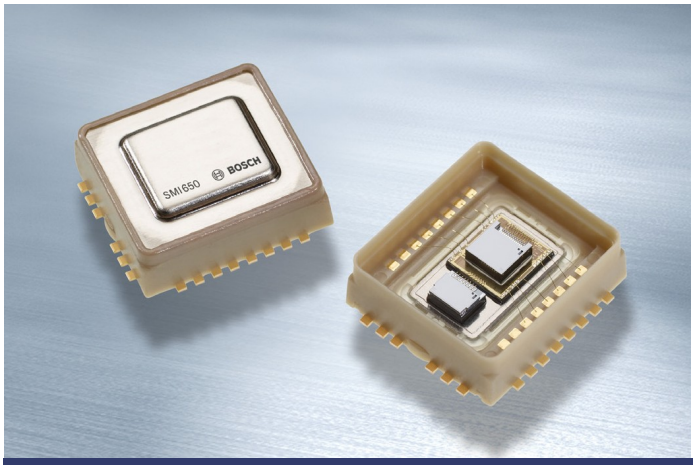
Automotive Electronics

Combined inertial sensor for vehicle dynamics control SMI650

BOSCH
Invented for life



Combined inertial sensor SMI650 for VDC (ESPi)

Customer benefit / features:

Integration of angular rate and two-axis acceleration sensors in a compact PM28D package allowing efficient system integration on PCB:

- High precision angular rate response (Ω_x)
- High precision linear accelerometer (a_y/a_z)
- Compact PM28D package with integrated damper 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
- 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
- Robust sensor for harsh environment (high vibration, temperature)

Overview

The inertial sensor SMI650 is a new compact inertial sensor with high accuracy and reliability, especially designed for automotive Vehicle Dynamics Control (VDC, ESPi) systems used in harsh environments e.g. in engine compartment (high vibration, temperature).
The sensor consists of two micro-machined sensor elements and a signal processing ASIC mounted in a premold SMD housing with integrated damper.
The concept of combining acceleration sensors and an angular rate sensor in one package aims to provide an efficient one-sensor solution for VDC applications without compromising quality for high performance VDC applications.

Product description

The SMI650 contains an angular rate sensor Ω_x and a dual-axis acceleration sensor (a_y/a_z). 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 sensor internal signal monitoring processes and an advanced safety concept, the sensor is particularly suitable for safety relevant applications.

The sensor accepts 5 V supply voltage and can be operated in a broad temperature range between -40 °C and +140 °C.

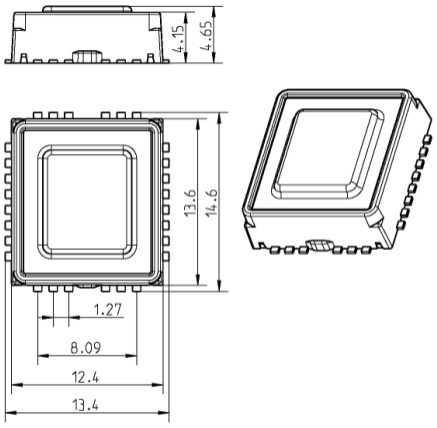
The sensor is RoHS compliant.

Parameters SMI650

Measurement and functional characteristics		
Measurement axis	Ω_x	a_y, a_z
Measurement range	±100 °/s	±2.0 g
Sensitivity (nominal)	100 LSB/°/s	5000 LSB/g
Sensitivity variation [1]	±3 %	±3.5 %
Non-linearity [1]	±0.5 °/s	±30 mg
Offset variation [1]	±3 °/s	±70 mg
Noise (rms @ 60 Hz)	0.6 °/s	10 mg
Bandwidth (-3dB)	13Hz or 57 Hz	
Start up time	Up to 650ms (including self test)	
Operating conditions		
Supply voltage (digital)	5 V	
Supply current	< 25 mA	
Operating temperature	-40 °C...+140°C	

[1] Over lifetime and temperature

Outline PM28D package



Dimensions in millimeters

Package

The SMI650 is packaged in a compact and easy mountable standard RoHS compliant PM28D package. The PM28D package is designed with an integrated damper structure for mechanical vibration isolation. This allows the use of the SMI650 in harsh application environments (high vibration, temperature), e.g. motor compartment.

Working principle

The sensor elements of the SMI650 are manufactured utilizing state-of-the-art Bosch surface micro-machining technology. The angular rate 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. Most of the signal evaluation is performed digitally allowing a sophisticated supervisory concept and highest reliability.

Interface

The SMI650 communicates via a digital serial peripheral interface (SPI) with a 16 bit resolution.

Portfolio

The SMI650 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.

Regional sales contacts
Europe/Japan bosch.semiconductors@de.bosch.com
USA/Canada bosch.semiconductors@us.bosch.com
China bosch.semiconductors@cn.bosch.com
Korea bosch.semiconductors@kr.bosch.com

www.bosch-semiconductors.com
www.bosch-sensors.com

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

www.bosch.de