Press release

January 15, 2018

Bosch technology enables redundancy needed for automated driving

- Redundant braking and steering solutions from Bosch aid the rollout of automated driving
- Bosch is working on redundant braking solutions for all levels of automated driving
- Fail-degraded brake system combines iBooster and ESC systems to realize redundant braking
- Bosch technology was recently named as an *Automotive News* PACE finalist
- Bosch systems and components, as well as redundancy expertise, are a key enabler of automated driving solutions

DETROIT – Without redundancy, there is no automated driving. The promise of automated driving requires a mix of technological, societal and regulatory development and cooperation. The technology continues to advance thanks to sensors and software, but also thanks to redundancy. In order to realize fully-automated driving on the path to the accident-free future, redundancy in safety-critical systems such as braking and steering is an absolute.

Bosch is actively developing and bringing to market redundant braking solutions to support all levels of automation as defined by SAE. At the 2018 North American International Auto Show, the leading global supplier of technology and services will showcase its braking solutions, including redundant braking for automated driving.

“The importance of redundancy for the rollout of automated driving goes beyond just the technological function as it ultimately will build confidence in consumers as they understand these systems are designed with deep levels of complexity to handle a variety of situations,” said Mike Mansuetti, president of Bosch in North America.

SAE level 3 (conditional automation) vehicles will begin to hit the market as soon as 2018. For these vehicles, a human driver is still necessary, but safety-critical

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functions may be completely shifted to the vehicle under certain traffic or environmental conditions. Drivers must still remain present, but will need a certain amount of time to realize that an intervention is necessary. Redundant functions ensure that all safety-critical functions continue during this time span, even in the rare case of a failure in the system. For SAE levels 4 and 5, the redundancy becomes even more critical as the time span increases without the driver in the loop.

Bosch's solution for a fail-degraded brake system (steering system and EE architecture) is the combination of its electromechanical brake booster iBooster and ESC (Electronic Stability Control), also known as ESP® (electronic stability program), systems. Both are independently capable of performing braking functions for the vehicle in the rare case of a single failure.

The technological breakthrough of redundant braking was achieved by modifying one system element; the vacuum brake booster is replaced by an intelligent electro-mechanical booster, the iBooster. A conventional brake system today comprises two actuators: a vacuum brake booster and ESC unit. The redundant brake system is comprised of two actuators that are each able to decelerate the vehicle independent of the driver applying the brake pedal. Even if a failure occurs in the brake system, either actuator (iBooster or ESC) is able to avoid wheel lock-up by modulating the brake pressure, which maintains the ability to steer during deceleration.

Bosch's redundant brake system for automated driving was named a finalist for the 2018 *Automotive News* PACE (Premier Automotive Suppliers' Contributions to Excellence) Award, which is acknowledged globally as a prestigious industry benchmark for automotive supplier innovation. Bosch was also honored with an eMove360° Award in the category of Automated Driving for the redundant braking technology.

Redundant steering is also a key technology for automated driving and Bosch is leading in this area. At NAIAS 2017, Bosch introduced its Electric Power Steering (EPS) system with fail-operational function. The system, which enables either a driver or auto pilot system to make a safe stop in the rare case of a single failure, is a key requirement on the path to fully automated driving.

Making automated driving a reality calls for profound understanding of all vehicle systems. Bosch has this expertise, and manufactures most of the key components itself – including radar, video, and ultrasonic sensors, brake control systems, electrical power-steering units, display instruments, and connectivity

solutions inside and outside the vehicle. Bosch has more than 3,000 engineers around the world working to make automated driving a reality.

EXPERIENCE BOSCH AT NAIAS 2018 in Detroit, Michigan, USA: At NAIAS 2018, Bosch is presenting automated, connected and electrified technologies with a focus on how vehicle electrification is becoming more desired and accessible.

BOSCH BOOTH: Monday to Thursday, January 15-18, 2017, on Level Three, Room 330A, Cobo Center.

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About Bosch
Having established a regional presence in 1906 in North America, the Bosch Group employs nearly 32,800 associates in more than 100 locations, as of December 31, 2016. In 2016 Bosch generated consolidated sales of $13.7 billion in the U.S., Canada and Mexico. For more information, visit www.boschusa.com, www.bosch.com.mx and www.bosch.ca.

The Bosch Group is a leading global supplier of technology and services. The company employs roughly 390,000 associates worldwide (as of December 31, 2016) and generated sales of 73.1 billion euros ($80.9 billion) in 2016. 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 industry. 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 create solutions for a connected life, and to improve 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 subsidiaries and regional companies in some 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 120 locations across the globe, Bosch employs 59,000 associates in research and development.

Additional information is available online at www.bosch.com, www.bosch-press.com, http://twitter.com/BoschPresse.

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