Overview

The inertial sensors SMI710 and SMI720 are new compact inertial sensors with high accuracy and reliability. The SMI710 is especially designed for premium vehicle dynamics (VDC) functions such as roll-stability control (RSC), active damping systems (AD), and rollover sensing (RoSe). The SMI720 is tailored for RoSe systems. The sensors consist of two micro-machined sensor elements and a signal processing ASIC mounted in a molded BGA housing (7 x 7 x 1.5 mm³).

The concept of combining acceleration sensors and an angular rate sensor in one package aims to provide a cost-efficient one-chip solution for VDC applications without compromising on quality and standard system performance.

Product description

The SMI710 sensor contains an \( \Omega_x \) angular rate sensor and a two-axis acceleration sensor (\( a_y/a_z \)). The SMI720 is sensitive for \( \Omega_x \) angular rate and \( a_z \) acceleration. In addition, the SMI710 features mid-g output options with ±35 g range for \( a_y \) and ±10 g range for \( a_z \).

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 (SMI720) or via SPI, PSI5, or CAN (SMI710) interfaces ensures an optimal signal quality to the electronic control unit.

In combination with a multitude of customer specific signal monitoring options and an integrated safety controller, the sensor is particularly suitable for safety relevant applications. The sensors are applicable in systems with safety requirements according to ISO26262 up to ASIL D (SMI710) or up to ASIL C (SMI720) depending on the target application.

The sensors are RoHS compliant and qualified according to AEC-Q100.
### Parameters | SMI710 | SMI720
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**Measurement characteristics of the angular rate channel**
Measurement axis | $\Omega_x$ | $\Omega_x$
Measurement range | $\pm 300 \, ^\circ/s$ | $\pm 300 \, ^\circ/s$
Sensitivity (nominal) | 100 LSB/$^\circ/s$ | 100 LSB/$^\circ/s$
Sensitivity variation 1) | $\pm 3 \%$ | $\pm 5 \%$
Offset variation 1) | $\pm 3 \, ^\circ/s$ | $\pm 1 \, ^\circ/s$ regulated
Noise (rms) 2) | 0.15 $^\circ/s$ | 1.5 $^\circ/s$

**Measurement characteristics of the acceleration channels**
Measurement axis | $a_y, a_z$ | $a_z$
Measurement range | $\pm 5.0 \, g$ | $\pm 5.0 \, g$
Sensitivity (nominal) | 5000 LSB/g | 5000 LSB/g
Sensitivity variation 1) | $\pm 3 \%$ | $\pm 6 \%$
Offset variation 1) | $\pm 50 \, mg (a_y)$ | $\pm 70 \, mg (a_z)$
Noise (rms) 2) | 6 $mg (a_y)$; 7 $mg (a_z)$ | 12.5 $mg$

**Functional characteristics**
Communication | SPI, PSI5, CAN | SPI
Bandwidth (-3dB) 3) | 11, 18, 21 or 77 Hz | 43 Hz
Start up time | max 400 ms 4) | 500 ms

**Operating conditions**
Supply voltage 5) | 3.3 V / 5 V | 3.3 V
Supply current 6) | $< 29 \, mA$ | $< 21 \, mA$
Temperature range | $-40...+125 \, ^\circ C$ | $-40...+105 \, ^\circ C$

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1) Over lifetime and temperature
2) Noise is defined for filter settings SMI710: 77 Hz, SMI720: 43 Hz
3) Nominal f-3dB for the rate channel corresponding to programmable filter settings
4) incl. up to 3 self-tests for 77.5 Hz setting
5) digital
6) SPI, PSI5

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### Working principle
The sensor elements of the SMI710 and SMI720 are manufactured utilizing state-of-the-art Bosch surface micromachining technology. The angular rate sensor is based on the coriolis vibratory gyroscope principle: High frequency electrostatic forces generate an 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.

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.

The MEMS elements of SMI710 have been optimized for vibration robustness and ultra-robust offset stability. The SMI720 is optimized as cost effective RoSe sensor with an offset compensating signal path for $\Omega_x$ and $a_z$.

### Portfolio
SMI710 and SMI720 are 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-electromechanical 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).