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Semiconductors – market of the future: Bosch is growing faster than the market Driving force in the automotive industry

November 2018
PI10778 BBM Fi/KB

- ▶ Jens Fabrowsky: “When it comes to semiconductors for vehicles, we have a singular advantage: Bosch is the only company equally at home in the automotive and semiconductor industries.”
- ▶ Electrification and automated driving are fueling the growth of Bosch’s semiconductor business.
- ▶ Every new vehicle has an average of nine Bosch chips on board.
- ▶ Bosch to premiere numerous semiconductor innovations at electronica 2018.

Reutlingen, Germany – Every car nowadays makes use of semiconductors, and that has been true for quite a while. A key technology in today’s modern world, these chips are core components of electrical systems – including those in vehicles. They regulate the powertrain and vehicle handling, tell the navigational system which way the vehicle is going, and signal the airbag to deploy when needed. Having been making semiconductors for more than 45 years, Bosch today is one of the world’s leading manufacturers of chips for mobility applications. “Semiconductors may have been around for a long time, but we have yet to realize their full potential. These components are key to modern-day mobility, and it is impossible to imagine cars today without them,” says Jens Fabrowsky, member of the executive management of Bosch’s Automotive Electronics division. In 2016, every vehicle newly registered worldwide had an average of more than nine Bosch chips on board. “When it comes to semiconductors for cars, we have a singular advantage: Bosch is the only company equally at home in both the automotive and semiconductor industries,” Fabrowsky says. In 2018, every new vehicle featured semiconductors worth 370 dollars (source: ZVEI), and thanks to increasing electrification and automation, demand for chips in vehicles is expected to rise further over the next few years.

The ultimate discipline: semiconductors for the auto industry

The global semiconductor market is worth billions: the market research company Gartner expects global semiconductor sales to reach 451 billion dollars in 2018. By 2019 alone, the market will have grown at an annual growth rate of more than 5 percent (source: PwC). “The Bosch semiconductor business is growing faster than the market,” Fabrowsky says. In the semiconductor market, the ultimate discipline is making chips for vehicles. Bosch has been making vehicles smart since the 1970s, when it started equipping them with its application-specific integrated circuits (ASICs). In a car, chips are exposed to strong vibrations and extreme temperatures that range from far below zero to far above 100 degrees Celsius. This requires higher standards for the toughness of these special components. Developing semiconductors that can withstand these stresses for a vehicle’s entire lifetime is an intensive process. Here is where Bosch leverages its special dual role: while other companies can process the information collected from semiconductors, Bosch can also apply its deep understanding of the physical principles at work in the chips, and of how to gather the data and ultimately integrate it into the vehicle systems. “Our comprehensive expertise in semiconductors helps us to both develop new automotive functions and steadily improve the chips themselves,” Fabrowsky says. Bosch holds over 1,500 patents and patent applications for engineering and manufacturing its semiconductors.

Electromobility and driver assistance systems boost demand

Bosch’s current semiconductor portfolio focuses on microelectromechanical systems (MEMS), ASICs for vehicle ECUs, and power semiconductors. Without the latter, there would be no hybrid or electric vehicles, as they regulate the electric motor and make sure that the battery is being used as efficiently as possible. “Power electronics for hybrid and electric vehicles are a growth driver for Bosch,” Fabrowsky says. Besides electrification, continued strong growth in demand for driver assistance systems is ensuring that more semiconductors with more and more functions are finding their way into cars. Chips with built-in “intelligence,” known as ASICs, are tailored to a particular application; for instance, signaling to airbags in a vehicle when they should deploy. These chips control handling to ensure a consistently safe journey. They also boost the measured signal from radar sensors, so that the proximity warning always functions reliably. “Progress in microelectronics is what made development of assistance systems and automated driving possible in the first place,” Fabrowsky says. Bosch microelectromechanical systems, or MEMS for short, are the sensory organs of modern vehicles. They supply a vehicle’s ECUs with important information regarding its handling, such as if the vehicle is braking or accelerating, or if it is skidding on a smooth road surface. The ESP electronic stability program uses this information to keep cars, trucks, and even motorcycles safely on track and in their lanes.

MEMS sensors tell runners how many calories they are burning

As a key technology for the internet of things (IoT), Bosch semiconductors have applications that extend far beyond the world of vehicles. The company's sensors can be found in more than half the world's smartphones, and are indispensable for fitness trackers, drones, game consoles, and smart home applications. When it comes to MEMS sensors, Bosch is both a pioneer and the world's leading manufacturer. More than 20 years ago, the supplier of technology and services itself developed the microfabrication technique, known worldwide as the "Bosch process," used to make these semiconductors.

One billion euros for one of Europe's most advanced wafer fabs

Bosch is underpinning its growth strategy for semiconductors with the single largest investment in the company's history: it is putting some one billion euros into a new wafer fab in Dresden, which will manufacture 300 mm wafers. Following a rollout phase, pilot manufacturing operations are expected to start at the end of 2021. Compared with conventional 150 and 200 mm wafers, 300 mm wafer technology offers greater economies of scale. Up to 700 associates will be involved in the highly automated chip manufacturing process, working to plan, manage, and monitor production. After Reutlingen, the Dresden plant will be Bosch's second wafer fab in Germany. With it, the company aims to expand its manufacturing capacity, and thus to further boost its competitive edge in global markets.

Press photos: #1136637, #1136646, #1339965, #1373444, #1371812, #1373446, #1687945

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BOSCH AT ELECTRONICA 2018 IN MUNICH

- **BOOTH: Tuesday through Friday, November 13-16, 2018**
Booth 522 in hall C3
- **FOLLOW** the Bosch electronica 2018 highlights on Twitter: **#BoschMEMS**

- **PANELS WITH BOSCH EXPERTS:**

- **Monday, November 12, 2018, 12:30 p.m.:** Presentation: “Sensors enabling future mobility solutions” with Dr. Markus Sonnemann, Vice President of Advance Engineering MEMS Sensors at Robert Bosch GmbH; electronica Automotive Conference of Messe München
- **Tuesday, November 13, 2018, 11:30 a.m.:** Presentation: “MEMS – One product one process?” with Dr. Udo-Martin Gómez, Senior Vice President of Engineering MEMS Sensors at Robert Bosch GmbH; SEMICON Europa; Fab Management Forum; ICM München; room 14c
- **Tuesday, November 13, 2018, 3:00 p.m.:** Automobilwoche’s electronica Talk from the Top with Jens Fabrowsky, executive management member of the Automotive Electronics division at Robert Bosch GmbH; Discovery Stage in hall C6
- **Tuesday, November 13, 2018, 3:30 p.m.:** Presentation: “MEMS mobility sensors for motion detection” with Michael Rupp, Senior Expert for Product Management Sensors at Robert Bosch GmbH; electronica Automotive Forum in hall B4
- **Wednesday, November 14, 2018, 3:10 p.m.:** Presentation: “The future of MEMS-based smart sensor nodes in the context of highly functional and ultra-low power IoT applications” by Dr. Ralf Schellin, Head of the MEMS business unit at Bosch Sensortec GmbH; International Congress Center (ICC)

Mobility Solutions is the largest Bosch Group business sector. In 2017, its sales came to 47.4 billion euros, or 61 percent of total group sales. This makes the Bosch Group one of the leading automotive suppliers. The Mobility Solutions business sector pursues a vision of mobility that is accident-free, emissions-free, and stress-free, and combines the group’s expertise in the domains of automation, electrification, and connectivity. For its customers, the outcome is integrated mobility solutions. The business sector’s main areas of activity are injection technology and powertrain peripherals for internal-combustion engines, diverse solutions for powertrain electrification, vehicle safety systems, driver-assistance and automated functions, technology for user-friendly infotainment as well as vehicle-to-vehicle and vehicle-to-infrastructure communication, repair-shop concepts, and technology and services for the automotive aftermarket. Bosch is synonymous with important automotive innovations, such as electronic engine management, the ESP anti-skid system, and common-rail diesel technology.

The Bosch Group is a leading global supplier of technology and services. It employs roughly 402,000 associates worldwide (as of December 31, 2017). The company generated sales of 78.1 billion euros in 2017. Its operations are divided into four business sectors: Mobility Solutions, Industrial Technology, Consumer Goods, and Energy and Building Technology. As a leading IoT company, Bosch offers innovative solutions for smart homes, smart cities, connected mobility, and connected manufacturing. It uses its expertise in sensor technology, software, and services, as well as its own IoT cloud, to offer its customers connected, cross-domain solutions from a single source. The Bosch Group’s strategic objective is to deliver innovations for a connected life. Bosch improves quality of life worldwide with products and services that are innovative and spark enthusiasm.

In short, Bosch creates technology that is “Invented for life.” The Bosch Group comprises Robert Bosch GmbH and its roughly 440 subsidiary and regional companies in 60 countries. Including sales and service partners, Bosch’s global manufacturing, engineering, and sales network covers nearly every country in the world. The basis for the company’s future growth is its innovative strength. At 125 locations across the globe, Bosch employs some 64,500 associates in research and development.

To learn more, please visit www.bosch.com, iot.bosch.com, www.bosch-press.com, twitter.com/BoschPresse.



Bosch announces industry's first Position Tracking Smart Sensor BHI160BP for wearables

Always-on position tracking at ultra-low power

November 7, 2018

PI 10655 SM/Ho

- ▶ Ultra-low power position tracking reduces system power consumption by up to 80%
- ▶ Seamless and more reliable localization than GPS-only solutions
- ▶ Wide range of features like 3D orientation and gesture recognition
- ▶ Bosch booth at electronica Munich: hall C3, booth 522

Reutlingen / Munich, Germany – At electronica Munich, Bosch Sensortec announces the BHI160BP, the industry's first Position Tracking Smart Sensor that utilizes integrated inertial sensors to improve GPS location tracking.

Always-on position tracking

When used with a GPS or GNSS module, the BHI160BP enables users to take full advantage of pedestrian position tracking with up to 80% saving in system power consumption compared with a typical GNSS-only solution, without compromising on accuracy. Users benefit from a greatly extended battery life and longer charging intervals for wearable applications such as smartwatches and fitness trackers and other mobile devices such as smartphones or hearables. This new position tracking approach is set to enable a new class of compact devices with even smaller batteries.

The BHI160BP tracks a person's position by intelligently applying an inertial sensor based algorithm for Pedestrian Dead Reckoning (PDR). To maintain accuracy, it calculates the user's relative location based on data collected from the inertial sensors and then re-calibrates itself every few minutes to obtain the absolute position provided by the GNSS/GPS module. This means that the GNSS/GPS module can be kept in sleep mode for most of the time, which drastically reduces a device's power consumption and extends its operating time.

"Pedestrian position tracking is a crucial application for mobile applications; unfortunately, GPS modules can rapidly drain a device's battery capacity – especially when the battery is as small as in wearable devices," says Dr. Stefan

Finkbeiner, CEO of Bosch Sensortec. "Our new Position Tracking Smart Sensor solves this problem and enables users to navigate reliably while extending the operation of GPS tracking in their devices from several hours up to several days."

Straightforward integration

The position tracking capability provided by the BHI160BP also means that a device can maintain solid accuracy even when the GNSS signal is blocked or weak, e.g. near tall buildings or indoors. This ensures accurate pedestrian navigation at all times, even in shielded indoor areas such as subways.

The BHI160BP is a new member of Bosch Sensortec's BHI160 family and adds application-specific functionality for position tracking. It provides a ready-to-use solution that can be quickly and easily integrated into a system design without requiring an update to a new GNSS module, thereby significantly cutting time to market.

While the current configuration is optimized for use with GNSS receivers (such as GPS), the BHI160BP can also support most of the common global localization technologies. As well as improving localization, the BHI160BP can also serve to handle gesture recognition and 3D orientation, with 3D calculations performed by the sensor itself rather than by an application processor.

Wide range of features and functionalities

The new BHI160BP draws only 1.3 mA in active operation mode and is the industry's lowest-power solution that integrates the Fuser Core (MCU) and a 6-axis Inertial Measurement Unit (IMU). Additionally, the Position Tracking Smart Sensor offers a variety of customized virtual sensors, such as a calibrated accelerometer, orientation and wake up gesture, within a single device. Furthermore, the BHI160BP can be extended by connecting additional physical sensors, such as a magnetometer, over a secondary interface.

The new BHI160BP comes in a compact 3 x 3 x 0.95 mm³ LGA-package and is pin-to-pin compatible with the BHI160.

Availability

The BHI160BP will be available via distribution in December 2018.

Press photo: #1371263, #1371264

YouTube: [Position Tracking Smart Sensor BHI160BP video](#)

Bosch Global: Explore and experience what the Position Tracking Smart Sensor BHI160BP has got to do with Harry Potter in [Harry Potter and the “Marauder’s Map”](#).

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Bosch at electronica 2018 in Munich

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Bosch Sensortec GmbH, a fully owned subsidiary of Robert Bosch GmbH, develops and markets a wide portfolio of microelectromechanical systems (MEMS) sensors and solutions tailored for smartphones, tablets, wearable devices and IoT (Internet of Things) applications. The product portfolio includes 3-axis acceleration, gyroscope and geomagnetic sensors, integrated 6- and 9-axis sensors, environmental sensors, optical microsystems and a comprehensive software portfolio. Since its foundation in 2005, Bosch Sensortec has emerged as the MEMS technology leader in the markets it addresses. Bosch has been both a pioneer and a global market leader in the MEMS sensor segment since 1995 and has, to date, sold more than 9.5 billion MEMS sensors. More than every second smartphone worldwide uses a Bosch Sensortec sensor.

For more information, please visit www.bosch-sensortec.com, twitter.com/boschMEMS

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Additional information is available online at www.bosch.com, www.iot.bosch.com, www.bosch-press.com



Versatile semiconductors: Bosch launches new automotive system-ICs at electronica 2018

November 2018

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- ▶ ICs with embedded "intelligence" manage important in-car processes.
- ▶ New system IC reliably separates the high voltage battery from the vehicle network in the event of an accident.
- ▶ Application-specific integrated circuits (ASICs) from Bosch have been used in vehicles since 1970

Munich and Reutlingen, Germany – System ICs are application-specific integrated circuits (ASICs) designed to meet special requirements in vehicle systems. They are integrated on a single silicon chip measuring only a few square millimeters, and house complex circuits with up to several million individual electronic functions. At electronica 2018, the world's leading trade show for electronics, Bosch introduces four new system-ICs.

A new chip for electric vehicles will shut off the power in the event of an accident, ensuring safety for driver and passengers and enable rescuers to work without being put in danger.

Semiconductors make electric cars safer in an accident

Pure electric or hybrid vehicles are equipped with special batteries that provide power to the electric motor at high voltages of 400 to 800 volts. For safety reasons, these high-voltage batteries, power electronics and their electrical wiring are designed to be highly robust. Nevertheless, the question of how secure a high-voltage battery is in the event of an accident is of vital concern to both the vehicle's occupants as well as any rescue workers. To prevent these persons from coming into contact with high voltage, while at the same time eliminating the risk of a vehicle fire, it must be possible to completely isolate the battery from the vehicle's electrical system.

During an accident, so-called "pyro fuses" blow out sections of the electrical wiring to the high-voltage battery by means of a small explosive charge, so that the circuit is interrupted quickly and effectively. Here, Bosch semiconductors play a crucial role: The integrated circuit CG912 can, as a part of the battery

management, fire up to four pyro fuses in the battery wiring in the event of an accident,. This mitigates the risk of electrical shock when touching the vehicle's chassis. In addition, this special IC can also provide power to the battery management. Bosch's CG912 was originally developed for deploying airbags and has been proven in the field a million times over.

New system ICs at electronica 2018

System ICs are truly versatile. They provide stable supply voltages, read sensor data, process information and drive actuators – in real time. The new oxygen sensor evaluation IC CJ138 offers, in comparison to its predecessors, extended options for adapting an engine control unit to a wide range of oxygen sensors, as well as accurate sensor cable diagnostic for short circuit or interruption. The highly integrated transmission IC CG270 precisely controls up to ten hydraulic valves in automatic transmissions and allows the design of more compact control units for modern multi-stage transmissions. CG135 is a transmission IC that monitors the supply voltages in a transmission control unit and prevents the transmission from being damaged in the event of a fault.

Press photo: #1653312, #1688030

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MEMS sensors from Bosch make driving safer, more fun, and more relaxed

New SMI860 inertial sensor

November 2018
PI10781 BBM Fi/KB

- ▶ Sensor optimizes ESP®, driver assistance systems, and sophisticated driving dynamics applications
- ▶ Yaw rate, roll-rate, and acceleration measurement in a single compact package
- ▶ SMI860 is especially robust for withstanding vibrations

Munich and Reutlingen, Germany – Stable vehicle handling under all weather conditions and traffic situations makes car driving not only safer and more comfortable but also delivers a higher degree of enjoyment and dynamics to the driving experience. At the electronica exhibition in Munich, Bosch reveals for the first time its SMI860 five-axis inertial sensor. This extremely robust MEMS sensor enables a safe and natural driving experience – both in everyday as well as demanding situations – noticeably improving driving safety, comfort and dynamics.

Car driving becoming even safer

The intelligent SMI860 MEMS sensor provides important support for active safety and driver assistance systems inside the vehicle. For example, the ESP electronic stability control system (anti-skidding system), greatly increases traffic safety and has, to date, saved more than 8,500 lives in Europe alone. Necessary dynamic driving state data is delivered to the anti-skid system also from the SMI860. It recognizes whether the vehicle is travelling in the direction in which the steering wheel is turned. In the event that these values diverge, the skid protection system is activated. In addition, this new sensor can precisely determine the position of the vehicle, which can be utilized in precise vehicle heading applications.

The SMI860 is the first example of a package from Bosch containing five inertial data measuring elements in a single sensor for active safety applications. The package includes two 16-bit gyroscopes for measuring yaw rate and roll rate, and

three 16-bit acceleration sensors. Algorithms are used to calculate the dynamic driving state and position of the vehicle based on the received signals.

Compact, robust, reliable, and temperature-tolerant

This intelligent sensor is built on Bosch's proven market-leading MEMS technology. Compared to its predecessor, it is better protected against vibrations and its exceptionally high offset stability will deliver reliable long-term operation. It has been developed according to ISO26262 for use in systems up to ASIL D.

Thanks to its small bias instability, the SMI860 delivers low noise performance, thereby further improving its accuracy. Noise (rms) is just ± 0.1 °/s for the gyroscope and 4 mg (x and y axes) and 6 mg (z axis) for the accelerometer. A signal conditioning ASIC provides on-chip processing and low-pass filtering, and an industry-standard SafeSPI interface is included for communication with other devices. To save space, the SMI860 is housed in a compact BGA package, measuring just 7mm x 7mm x 1.5mm. Required supply current for the sensor does not exceed 28mA. Its operating temperature range of -40°C to +125°C enables it to be installed in practically any location.

Press photos: #1487006, #1487007

Further information:

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MEMS sensors from Bosch enable cars to navigate without GPS

SMI230 inertial sensor improves reliability of navigation systems

November 2018
PI10780 BBM Fi/KB

- ▶ New MEMS sensor from Bosch helps to keep on track even under poor GPS signal conditions
- ▶ Accelerometer and gyroscope combined in a single package
- ▶ Sensor is highly precise, stable and extremely power-efficient

Munich and Reutlingen, Germany – The loss of a GPS signal has brought many relaxing car trips to an abrupt end. At Munich's world-renowned electronics exhibition: electronica, Bosch today announced the new SMI230 six-axis inertial sensor. With this sensor onboard, navigation systems will not take their eye off the destination – even when the GPS signal is interrupted. The SMI230 from Bosch provides the navigation system with motion data, enabling the current position of the travelling vehicle to be determined even when the GPS signal is weak or nonexistent. Navigation systems will become even more precise and reliable.

No longer travelling blind when without GPS

Millions of car drivers today rely on GPS navigation. If a satellite signal is weak, distorted or interrupted, e.g. due to mountains, tall buildings or even tunnels, then the navigation system will lose its direction. That is when the SMI230 MEMS sensor from Bosch comes into play: it precisely measures the yaw rate and acceleration of the vehicle. In this way the onboard navigation system continuously calculates the travel direction and position while the car is moving. The navigation is not disrupted when inside a tunnel or an 'urban canyon'. The capabilities of the sensor improve not only navigation but also find their niche in fleet management, toll systems and car alarm installations. Here too, precise determination of position is essential.

Versatility brings flexibility

The SMI230 conveniently combines one three-axis MEMS accelerometer with one three-axis MEMS gyroscope in a single compact package. Both sensors run digitally in 16-bit mode based on proven MEMS technology from Bosch. Adding to this already powerful combination is the fact that the gyroscope and accelerometer can either be operated individually or interconnected for data synchronization purposes.

Accurate, stable and power efficient

The SMI230 delivers high accuracy – the prerequisite for the best-possible precision in navigation: noise is only $0.02^\circ/\text{s}/\sqrt{\text{Hz}}$ (rms) for the gyroscope and $0.12 \text{ mg}/\sqrt{\text{Hz}}$ (rms) for the accelerometer. Also, the accelerometer has rock-solid temperature stability, with a low temperature coefficient offset (TCO) of typically below $0.2 \text{ mg}/\text{K}$ and temperature coefficient sensitivity (TCS) of only $0.002 \text{ } \%/ \text{K}$. Typical bias instability of the gyroscope is well below $2^\circ/\text{h}$.

Power consumption plays a decisive role in many applications. Therefore, the SMI230 supports three power saving modes - accelerometer: suspend mode; gyroscope: suspend mode and deep suspend mode.

Backward compatible to accelerate the development cycle

The SMI230 is pin-for-pin compatible with Bosch's SMI130, and offers an identical gyroscope programming interface, making it fast and easy to integrate into existing platforms without any time-consuming layout re-work. The new sensor is housed in an ultra-compact 16-pin standard LGA package, measuring just $3 \text{ mm} \times 4.5 \text{ mm} \times 0.95 \text{ mm}$.

The sensor will be available in May 2019.

Press photos: #1487003, #1487004

Further information:

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BOSCH AT ELECTRONICA 2018 IN MUNICH

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- **PANELS WITH BOSCH EXPERTS:**
 - **Monday, November 12, 12:30 p.m.:** presentation “Sensors enabling future mobility solutions” by Dr. Markus Sonnemann, Vice President Pre-Development MEMS sensors at Robert Bosch GmbH, electronica Automotive Conference at ICM Munich
 - **Tuesday, November 13, 11:30 a.m.:** presentation “MEMS – one product one process?” by Dr. Udo-Martin Gómez, Senior Vice President MEMS sensors, Robert Bosch GmbH, SEMICON Europe, Fab Management Forum at ICM Munich in room 14c
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 - **Wednesday, November 14, 3:40 p.m.:** presentation “The future of MEMS-based smart sensor nodes in the context of highly functional and ultra-low power IoT applications” by Dr. Ralf Schellin, Head of Product Area MEMS at Bosch Sensortec GmbH, International Congress Center (ICC)

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November 2018
PI10779 BBM Fi/KB

Bosch MEMS sensors now enable faster airbag deployment

New high-G acceleration sensors increase driver and passenger safety

- ▶ MEMS sensors improve driver and passenger safety in motor vehicles
- ▶ Accurate signal detection with faster signal processing thanks to a doubled bandwidth
- ▶ Large number of packaging and installation options provide greater flexibility
- ▶ Improved frontal, side and rollover crash detection

Munich and Reutlingen, Germany – Precision meets speed. At electronica, the world's leading trade fair for electronics, Bosch announces a new generation of high-g acceleration sensors. The SMA7xy sensor family improves safety for car drivers and passengers. When the acceleration sensors detect a collision, the passive safety systems such as airbags can now be deployed earlier, and the restraining effect can be precisely set for the given accident scenario. In this way, the consequences of accidents can be further mitigated. The new SMA7xy family comprises of multiple sensors for airbag systems based on Bosch's market leading MEMS technology.

Universally applicable, very fast crash sensors

The sensors from the new SMA7xy product family enable extremely fast signal processing. Compared to the sensors of the preceding generation, Bosch has doubled the bandwidth, and thereby increased crash signal processing speeds by one hundred percent. The acceleration sensors are located either directly in the airbag ECU or in satellites located at the A- B- or C-pillar or at the front bumper. The sensors detect impact or a car rollover event within fractions of a second and send this information to the airbag ECU, which then deploys the vehicle's passive safety systems in time.

One of the sensors from the SMA7xy family, the SMA760 precisely detects front and side impacts. A second sensor, the SMA720 contains one x and one z

channel to measure acceleration along the vertical axis. This makes the SMA720 an ideal companion to the SMI860 for vehicle rollover detection. Both sensors support the SafeSPI communication interface standard.

All sensors from the SMA7xy family conform to the ASIL D safety level of ISO 26262 and meet the VDA AK-LV27 specification. The PSI5 sensor versions, designed specifically for use along the periphery, offer a wide acceleration range: 30g, 60g, 120g, 240g, or 480g. For improved design flexibility Bosch offers a number of variants, for example an upright face mount option with a smaller footprint.

Flexible options providing design freedom

The peripheral-type sensors of the SMA7xy family are available in many variants, with two package options, four sensor axis configurations, several measurement range options and well over 80 different PSI5 modes – there is a suitable sensor to meet every requirement. One package option is the SOIC8, a well-established housing that is widely used and exceptionally robust, whilst the LGA System-in-package (SiP) houses integrated passive components.

Press photos: #1486998, #1487000

Further information: www.bosch-semiconductors.com

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SiTime and Bosch accelerate innovation in MEMS Timing for 5G and IoT

September 4, 2018
PI10762 BBM Fi/KB

- ▶ A billion MEMS timing solutions from SiTime enable synchronization and connectivity of electronic devices
- ▶ Since 2009, Bosch has supplied MEMS wafers and implemented new process technologies that have helped enhance SiTime's timing solutions
- ▶ SiTime and Bosch are strengthening their process and manufacturing partnership to provide innovative timing solutions for future 5G, IoT and automotive applications

SANTA CLARA, Calif. – SiTime Corporation, a leading provider of MEMS timing, and Bosch, a global supplier of technology and services, announced a strategic technology partnership to accelerate innovation in micro-electro-mechanical systems (MEMS) timing. SiTime will work with Bosch to develop processes for next-generation MEMS resonator products. These MEMS resonators are the heartbeat of 5G, IoT and automotive electronics, and will enable the higher speeds of 5G, long battery life of IoT devices and increased reliability of driver assistance systems in automotive. Bosch will utilize its expertise in MEMS manufacturing to produce these resonators for SiTime and ensure availability of high-volume capacity.

Mobile phones, high-speed trains and stock markets have one thing in common – they must stay on time. And they do thanks to accurate MEMS timing devices found in millions of telecom, enterprise, and consumer electronic products.

“Since 2009 SiTime has counted on Bosch to manufacture more than a billion MEMS resonators,” said Rajesh Vashist, CEO of SiTime. “Over the next decade, the 5G, IoT, and automotive markets will drive the growth of the timing industry by creating a 200 billion unit opportunity. Automation, communications, and computing applications in these markets will require more features, higher accuracy and reliability from timing components.”

SiTime has revolutionized the \$6 billion timing industry with innovative MEMS timing solutions that offer unique benefits. SiTime has shipped over a billion units into all electronics markets, has over 90 percent share of the MEMS timing market, and has partnered with industry leaders, such as Intel, to drive timing innovation in 5G.

“Stable, reliable MEMS timing devices are needed for successful operation of new, high-bandwidth 5G, IoT and driver assistance systems,” said Jens Fabrowsky, executive vice president of the Automotive Electronics division at Robert Bosch GmbH. “Without ultra-precise timing, the benefits and opportunities for next generation systems will not be achieved. With Bosch’s MEMS leadership and manufacturing excellence, and SiTime’s groundbreaking MEMS timing technology, this partnership will make possible unique new features and mission-critical services in 5G, IoT, and automotive applications.”

Bosch has been both a pioneer and a global market leader in the MEMS sensor segment since 1995 and has sold more than 9.5 billion MEMS sensors. The company developed the manufacturing process behind MEMS technology nearly 25 years ago. More than every second smartphone worldwide uses a Bosch MEMS sensor.

“Bosch’s strong MEMS process capabilities are a foundation on which we can develop our next generation of higher performance MEMS resonators,” said Vashist. “Our partnership with Bosch will help extend our leadership into the coming decades.”

Press photo: #1463750

More Information:

[SiTime Fact Sheet](#)

[About SiTime](#)

[SiTime Website](#)

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About SiTime

SiTime Corporation, the leader in MEMS timing and a wholly owned subsidiary of MegaChips Corporation (Tokyo Stock Exchange: 6875), offers MEMS-based silicon timing solutions that replace legacy quartz products. SiTime's configurable solutions enable customers to differentiate their products with higher performance, smallest size, lowest power, and best reliability. The rich feature set and flexibility of SiTime's solutions allow customers to consolidate their supply chain, reducing the cost of ownership and time to market. By using standard semiconductor processes and high-volume packaging, SiTime offers the best availability and shortest lead times in the industry. With 90% market share and over 1 billion devices shipped, SiTime is driving the electronics industry to use 100% silicon-based timing. www.sitime.com.

About Bosch

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Bosch lays foundation stone for factory of the future Boosting Germany as a high-tech location

June 25, 2018

PI 10669 RB Ka/af

- ▶ Key technology: semiconductors for automotive technology and the internet of things
- ▶ Expansion of manufacturing capacity: more and more chip applications
- ▶ Ten-figure sum: high-tech factory to employ 700
- ▶ Artificial intelligence: Quality assurance through connected manufacturing
- ▶ Bosch board of management member Hoheisel: “Semiconductors pave the way for better quality of life.”
- ▶ Federal and state officials emphasize contribution to Germany’s competitiveness

Stuttgart and Dresden, Germany – The foundation stone laid today in Dresden is a key milestone in the construction of the Bosch Group’s state-of-the-art wafer fab. Construction is scheduled to be completed in late 2019, when installation of the production machinery will start. “Today we are laying the foundation stone for the wafer fab of the future, and with it the foundation for improving people’s quality of life and their safety on the road,” said Dr. Dirk Hoheisel, member of the board of management of Robert Bosch GmbH, at the formal ceremony in Dresden. “Semiconductors are the key technology for the internet of things and the mobility of the future. When installed in cars’ control units, for example, they enable automated, efficient driving and the best possible passenger protection.” In his address, Peter Altmaier, the German Federal Minister for Economic Affairs, underlined the central importance of this Bosch investment: “We are today taking an important step toward securing the future competitiveness of Germany as an industrial location. The research community in Germany and Europe is an excellent one, but we cannot afford to rest on our laurels. In the field of microelectronics, we also need engineering skills and know-how, and especially industrial-scale manufacture and application, in Germany and Europe. Today’s

ceremony is an important step on this route.” As a supplier of technology and services, Bosch is investing roughly one billion euros in its new location in the Saxony state capital. The first associates are due to start work in the new plant in early 2020.

After Reutlingen, the Dresden plant is the Bosch Group’s second wafer fab in Germany. With it, the company aims to expand its manufacturing capacity, and thus to boost its competitive edge in global markets. Semiconductors are finding their way into more and more applications relating to the internet of things and mobility solutions. According to the market research company Gartner, semiconductor sales around the world rose by some 22 percent in 2017 alone. Otto Graf, who will manage the new plant, said: “Construction is proceeding right on schedule. “During the construction phase, we will move some 7,500 truckloads of earth, lay about 80 kilometers of piping and ductwork, and mix more than 65,000 cubic meters of concrete – 8,000 concrete mixers-worth.” Following a rollout phase, pilot manufacturing operations are expected to start at the end of 2021. The plot of land – measuring some 100,000 square meters, or roughly 14 soccer fields – will also be home to a nearly 72,000 square-meter multistory building housing offices and production space. Up to 700 associates will be involved in the highly automated chip manufacturing process, working to plan, manage, and monitor production. This also includes modifying the production processes and evaluating the data from Dresden in Bosch’s global manufacturing network.

Saxony as a business location: driving Europe’s microelectronics industry

“Bosch’s decision is an important milestone. The construction of the new wafer fab here in Dresden will create many other attractive jobs, strengthen Saxony’s reputation as a location for technology and business, and is good for Germany and Europe as well. This project will play a decisive part in securing a leading role for European industry as a whole in the technologies of the future,” said Michael Kretschmer, the Minister-President of the state of Saxony. “This investment in such a major project is a sign of confidence in Saxony, in its people, in the research and industrial network that has become established here, and in its innovativeness.” In its search for a new location, Bosch considered several cities around the world. In Hoheisel’s words, “Dresden is an excellent microelectronics cluster.” He added that the city’s infrastructure is excellent: everything is easily accessible, and the transportation connections are good.

The cluster also includes automotive suppliers and service providers, as well as universities offering technological expertise. As Hoheisel pointed out: “We want to work closely with semiconductor companies and universities to increase semiconductor technology’s competitive edge – not only in Germany, but across Europe.”

Semiconductors: key technology for the internet of things

Manufacturing semiconductor chips always starts with a silicon disc, or wafer.

The bigger the wafer’s diameter, the more chips that can be made per manufacturing cycle. This is one reason why the new Bosch factory will focus on the production of 300 mm wafers: Compared with conventional 150 and 200 mm wafer fabs, 300 mm wafer technology offers greater economies of scale.

Semiconductors are extremely small integrated circuits with structures measured in fractions of a micrometer. Manufacturing them requires a highly automated and complex process consisting of several hundred individual steps over several weeks. It takes place in clean-room conditions, as even the tiniest particles in the ambient air can damage the delicate circuits.

Connected manufacturing: 22 metric tons of data a day for higher quality

Wafer production is one of the forerunners of connected manufacturing. The Dresden plant is expected to generate production data equivalent to 500 text pages per second – written out on paper, that would be more than 42 million pages a day, weighing 22 metric tons. This is why artificial intelligence will play a special part in chip manufacturing in the factory: the highly automated production facilities analyze their own data in order to optimize their processes. As a result, the quality of the chips rises while production costs go down. Furthermore, planning and process engineers can access this production data at any time to accelerate the development of new wafer products or minimize tolerances early on in the manufacturing process. “We need creative minds for our connected and automated manufacturing operations – particularly experts in wafer technology, like process engineers, mathematicians, or software developers,” Graf said. Many new associates have already been hired for the Dresden plant, he added, and there has been no drop in the number of applications.

Leading semiconductor manufacturer with 45 years of experience

For more than 45 years, Bosch has been making semiconductor chips in various forms, above all as application-specific integrated circuits (ASICs). At its wafer fab in Reutlingen, Germany, Bosch currently manufactures ASICs, power semiconductors, and microelectromechanical systems (MEMS). Bosch ASICs have been used in vehicles since 1970. They are customized to individual

applications, and essential for functions such as engine management or airbag deployment. In 2016, every car rolling off the production lines worldwide had on average more than nine Bosch chips on board.

Press photos: #1361836, #1164163, #1339964, #1100697, #1136646, #534371, #1289914, #1243990, #1373444, #1373445, #1373446

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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 upfront 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.

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