

Strong growth with MEMS **One billion Bosch micro-mechanical sensors** For automotive and consumer electronics

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- ▶ More than one billion sensors manufactured since sales started in 1995
- ▶ Annual production exceeds 200 million units

Since 1995, Bosch has manufactured one billion MEMS sensors (micro-electro-mechanical systems or MEMS) at its Reutlingen plant. The annual production volume has increased to more than 200 million sensors – more than half a million units per working day. This makes Bosch the uncontested number one in the global market for MEMS sensors.

Sensors are the electronic sensory organs which perceive the surrounding conditions. MEMS sensors include mechanical functional elements such as springs, beams, weights, or membranes in the form of fine silicon structures just thousandths of a millimeter thick. They are used to measure physical variables such as pressure, acceleration, yaw-rate, flow quantity, or gas composition accurately and reliably. Highly integrated electronic circuits preprocess the fine sensor signals and transmit them via analog or digital interfaces to control units for further processing.

Bosch has many years of experience in the development and manufacture of micro-mechanical sensors. Since the middle of the 1980's, Bosch researchers have developed the fundamental manufacturing technologies needed for volume and surface micro-mechanics, thus paving the way for the mass production of MEMS sensors.

Following the start of production in 1995, economic success was quickly achieved. In 2007, Bosch researchers received the European Patent Office's Inventor Award for their development of a process for vertical silicon structuring, known as the "Bosch process." On the basis of this invention, Bosch has taken a number of micro-mechanical processes from research to industrial mass manufacturing during the past decade. In recog-

nition of this, a Bosch team is currently nominated for the German federal president's prize for innovation and advanced technology.

Optimized sensor distribution channels for automotive technology and consumer electronics

Bosch extended its MEMS sensor business in 2005. The Automotive Electronics division covers the automotive industry's needs, and the separately founded subsidiary Bosch Sensortec serves the consumer electronics industry. This two-pronged approach is clearly reflected in the product portfolio: extreme functional safety and robustness are the main concern for automotive sensor technology. The Bosch Automotive Electronics program encompasses several hundred model variants of such intelligent sensors, adapted to the specific requirements of individual vehicle types. Nowadays, compact-class vehicles incorporate a good 50 of these measurement sensors, and the premium class includes more than twice as many. The applications for MEMS sensors in cars include measurement of the intake pressure for engine management, fill level measurement in fuel tanks, yaw-rate measurement for the ESP® electronic stability program, triggering roll-over protection, or collision detection to activate airbags.

Consumer electronics present completely different requirements for MEMS sensors. Here, every cubic millimeter less space and each microampere less current consumption can be decisive. That is why the smallest Bosch Sensortec MEMS sensors measure 3 x 3 x 0.9 millimeters and require so little current in stand-by mode that even the self-discharge of the energizing batteries is higher. Due to their accurate altitude measurement, MEMS sensors improve the navigation function for mobile consumer items such as cell phones. They record hand movement for device control in new operating concepts, change automatically between landscape and portrait format in digital cameras, open up surprising variants for game consoles, and protect laptop hard disks against data loss due to rough treatment or impact. MEMS sensors have only just started to find their way into mobile consumer items and to open up new functions. The innovation potential in this market is very high.

Bosch Automotive Electronics and Bosch Sensortec will present the latest MEMS exhibits from the worlds of automobile and consumer electronics at their shared stand A340 in Hall 6 at the Electronica 2008 trade fair in Munich. In order to show how they work, demonstration models will be presented at the stand: in the area of automotive sensors, demonstrators will explain how the SMG10x yaw-rate sensor safely recognizes a vehicle roll-over, or how the CCS climate control sensor measures the amount of

carbon dioxide (CO₂) in the vehicle interior and controls the air conditioning energy-efficiently. A "giant cell phone" will give an idea of the scope for new operating concepts in the consumer electronics sector.

Further information on Bosch MEMS activities:

www.bosch-presse.de (keyword MEMS) and
www.deutscher-zukunftspreis.de (Press service, 2008)

Press photos: 1-1-AE-15233, 1-AE-15234

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The Bosch Group is a leading global supplier of technology and services. In the areas of automotive and industrial technology, consumer goods, and building technology, some 271,000 associates generated sales of 46.3 billion euros in fiscal 2007. The Bosch Group comprises Robert Bosch GmbH and its more than 300 subsidiaries and regional companies in roughly 50 countries. This worldwide development, manufacturing, and sales network is the foundation for further growth. Each year, Bosch spends more than 3 billion euros for research and development, and applies for over 3,000 patents worldwide. The company was set up in Stuttgart in 1886 by Robert Bosch (1861-1942) as "Workshop for Precision Mechanics and Electrical Engineering."

The special ownership structure of Robert Bosch GmbH guarantees the entrepreneurial freedom of the Bosch Group, making it possible for the company to plan over the long term and to undertake significant up-front investments in the safeguarding of its future. Ninety-two percent of the share capital of Robert Bosch GmbH is held by Robert Bosch Stiftung GmbH, a charitable foundation. The majority of voting rights are held by Robert Bosch Industrietreuhand KG, an industrial trust. The entrepreneurial ownership functions are carried out by the trust. The remaining shares are held by the Bosch family and by Robert Bosch GmbH.

Additional information can be accessed at www.bosch.com.