-machined sensor elements and a signal processing ASIC packaged together in a molded plastic housing for surface mounting.
The concept of combining acceleration sensors and an angular rate sensor in one SOIC16w package aims to provide a cost-efficient one-chip solution for VDC applications without compromising on quality and standard system performance.

Product description

The SMI540 contains an Ω_z angular rate sensor and a two-axis acceleration sensor (a_x/a_y), 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 pure digital signal processing of all sensor signals combined with a closed loop operation of the angular rate sensor. The digital output via serial peripheral interface (SPI) ensures an optimal signal quality to the electronic control unit.

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 +105 °C.

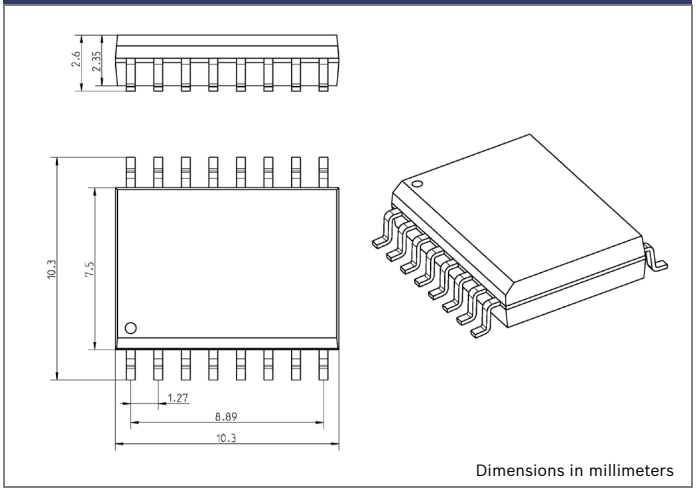
The sensor is RoHS compliant and qualified according to AEC-Q100.

Parameters SMI540

Measurement and functional characteristics		
Measurement axis	Ω_z	a_x, a_y
Measurement range	±187 °/s	±4.9 g
Sensitivity (nominal)	175 LSB/°/s	6667 LSB/g
Sensitivity variation [1)]	±3 %	±3 %
Non-linearity [1)]	±1 °/s	±40 mg
Offset variation [1)]	±3 °/s	±100 mg
Noise (rms @ 57 Hz)	0.2 °/s	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	20 mA	
Operating temperature	-40 °C ... +105 °C	

[1)] Over lifetime and temperature

Outline SOIC16w package



Dimensions in millimeters

Package

The SMI540 is packaged in a small and easy mountable standard RoHS compliant SOIC16w package.

Interface

The SMI540 communicates via a 16 bit digital serial peripheral interface (SPI).

Working principle

The sensor elements of the SMI540 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 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. The signal evaluation is performed digitally allowing a sophisticated supervisory concept and highest reliability.

Portfolio

The SMI540 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 900 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.

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