



Automotive application guide

We make cars clean, safe and smart.



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We make cars clean, safe and smart.

Infineon Technologies AG is a leading player and pioneer in automotive electronics. Our enduring success in this field is due to a clear strategic focus on automotive applications and standards, along with the understanding and insights that have emerged from over 40 years of dedicated experience and our ability to continually innovate this market with a broad portfolio of outstanding quality. Our sensors, microcontrollers and power semiconductors help automotive manufacturers achieve their increasingly challenging safety, affordability and efficiency targets. Above all, we are helping to create more sustainable mobility choices by lowering emissions and fuel consumption.

Paving the way for more sustainable mobility choices

In a more and more mobile society, carbon dioxide emissions are rising and fossil fuel reserves are dwindling. The automotive industry faces the challenge of powering today's mobile lifestyle while simultaneously reducing its carbon footprint. Electronic components play a key role in improving energy efficiency.

The demand for alternative, more energy-efficient forms of mobility is increasingly geared toward electromobility. Drivetrain electrification, whether in hybrid electric vehicles or – ultimately – fully electric vehicles, has the advantages of higher energy efficiency and zero tailpipe emissions. As the world leader in automotive and advanced power electronics, with over ten years of experience in electromobility, Infineon delivers a broad suite of best-in-class microcontrollers, power semiconductors and sensors that are helping to solve today's electromobility challenges.

As we transition toward greater electromobility, Infineon is also working with leading car manufacturers and system suppliers to improve the energy efficiency of combustion engines and the various subsystems in today's vehicles. We offer a range of dedicated products and solutions targeting hotspots such as demand-driven accessories, energy management and electric power distribution. These solutions embody Infineon's commitment to the exceptional quality and reliability that the world's leading vehicle manufacturers expect.



Reducing road fatalities

New Car Assessment Programs (NCAP) and governments all over the world have set ambitious road fatality reduction targets. The automotive industry actively contributes to road safety by developing and evolving technologies that reduce the likelihood or impact of accidents, for example by improving reactive airbag and stability control systems. Similarly, new active safety features include adaptive cruise control and lane departure warning, where the vehicle acts proactively before a crash occurs.

Infineon is continuously optimizing chipsets that enable safety features designed to reduce the number of road accidents. With the most rigorous Euro NCAP in mind, we lead the field in many safety innovations for passive, active and preventive safety systems, such as RADAR technologies.

Complying with functional safety requirements

The increasing number of electronic systems leads to ever more considerations regarding the functional safety of vehicle systems. Infineon has adopted the ISO Standard 26262 for designing the appropriate products but also for setting up the appropriate processes for the development of such products.

Meeting increased data security demands

As system complexity in cars increases, so does the volume of data to be processed and distributed. Therefore, automakers need to ensure that information is processed securely and protected against external access and manipulation (e.g. car tuning or counterfeit spare parts). Furthermore, new payment methods, such as parking fees or road tolls, require a secure flow of transaction data. Infineon can draw on years of expertise in chip card and identification systems to propel automotive data security to the next level.



Safety applications

Both customer demands and government legislation continue to improve traffic safety. Electric and electronic safety systems play a key role in this trend. Electric power steering is a good example of how a safety application perfectly combines improved fuel efficiency with enhanced comfort.

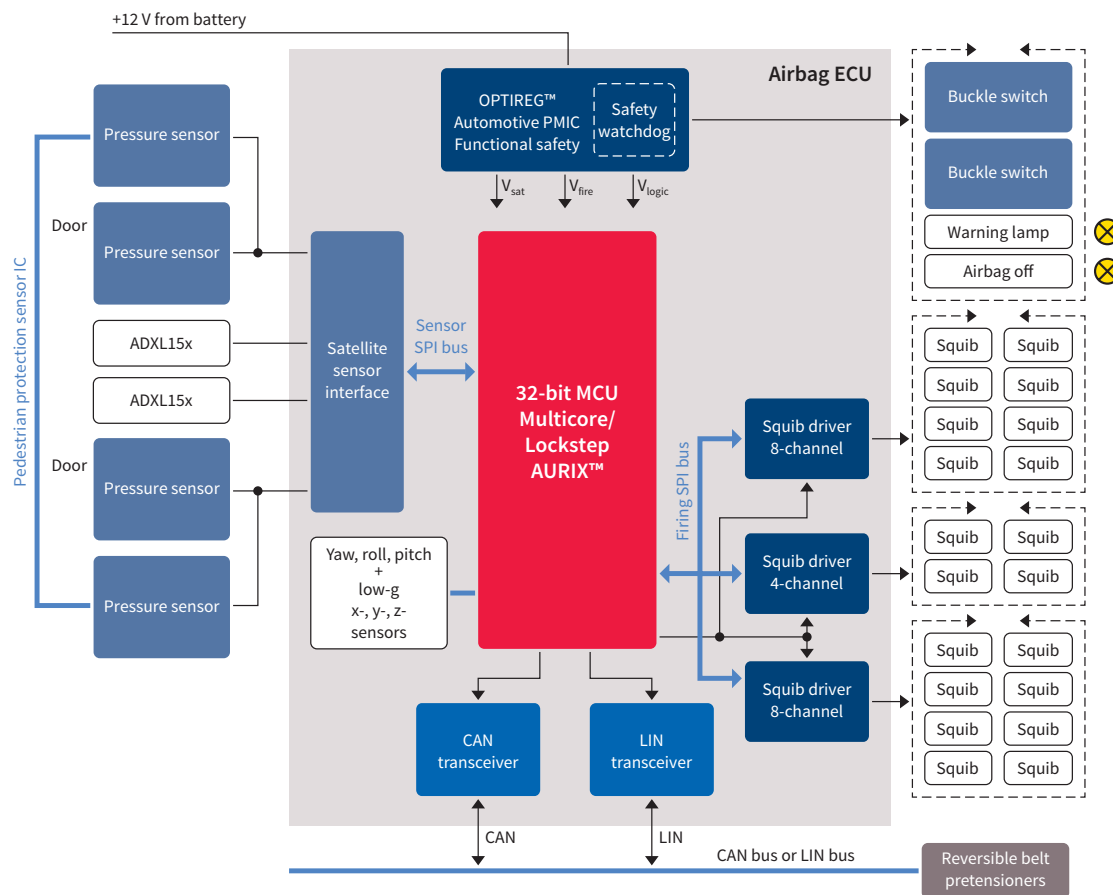
Infineon is the broadest supplier with a portfolio extending from intelligent sensors and microcontrollers through automotive power standard products and Application-Specific Standard Products (ASSPs) to highly integrated customized Application-Specific ICs (ASICs). This comprehensive product portfolio – combined with our application expertise gained during four decades of activity in the automotive industry – positions us ideally to help customers overcome their key challenges. These include ongoing application optimization plus the implementation of new features to meet stringent safety requirements. The ISO 26262 safety standard is one example of the exacting standards that apply today.

To help customers to reach the desired Automotive Safety Integrity Level (ASIL) certification, Infineon has already introduced its own PRO-SIL™ concept. This trademark clearly identifies the products which contain “SIL-supporting” features. The Infineon PRO-SIL™ concept includes safety-focused organization and business processes for the generation of hardware and software safety features, including safety documentation.

The functional complexity and levels of integration of real-time safety-critical applications continue to increase exponentially. In addition, the product life cycle of these applications has to meet stringent safety standards. The ISO 26262 mandates more robust and comprehensive product development processes and functional safety concepts in automotive applications.



Airbag system



System benefits

- › Airbag systems are standard in most cars and are mandatory equipment in many countries, saving thousands of lives
- › Infineon's broad product spectrum supports scalability and flexibility for building systems from 4 to over 20 firing loops
- › Full range of airbag ASSPs ranging from pressure sensors for side crash detection to driver and transceiver ICs
- › High-performance 32-bit AURIX™ MCU family with dedicated safety features enables the integration of multiple functions
- › The parts are optimized in terms of both system interoperability and the best price-performance ratio
- › These systems are mandatory in order to achieve the highest possible scores in the various "New Car Assessment Programs" (NCAP) throughout the world

Suggested products

Product type	Description
Microcontroller	AURIX™ high-performance 32-bit multicore microcontroller
Power management IC	OPTIREG™ Automotive PMIC
Network transceivers	CAN FD and LIN transceiver
Airbag ASSP	Airbag deployment ASSPs; Airbag satellite receiver
Pressure sensors	XENSIV™ application-specific sensor for side airbag pressure sensing
	XENSIV™ application-specific sensor for side airbag pressure sensing; fully PSI5-compliant
	XENSIV™ application-specific sensor for pedestrian protection sensing
Magnetic sensors	XENSIV™ Hall switches for buckle switch application

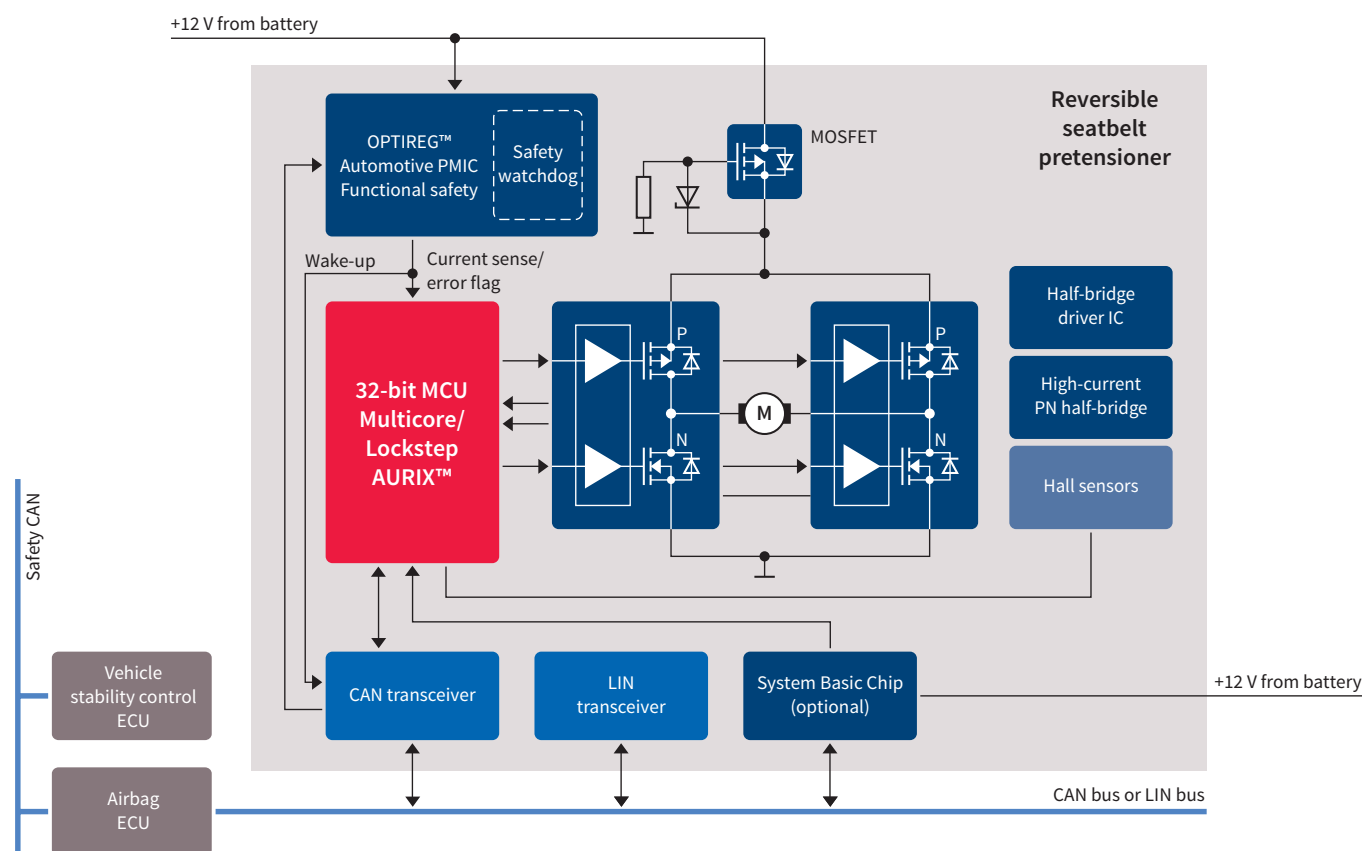


ISO 26262
compliant

www.infineon.com/airbag



Reversible seatbelt pretensioner



System benefits

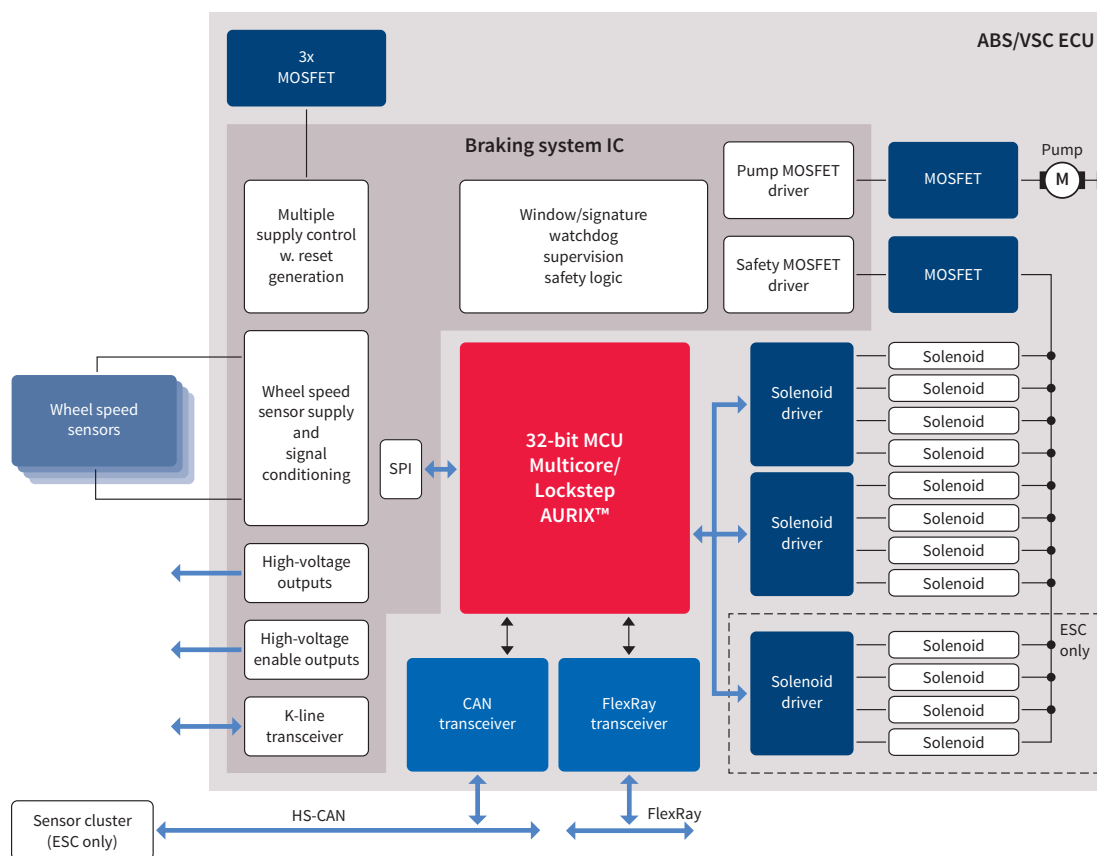
- › Seatbelts are still the primary safety feature for protecting car passengers from severe harm
- › Correct belt tension before a crash reduces the severity of injuries while also increasing passenger comfort during normal use
- › Safety experts predict that reversible seatbelt pretensioner will become mainstream in the future
- › The illustration shows the partitioning of an Infineon system solution for this application which includes supply, microcontroller, sensor, power and communication ICs

Suggested products

Product type	Description
Microcontroller	AURIX™ high-performance 32-bit multicore microcontroller
Power management IC	OPTIREG™ Automotive PMIC
Network transceivers	CAN FD and LIN transceiver
SBC	System Basis Chip integrates power supply and network transceivers (CAN/LIN)
MOSFET	OptiMOS™ MOSFET family
Magnetic sensors	XENSIV™ Hall switches for position/rotation sensing and rotor index counting
Half-bridges	High-current PN half-bridge IC s



Brake Vehicle Stability Control (VSC)



System benefits

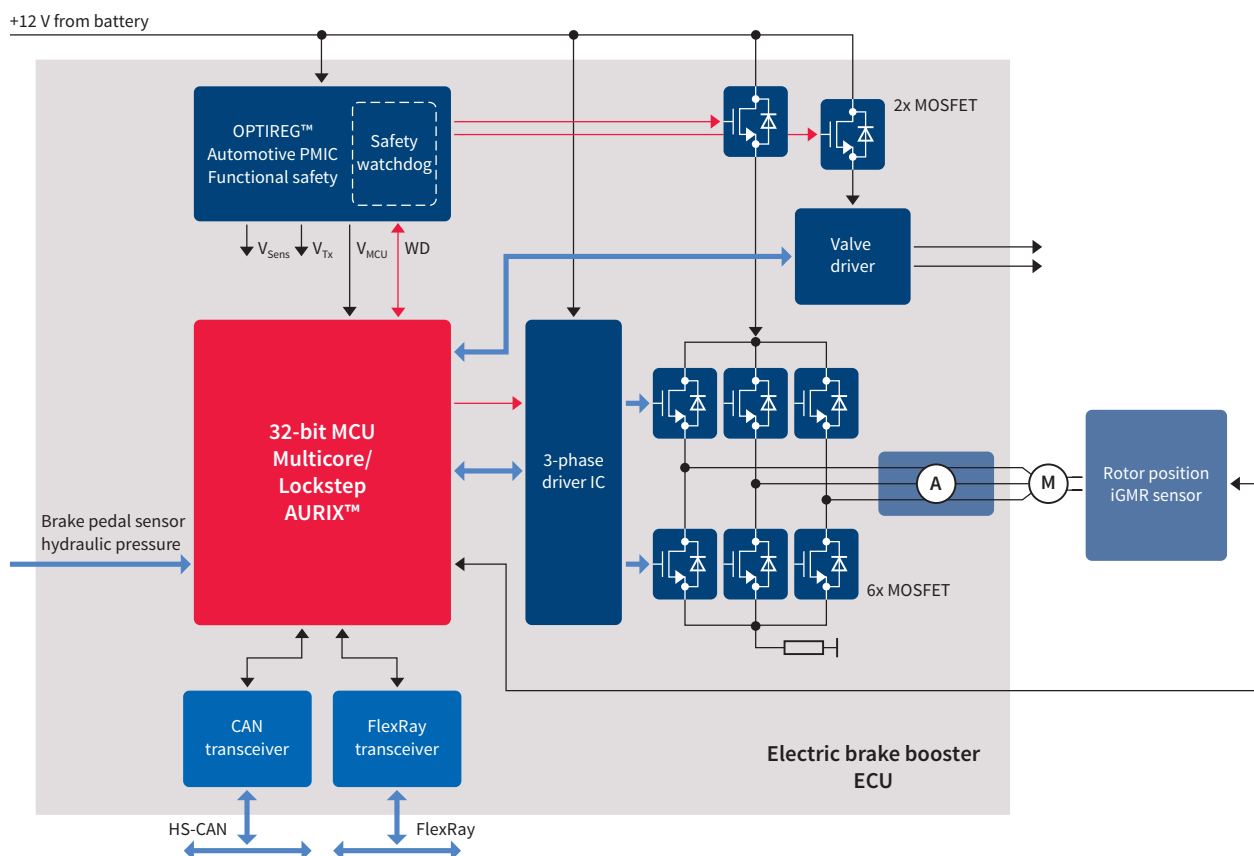
- › Vehicle stability control systems can be found in all car classes on our roads, providing safety while reducing braking distances and keeping the car under control in critical situations
- › These systems are mandatory in order to achieve the highest possible scores in the various “New Car Assessment Programs” (NCAP) throughout the world and are even legislated in some countries
- › Infineon’s range of products for braking systems stretches from scalable microcontrollers, state-of-the-art wheel speed sensors, CAN and FlexRay transceivers to MOSFETs and valve drivers

Suggested products

Product type	Description
Microcontroller	AURIX™ high-performance 32-bit multicore microcontroller
Network transceivers	CAN FD and FlexRay transceiver
Driver IC's	Quad solenoid driver
MOSFET	OptiMOS™ N-Channel MOSFET family
Wheel speed sensors	XENSIV™ magnetic sensors
Trackers	OPTIREG™ Automotive linear voltage trackers supplying sensors



Electric brake booster



System benefits

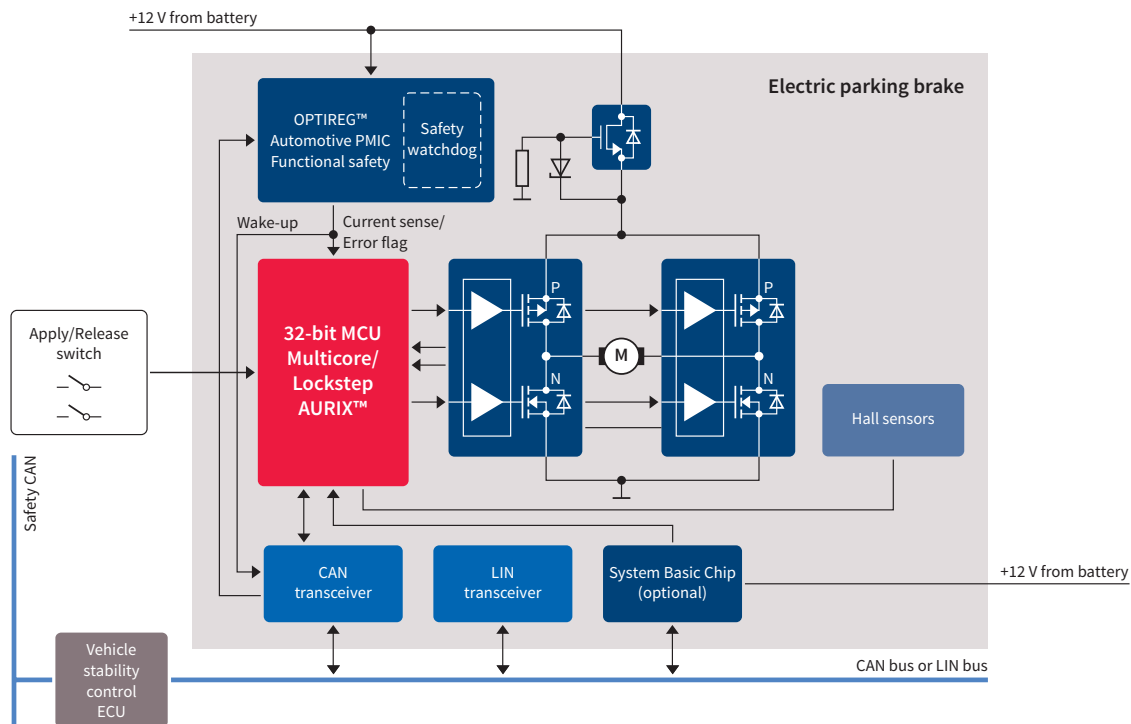
- › Next-generation drivetrains, such as hybrid and electric vehicles and even contemporary highly efficient combustion engines, require a new braking assistance system
- › Current systems are mainly dependent on vacuums generated by the combustion engine or vacuum pumps, which use up electrical energy as well as package space under the hood and are not flexible enough for the driver assistance systems of tomorrow
- › The above illustration shows the new concept of a fully electric brake booster, incorporating vehicle stability control functionality with an efficient and flexible design

Suggested products

Product type	Description
Microcontroller	AURIX™ high-performance 32-bit multicore microcontroller
Power management IC	OPTIREG™ Automotive PMIC
Network transceivers	CAN FD and FlexRay transceiver
Bridge drivers	3-phase bridge driver IC for automotive safety applications
MOSFET	OptiMOS™ T 40V N-Channel MOSFET family, optimized for EPS applications
Magnetic sensors	XENSIV™ linear Hall sensor family for torque and current sensing; iGMR sensors for rotor position sensing, TMR angle sensor
Trackers	OPTIREG™ Automotive linear voltage trackers for supplying sensors



Electric parking brake



System benefits

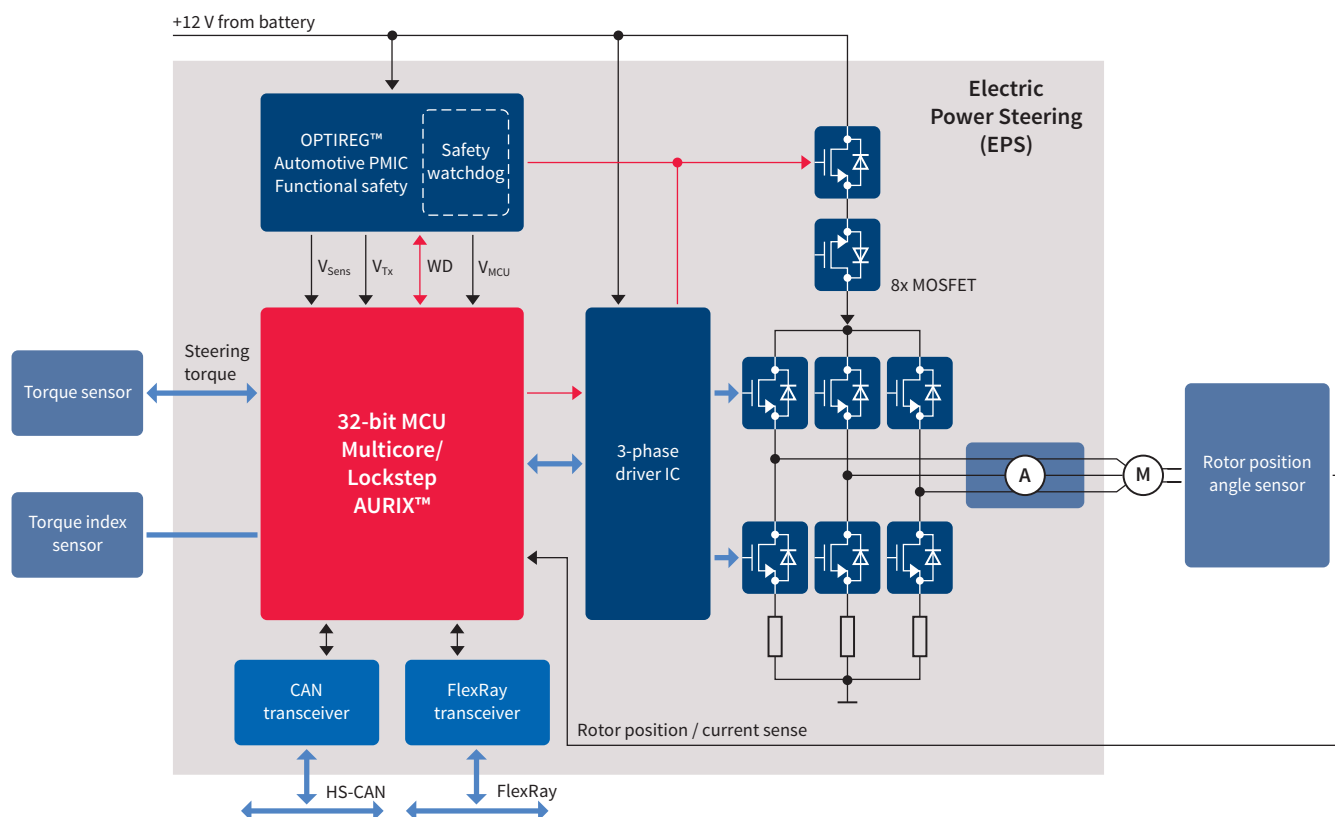
- › The electric parking brake provides drivers with many more comfort and convenience features than the standard mechanical system
- › Hill hold, launch control and roll-away prevention are all possible
- › These convenience features are in many cases safety relevant and should therefore be implemented using safety-compliant hardware (according ISO 26262)

Suggested products

Product type	Description
Microcontroller	AURIX™ high-performance 32-bit multicore microcontroller
Power management IC	OPTIREG™ Automotive PMIC
Network transceivers	CAN FD and LIN transceiver
SBC	System Basis Chip integrates power supply and network transceivers (CAN/LIN)
Half-bridges	High-current PN half-bridge ICs
Magnetic sensors	XENSIV™ Hall switches for position/rotation sensing and rotor index counting
Trackers	OPTIREG™ Automotive linear voltage trackers for supplying sensors



Electric Power Steering (EPS)



System benefits

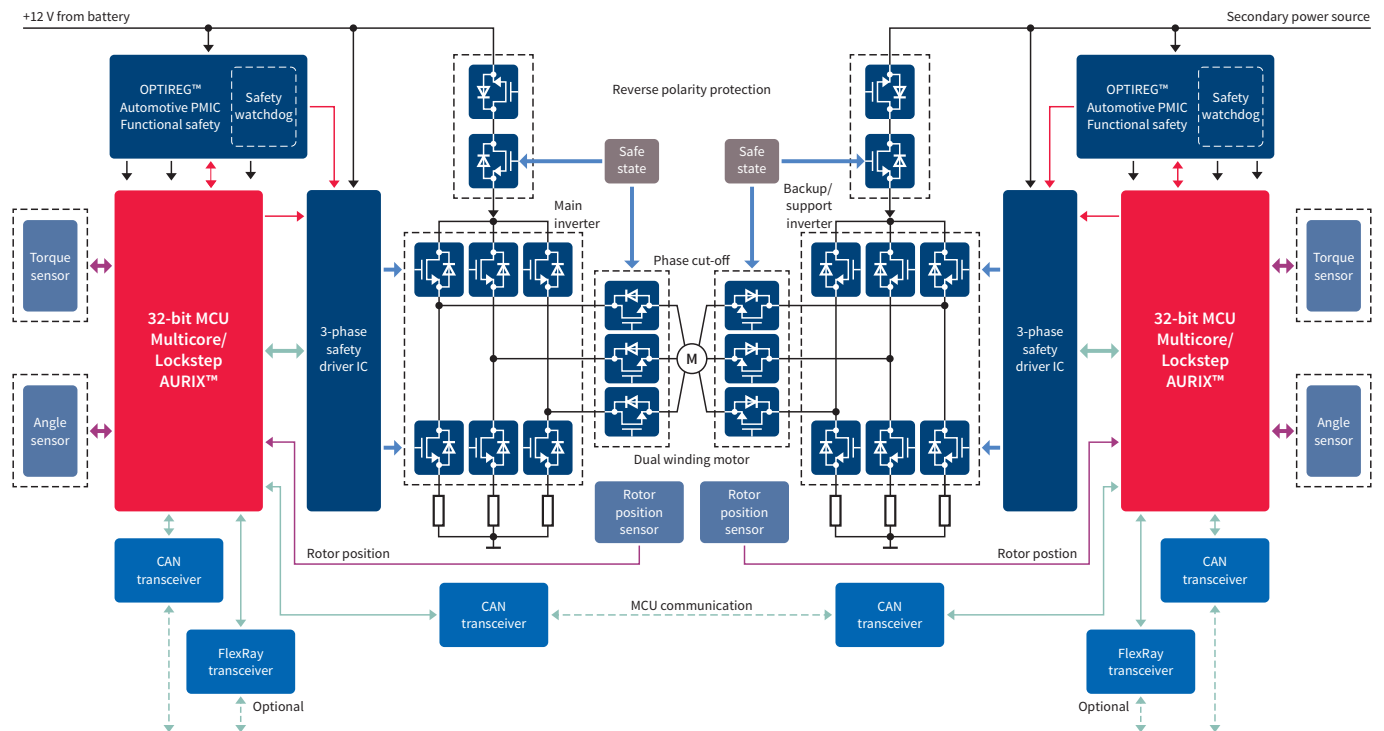
- › Electric Power Steering (EPS) improves fuel efficiency by approximately 3 percent, while also having a positive impact on car handling, the overall driving experience and comfort
- › It combines a compact design with reduced mounting costs
- › EPS can be adapted via software to suit diverse car models as well as dedicated driving modes
- › EPS is the steering technology needed to enable advanced driver assistance systems such as side-wind compensation, lane assist/keeping and parking assistance systems
- › Infineon has over twenty years of experience in this exciting application and provides the full range of ICs, from sensors to microcontrollers, and from bridge drivers to world-class MOSFETs

Suggested products

Product type	Description
Microcontroller	AURIX™ high-performance 32-bit multicore microcontroller
Power management IC	OPTIREG™ Automotive PMIC
Network transceivers	CAN FD and FlexRay transceiver
Bridge drivers	3-phase bridge driver IC for automotive safety applications
MOSFET	OptiMOS™ T 40V N-Channel MOSFET family in a TOLL package, optimized for EPS applications
Magnetic sensors	XENSIV™ linear Hall sensor family for torque and current sensing, XENSIV™ iGMR sensors for rotor position sensing
	XENSIV™ Hall switch for index counting, XENSIV™ TMR angle sensor
	XENSIV™ iAMR/iGMR dual angle sensor for rotor positioning sensor
Trackers	OPTIREG™ Automotive linear voltage trackers for supplying sensors



Fail Operational Electric Power Steering (EPS)



Fail Operational EPS Systems will be not only required for future high and full automated cars, but will make used today assisted cars more dependable.

System benefits

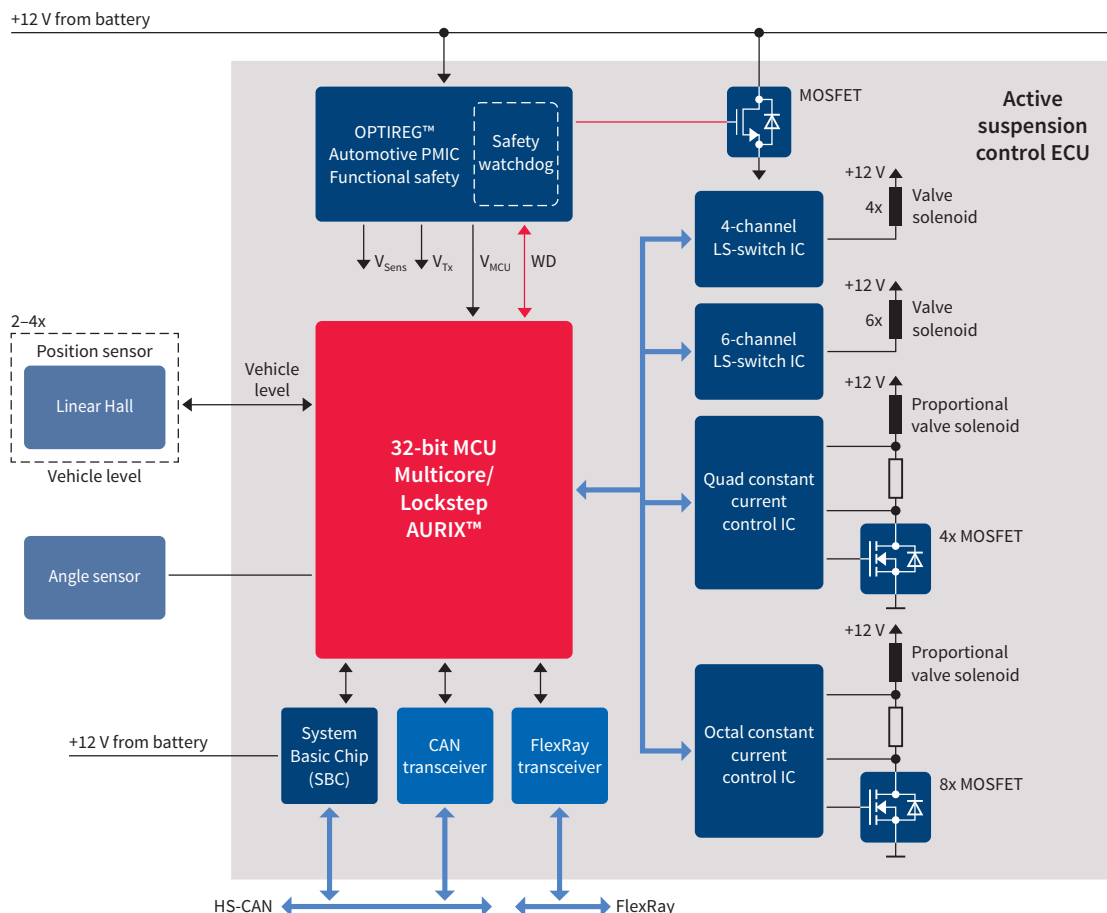
- › Chipset solution, enabling redundant layout combined with performance, scalability and small footprint
- › Supporting multiple 3-phase based fail-safe, high availability and fail operational EPS systems
- › Aligned safety concept with special focus on power supply and microcontroller
- › Future requirements by e.g. Steer-By-Wire concepts can be covered

Suggested products

Product type	Description
Microcontroller	AURIX™ high-performance 32-bit multicore microcontroller
Power management IC	OPTIREG™ Automotive PMIC
Network transceivers	CAN FD and FlexRay transceiver
Bridge drivers	3-phase bridge driver IC for automotive safety applications
MOSFET	OptiMOS™ T 40V N-Channel MOSFET family in a TOLL package, optimized for EPS applications
Magnetic sensors	XENSIV™ linear Hall sensor family for torque and current sensing, XENSIV™ iGMR sensors for rotor position sensing
	XENSIV™ Hall switch for index counting, XENSIV™ TMR angle sensor
	XENSIV™ iAMR/iGMR dual angle sensor for rotor positioning sensor
Trackers	OPTIREG™ Automotive linear voltage trackers for supplying sensors



Active suspension control system



System benefits

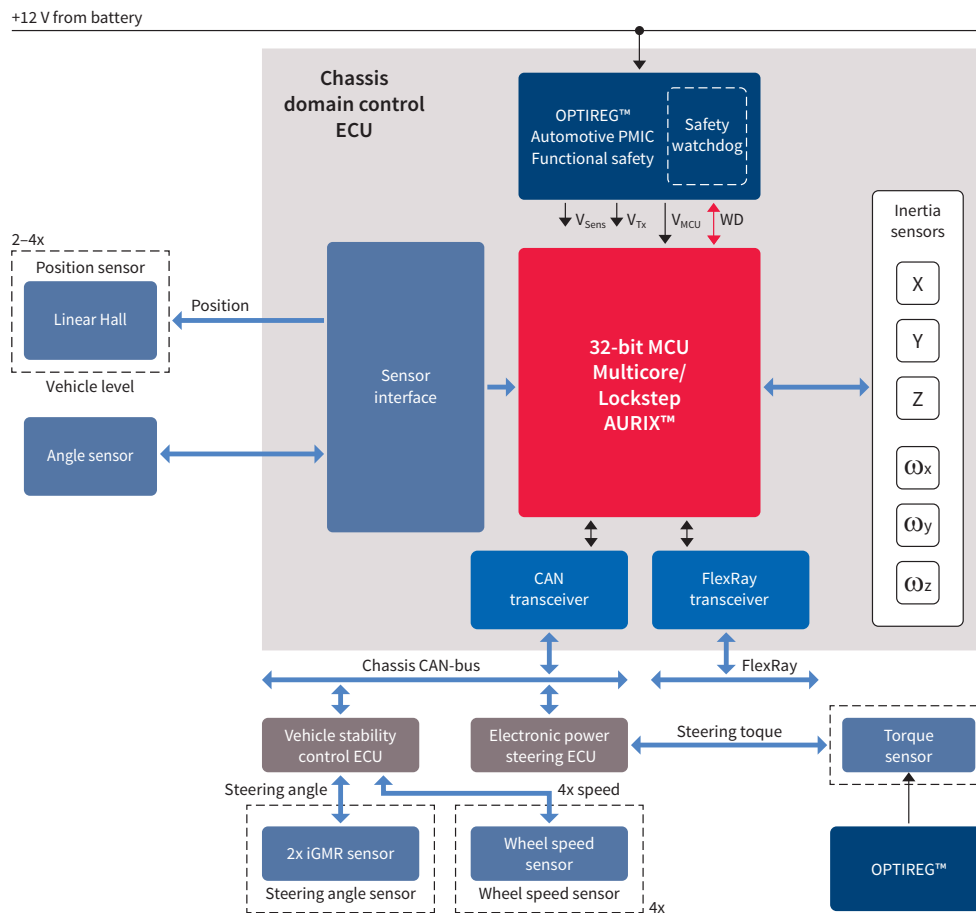
- Advanced suspension systems originally used in high end sports and luxury cars are now prevalent in the mid-market car segment
- By adapting both the vehicle's leveling and damping characteristics, these systems significantly improve car comfort, handling performance and driving safety
- Infiniteon's broad product spectrum – including high-end 32-bit microcontrollers as well as multichannel drivers for bistable and analog valves – covers the full range of suspension systems, ranging from car/load leveling, semi-active to active suspension and air-suspension systems

Suggested products

Product type	Description
Microcontroller	AURIX™ high-performance 32-bit multicore microcontroller
Power management IC	OPTIREG™ Automotive PMIC
Network transceivers	CAN FD and FlexRay transceiver
SBC	System Basis Chip integrates power supply and network transceivers (CAN/LIN)
Switch ICs	6-channel low-side switch IC; 4-channel low-side switch IC
Pre-drivers	Quad constant current pre-driver IC; Octal constant current pre-driver IC
Magnetic sensors	XENSIV™ linear Hall sensors for vehicle level sensing
Regulators and trackers	Post regulator to supply CAN transceiver; OPTIREG™ Automotive linear trackers for supplying sensors



Chassis domain control



System benefits

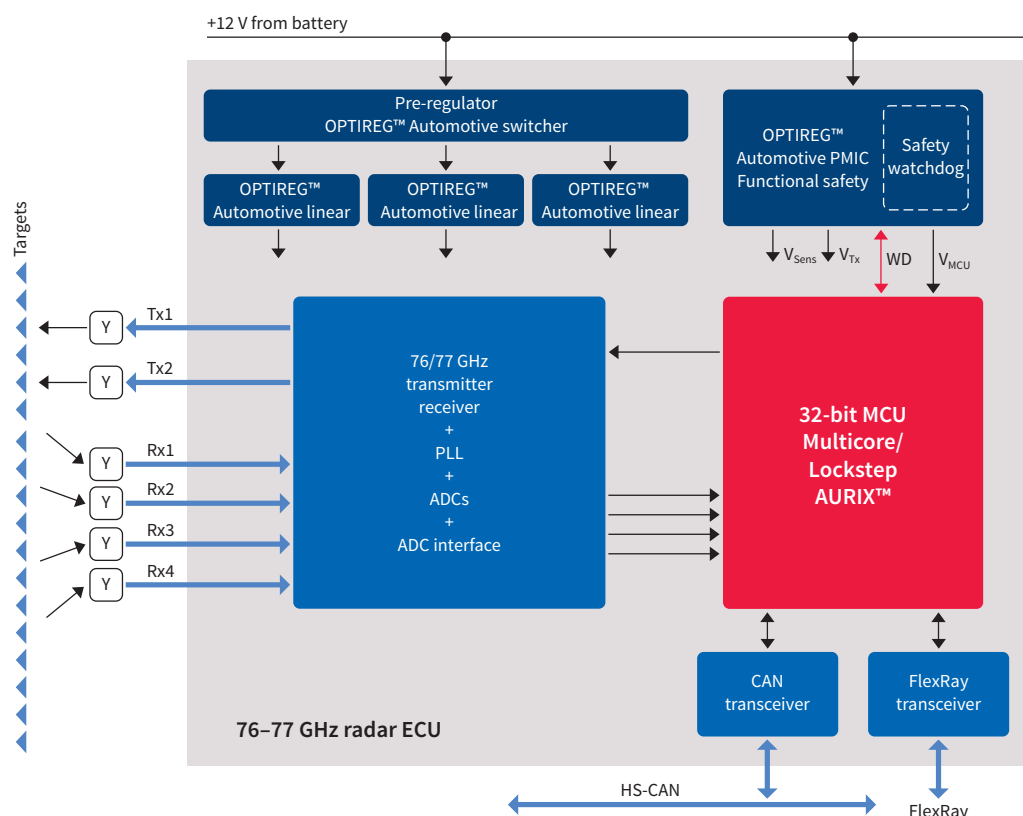
- › The chassis domain control approach provides a high-performance, scalable and safe computing platform which already includes the sensor cluster with all its multi-axle inertia sensors
- › Domain controllers allow a cost-efficient x-check and fusion of the inertia sensor signals, as well as highly efficient and safe computing of the vehicle dynamic model
- › Consequently, the chassis domain control unit represents a promising approach to perfectly coordinating functions such as VSC, semi-active suspension and drivetrain, especially when a four-wheel drive with torque vectoring is required

Suggested products

Product type	Description
Microcontroller	AURIX™ high-performance 32-bit multicore microcontroller
Power management IC	OPTIREG™ Automotive PMIC
Network transceivers	CAN FD and FlexRay transceiver
Magnetic sensors	XENSIV™ iGMR sensor with integrated 8-bit microcontroller
	XENSIV™ linear Hall sensors
	XENSIV™ iGMR wheelspeed sensor
	XENSIV™ digital iGMR angle sensor for functional safety applications
	XENSIV™ Hall switch for index counting
Power Supply ICs	OPTIREG™ Automotive switcher, OPTIREG™ Automotive linear trackers for supplying sensors



Automotive 77 GHz radar system



System benefits

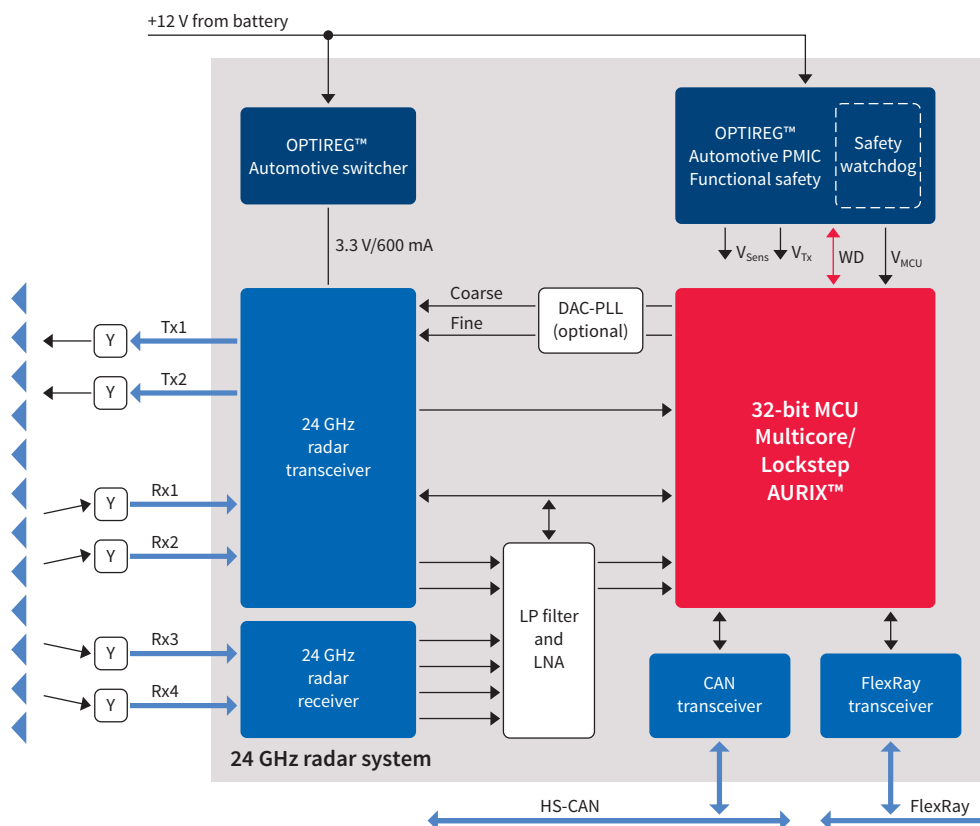
- › Automotive radar sensors are a key technology for enabling future driver assistance functions and securing high ratings in the New Car Assessment Programs (NCAP) throughout the world
- › The Radar System IC (RASIC™) series consists of a group of highly-integrated functions for the 76–77 GHz range for automotive radar
- › The ICs offer a high level of integration and need only a few – if any – external components
- › Infineon's SiGe process benefits from its origins in the volume bipolar segment. Its unique features include its high-frequency capability and robustness, making it suitable for automotive environments over the full temperature range up to full automotive qualification according to AEC-Q100
- › Infineon's AURIX™ 32-bit multicore ADAS derivative offers a dedicated feature set for radar applications which, in many cases, renders additional DSP, external SRAM and external ADC ICs obsolete. This results in cost-efficient short-range radar implementation.

Suggested products

Product type	Description
Microcontroller	AURIX™ powerful 32-bit multicore microcontroller family with dedicated ADAS features
Power Supply ICs	OPTIREG™ Automotive switcher, OPTIREG™ Automotive linear
Network transceivers	CAN FD and FlexRay transceiver
Radar chipset	76/77 GHz radar 2-channel transmitter IC; 76/77 GHz radar 4-channel receiver IC ; Wave form generator IC
Regulators	OPTIREG™ Automotive linear low noise post regulator, OPTIREG™ Automotive switcher pre-regulator



Automotive 24 GHz radar system



System benefits

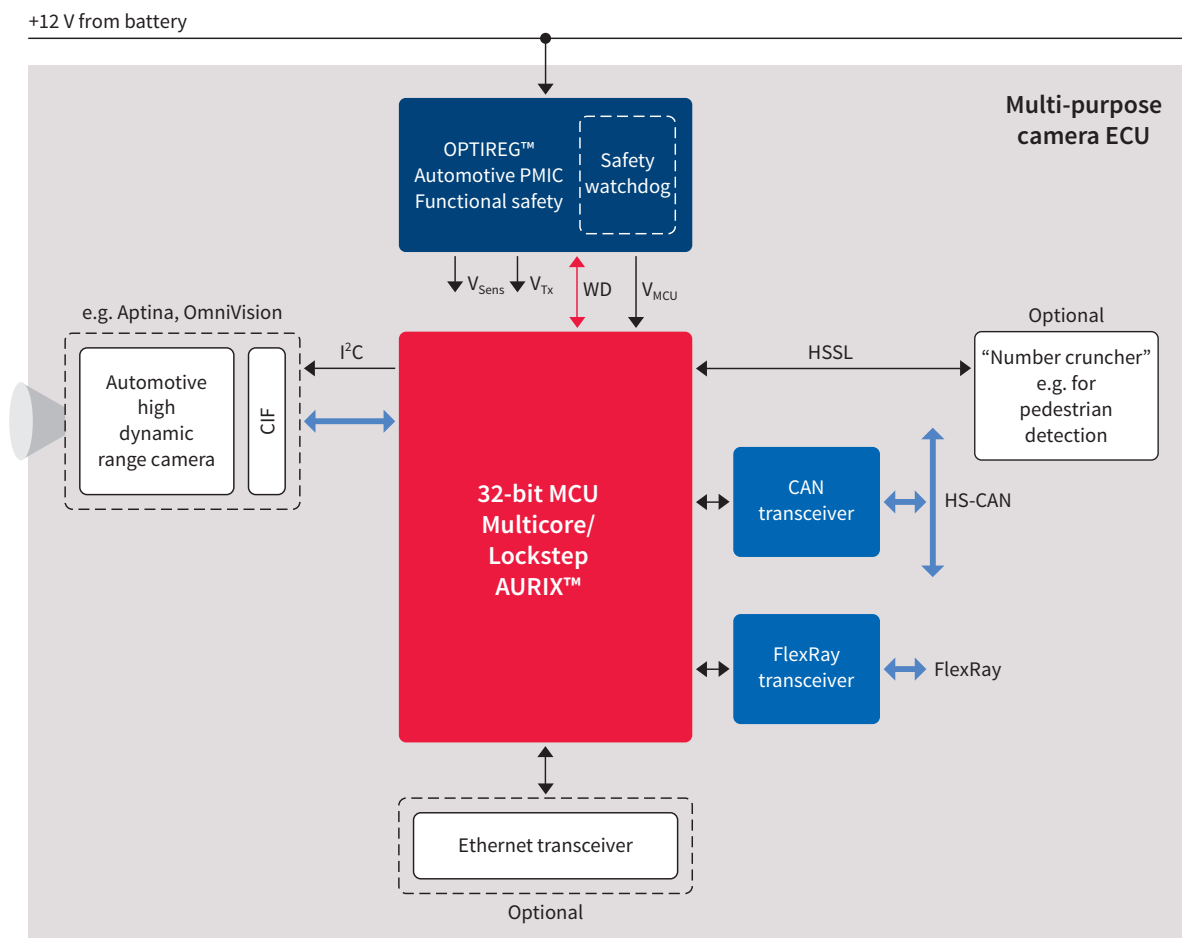
- › Infineon's 24 GHz radar technology offers a cost-efficient solution for driver assistance systems such as blind spot detection
- › The Infineon 24 GHz transceiver is a highly integrated, SPI-controlled solution consisting of a VCO, medium power amplifier, power amplifier, frequency dividers, several sensors and two complete IQ receivers
- › The signal generation unit is a standalone transmitter MMIC with the fully integrated IQ twin-receiver MMIC, in which two complex homodyne down-conversion mixers are combined; a lot of different system architectures can be served by combining the individual components
- › With its SiGe-based technology, Infineon is the first big market player to offer a competitive solution with a long-term roadmap approach for any kind of short-range radar ADAS applications
- › Infineon's AURIX™ 32-bit multicore ADAS derivative offers a dedicated feature set for radar applications which, in many cases, renders additional DSP, external SRAM and external ADC ICs obsolete. This results in cost-efficient short-range radar implementation

Suggested products

Product type	Description
Microcontroller	AURIX™ powerful 32-bit multicore microcontroller family with dedicated ADAS features
Power management IC	OPTIREG™ Automotive PMIC
Power Supply IC	OPTIREG™ Automotive switcher
Network transceivers	CAN FD and FlexRay transceiver
24 GHz radar chipset	24 GHz radar 2-channel receiver IC; 24 GHz radar 1-channel transmitter, 2-channel receiver IC
Regulators	OPTIREG™ Automotive switcher pre-regulator, OPTIREG™ Automotive linear low noise post regulator



Multi-purpose camera



System benefits

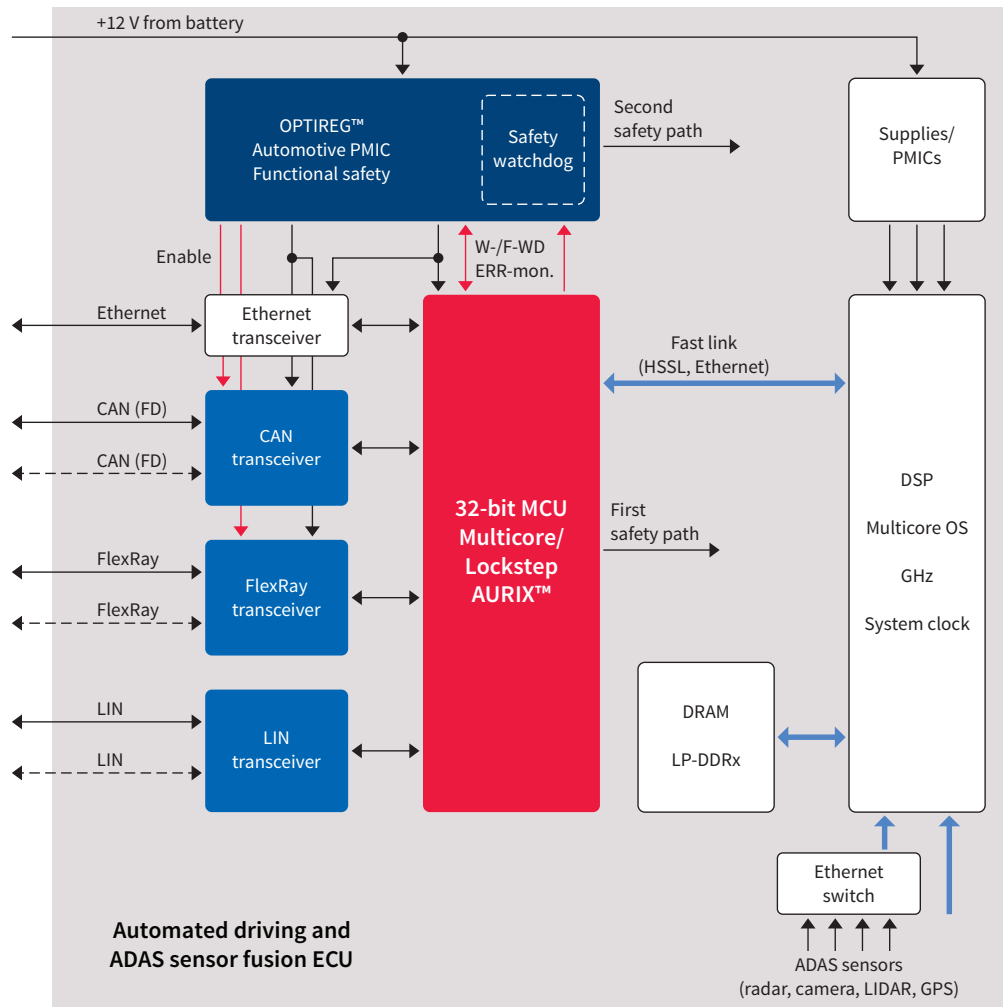
- › The market for automotive cameras is quickly growing, enabling advanced driver assistance functions such as lane departure warning, forward collision warning, along with traffic sign and pedestrian recognition
- › Infineon offers a highly integrated solution to enable compact and efficient camera systems for the next generation of assistance functions
- › This includes ISO 26262 support, innovative supply concepts and best-in-class power consumption
- › AURIX™ multicore architecture includes encapsulation features to support freedom from interference between multiple applications

Suggested products

Product type	Description
Microcontroller	AURIX™ high-performance 32-bit multicore microcontroller
Power management IC	OPTIREG™ Automotive PMIC
Network transceivers	CAN FD and FlexRay transceiver
Regulators	OPTIREG™ Automotive linear low noise post regulators



Sensor fusion



System benefits

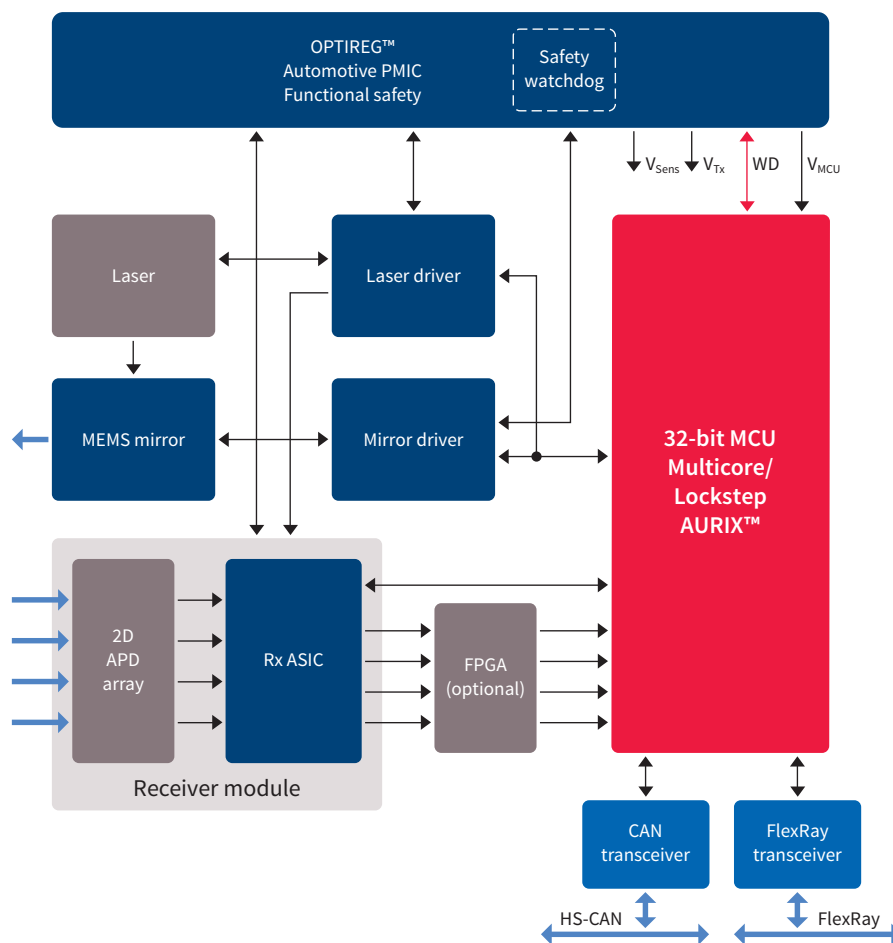
- › Enables the sensor data fusion of several environmental sensors such as radar, camera, ultrasonic and lidar
- › Enhanced ADAS functions, such as cross traffic assist and autonomous obstacle avoidance, require the data from more than one sensor and the corresponding sensor fusion
- › Since the system can make critical, autonomous decisions, safety and security implementation is a must and is supported by Infineon's high-performance AURIX™ microcontroller
- › AURIX™ combined with the TLF35584 safety power supply and a dedicated processor enables new and enhanced ADAS features

Suggested products

Product type	Description
Microcontroller	AURIX™ high-performance 32-bit multicore microcontroller family
Power management IC	OPTIREG™ Automotive PMIC
Network transceivers	CAN FD, LIN and FlexRay transceiver



Lidar sensors



System benefits

- › Highly and fully automated driving cars require multiple sensor systems. Together with camera and Radar, Lidar is a key technology to sense the environment around the vehicle
- › Using the latest developments in technology within a small form factor, Infineon offers a chip set to enable cost-effective solid state Lidar sensors for mass-market adoption which are developed to enable very accurate object tracking and recognition.
- › Lidar chip set to enable long range (> 200m) and high resolution (up to 0.1°) solid state Lidar for ADAS and automated driving.
- › High optical efficiency with low power consumption

Suggested products

Product type	Description
Microcontroller	AURIX™ 32-bit multicore microcontroller family with dedicated ADAS features
Power management IC	OPTIREG™ Automotive PMIC
MEMS mirror	1D scanning MEMS mirror of 2.7 x 2.3 mm; large optical FOV of 60°; low operating power of < 0.1 W
Mirror driver	Functional safe ASIC to control and drive the MEMS mirror
2D APD array	Switchable APD columns to reduce ambient noise
Rx ASIC	Multichannel receiver ASIC to read out enabled APD columns

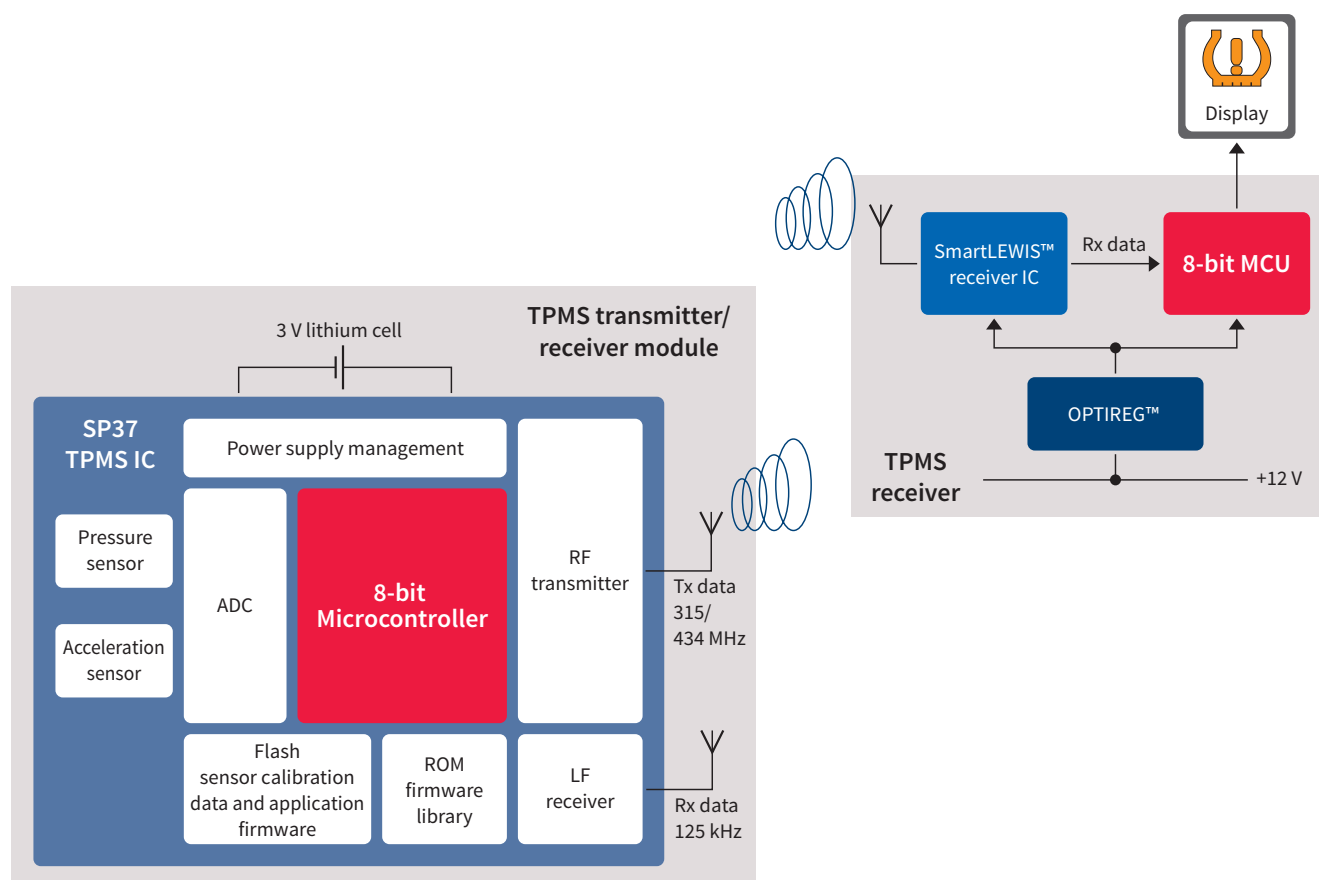


AUTOSAR

CAN FD



Tire Pressure Monitoring System (TPMS)



System benefits

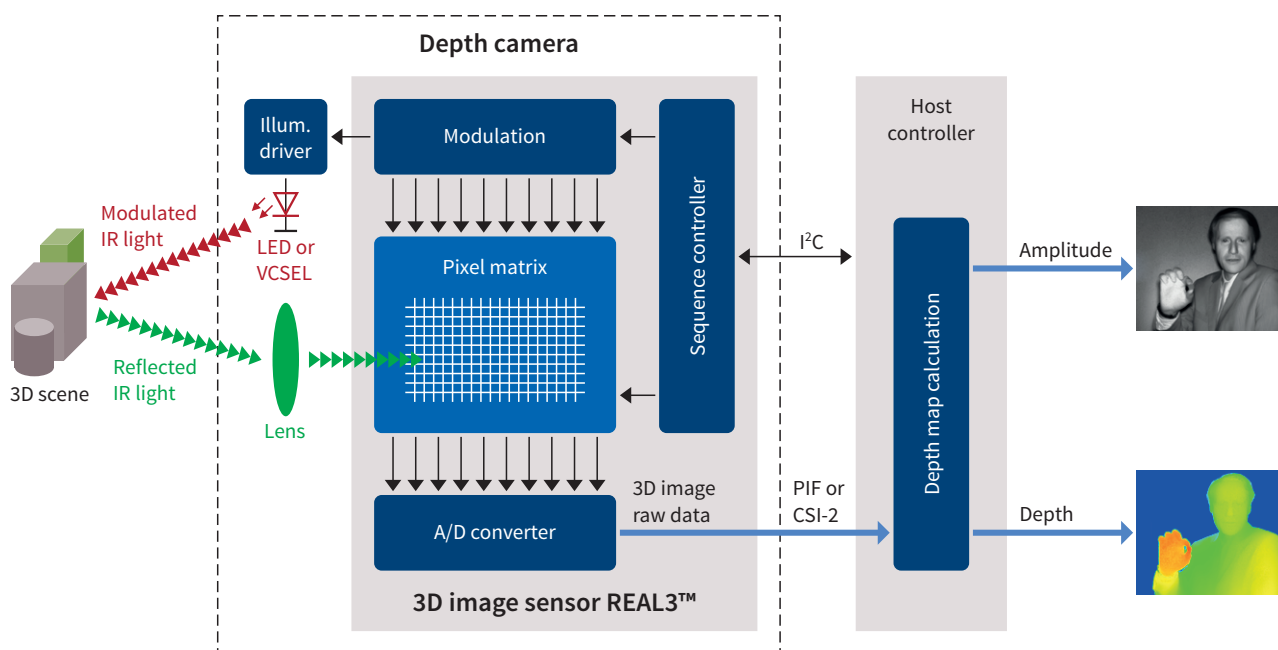
- › TPMS ensures correct tire pressure which is essential for car safety, handling, comfortable driving and tire lifetime
- › Furthermore, accurate tire pressure prevents increased fuel consumption/CO₂ emissions
- › TPMS is already mandatory in the USA, EU and South Korea
- › Infineon's TPMS IC SP37 provides
 - various surveillance functions ensuring reliable measurements
 - a pre-calibrated pressure sensor system for instant use
 - a fully packaged sensor system proven to withstand harsh automotive environments
 - a microcontroller-based architecture enables flexible system design
 - a high level of integration for reducing overall system component count
 - an increased tire lifetime by up to 30 percent

Suggested products

Product type	Description
Microcontroller	8-bit microcontroller with dual-cycle 8051 core
Power Supply ICs	OPTIREG™ Automotive linear voltage regulators, OPTIREG™ Automotive switcher
Receiver	SmartLEWIS™ RX autonomous receiver
Transmitter	Wireless control transmitter
TPMS	TPMS system with integrated microcontroller and RF transmitter for pressure ranges 450 kPa, 900 kPa, 1300 kPa (trucks). Suitable for standard application
	TPMS system with smaller package, increased flash size and lower power consumption. Pressure range 100 to 900 kPa. Suitable for standard application and on-tire application.



In-cabin sensing applications



System benefits

- › Highly robust 3D data based on the Time-of-Flight principle with an outstanding depth performance and lowest power consumption
- › Reliable in all ambient light conditions – in sunlight, darkness and changing light levels
- › Smallest footprint thanks to single-chip design and monocular 3D camera architecture
 - no baseline between active parts
 - no risk of misalignment, for example through temperature fluctuations or vibrations
 - minimum calibration work
- › Reduced computing time, regardless of the color, pattern and structure of objects

Suggested products

Product type	Description
3D image sensor	XENSIV™ 3D image sensor (REAL3™) with 100 k pixel resolution (352 x 288 pixel), automotive-qualified BGA package





Body and convenience applications

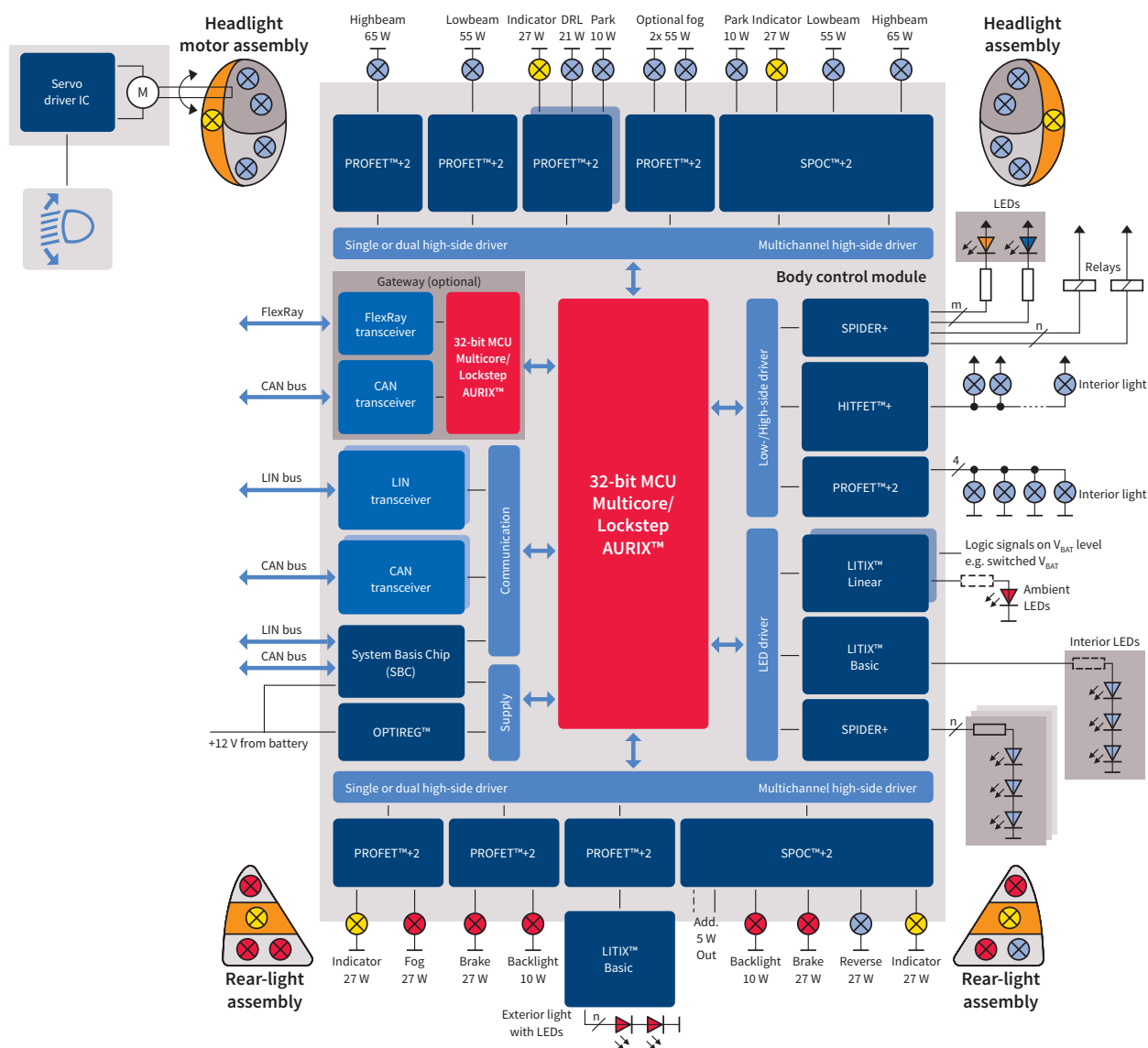
Infineon offers a wide variety of products dedicated to body and interior electronics. These include protected power switches for bulb and motor control, dedicated system basis chips and easy-to-use Hall sensor solutions. The new TriCore™-based AURIX™ family provides sufficient performance, as well as dedicated safety and security features, to meet the needs of upcoming domain electronics modules. As one example, a **high-feature body control module with integrated gateway** functionality is shown on page 27.

The following pages present well-known electronic modules for car body interior and comfort systems, such as the **body control modules** including a dedicated low-cost version, the Seat Electronics Module and the **HVAC control module**. Further modules reveal the growing trend toward decentralized modules at the point of load, such as a **front light module** or a **smart window lift module**.

Some new electronic module designs reflect the latest functional and architectural advances. One prominent example is a **power distribution system** for high-current applications supporting the move toward more advanced and efficient wiring harness systems in start/stop-capable vehicles. Another example is an **interior light module with touch-sensitive** control based on a similar human-machine interface to that featured in the latest consumer electronics devices. Finally, the growing family of system-on-chip devices supports space and cost-optimized single-chip solutions for various motor control applications, such as window lift, fuel pump and HVAC blower.



Central body control module



System benefits

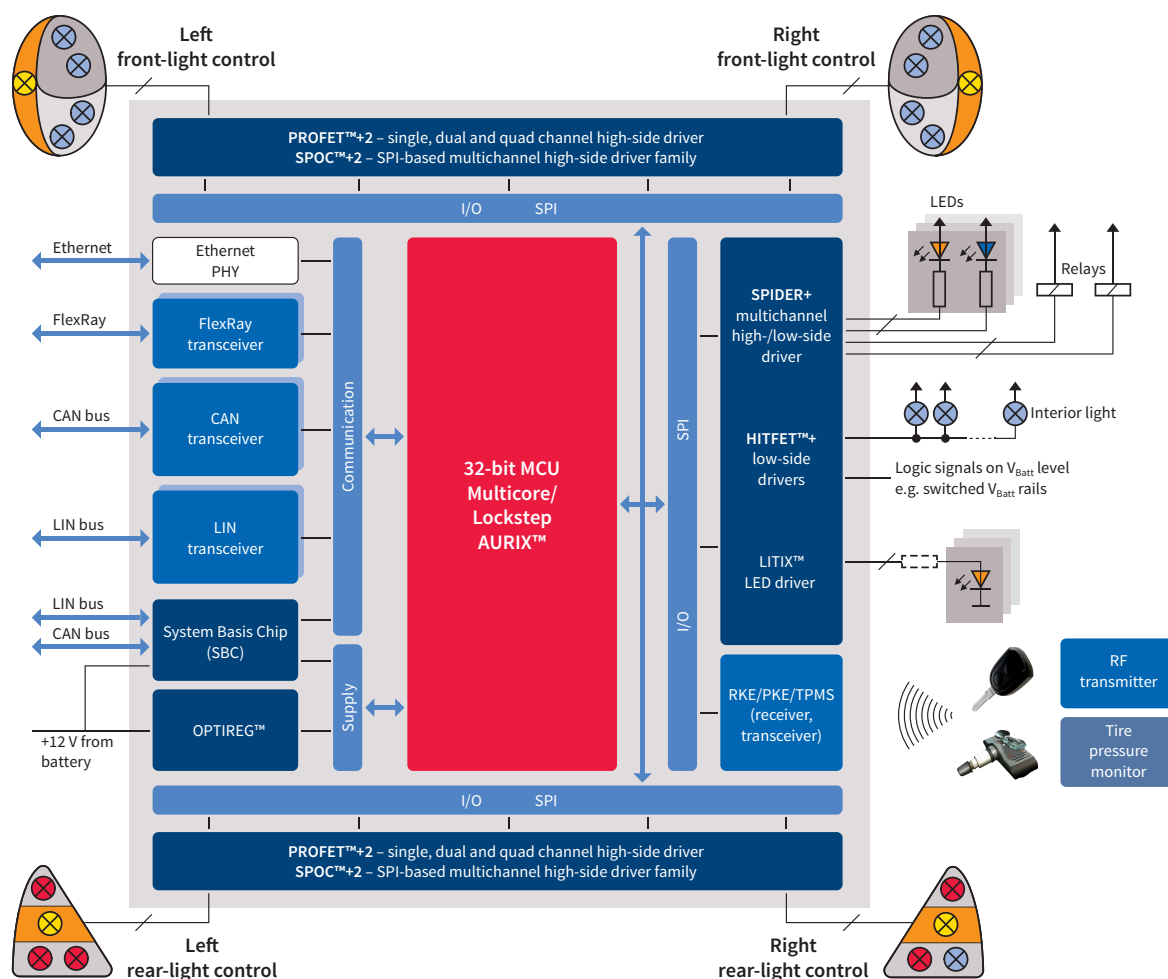
- › Reduced board space due to integrated functionality
- › Protected load control with sophisticated diagnostic features
- › Supports the “Limp Home” functional safety concept
- › High scalability and benchmark short-circuit robustness of power semiconductors (PROFET™)
- › Supports a smooth transition to LEDs for interior and exterior lighting

Suggested products

Product type	Description
Microcontroller	AURIX™ scalable 32-bit TriCore™ microcontroller family from single to multicore
Power Supply ICs	OPTIREG™ Automotive linear voltage regulators, OPTIREG™ Automotive switcher
High- and low-side switchers	SPIDER, HITFET™ single and multichannel protected high- and low-side switchers
High-side switchers	PROFET™, SPOC™+2 single and multichannel protected high-side switchers
LED driver	LITIX™ Basic linear current sources for LED applications
Network transceivers	CAN, LIN and FlexRay transceiver
SBC	System Basis Chip integrates power supply and network transceivers (CAN/LIN)



High-feature body control module



System benefits

- › AURIX™ multicore concept enables integration of two applications into one device
- › AURIX™ supports safety requirements up to ASIL-D (ISO 26262)
- › AURIX™ hardware encryption (HSM) enabling advanced security features
- › Encapsulation feature allows software development without interference between multiple applications
- › Very high integrated functionality enables reduced board space
- › All features of a classic Body Control Module are available, including protected load control with sophisticated diagnostics

Suggested products

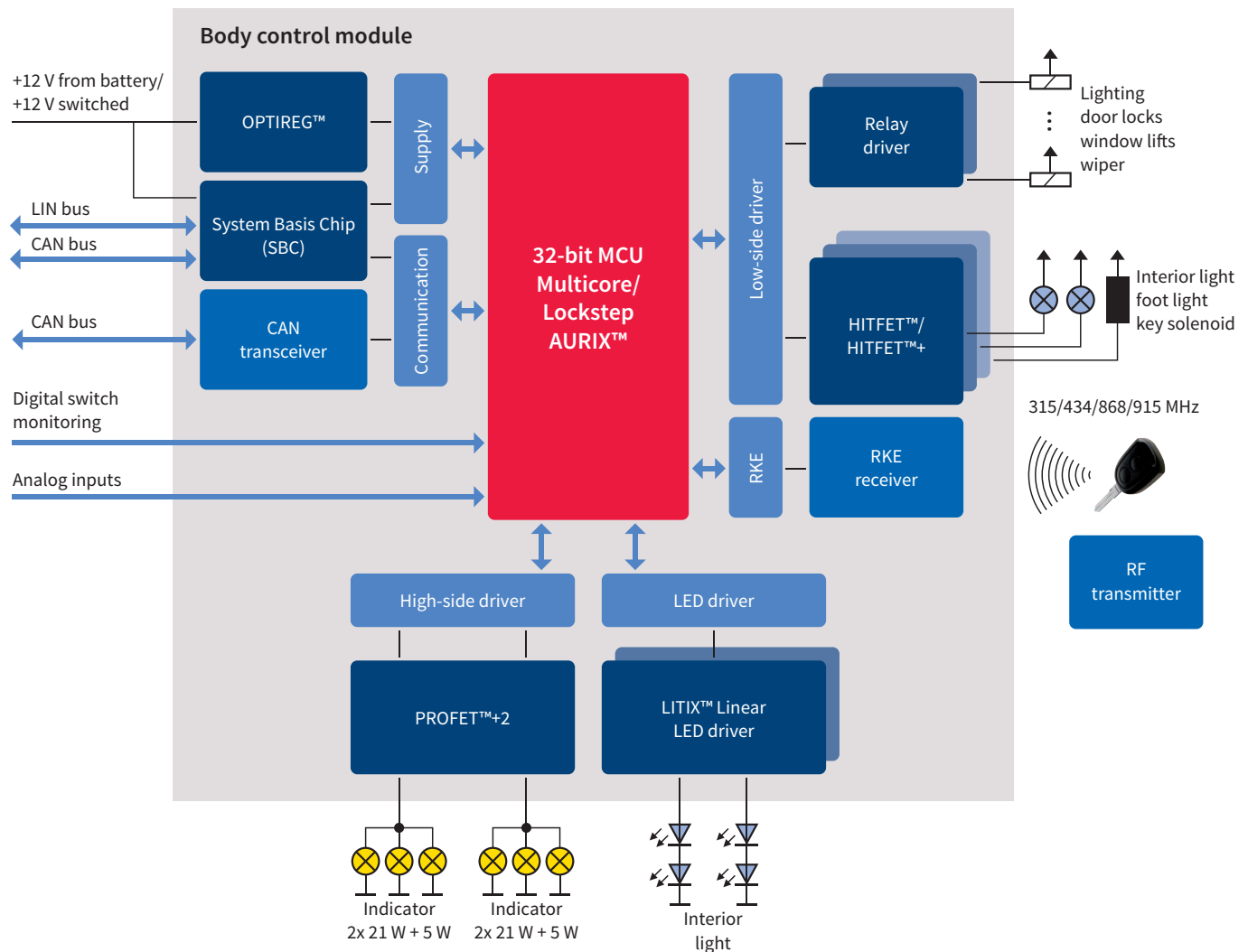
Product type	Description
Microcontroller	AURIX™ scalable 32-bit TriCore™ microcontroller family from single to multicore
Power Supply ICs	OPTIREG™ Automotive linear voltage regulators, OPTIREG™ Automotive switcher
High- and low-side switchers	SPIDER, HITFET™ single and multichannel protected high and low-side switchers
High-side switchers	PROFET™, SPOC™+2 single and multichannel protected high and low-side switchers
LED driver	LITIX™ Basic linear current sources for LED applications
Network transceivers	CAN, LIN and FlexRay transceiver
SBC	System Basis Chip integrates power supply and network transceivers (CAN/LIN)
RKE, PKE, TPMS	Chipset for remote keyless entry and tire pressure monitoring applications



www.infineon.com/bcm_advanced



Low-cost body control module



System benefits

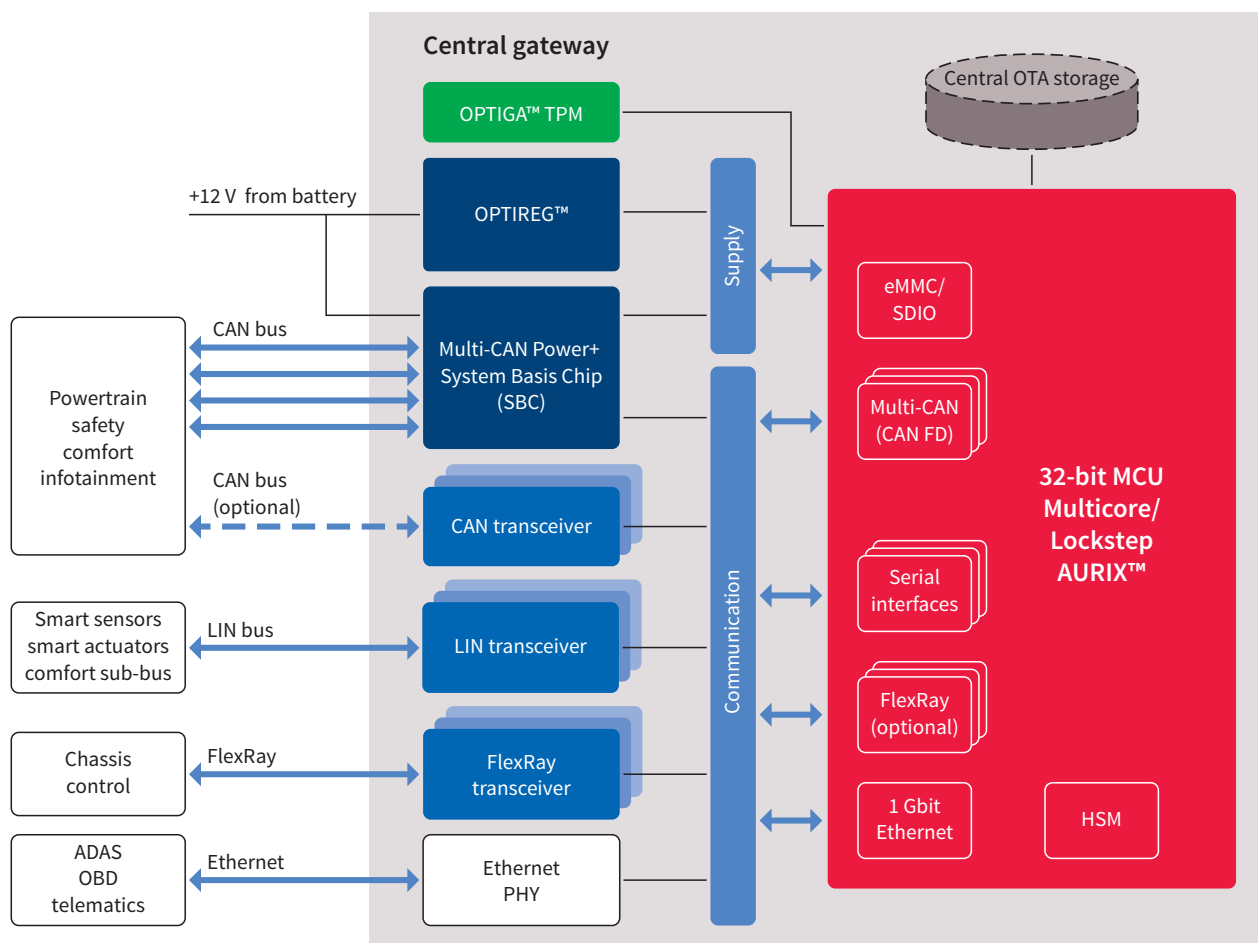
- › Single low-cost module solution for the car body electronics
- › Scalability of the devices increases the reuse grade and design flexibility
- › Benchmark short-circuit robustness of power semiconductors improves system reliability (PROFET™)
- › Full integration of load protection and diagnostics reduces PCB area and improves the design quality

Suggested products

Product type	Description
Microcontroller	AURIX™ scalable 32-bit TriCore™ microcontroller family from single to multicore
Power Supply ICs	OPTIREG™ Automotive linear voltage regulators, OPTIREG™ Automotive switcher
High- and low-side switchers	SPIDER, HITFET™ single and multichannel protected high- and low-side switchers
High-side switcher	PROFET™ protected high-side switcher
LED driver	LITIX™ Basic linear current sources for LED applications
Network transceivers	CAN and LIN transceiver
SBC	System Basis Chip integrates power supply and network transceivers (CAN/LIN)
RKE	Chipset for remote keyless entry applications



Gateway



System benefits

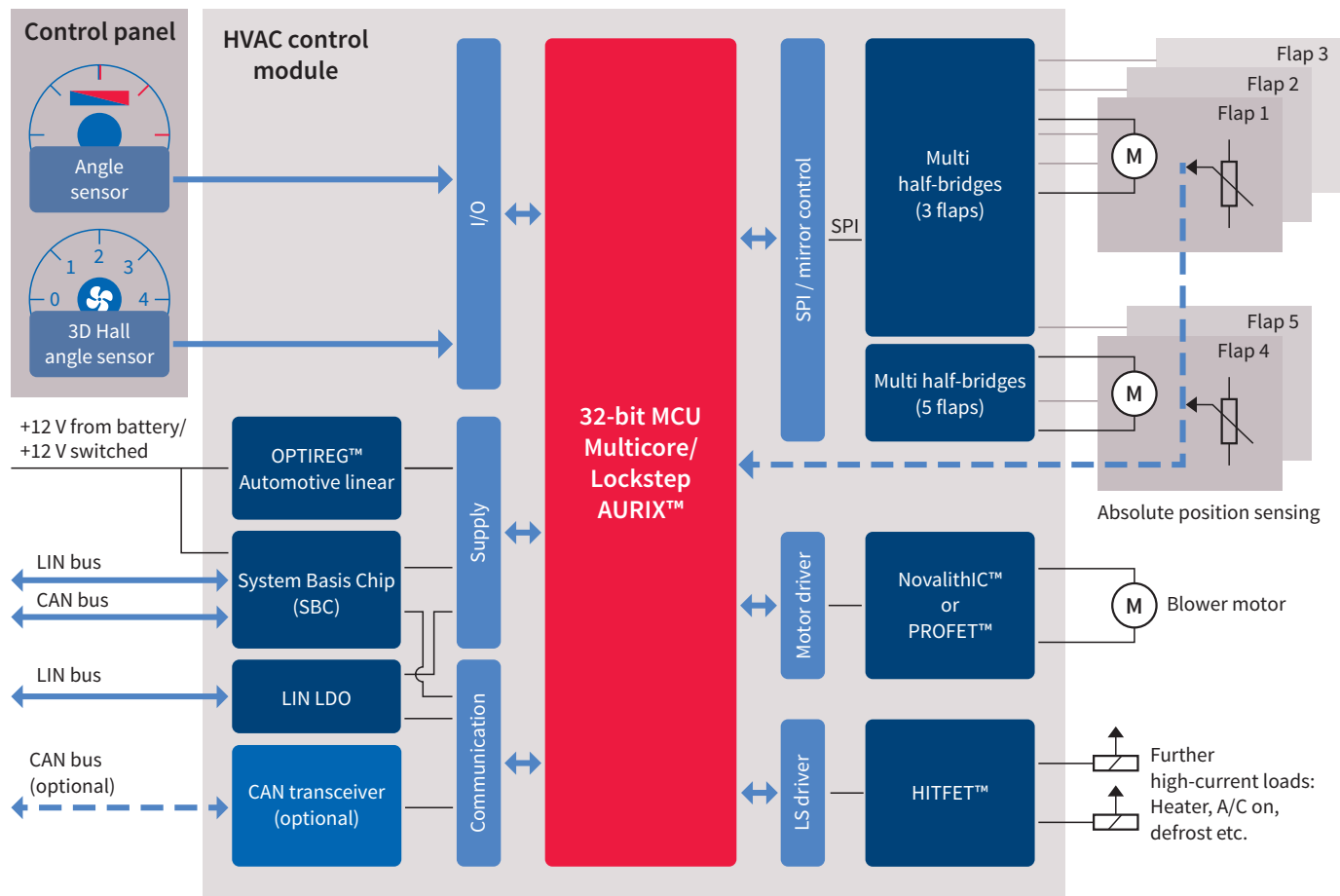
- › Enables pretended networking and ECU degradation
- › High integration leads to significant cost savings
- › High integration results in reduced complexity
- › ISO 26262 compliance supports ASIL requirements
- › Innovative supply concept leads to best-in-class power consumption

Suggested products

Product type	Description
Microcontroller	AURIX™ scalable 32-bit TriCore™ microcontroller family from single to multicore
Security IC	OPTIGA™ TPM quality hardened Trusted Platform Module (TPM) for special use in automotive applications
Power Supply ICs	OPTIREG™ Automotive linear voltage regulators, OPTIREG™ Automotive switcher
Network transceivers	CAN, LIN and FlexRay transceiver
SBC	Multi-CAN Power+ SBC integrates power supply and 4x CAN transceivers



HVAC control module



System benefits

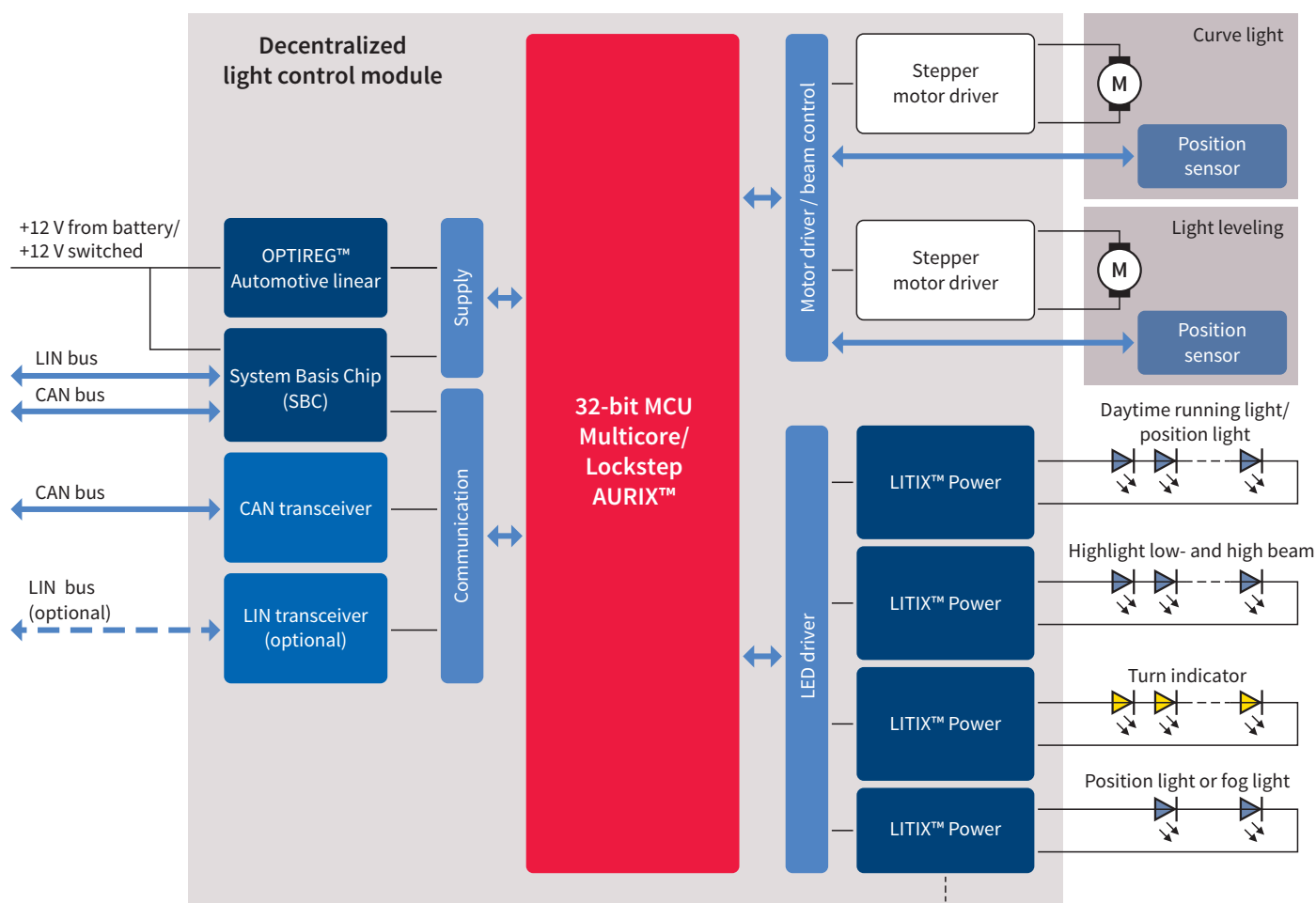
- › High-performance, scalable microcontroller family for various classes of HVAC control algorithms
- › Integrated motor control with diagnostics
- › Dedicated multi half-bridge devices for flap motor control with potentiometer feedback
- › Powerful half-bridge devices (NovalithIC™) with high-frequency PWM capability for the blower control

Suggested products

Product type	Description
Microcontroller	AURIX™ scalable 32-bit TriCore™ microcontroller family from single to multicore
Power Supply ICs	OPTIREG™ Automotive linear voltage regulators
High-side switcher	PROFET™ protected high-side switcher
Low-side switcher	HITFET™ protected low-side switcher
LIN LDO	Voltage regulators with LIN transceiver
Network transceivers	CAN and LIN transceiver
SBC	System Basis Chip integrates power supply and network transceivers (CAN/LIN)
Multi half-bridges	NovalithIC™ integrated motor control. Powerful half-bridge devices (NovalithIC™) with high-frequency PWM capability for blower control.
Position sensor	XENSIV™ Hall switches – magnetic field sensors with a discrete output signal
Angle sensors	XENSIV™ 3D Hall sensor, xMR angle sensor



Decentralized front light module



System benefits

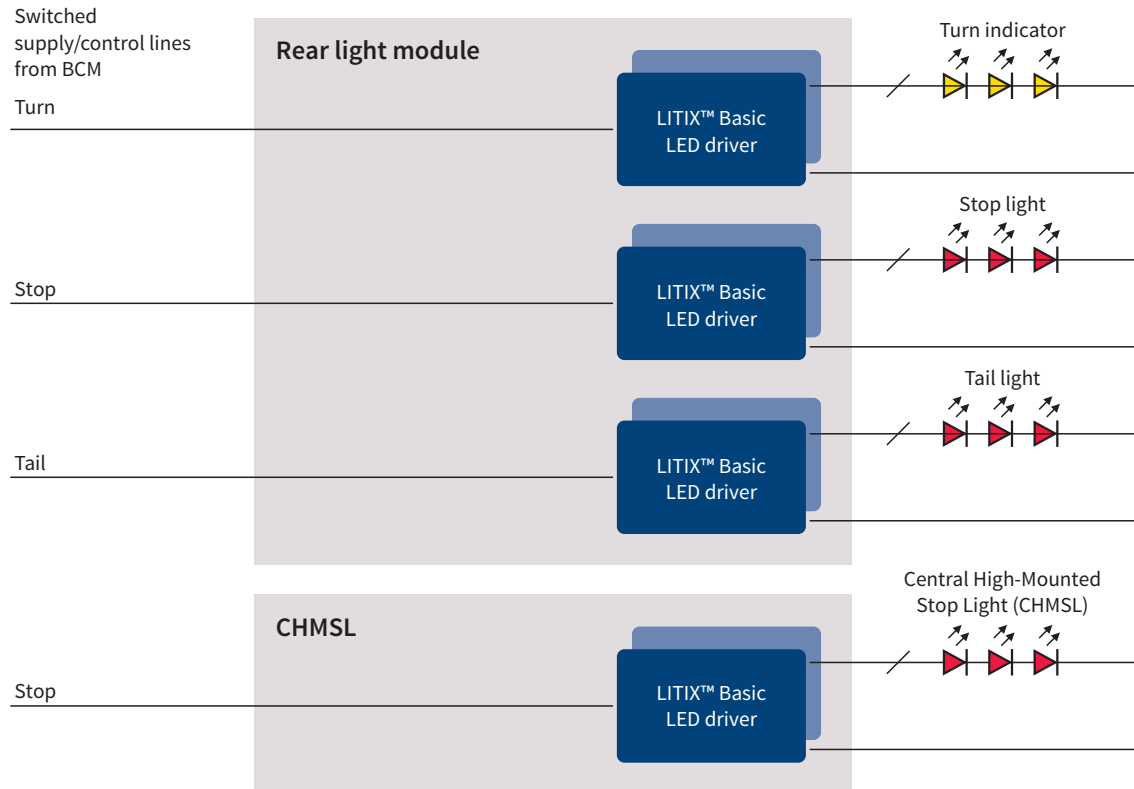
- › Automotive LED drivers for high-brightness LEDs
- › LED driver ICs supporting various DC-DC topologies (buck, boost, SEPIC)
- › Microcontroller peripherals enable light control with a low CPU load
- › System basis chips combine supply, network transceiver and supervision functions in a monolithic device

Suggested products

Product type	Description
Microcontroller	AURIX™ scalable 32-bit TriCore™ microcontroller family from single to multicore
Power Supply ICs	OPTIREG™ Automotive linear voltage regulators
LED driver	LITIX™ Power DC-DC converter and controller for high-power LED lighting
Network transceivers	CAN and LIN transceiver
SBC	System Basis Chip integrates power supply and network transceivers (CAN/LIN)



LED rear light module



System benefits

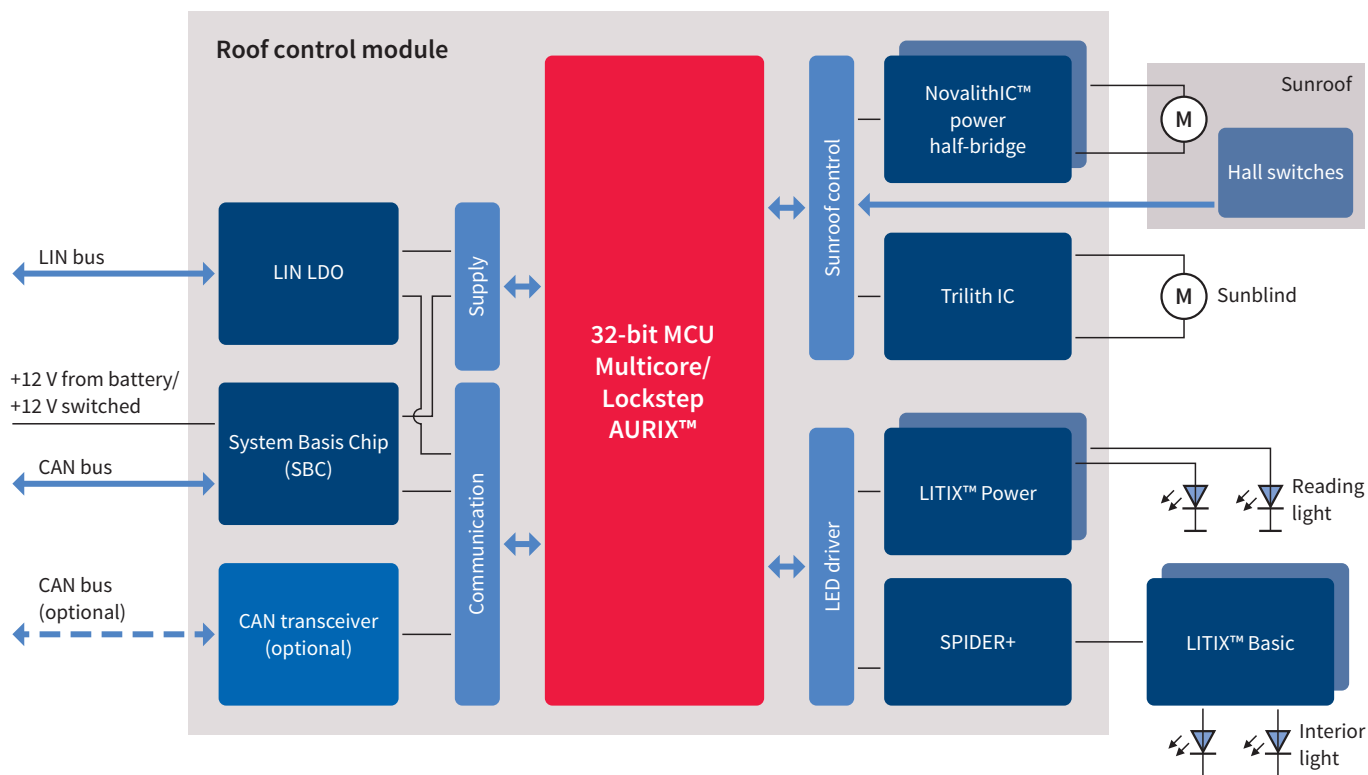
- › Integrated LED control with diagnostic and dimming capability
- › Reduced system complexity and board space
- › Pin-to-pin footprint compatibility
- › Reduced effort for design adaptations
- › Increased lifetime for LED and driver due to integrated protection

Suggested products

Product type	Description
LED driver	LITIX™ Basic linear constant current sources with scalable feature set



Roof control module with interior and ambient light control



System benefits

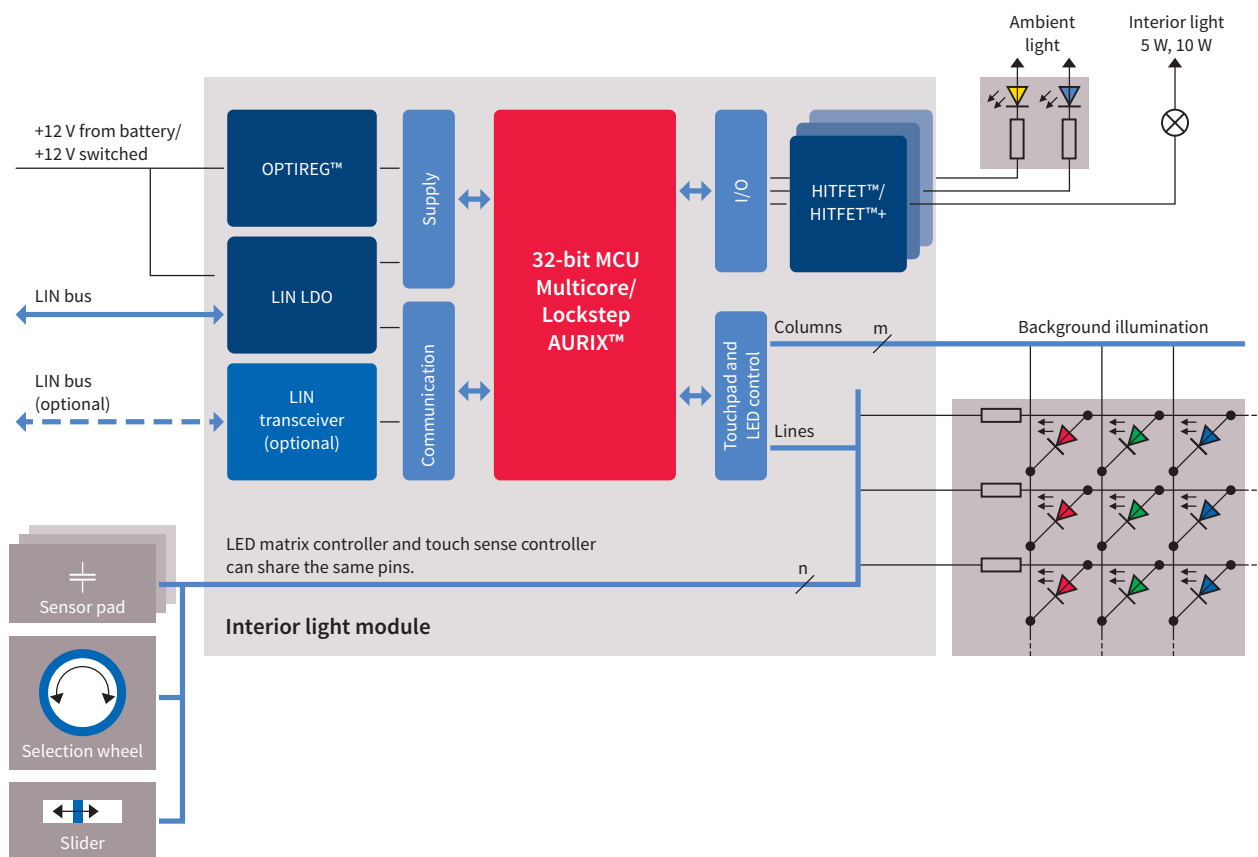
- › Integrated motor control with diagnostics
- › Automotive LED drivers for high brightness LED's
- › High-performance MCU supporting ripple count algorithms
- › Dedicated LIN slave devices for RGB ambient lighting

Suggested products

Product type	Description
Microcontroller	AURIX™ scalable 32-bit TriCore™ microcontroller family from single to multicore
High- and low-side switchers	SPIDER Multichannel protected high- and low-side switchers
LIN LDO	Voltage regulators with LIN transceiver
LIN LED driver	Smart LED control system-on-chip for multicolor and RGB lighting
LED driver	LITIX™ Power DC-DC converter and controller for high-power LED lighting
Network transceivers	CAN and LIN transceiver
SBC	System Basis Chip integrates power supply and network transceivers (CAN/LIN)
Trilith IC	NovalithIC™ integrated motor control devices with diagnostics
Position sensor	XENSIV™ Hall switches – magnetic field sensors with a discrete output signal



Interior light control with capacitive touch sensor



System benefits

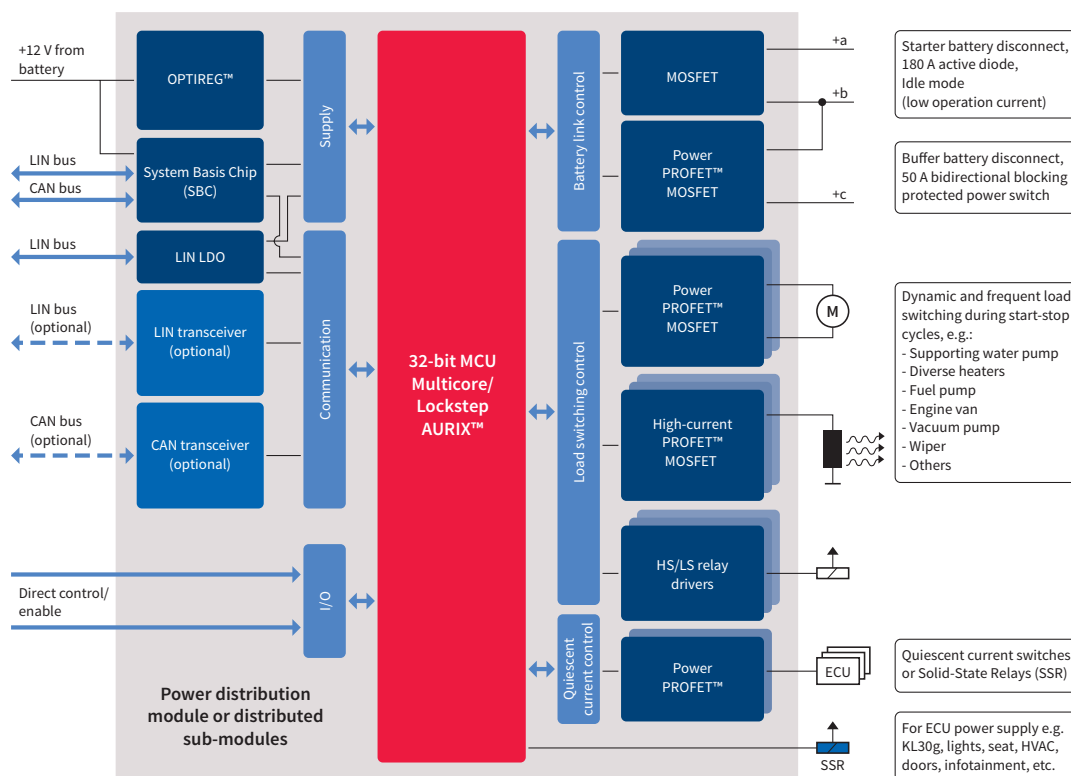
- › Replacing mechanical switches offers high system cost savings
- › Robust and reliable touch sense control technology, especially in noisy environments in combination with multiple coverage options such as acrylic glass (~2mm)
- › Enables the efficient design of HMIs with up to 20 touch buttons
- › Low pin count and cheap single layer PCB solutions
- › High feature integration: combined control and drive of displays or stepper motors with up to 50 mA
- › Easy and flexible implementation: optimized SW library for touch sense control in ROM frees up flash memory and CPU resources for customer-specific solutions

Suggested products

Product type	Description
Microcontroller	AURIX™ scalable 32-bit TriCore™ microcontroller family from single to multicore
Power Supply ICs	OPTIREG™ Automotive linear voltage regulators, OPTIREG™ Automotive switcher
Low-side switcher	HITFET™ smart low-side switcher
LIN LDO	Voltage regulator with integrated LIN transceiver
Network transceivers	LIN and CAN transceivers



Power distribution for start-stop systems with a dual-battery approach



System benefits

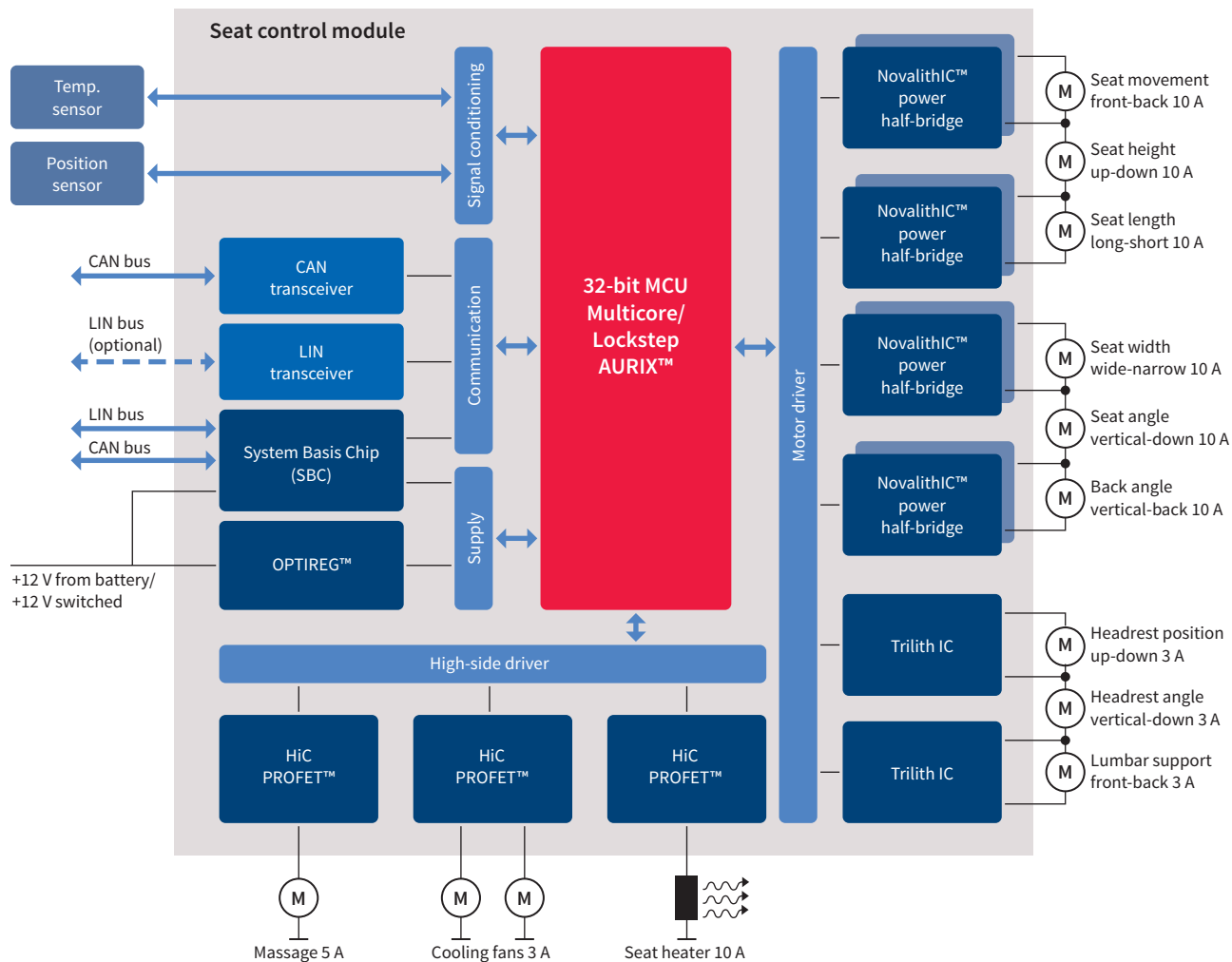
- Smart high-current, high-power switching
- Solid-state power switch provides relay functionality with alternative fuse
- Low power losses due to extremely low-ohmic devices
- Alternative protection modes: smart or fuse protection
- Some power switches with current input control for long control wires
- Sophisticated diagnostic features
- High number of switching activations, negligible aging
- Bidirectional blocking power switches
- Active diode functionality
- Solid-state relay (power switch inside relay housing)
- Smart relay driver, optional with constant current control

Suggested products

Product type	Description
Microcontroller	AURIX™ scalable 32-bit TriCore™ microcontroller family from single to multicore
Power Supply ICs	OPTIREG™ Automotive linear voltage regulators, OPTIREG™ Automotive switcher
High-side switcher	Power PROFET™ protected power high-side switcher
High- and low-side switchers	SPIDER protected multichannel high- and low-side switchers
Quiescent current switchers	Constant current relay driver
LIN LDO	Voltage regulator with integrated LIN transceiver
Network transceivers	CAN and LIN transceiver
SBC	System Basis Chip integrates power supply and network transceivers (CAN/LIN)
SSR	Solid-state relay (power switch inside relay housing)
MOSFET	OptiMOS™ T2 automotive trench power



Seat control module



System benefits

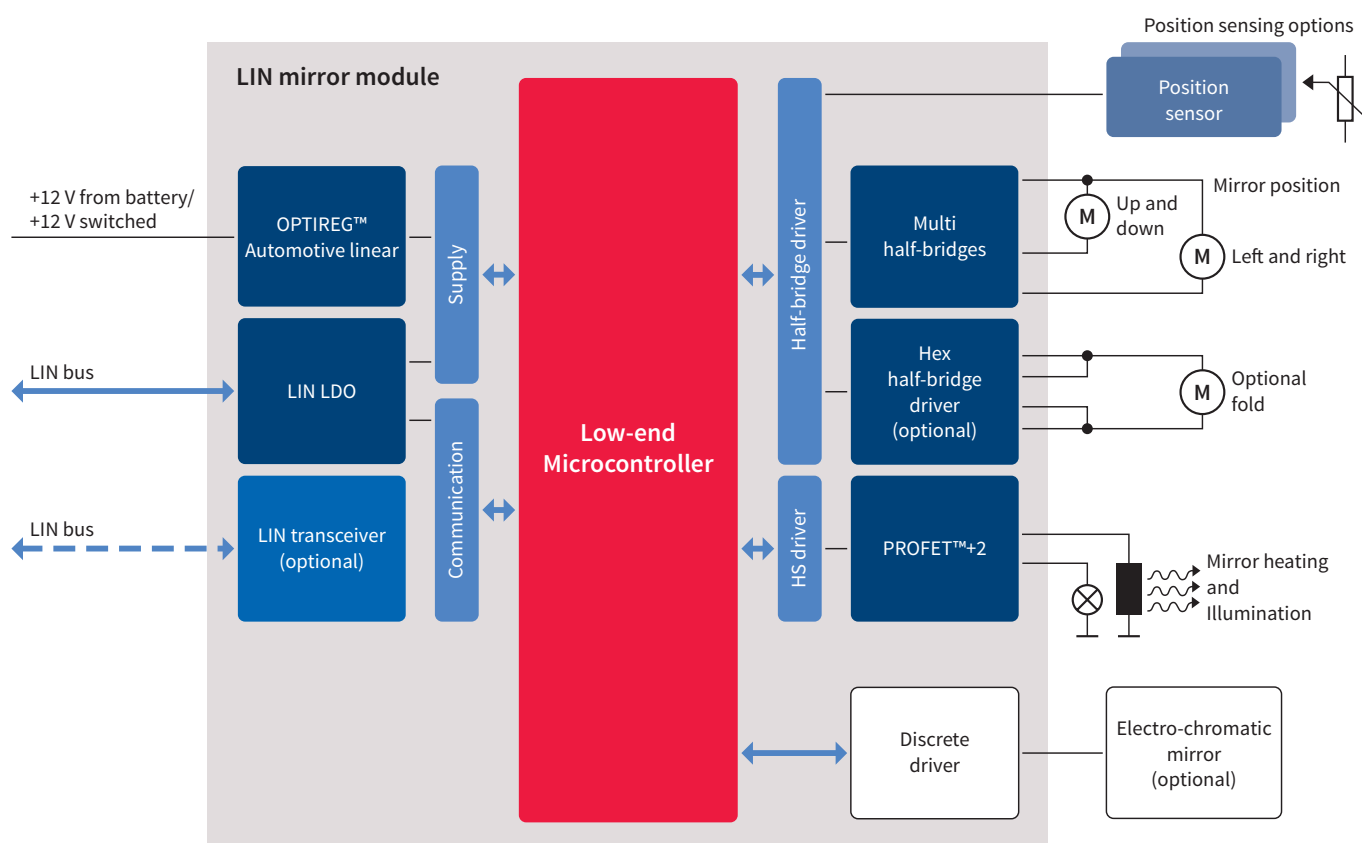
- › System-in-a-package solutions for high power integrated and protected motor control
- › Reduced board space due to integrated functionality
- › Protected load control with sophisticated diagnostic features

Suggested products

Product type	Description
Microcontroller	AURIX™ scalable 32-bit TriCore™ microcontroller family from single to multicore
Power Supply ICs	OPTIREG™ Automotive linear voltage regulators, OPTIREG™ Automotive switcher
High-side switcher	PROFET™ protected high-side switcher
Network transceivers	CAN and LIN transceivers
SBC	System Basis Chip integrates power supply and network transceivers (CAN/LIN)
Trilith IC	NovalithIC™ integrated motor control solutions with diagnostics
3D Hall sensor	XENSIV™ 3D magnetic field sensor with I ² C output
Position sensor	XENSIV™ magnetic field sensor with discrete output signal



Decentralized mirror module



System benefits

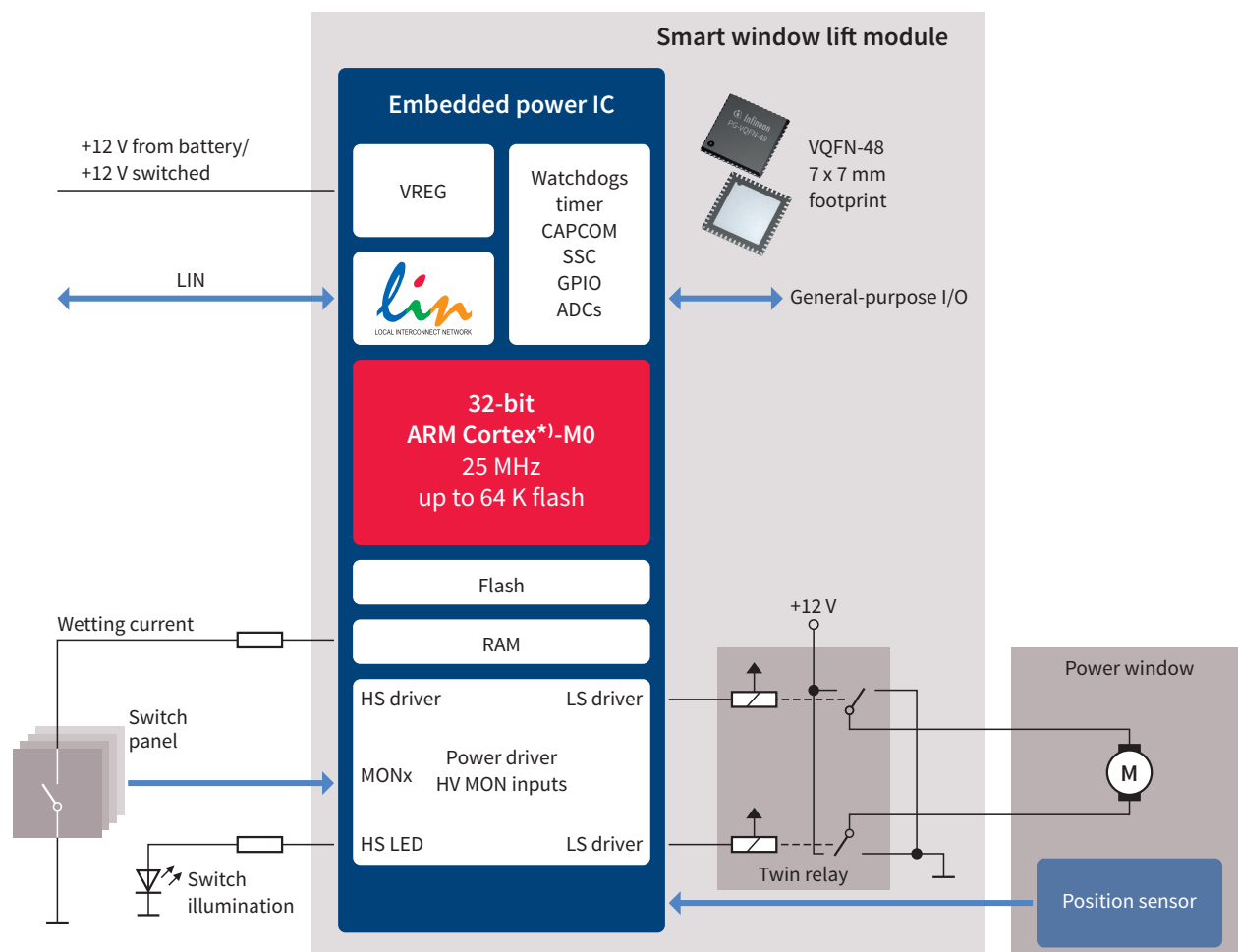
- › Low power consumption, as well as low quiescent current
- › Excellent price-performance ratio
- › Space-saving devices for integrated motor control
(mirror x/y adjustment, optional fold feature)

Suggested products

Product type	Description
Microcontroller	AURIX™ scalable 32-bit TriCore™ microcontroller family from single to multicore
Power Supply ICs	OPTIREG™ Automotive linear voltage regulators
LIN LDO	Voltage regulator with integrated LIN transceiver
High-side switcher	PROFET™ protected high-side switcher
Network transceivers	CAN and LIN transceiver
Multi half-bridges	Integrated motor control
Position sensor	XENSIV™ Hall switches – magnetic field sensors with a discrete output signal



Smart window lift/roof control module



System benefits

- › System-on-chip solution with integrated ARM Cortex*-M0 industry-standard microcontroller core
- › Platform solution for a size- and weight-optimized relay based motor control
- › Integrated voltage regulator, LIN transceiver, switch inputs and relay driver
- › Cyclic sense and cyclic wake-up capability saves average current consumption
- › Package with very small form factor saves PCB board space
- › Single-chip solution improves module reliability

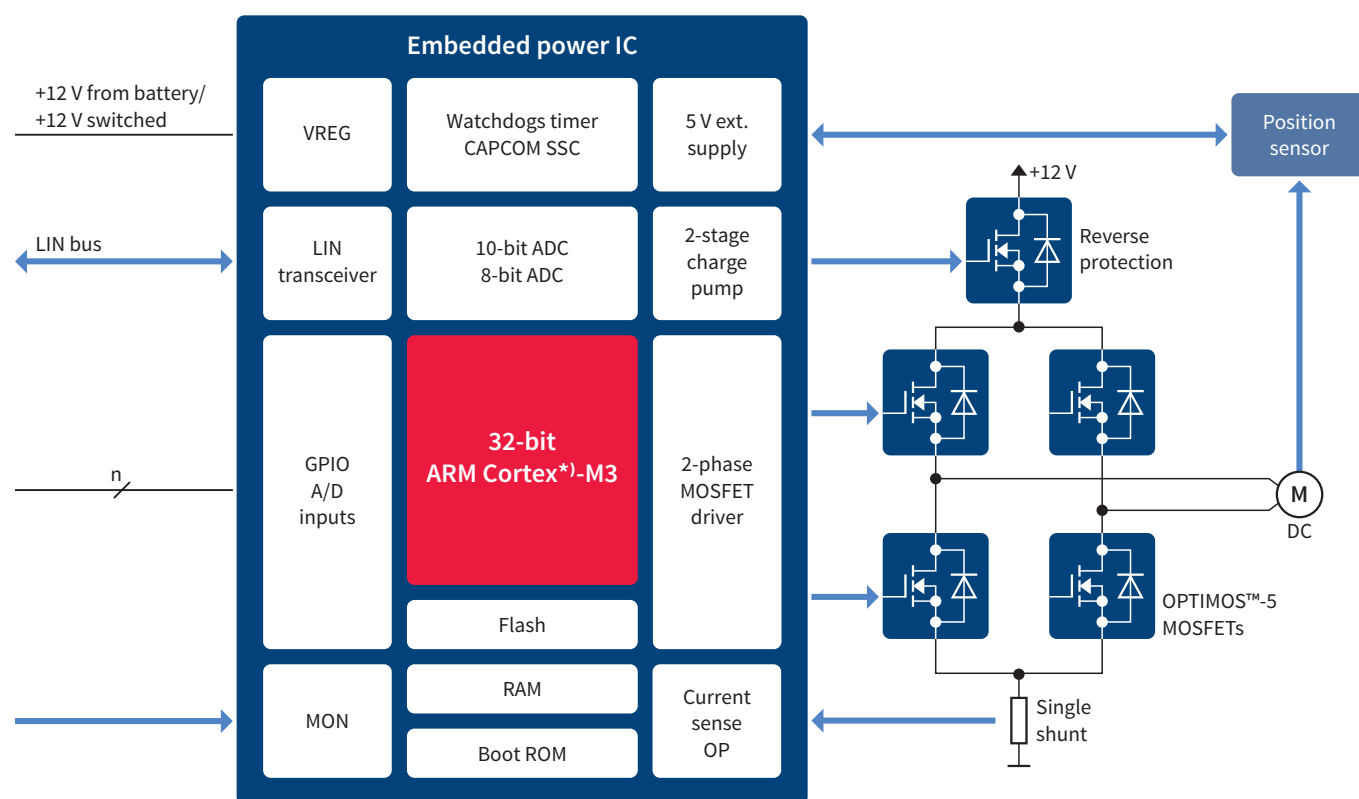
Suggested products

Product type	Description
Embedded power IC	Motor driver IC for external relays with an integrated ARM Cortex*-M0 MCU
Position sensor	XENSIV™ Hall switches – magnetic field sensors with a discrete output signal

*) ARM and Cortex are trademarks of ARM Limited, UK



Wiper/Integrated solution for DC applications



System benefits

- › System-on-chip solution with an integrated ARM Cortex*-M3 industry-standard microcontroller core
- › Platform solution for a wide range of size and weight-optimized motor applications
- › Package with a very small form factor saves PCB board space
- › Integrated voltage regulator, LIN transceiver, switch input and direct control of N-Channel MOSFETs
- › Configurable MOSFET driver simplifies EMC design
- › Supports various motor control algorithms including sensorless control
- › Integrated intelligent power-saving modes and energy management
- › Single-chip solution improves module reliability

Suggested products

Product type	Description
Embedded power IC	2-phase driver with an Integrated ARM Cortex*-M3 MCU
MOSFET	OptiMOS™5 40 V automotive trench power MOSFET

*) ARM and Cortex are trademarks of ARM Limited, UK



Powertrain applications

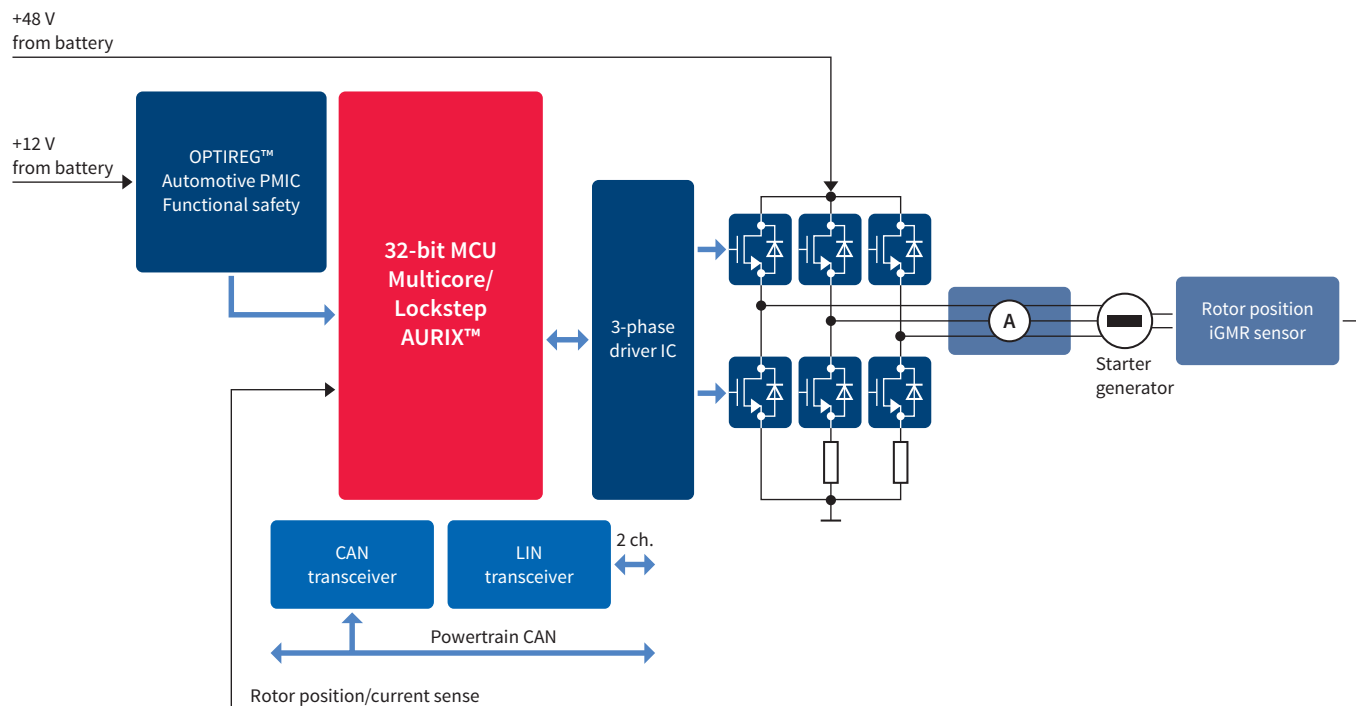
The powertrain market is driven by the need to reduce the carbon footprint of cars via affordable, efficiency-enhancing innovations. Concrete measures include rightsizing engines, improving fuel injection accuracy and increasing after-treatment efficiency. On the transmission side, car-makers are looking to optimize both the gear ratio and gear shifting. Other efficiency-enabling activities include reducing friction and hydraulic losses. In a more general context, the drive for greater ecology on the roads is pushing the transition toward vehicle electrification and hybridization.

As one of the largest automotive semiconductor suppliers, Infineon has been active in the powertrain electronic business for over 40 years. Our position as innovation leader, coupled with longterm partnerships with OEMs, Tier 1 and engineering service providers, means we reap the benefits of in-depth system expertise and broad application competence. Infineon delivers an extensive range of optimized, competitive and scalable powertrain products and chipset solutions. Our portfolio covers the full sensor spectrum from position, over angle and speed to barometric and manifold pressure, supplemented by a strong 8-bit, 16-bit and 32-bit powertrain microcontroller portfolio. In addition to the necessary power components, such as voltage supplies, MOSFETs and IGBTs, smart low-side and high-side switches, CAN/LIN and FlexRay transceivers, the product range is rounded off by a multitude of highly integrated automotive system ICs, such as engine management ICs, alternator regulators, System Basis Chips (SBC) and constant current control ICs for transmission control.

Electrification is the key topic in the powertrain segment. 48 V mild-hybrid, hybrid and battery electric vehicles will penetrate the market over the coming years and will see double digit growth rates. Infineon doesn't only have more than 70 years of experience in power semiconductors & packaging, but has started years ago to significantly invest into enlarging the portfolio to serve automotive needs. Today, Infineon provides the largest portfolio of product and chipset solutions in the market for all new applications like traction and auxiliary inverters, onboard chargers, power converters (DC-DC) and battery management systems. The products' range covers high-performant microcontrollers, networking ICs, ASICs, sensors, drivers, low- and high-voltage power components. All of them are specifically designed for automotive use and are developed based on our long experience in the automotive environment.



48 V micro-hybrid



System benefits

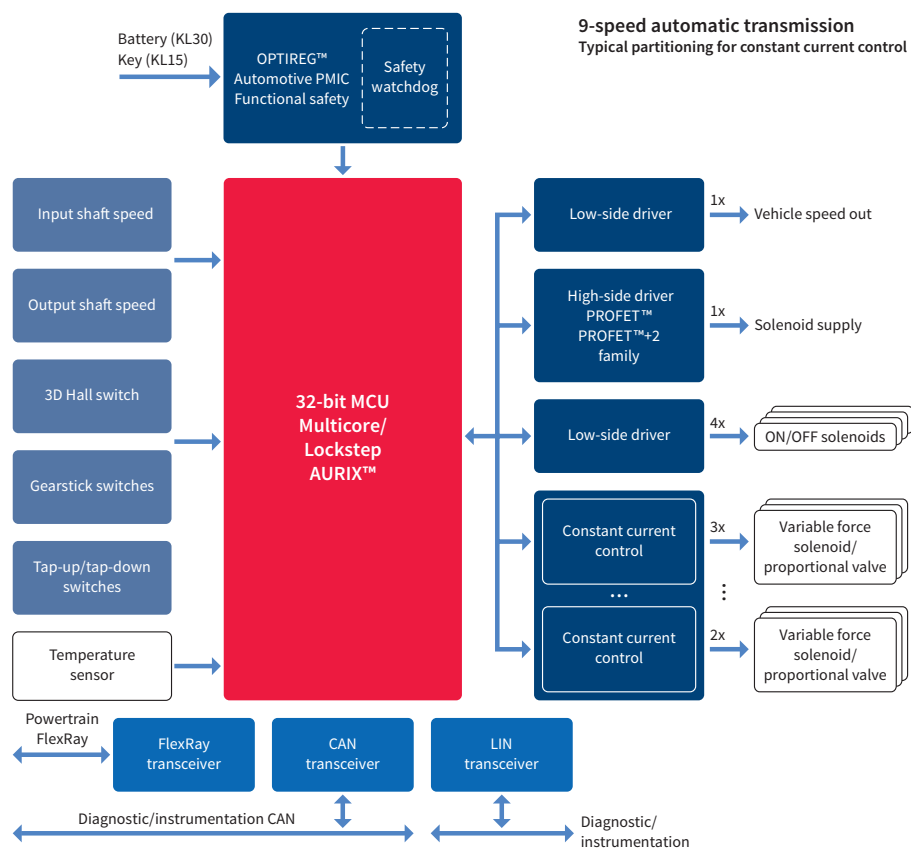
- › Full range of products ranging from voltage regulators, transceivers, sensors, microcontrollers and smart power drivers
- › Leading-edge OptiMOS™ MOSFET technology combined with a robust package for ensuring best-in-class performance and outstanding current capacity
- › Higher alternator efficiency thanks to MOSFET rectification
- › Higher output current at low alternator RPM
- › Advanced modes supported: engine brake emulation, car sailing/coasting, electrical car launch

Suggested products

Product type	Description
Microcontroller	AURIX™ cost-optimized TriCore™ 32-bit microcontroller with dedicated motor control features
Power management IC	OPTIREG™ Automotive PMIC
Network transceivers	CAN (Control Area Network) serial bus transceiver with multi-master capabilities for data communication in harsh environments, supporting Flexible Data-rate (CAN FD)
	LIN (Local Interconnect Network) bus for local communication between actuators, sensors or switches and an ECU
Driver IC	3-phase bridge driver IC
MOSFET	OptiMOS™ N-Channel 100 V MOSFET, optimized for high-current motor applications
Magnetic Sensors	XENSIV™ linear Hall sensor family for current sensing, iGMR sensor for angle and rotor position sensing
Power Supply ICs	OPTIREG™ Automotive linear post regulators, OPTIREG™ Automotive switcher



Automatic transmission – hydraulic control



System benefits

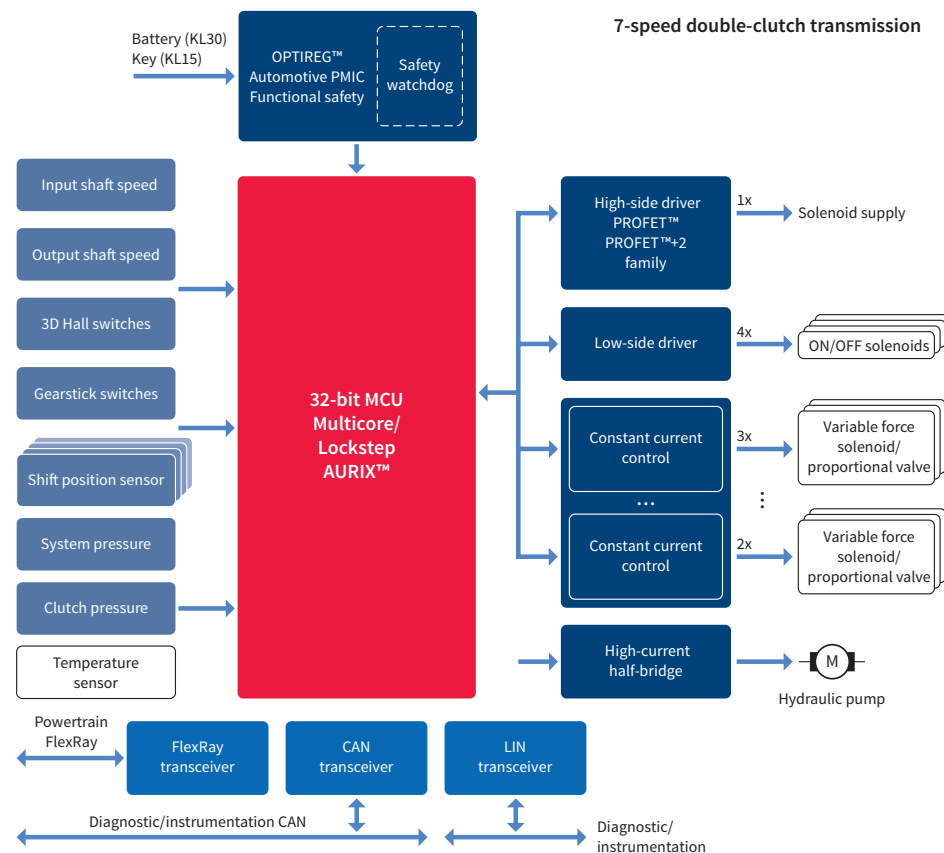
- › Full range of products ranging from voltage regulators, transceivers, sensors, microcontrollers and smart power drivers
- › Valve actuator ICs supporting highest precision current control
- › Optimized sensors providing enhanced disturbance immunity (e.g. vibration) and direction detection
- › High-temperature bare die IC supporting integrated transmission control up to the highest torque rate

Suggested products

Product type	Description
Microcontroller	AURIX™ 32-bit multicore TriCore™ microcontroller family, optimized for highly demanding powertrain applications
Power management IC	OPTIREG™ Automotive PMIC
Network transceivers	LIN (Local Interconnect Network) bus for local communication between actuators, sensors or switches and an ECU
	CAN (Control Area Network) serial bus transceiver with multi-master capabilities for data communication in harsh environments, supporting Flexible Data-rate (CAN FD)
	FlexRay: serial, deterministic bus transceiver for real-time control applications
Transmission IC	Integrated transmission ICs for precise variable force or constant current solenoid control
High-side switcher	PROFET™ smart high-side switcher
Low-side driver IC	Smart low-side power switches in single or multichannel configuration. Applicable product families: HITFET, FLEX, IPS.
Sensor ICs	XENSIV™ speed sensing
	XENSIV™ position sensing
	XENSIV™ 3D magnetic field sensing
Trackers	OPTIREG™ Automotive linear-voltage trackers for supplying sensors



Double-clutch transmission – hydraulic control



System benefits

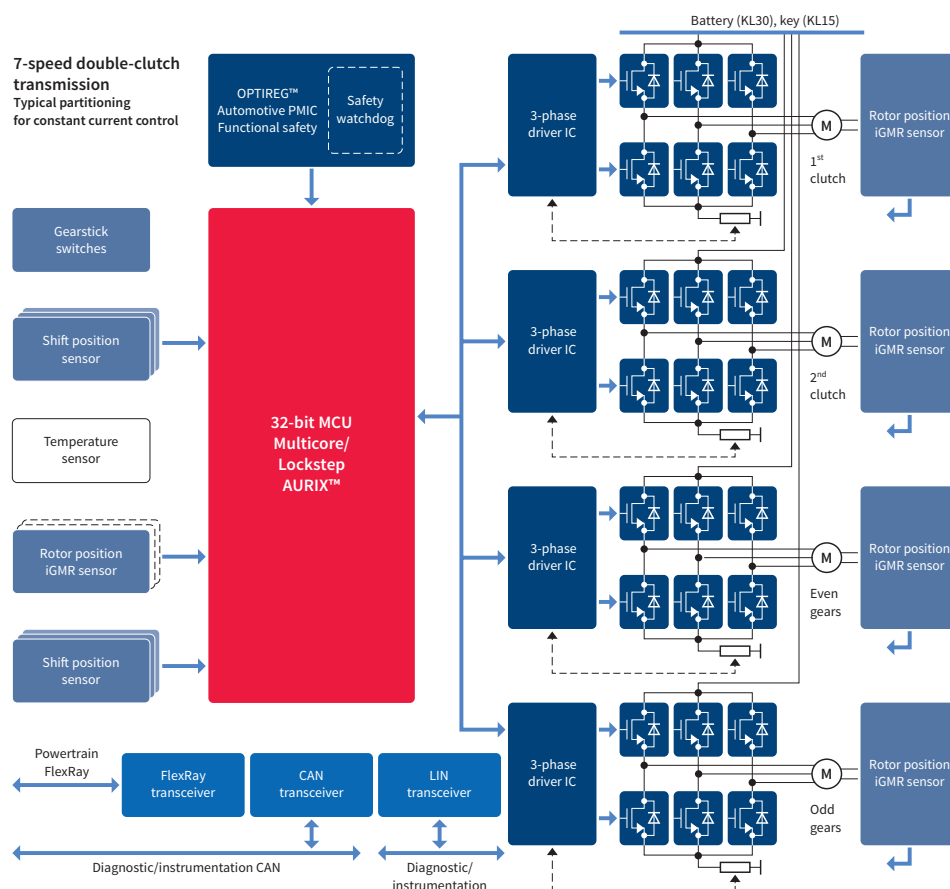
- › Full range of products ranging from voltage regulators, transceivers, sensors, microcontrollers and smart power drivers
- › Valve actuator ICs supporting highest precision current control
- › Optimized sensors providing enhanced disturbance immunity (e.g. vibration) and direction detection
- › High-temperature bare die IC supporting integrated transmission control up to the highest torque rate
- › Coherent chipset solution for an easy and effective ISO 26262-compliant system implementation

Suggested products

Product type	Description
Microcontroller	AURIX™ 32-bit multicore TriCore™ microcontroller family, optimized for highly demanding powertrain applications
Power management IC	OPTIREG™ Automotive PMIC
Network transceivers	CAN (Control Area Network) serial bus transceiver with multi-master capabilities for data communication in harsh environments, supporting Flexible Data-rate (CAN FD)
	FlexRay: serial, deterministic bus transceiver for real-time control applications
	LIN (Local Interconnect Network) bus for local communication between actuators, sensors or switches and an ECU
Transmission IC	Integrated transmission ICs for precise variable force or constant current solenoid control
High-side switcher	PROFET™ smart high-side switcher
Driver ICs	Single high-current half-bridge driver for motor control
	Smart low-side power switches in single or multichannel configuration. Applicable product families: FLEX, IPS
MOSFET	OptiMOS™ dual N-Channel 60 V MOSFET in a super SO8 package, offering significant PCB board space savings
Sensor ICs	XENSIV™ Precise and robust speed sensing
	XENSIV™ Robust and flexible position sensing
Trackers	OPTIREG™ Automotive linear-voltage trackers for supplying sensors



Double-clutch transmission – electrical control



System benefits

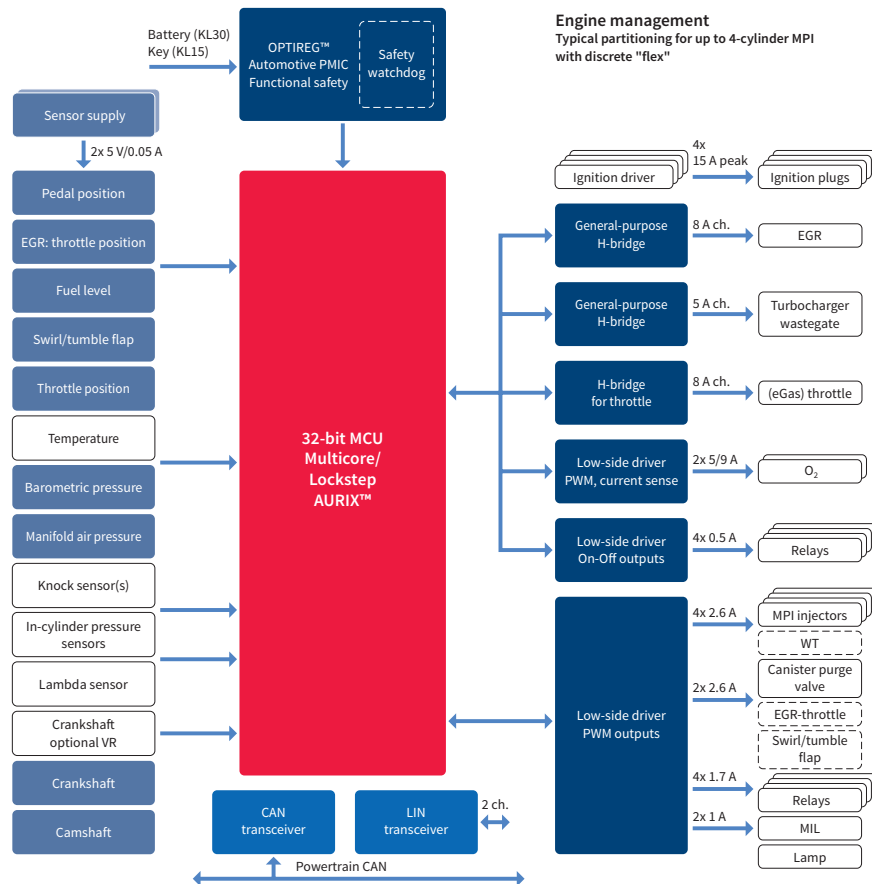
- Full range of products ranging from voltage regulators, transceivers, sensors, microcontrollers and smart power drivers
- Leading-edge OptiMOS™-T2 MOSFET technology combined with a robust package for ensuring best-in-class performance and outstanding current capacity
- Optimized sensors providing enhanced disturbance immunity (e.g. vibration) and direction detection
- Reduces fuel consumption compared to manual transmission
- Coherent chipset solution for an easy and effective ISO 26262-compliant system implementation

Suggested products

Product type	Description
Microcontroller	AURIX™ 32-bit multicore TriCore™ microcontroller family, optimized for highly demanding powertrain applications
Power management IC	OPTIREG™ Automotive PMIC
Network transceivers	FlexRay: serial, deterministic bus transceiver for real-time control applications
	LIN (Local Interconnect Network) bus for local communication between actuators, sensors or switches and an ECU
	CAN (Control Area Network) serial bus transceiver with multi-master capabilities for data communication in harsh environments, supporting Flexible Data-rate (CAN FD)
Driver IC	3-phase bridge driver IC
MOSFET	OptiMOS™-T2 40 V N-Channel MOSFET family, optimized for high-current motor applications
Sensor ICs	XENSIV™ iGMR sensor for angle and rotor position sensing
	XENSIV™ robust and flexible position sensing
	XENSIV™ precise and robust speed sensing
Trackers	OPTIREG™ Automotive linear-voltage trackers for supplying sensors



Gasoline multi-port injection – discrete solution



System benefits

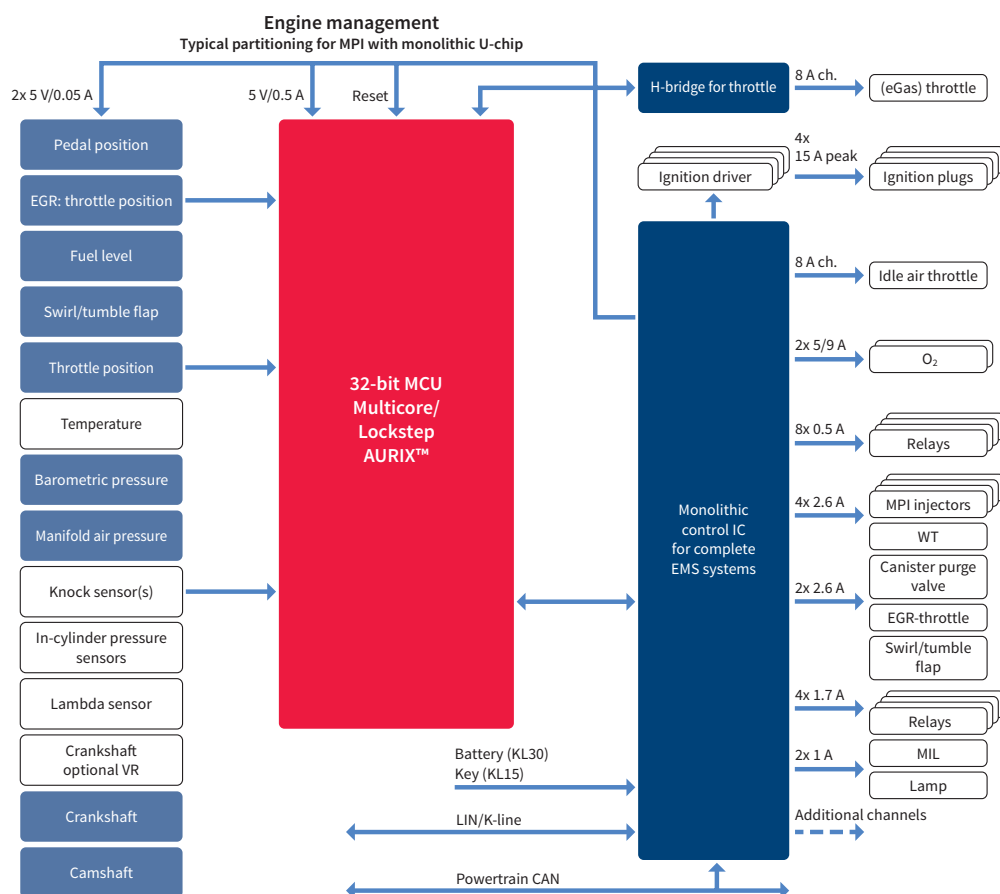
- › Flexible and scalable product portfolio tailored to the cost and performance needs of the mid-end and entry segments
- › Industry benchmark in embedded real time performance facilitates pumping loss reduction, knock detection and efficient after-treatment
- › Conforming with upcoming emission legislation at maximized fuel efficiency with even more driving pleasure, new sensor families provide enhanced measurement precision (e.g. ignition control, misfire detection)

Suggested products

Product type	Description
Microcontroller	AURIX™ 32-bit multicore TriCore™ microcontroller family, optimized for highly demanding powertrain applications
Power management IC	OPTIREG™ Automotive PMIC
Network transceivers	CAN (Control Area Network) serial bus transceiver with multi-master capabilities for data communication in harsh environments, supporting Flexible Data-rate (CAN FD) LIN (Local Interconnect Network) bus for local communication between actuators, sensors or switches and an ECU
Throttle driver IC	Electronic Throttle Control (ETC) driver
Driver ICs	New cost-efficient H-bridge driver for non-ETC use cases, such as exhaust gas recirculation (EGR), turbocharger waste gate, turbocharger geometry and other DC motor driver actuators Smart low-side power switches in single or multichannel configuration. Applicable product families: FLEX, IPS.
Sensor ICs	XENSIV™ pressure (MAP and BAP), magnetic cam, crankshaft and position sensors XENSIV™ sensor with a digital SENT interface in development
Trackers	OPTIREG™ Automotive linear-voltage tracker for independent sensor supply



Gasoline multi-port injection – integrated solution



System benefits

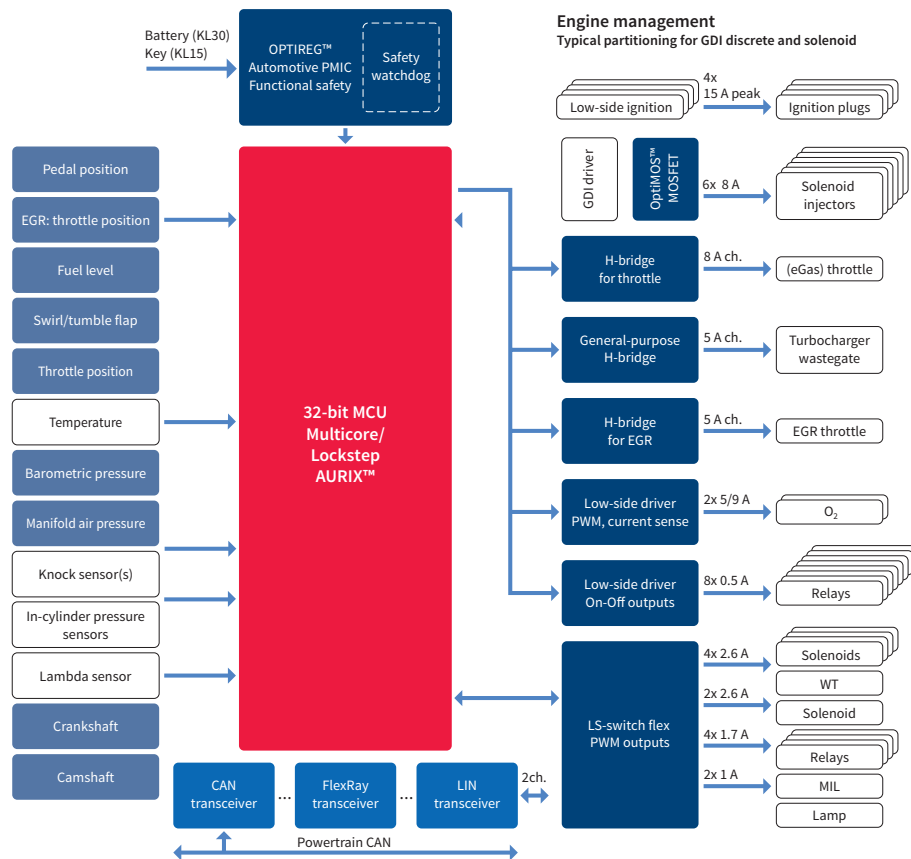
- › Flexible and scalable product portfolio tailored to the cost and performance needs of the mid-end and entry segments
- › Industry benchmark in embedded real time performance facilitates pumping loss reduction, knock detection and efficient after-treatment
- › Conforming with upcoming emission legislation while delivering maximum fuel efficiency and even more driving pleasure, the new sensor families provide enhanced measurement precision (e.g. ignition control, misfire detection)

Suggested products

Product type	Description
Microcontroller	AURIX™ 32-bit multicore TriCore™ microcontroller family, optimized for highly demanding powertrain applications
EMS IC	Monolithic control IC for complete EMS systems
Throttle driver IC	Electronic Throttle Control (ETC) driver
Sensor ICs	XENSIV™ broad portfolio of pressure sensors (MAP and BAP) as well as magnetic cam and crankshaft and position sensors
	XENSIV™ sensor with a digital SENT interface in development
Trackers	OPTIREG™ Automotive linear-voltage trackers for supplying sensors



Gasoline direct injection



System benefits

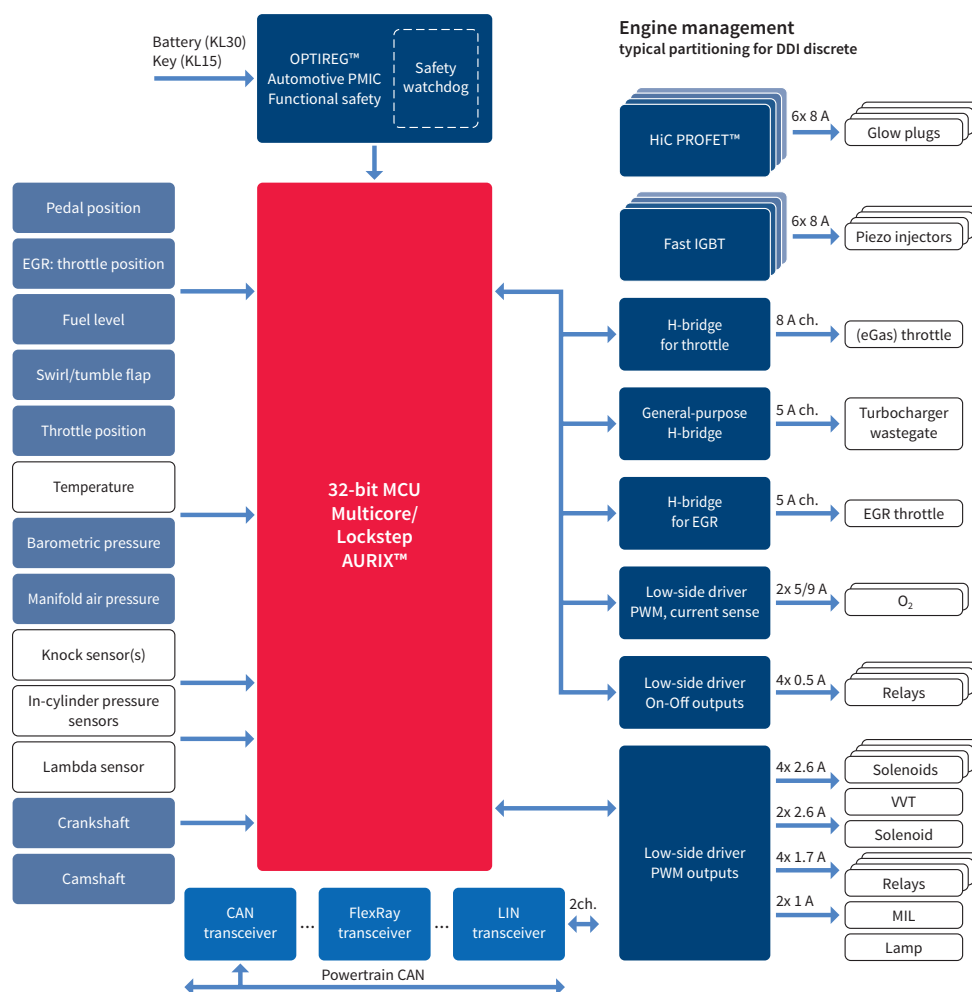
- › Flexible and scalable product portfolio tailored to the performance and real-time needs of the premium and value segment
- › Conforms with the latest emission legislation while delivering the highest possible fuel efficiency and even more driving pleasure
- › Benchmark-setting real-time performance facilitates down-sizing, direct injection, turbocharging and highly efficient after-treatment
- › New sensor families provide enhanced measurement precision (e.g. ignition control, misfire detection)

Suggested products

Product type	Description
Microcontroller	AURIX™ 32-bit multicore TriCore™ microcontroller family, optimized for highly demanding powertrain applications
Power management IC	OPTIREG™ Automotive PMIC
Network transceivers	CAN (Control Area Network) serial bus transceiver with multi-master capabilities for data communication in harsh environments, supporting Flexible Data-rate (CAN FD)
	LIN (Local Interconnect Network) bus for local communication between actuators, sensors or switches and an ECU
	FlexRay: serial, deterministic bus transceiver for real-time control applications
Throttle control IC	Electronic Throttle Control (ETC) driver
Driver ICs	New cost-efficient H-bridge driver for non-ETC use cases, such as Exhaust Gas Recirculation (EGR), turbocharger wastegate, turbocharger geometry and other DC motor driver actuators
	Smart low-side power switches in single or multichannel configuration. Applicable product families: FLEX, IPS
MOSFET	OPTIMOS™ 60/100 V N-Channel MOSFET products in a compact Dual SS08 package
Sensor ICs	XENSIV™ broad portfolio of pressure sensors (MAP and BAP) as well as magnetic cam and crankshaft and position sensors
	XENSIV™ sensor with a digital SENT interface in development
Trackers	OPTIREG™ Automotive linear-voltage trackers for supplying sensors



Diesel direct injection



System benefits

- › Large and scalable product portfolio tailored to the performance needs of the entire diesel segment
- › Conforms with upcoming emission legislation while delivering maximum fuel efficiency and the ultimate in driving pleasure
- › Benchmark-setting real-time performance facilitates in-cylinder pressure measurement and highly efficient after-treatment (incl. hot and cold EGR, oxidation catalyst, particulate treatment, NOx treatment)
- › New sensor families provide enhanced measurement precision

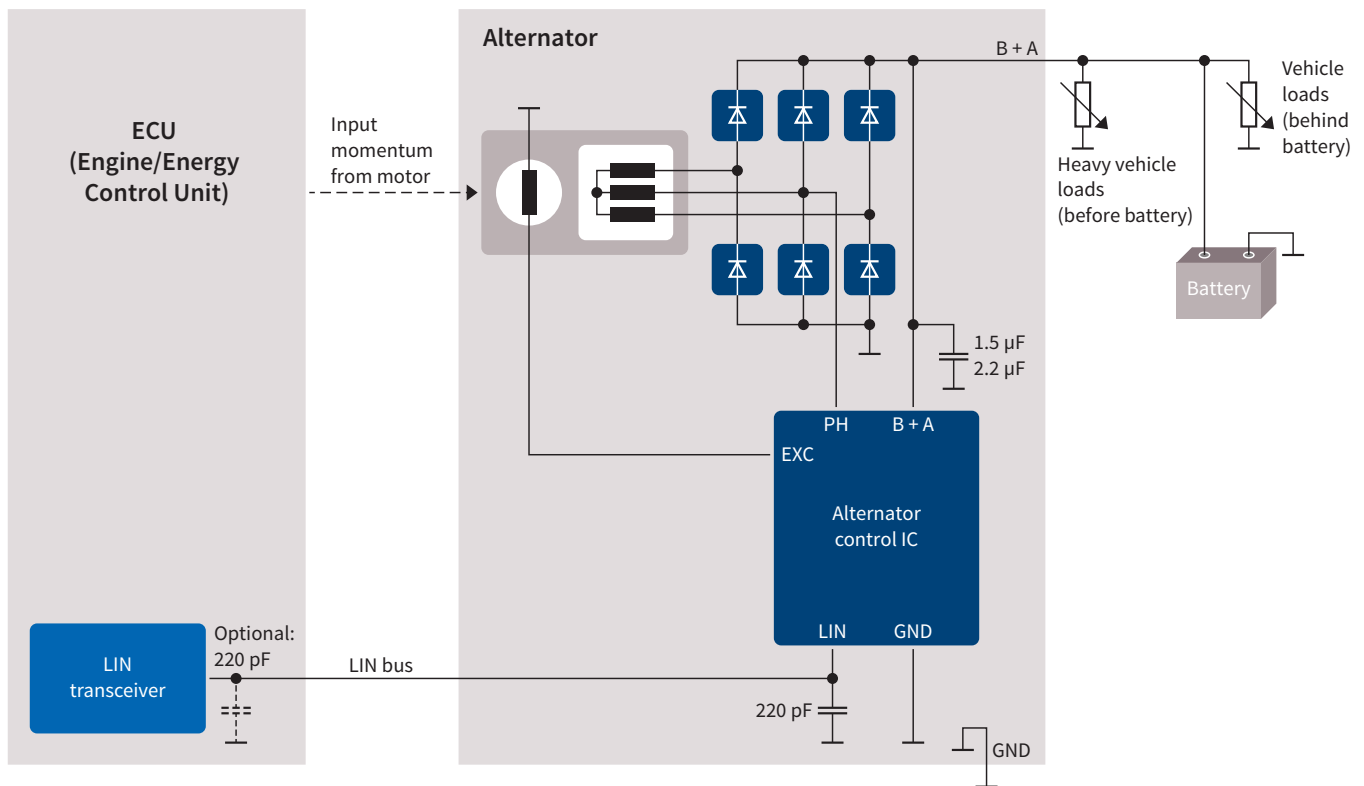
Suggested products

Product type	Description
Microcontroller	AURIX™ 32-bit multicore TriCore™ microcontroller family, optimized for highly demanding powertrain applications
Power management IC	OPTIREG™ Automotive PMIC
Network transceivers	CAN, LIN and FlexRay transceivers
Throttle control IC	Electronic Throttle Control (ETC) driver
Driver ICs	New cost-efficient H-bridge driver for non-ETC use cases, such as Exhaust Gas Recirculation (EGR), turbocharger wastegate, turbocharger geometry and other DC motor driver actuators Smart low-side power switches in single or multichannel configuration. Applicable product families: FLEX, IPS
Sensor ICs	XENSIV™ broad portfolio of pressure sensors (MAP and BAP) as well as magnetic cam and crankshaft and position sensors XENSIV™ sensor with a digital SENT interface in development
Trackers	OPTIREG™ Automotive linear-voltage trackers for supplying sensors



LIN alternator regulator

Regular diodes (3-phase example)



System benefits

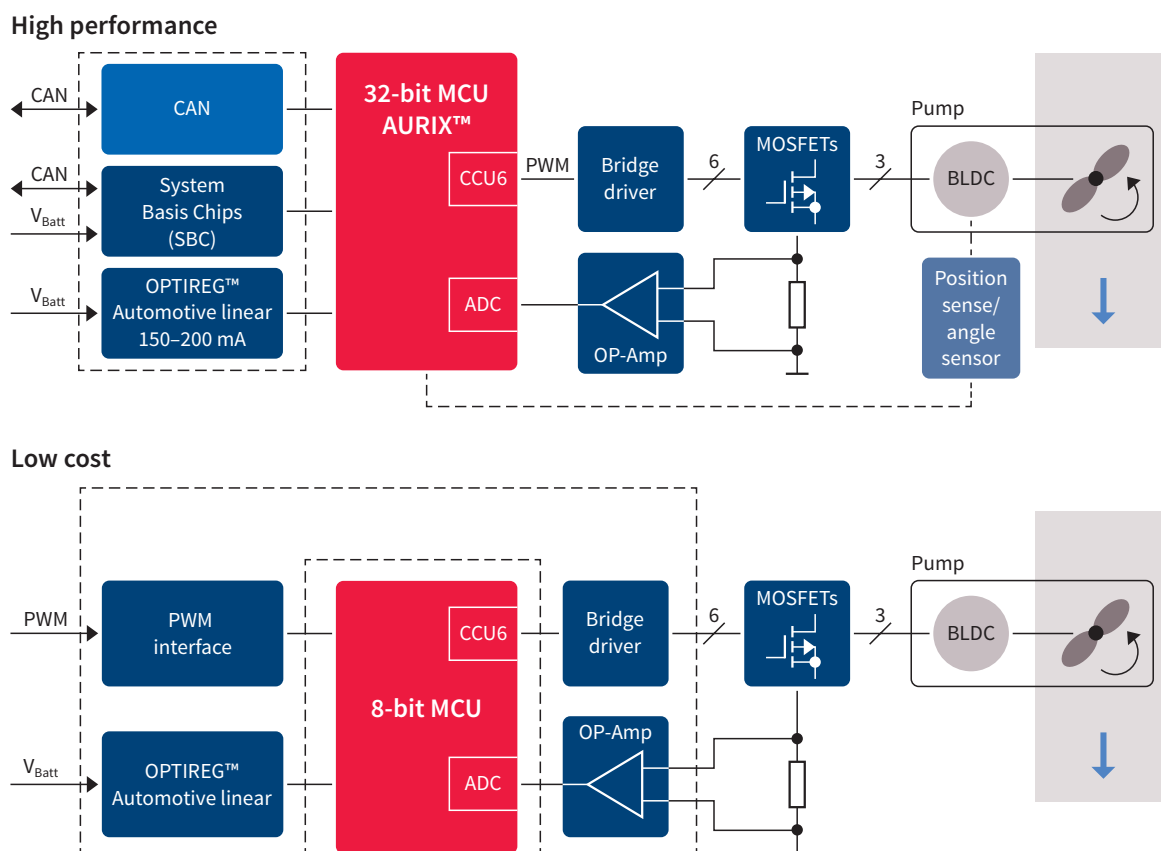
- › Supports conventional alternator and start-stop systems
- › Fully digital PI regulation with a very fast and accurate performance
- › Compliant with VDA LIN-generator-regulator specifications
- › Supports rectification with standard P/N diodes, low-loss diodes and MOSFETs
- › EEPROM for outstanding flexibility during on-site customization of target application
- › LIN interface (LIN 2.1 on physical layer, LIN 1.3/LIN2.1 on datalink layer)
- › Very low quiescent current (less than 80 µA at 25°C), excellent EMC performance
- › High ESD resistivity of 8 kV on all lines
- › High current (12 A) and temperature (up to 175°C) capability
- › Available as bare die for mechatronic brush holder as well as in automotive industrial standard package TO-220-5
- › Green product (RoHS-compliant) and AEC-Q100-qualified

Suggested products

Product type	Description
Alternator regulator ICs	Monolithic full-feature regulator specifically designed for closed-loop voltage control in 12 V automotive multiphase alternators. This regulator is able to communicate with an engine-management or energy-management ECU via a standard LIN1.3 (datalink layer) interface. By using freely adjustable parameters, the regulator is able to operate even without any communication interface.
	Same as above but, among others, ECU communication via a standard LIN2.1 (datalink layer) interface
Network transceivers	LIN transceiver with integrated wakeup and protection features



Electric water pump



System benefits

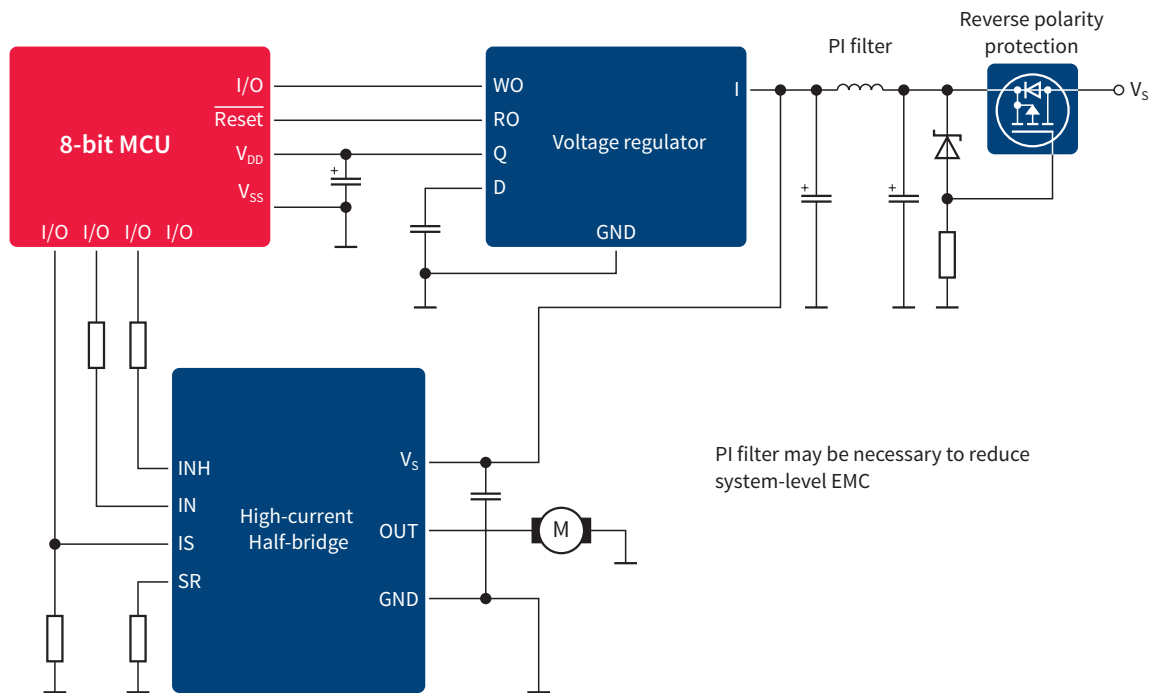
- › Large and scalable product portfolio tailored to performance and budget requirements
- › Fuel saving of > 4 percent compared to mechanical solution
- › Improved thermal control of engine
- › Enhanced pump efficiency
- › Reduces power consumption

Suggested products

Product type	Description
Microcontrollers	16/32-bit microcontrollers XC27x3X
	8-bit microcontrollers XC8xx
Power Supply IC	OPTIREG™ Automotive linear low-dropout fixed-voltage regulator
SBC	System Basis Chip integrates power supply and network transceivers (CAN/LIN)
Driver IC	High-current 3-phase bridge driver ICs
MOSFET	OPTIMOS™ 40 V N-Channel MOSFET, optimized for high-current motor applications



Fuel pump



System benefits

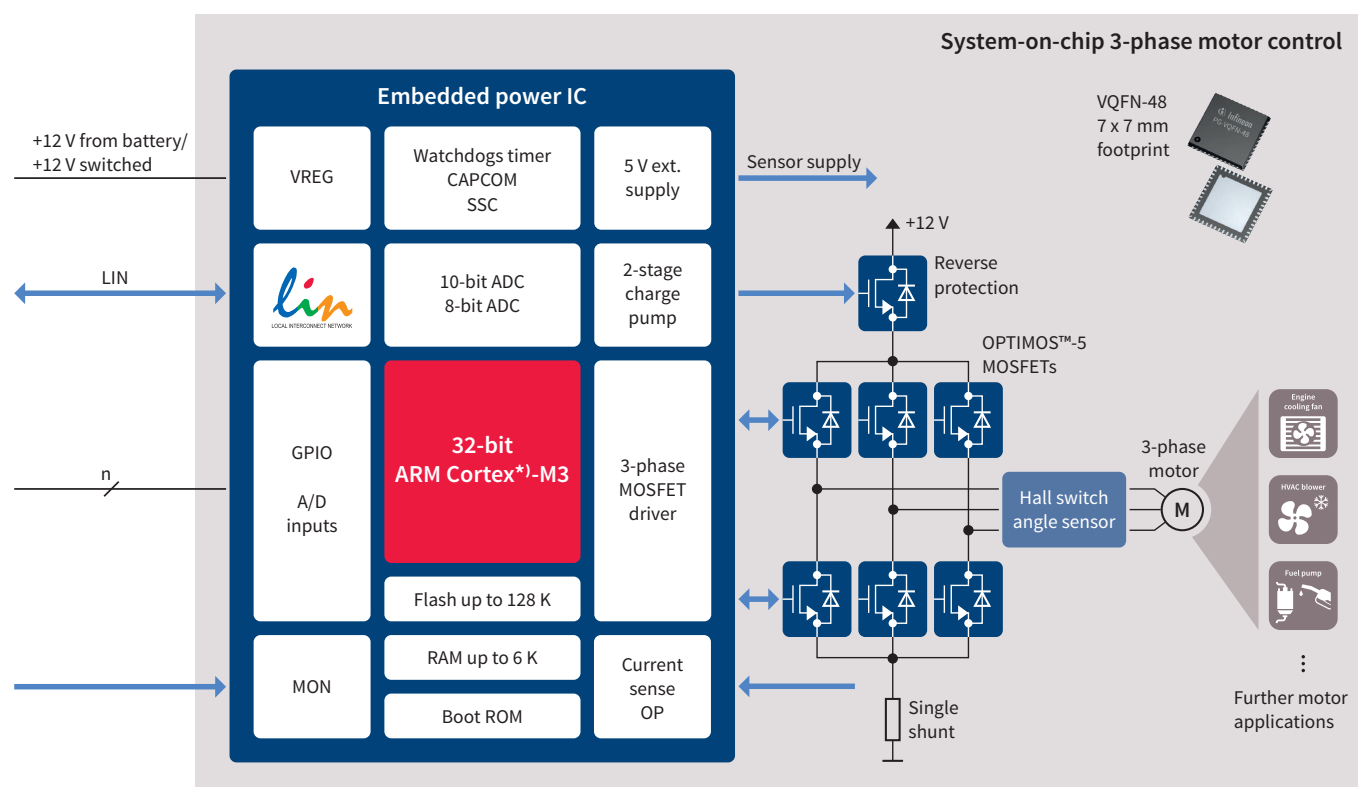
- > Large and scalable product portfolio tailored to performance and budget requirements
- > Fuel saving of > 1 percent compared to mechanical solution
- > Lower hydrocarbon emissions
- > Increased lifetime

Suggested products

Product type	Description
Microcontroller	8-bit microcontrollers XC8xx
Trilith IC	NovalithIC™ integrates the high-current PN half-bridge family
Power Supply IC	OPTIREG™ Automotive linear low-dropout voltage regulator with reset and watchdog



Auxiliary pumps and fans



System benefits

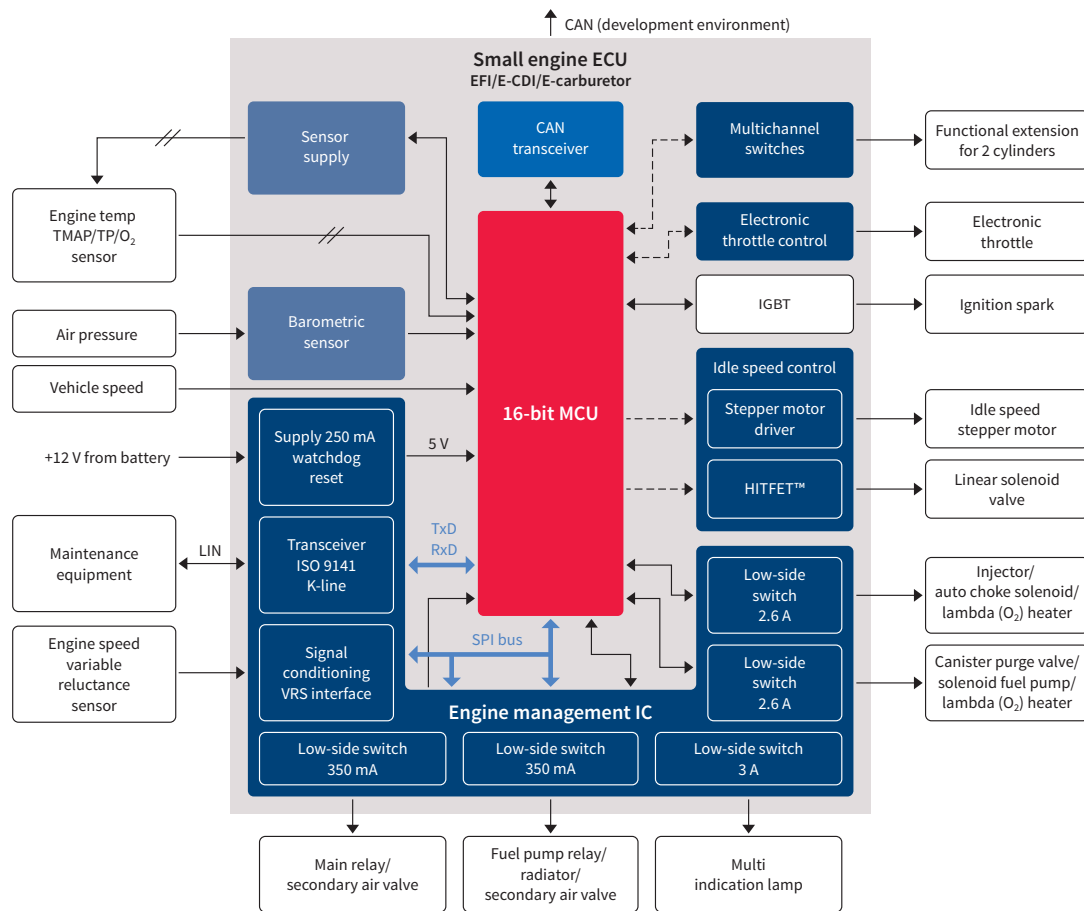
- › System-on-chip solution with integrated ARM Cortex[®] M3 industry-standard microcontroller core
- › Platform solution for a wide range of size- and weight optimized motor applications up to 1 kW
- › Package with very small form factor saves PCB board space
- › Integrated voltage regulator, LIN transceiver, switch input and direct control of N-channel MOSFETs
- › Configurable MOSFET driver simplifies EMC design
- › Supports various motor control algorithms including sensorless control
- › Integrated intelligent power-saving modes and energy management
- › Single-chip solution improves module reliability
- › Embedded power IC Automotive Qualified up to $T_{J, \max} = +175^{\circ}\text{C}$

Suggested products

Product type	Description
Embedded power IC	3-phase motor driver with an Integrated ARM Cortex [®] -M3 MCU
MOSFET	OptiMOS [™] T2 automotive trench power MOSFET
Angle sensor	XENSIV [™] Hall switch – magnetic field sensors with a discrete output signal
	XENSIV [™] TMR angle sensor with analog output
	XENSIV [™] iAMR/iGMR dual angle sensor with analog output
	XENSIV [™] iGMR angle with analog output



Small 1-/2-cylinder engine management solution



Complete Infineon reference solution including

- › Small engine control unit
- › MECTRONIK MECLAB™ configuration and calibration software for running 1-cylinder 4-stroke combustion engine systems
- › U-Connect XC2704 interface board USB-CAN
- › Miniwiggler JTAG debugging interface
- › Cable harness

Target applications

- › Electronic Fuel Injection (EFI)
- › Electronic e-carburetor
- › Enhanced capacitor discharge ignition

Features/benefits

- › Easy to use as reference board
- › Plug-and-play Electronic Control Unit (ECU)

Suggested products

Product type	Description
Microcontroller	C166-compatible high-performance 16-bit MCU (up to 150 KB flash at 66 MHz performance)
Power Supply IC	OPTIREG™ Automotive linear low-dropout fixed-voltage regulator
Engine management IC	Highly integrated system ICs for internal combustion engine control
Throttle control IC	Electronic throttle control driver
Power switch IC	Multichannel switches
Driver ICs	Smart low-side power switchers in single or multichannel configuration. Applicable product families: HITFET™, FLEX, IPS
Sensor ICs	XENSIV™ barometric Air Pressure sensors (BAP) with an analog or SPI/digital interface
	XENSIV™ magnetic speed sensor
Trackers	OPTIREG™ Automotive linear-voltage trackers for supplying sensors





(H)EV applications

Although electric drivetrains are already more energy efficient than combustion models, further improvements are still required. Infineon delivers various chips and modules that can play a valuable role in minimizing power losses, maximizing power savings and boosting performance. As a leading supplier of high-power IGBT modules for drive and traction applications for many decades now, Infineon supplied the IGBT modules that powered the TGV to a new world speed record in 2007, for example. Drawing on its industrial experience, Infineon has developed dedicated (H)EV power modules delivering the ultimate in power density and efficiency.

As the world leader in advanced power and automotive electronics, Infineon has the broadest product portfolio for high-efficiency electric drivetrain designs. Combining affordability with ecology, our electromobility solutions help to significantly reduce the overall system cost of powertrain and electronics, increase mileage and improve battery efficiency. Carmakers and system sup-

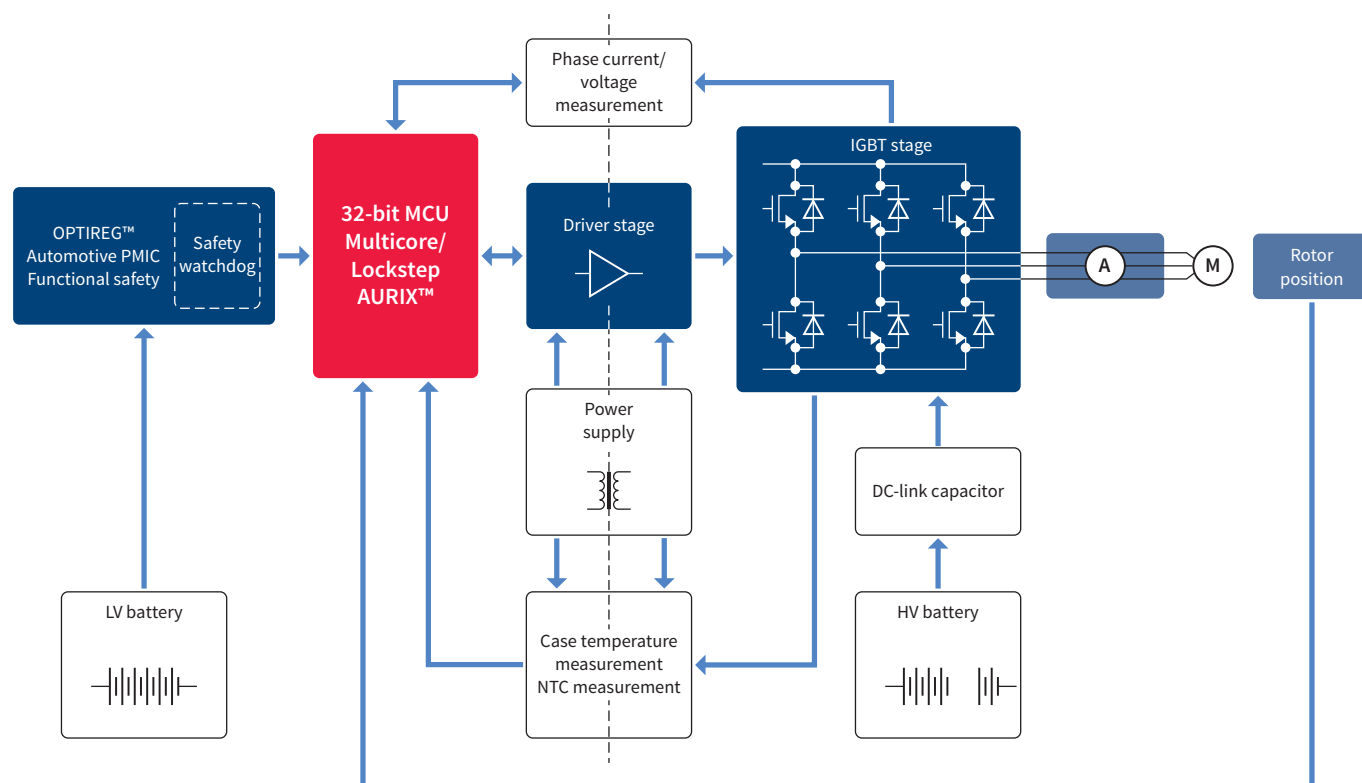
pliers can rely on best-in-class semiconductor products from Infineon Technologies AG to drive new innovations. For instance, 75 Infineon semiconductors ensure a highly efficient electric drive in the BMW i3, including, for example, a TriCore™ 32-bit microcontroller, IGBT power module, EiceDRIVER™ products and CoolMOS™ high-voltage MOSFETs. And this is only one example.

Suitable for all electric drivetrain architectures, Infineon's product portfolio comprises discrete components, power semiconductors, microcontrollers and sensors, as well as high-power modules. Thanks to our system expertise, we are able to provide complete chipsets offering optimized performance while reducing overall system costs.

Infineon's semiconductor solutions for (H)EV are testament to the company's ongoing commitment to deliver the exceptional quality and reliability that the world's leading car and automotive system manufacturers expect.



Traction inverter for (hybrid-) electric vehicles



System benefits

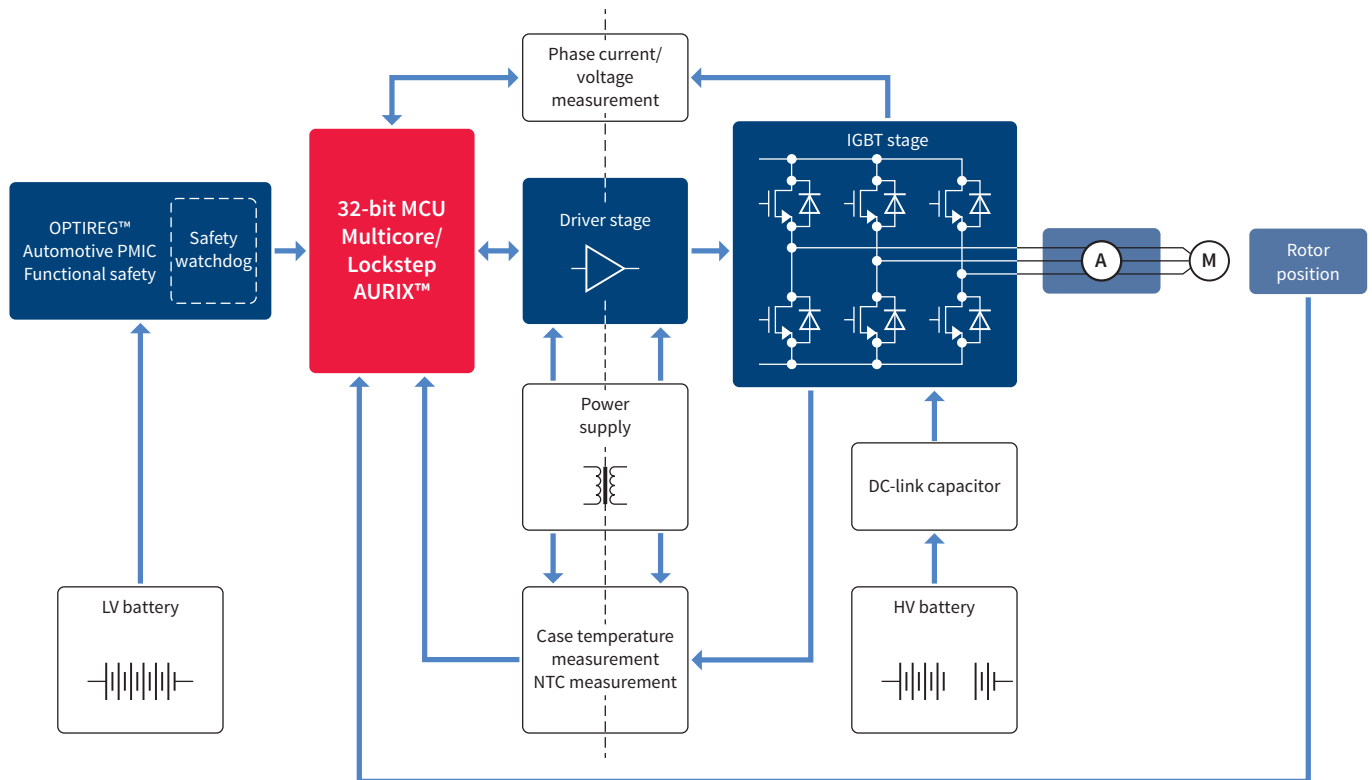
- › Fully automotive-qualified product portfolio supporting wide range of motors, generators and power classes
- › Highly efficient 3-phase drive thanks to very low conducting losses even at high switching frequencies
- › Isolation-integrated in gate driver
- › Wide range of 16 and 32-bit microcontroller solutions dedicated to (H)EV applications with a highly cost-effective resolver interface
- › Evaluation kit available to reduce system on development time

Suggested products

Product type	Description
Microcontroller	AURIX™ high-performance 32-bit multicore microcontrollers for safety applications
Power management IC	OPTIREG™ Automotive PMIC
Driver ICs	Automotive EiceDRIVER™, single-/dual-channel isolated IGBT driver for 650 V/1200 V IGBTs
	New generation EiceDRIVER™ supporting cost-effective implementation of ASILC/D systems
	Automotive level shift driver ICs help simplify design and optimize performance in all FETs and IGBTs driving stages
HybridPACK™ power modules	HybridPACK™ Drive: Latest-generation – IGBT power module with up to 820 A/750 V with power ratings up to 150 kW
	HybridPACK™ 2 Enhanced: IGBT power modules dedicated to automotive applications with power ratings up to 200 kW
	HybridPACK™ 1: IGBT power module with up to 400 A/705 V for power ratings up to 100 kW
	HybridPACK™ DSC: IGBT power module with double-sided cooling and possibility to scalability
Power switches	IGBT discretes from 75 A – 120 at 600 V with optimized characteristics for parallelization



Auxiliary inverter for (hybrid-) electric vehicles



System benefits

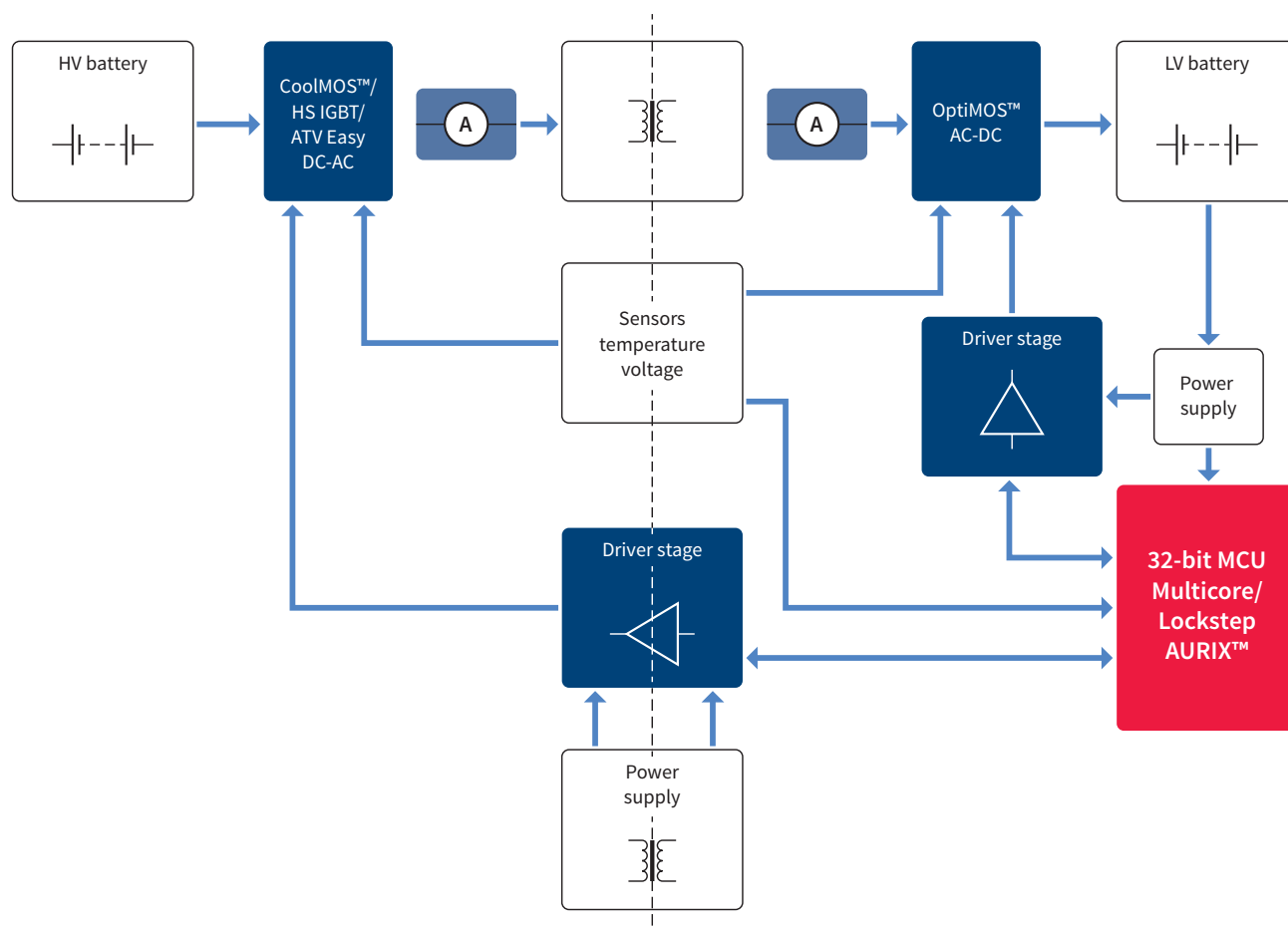
- › Fully automotive-qualified product portfolio supporting a wide range of motors, generators and power classes; compact design with high power density
- › Highly-efficient 3-phase drive due to very low conducting losses even at high switching frequencies
- › Isolation-integrated in gate driver
- › Wide range of 16 and 32-bit microcontroller solutions dedicated to (H)EV applications
- › Evaluation Kit available to reduce system development time

Suggested products

Product type	Description
Microcontroller	AURIX™ high-performance 32-bit multicore microcontrollers for safety applications
Power management IC	OPTIREG™ Automotive PMIC
Driver ICs	Three phase driver for 600 V MOSFETs and IGBT
	Family of 600 V half bridge drivers, for MOSFETs and IGBTs
	Automotive EiceDRIVER™, dual-channel isolated IGBT driver for 50 V/1200 V IGBTs
Power switches	IGBT discretes from 20 A to 75 A, 600 V with soft, fast recovery anti-parallel EmCon3 diode
Automotive Easy power module	Automotive Easy: IGBT power modules dedicated to automotive applications with power ratings up to 10 kW



HV/LV DC-DC converter for (hybrid-) electric vehicles



System benefits

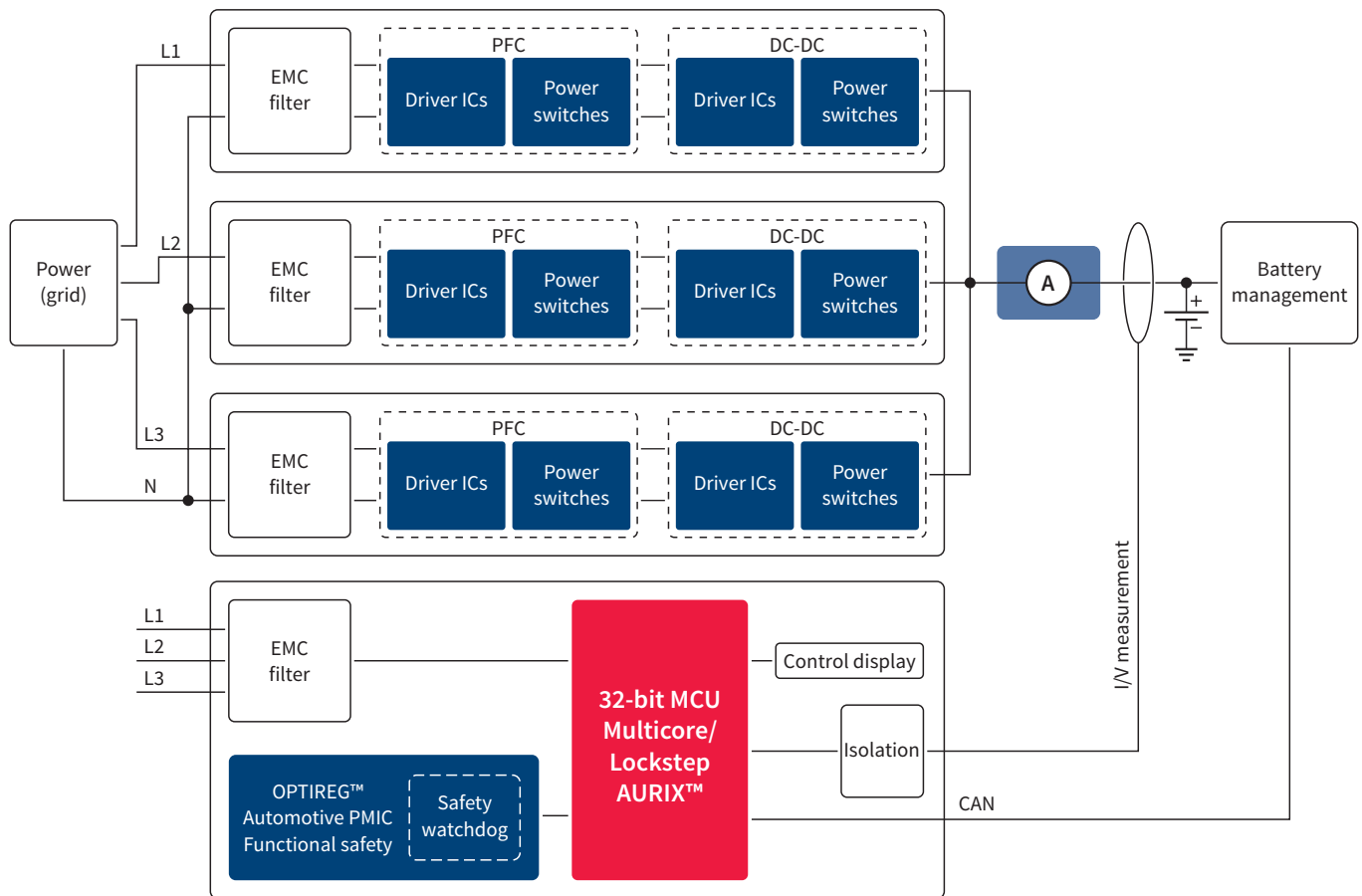
- › Fully automotive-qualified product portfolio including both power module and discrete solutions
- › Supports a wide range of highly-efficient conversion topologies (including bidirectional)
- › Compact design with highest power density
- › Very low switching losses at high switching frequencies
- › Isolation-integrated in gate driver
- › High-performance 32-bit microcontroller solutions
- › Evaluation Kit available to reduce system development time

Suggested products

Product type	Description
Microcontroller	AURIX™ high-performance 32-bit multicore microcontrollers for safety applications
Power management IC	OPTIREG™ Automotive PMIC
Driver ICs	Automotive qualified, fast high- and low-side driver, for 600 V MOSFETs and IGBTs
	Family of Automotive qualified 600V high- and low-side drivers, for MOSFETs and IGBTs
	High-current, high-speed synchronous rectification drivers
Power switches	650 V CoolMOS™ discrete high-voltage MOSFETs with a fast body diode
	IGBT discretes dedicated to automotive HV/LV DC-DC converters with switching frequencies up to 150 kHz
	IGBT discretes without anti-parallel diode
Automotive Easy power module	Automotive Easy: IGBT power modules dedicated to automotive HV/LV DC-DC converters with switching frequencies up to 100 kHz
MOSFET	OptiMOS™ 5 100 V in TOLL package



On-board charger for (hybrid-) electric vehicles



System benefits

- › Suitable for plug-in hybrid and EV
- › Integrated Power Factor Correction (PFC)
- › Galvanic isolation
- › Wide range of input and output voltages
- › Adjustable current limits
- › Automotive standard communication (CAN)
- › Modular concept enables 1- to 3-phase AC power supply

Suggested products

Product type	Description
Microcontroller	AURIX™ high-performance 32-bit multicore microcontrollers for safety applications
Power management IC	OPTIREG™ Automotive PMIC
Driver ICs	Automotive qualified, high-current dual low-side driver for MOSFETs and IGBTs
	Automotive qualified, fast high- and low-side driver, for 600 V MOSFETs and IGBTs
	Fast, high-current, self-controlled synchronous rectification driver for resonant converters
Power switches	High-voltage automotive MOSFETs for low-power charging solutions (overnight)
	IGBT discretes dedicated to automotive HV/LV DC-DC converters with switching frequencies up to 150 kHz
	SiC diodes for high efficient charging
Automotive Easy power module	Automotive Easy: Flexible power module solution for low-power charging solutions





Trusted driving with secured connectivity

As the global market leader in security microcontrollers for 15 consecutive years and with more than 40 years of experience in the automotive sector, Infineon offers a broad portfolio of innovative automotive security solutions. The product range includes hardware components, such as 32-bit microcontrollers with embedded hardware secu-

urity modules, embedded SIM cards and tamper-resistant security certified secure elements (like TPM) as well as related software packages. This allows the security level to be precisely customized to suit the protection needs of a particular application.



Discover what's possible with Infineon's solutions in the use cases below.



Immobilizer

Authentication (i.e. proof of identity) is an integral part of automotive security systems. The best-known application is the electronic immobilizer as a central component of theft protection.



Secure on-board communication

Security solutions for on-board communication need to be safe and compliant with hard, real-time constraints and legacy bus standards, with minimum data overhead and costs.



Secure V2X communication

Vehicle-to-vehicle and vehicle-to-infrastructure communication helps to increase road safety and to improve traffic efficiency. It is a key element for automated driving solutions and has very high security and certification requirements as it is a part of a safety relevant system.



eSIM connectivity with high quality

In a connected car, the eSIM is the linking element between the automotive and the telecommunication world. While automakers have a strong focus on meeting the highest quality levels, mobile network operators (MNOs) focus on protecting their security credentials against theft and cloning. The SLI 97 enables secured cellular connectivity for intelligent telematics to provide advanced usage-based services and to improve the driver's safety in solutions such as eCall or V2X.



Software update over the air (SOTA)

Updating software over the air (internet connection) requires a complex security system.



Secured in-vehicle key management

The protection of critical cryptographic keys is fundamental for the overall security of automotive systems and forms the basis for secured connected vehicle functions, such as external communication to the backend. This starts with secured on-board key generation, storage and deployment in OEM manufacturing and encompasses the entire vehicle life-cycle along the supply chain.

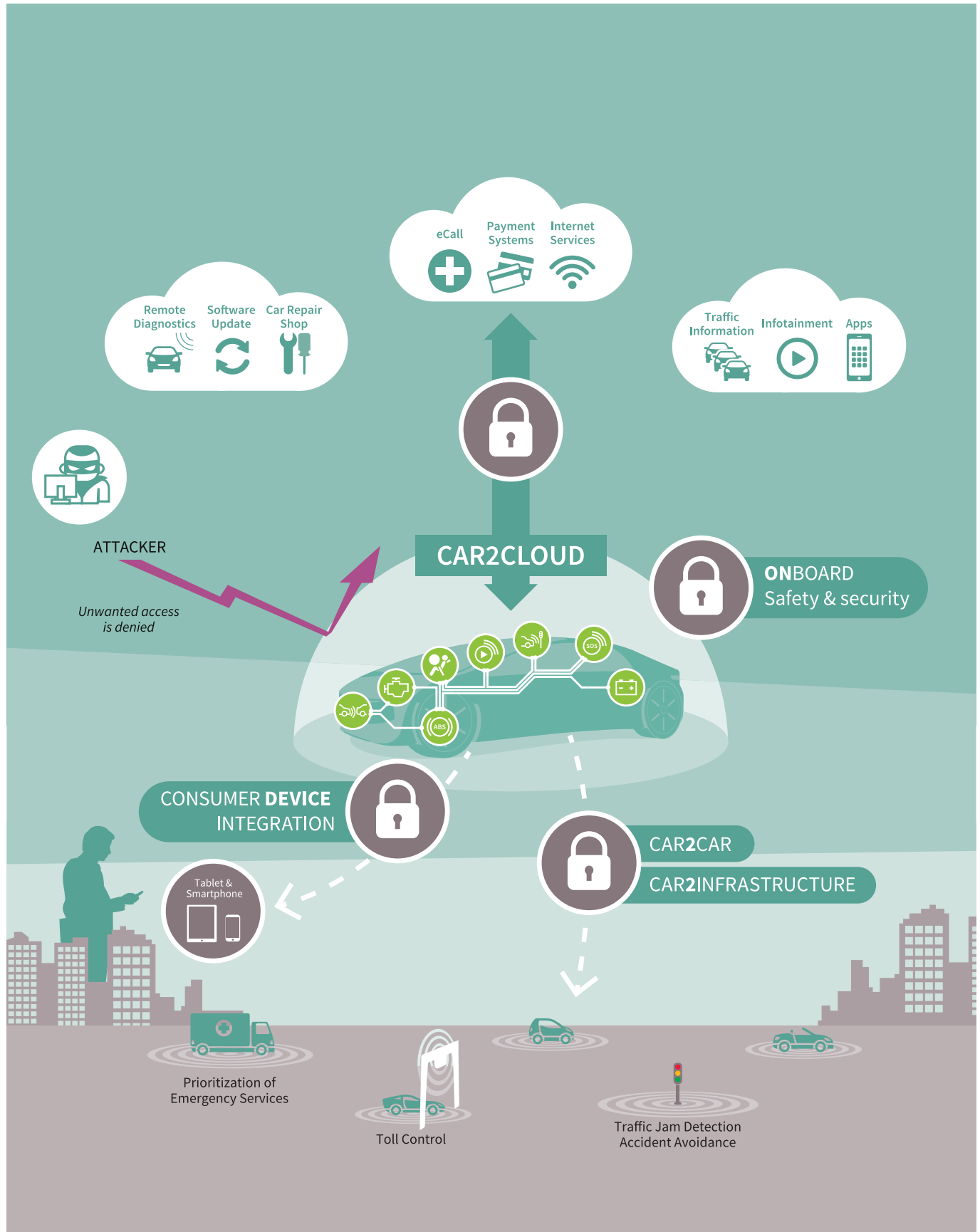


Tuning protection

Chip tuning allows for increased performance of the internal combustion engine, improves acceleration and increases top speed. However, the negative consequences are often overlooked. These include the possible failure of safety inspections and loss of insurance coverage as well as additional risks to drivers, such as those associated with excessive stress on vehicle components.

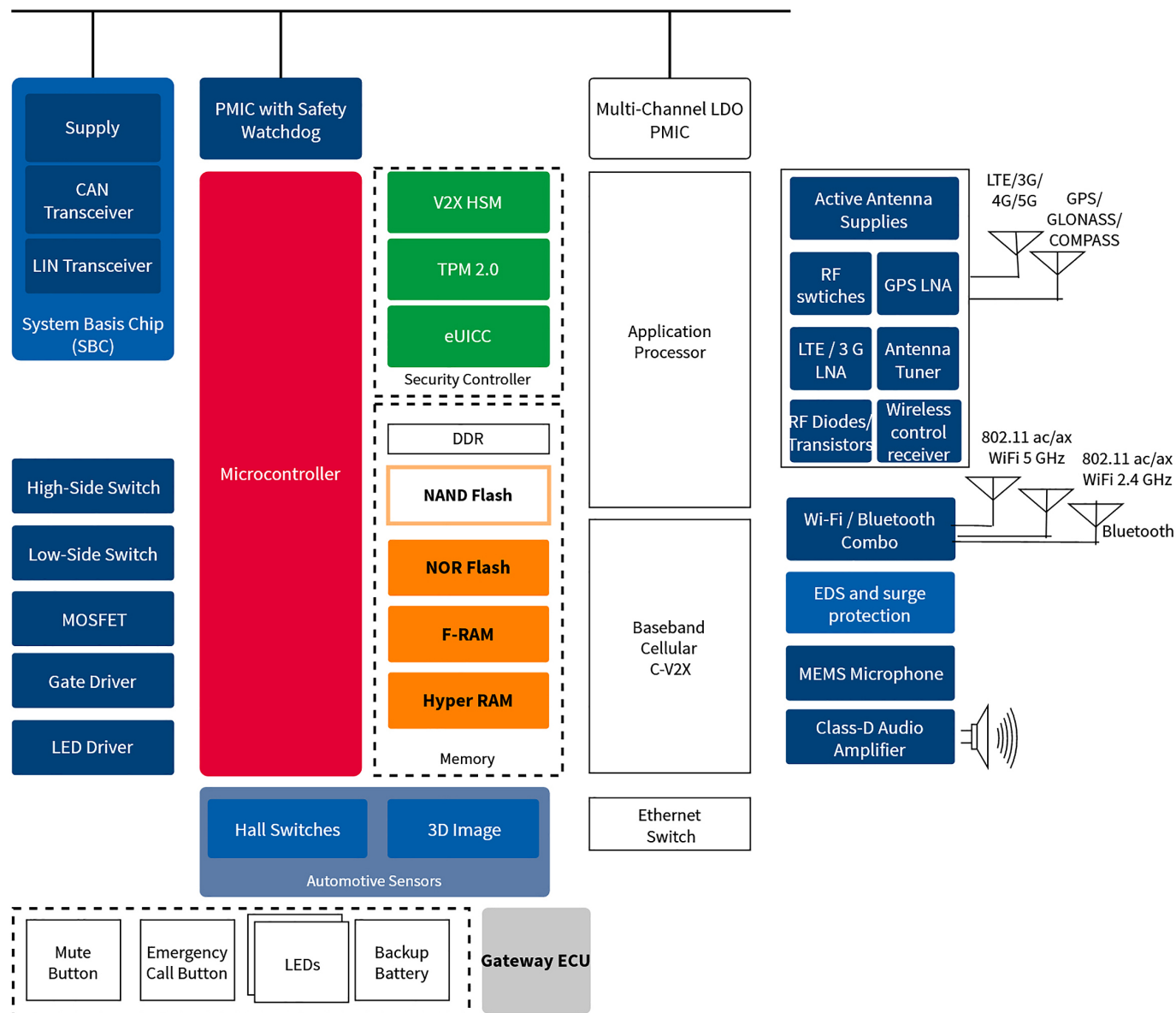
Car security for trusted driving

Enable smart mobility with Infineon's comprehensive system expertise and proven security solutions for today and tomorrow



Telematics control unit

+12V from Battery



System benefits

Performance

- › Two powerful and scalable 32-bit MCUs families:
 - AURIX™ TC2xx/TC3xx and Traveo™ II
 - Device connectivity incl. QSPI, I²C, SENT, PSI5, PSI5S, HSSL, MSC, I²S
 - In vehicle network connectivity incl. FlexRay, LIN, CAN/ CAN FD, Gbit Ethernet
 - Safety & security gateway (up to ASIL-D)
 - Power efficiency: Traveo™ II DeepSleep as low as 35 µA
- › Industry-leading, automotive Wi-Fi® and Bluetooth® solutions:
 - Wi-Fi® + Bluetooth® Combo ICs, Wi-Fi® ICs and Bluetooth® SoCs
- › Instant-on boot:
 - Safe, reliable, and high-performance Semper™ Flash
 - Read bandwidth up to 400 MB/s (JEDEC xSPI)
 - Endurance of 1+ million cycles and 25 years data retention



www.infineon.com/car-security



AUTOSAR

CON FD



Security

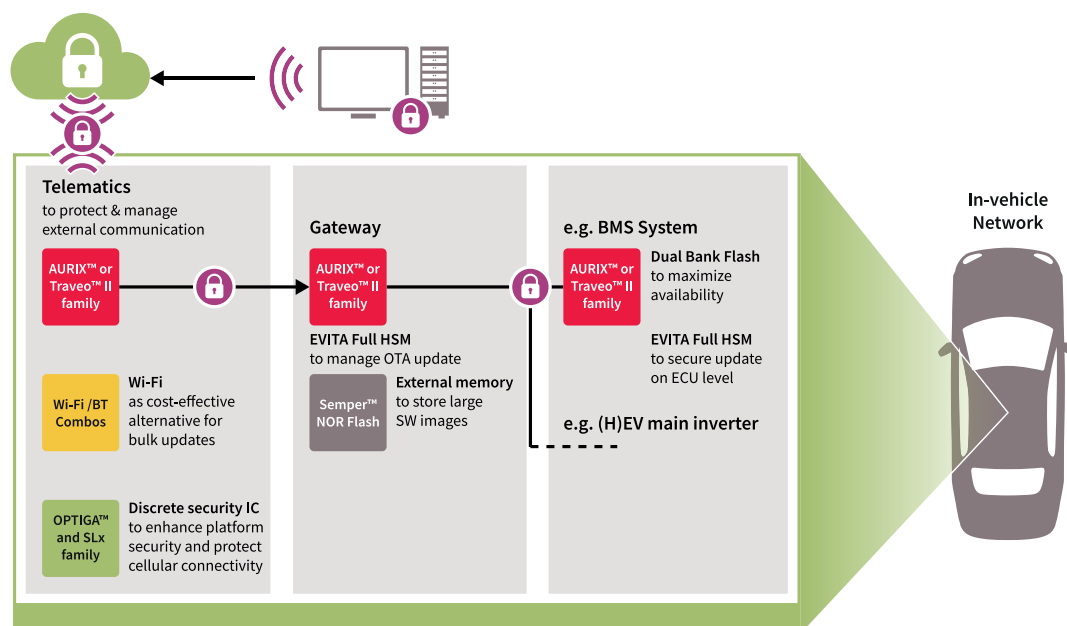
- › Hardware root-of-trust for application processors:
 - Semper™ Secure NOR-Flash w. immutable, unclonable identity and HW-accelerated crypto engine
- › End-to-end protection:
 - 32-bit MCUs w. EVITA Full HSM and configurable access control for protected real-time communication and data processing
- › Tamper resistance:
 - Certified (up to CC EAL6+ high) 32-bit automotive security controllers for mobile network authentication and V2X

Time to market

- › Scalable chip-set solutions:
 - Allowing for very cost and time efficient R&D projects
- › Global Ecosystem:
 - Extensive network of 3rd party embedded software & tool chain partners
 - Consulting support from Infineon's Preferred Design-House & Security Partner Network
- › Development Tools:
 - Application and demonstration boards for quick evaluation of innovations

Over-The-Air (OTA) Software Update

The OTA capability allows seamless installation of new features or feature upgrades, while reacting swiftly to potential security attacks. Thus OTA increases customer satisfaction, reduces cost & recalls and has the potential to open new revenue streams for the OEMs. The Infineon solutions enable complete end-to-end protection while helping to minimize vehicle unavailability to the bare minimum.

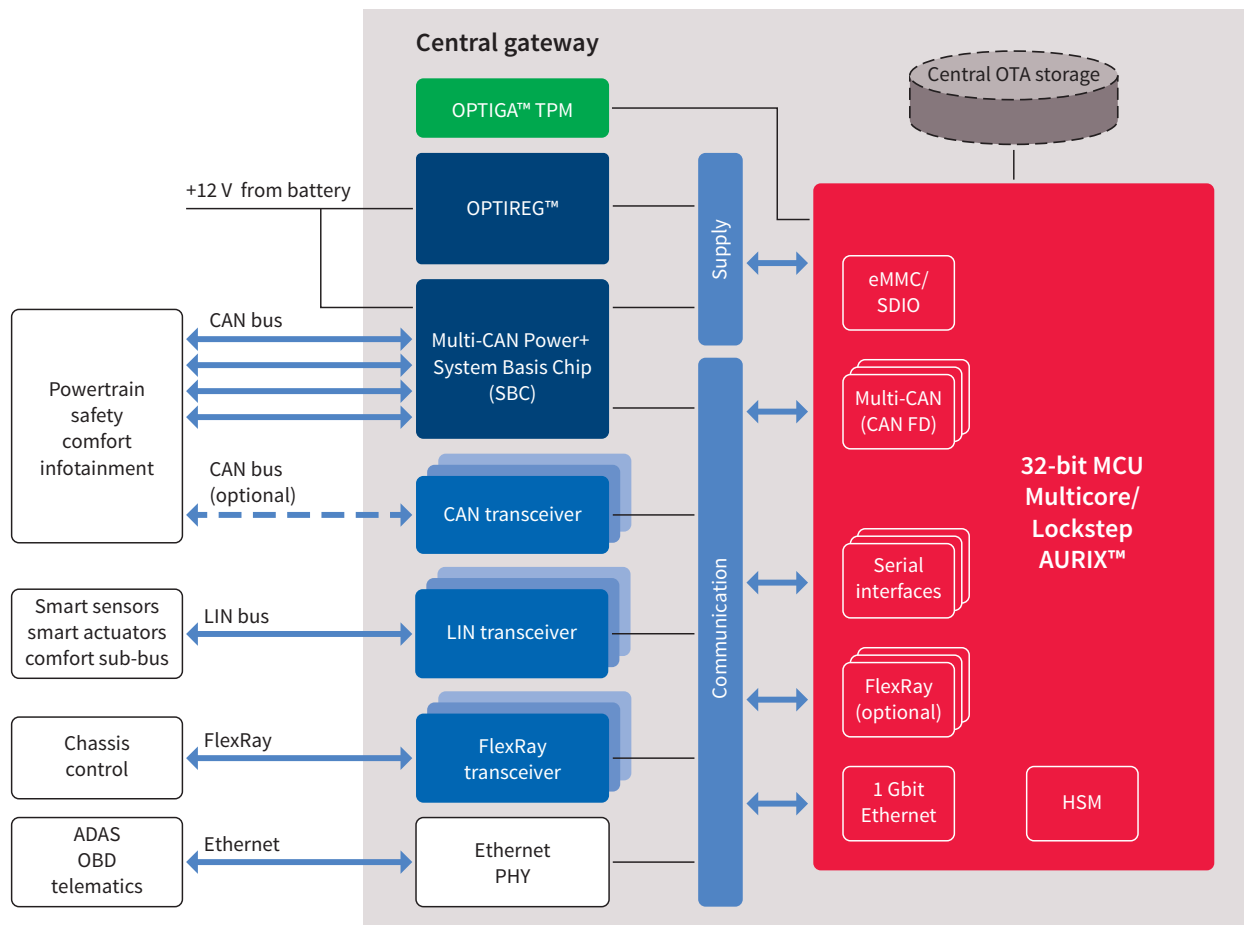


Suggested products

Product type	Description
Microcontroller	AURIX™ & Traveo™ II high-performance 32-bit multicore microcontroller family
Security controllers	OPTIGA™ TPM, Embedded SIM (eUICC), V2X HSM etc.
Automotive wireless	Wi-Fi® + Bluetooth® Combo ICs, Wi-Fi® ICs and Bluetooth® SoCs
Automotive memory	Semper™ Flash, HyperRAM™ & Excelon™ Auto F-RAM
Power management	OPTIREG™: PMICs, Linear Supplies & Antenna Supplies, System Basis Chips (SBC)



Gateway



System benefits

- › Enables pretended networking and ECU degradation
- › High integration leads to significant cost savings
- › High integration results in reduced complexity
- › Different security solutions according to custom requirements
- › ISO 26262 compliance
- › Hardware security on different levels

Suggested products

Product type	Description
Microcontroller	AURIX™ scalable 32-bit TriCore™ microcontroller family from single to multicore
Security IC	OPTIGA™ TPM quality hardened Trusted Platform Module (TPM) for special use in automotive applications
Power Supply ICs	OPTIREG™ Automotive linear voltage regulators, OPTIREG™ Automotive switcher
Network transceivers	CAN, LIN and FlexRay transceiver
SBC	Multi-CAN Power+ SBC integrates power supply and 4x CAN transceivers



www.infineon.com/gateway



AUTOSAR

CAN^{FD}



eSIM – SLI 97

The SLI 97 has been designed to be a perfect match for cellular connectivity. The capability of the embedded SIM (eSIM) to remotely manage mobile network operator

Key product features

Infineon answers to challenging quality and security requirements with the SLI 97 product family, which is tailored to the automotive industry including the following product features:

- › ARM SECURCORE[®] SC300™ enhanced by Infineon's 2 kB cache and security technology
- › Up to 1 MB SOLID FLASH™ allowing fast prototyping and short time-to-market
- › Very high endurance NVM for best quality products
- › Symmetric and asymmetric crypto processors
- › Wide interface choice: ISO 7816, SWP, USB, I²C, SPI
- › Common Criteria EAL 5+ high meeting industry's highest security level

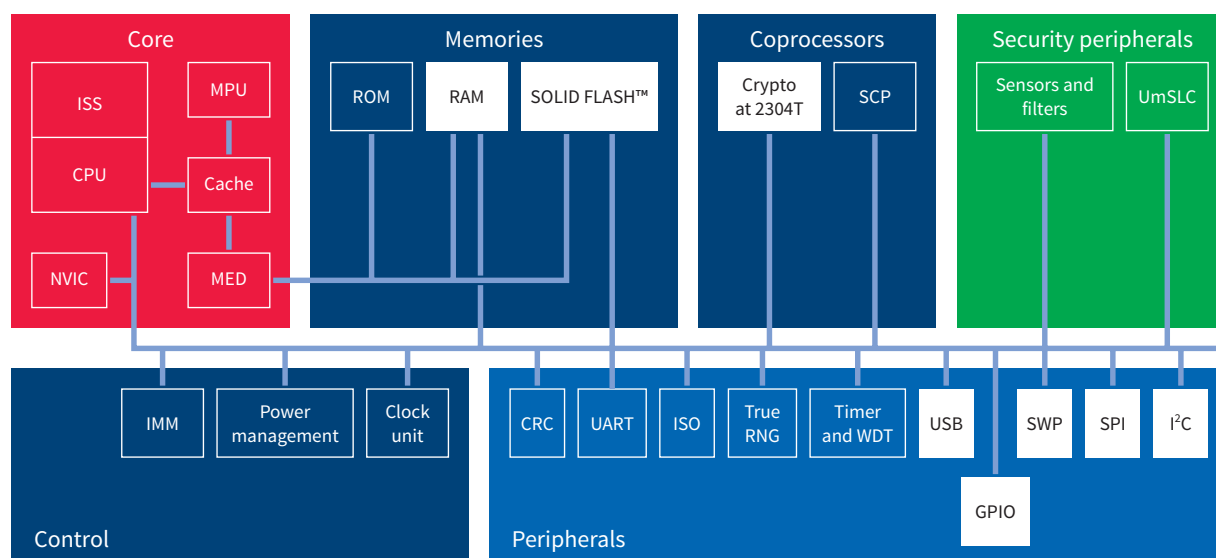
subscriptions allows automakers to reduce logistical complexity and easily deploy new services for their customers during the vehicle's lifetime.

Customer benefits

- › Extended temperature range: -40 to 105°C
- › AEC-Q100 qualification and PPAP documentation
- › Extended quality gates and test scope to reduce failure rates
- › Standard embedded M2M delivery forms: MFF2 and VQFN-32

Typical use cases

- › eSIM automotive



CPU	Central Processing Unit
CRC	Cyclic Redundancy Check
EEPROM	Electrically Erasable Programmable Read-Only Memory
Flash	Flash Memory
GPIO	General Purpose Input Output
ISO	Standard Interface
ISS	Instruction Stream Signature Checking

I ² C	Inter-Integrated Circuit
IMM	Interface Management Module
MED	Memory Encryption/Decryption
MPU	Memory Protection Unit
NVIC	Nested Vectored Interrupt Controller
RAM	Random Access Memory
RNG	Random Number Generator
ROM	Read-Only Memory

SCP	Symmetric Cryptographic Processor
SPI (SSC)	Serial Peripheral Interface
SWP	Single-Wire Protocol
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus
UmSLC	User mode Security Life Control
WDT	Watchdog Timer

□ Availability or configuration is product specific

SLI 97 provides multiple interfaces and hardware crypto coprocessors, making it a perfect solution for security-critical embedded SIM (eSIM).



OPTIGA™ TPM SLI 9670 for automotive security

The OPTIGA™ TPM SLI 9670 is a quality hardened Trusted Platform Module (TPM) for special use in automotive applications and based on a tamper resistant secure microcontroller (MCU) using advanced hardware security technology. As turnkey solution it is flashed with a securely coded firmware according to latest TCG family 2.0 specifications offering a rich feature set of security functions, like key management, authentication, signature functions (signing/verifying), encryption/decryption, secured logging and secured time.

Customer values

- › Tamper resistant hardware architecture with performant core and peripheral set (crypto coprocessors, TRNG etc.) based on market leading security expertise
- › Reduced risk based on proven technology (standardized and market approved turn-key security solution preprogrammed with rich security functions (TCG standard TPM 2.0))
- › Flexibility thanks to a wide range of integrated security functions (e.g. dedicated key management)
- › Secured key store and management: secured personalization (key injection in secured environment), additional keys generated on-chip
- › Plug-and-play security solution
 - Easy and cost efficient system integration through available open source complex drivers
 - Fast time to market

Typical automotive security use cases

- › Secured key store and management
- › Remote attestation
- › Privacy protection
- › Car sharing
- › Diagnostic access

The OPTIGA™ TPM SLI 9670 is qualified according to the automotive AEC Q100 standard making it an ideal solution for automotive applications in telematics, gateway, multi media head units and other ECUs with strong security requirements. This TPM is also security certified according to Common Criteria EAL4+. It is available in a PG-VQFN-32 package.

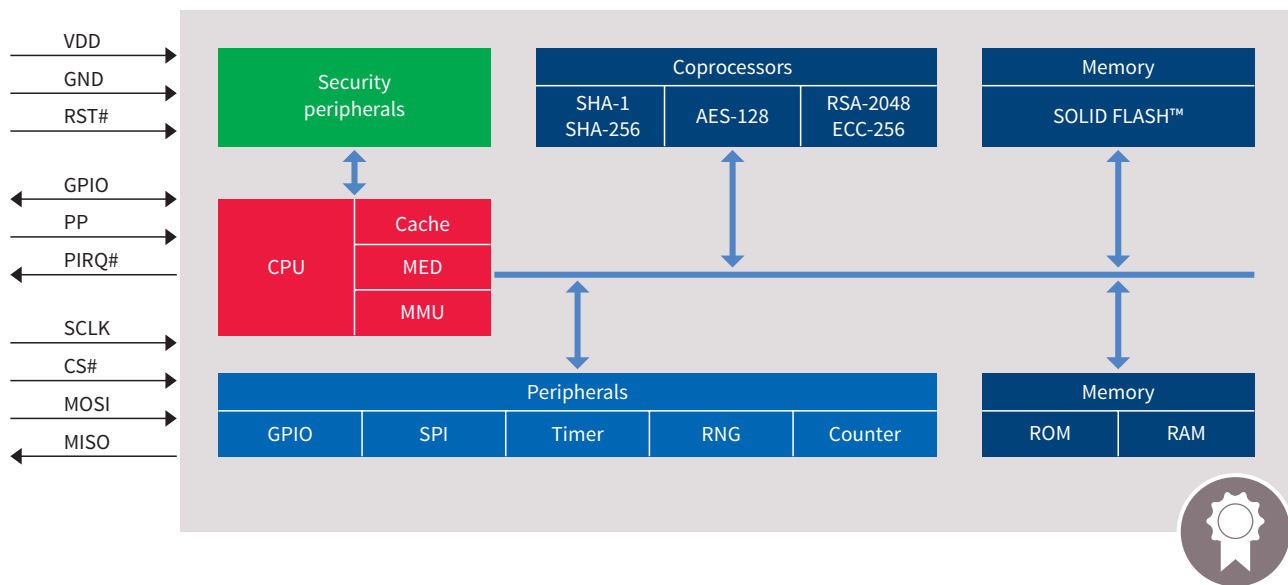
Key product features

- › Standardized and market approved turn-key security solution (TCG standard TPM 2.0)
- › High-end tamper resistant security controller with advanced cryptographic algorithms implemented in hardware (ECC, RSA, SHA, AES, HMAC)
- › Highly reliable NVM technology
- › SPI interface
- › Extended temperature range (-40°C to 105°C)
- › Automotive qualification according to AEC-Q100
- › Security certification according Common Criteria EAL4+

Applications

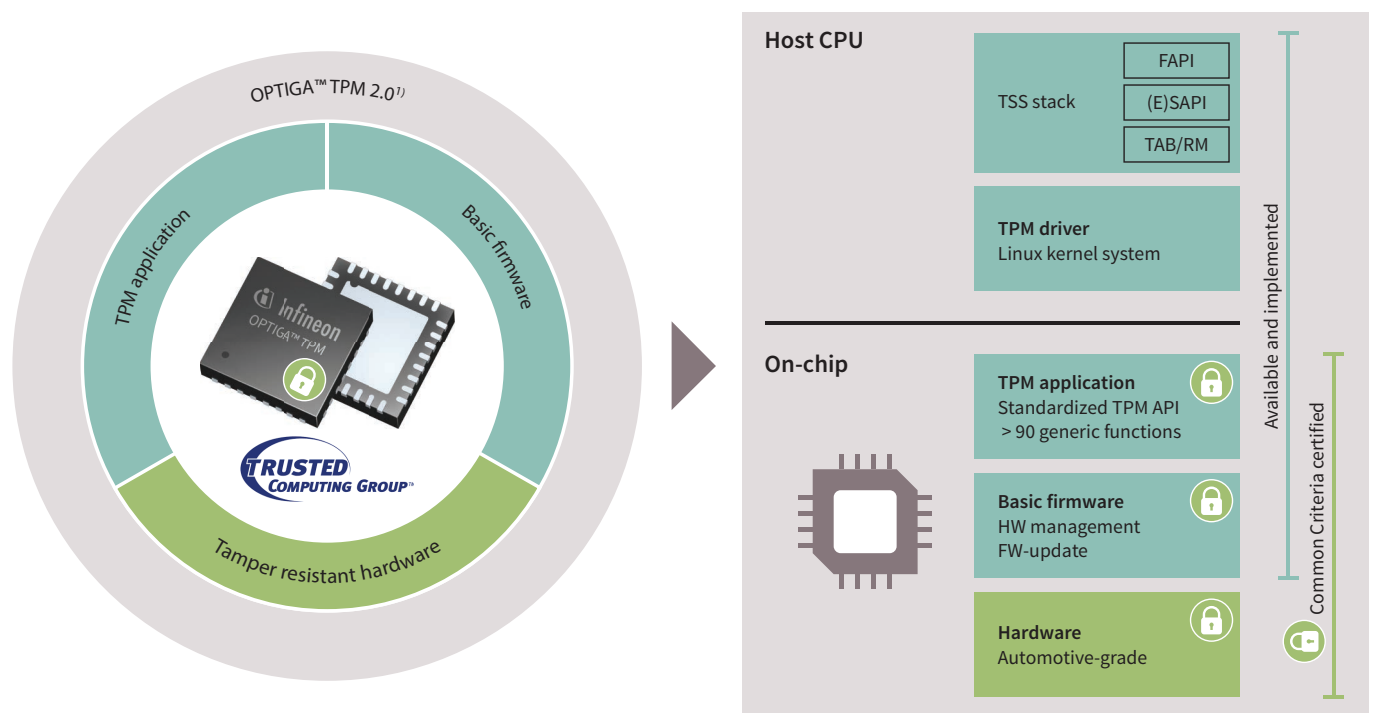
- › Telematics control units
- › Connected gateways
- › Multi media head units
- › ECUs requiring strong security protection





Block diagram

The hardware of the OPTIGA™ TPM SLI 9670 consisting of a tamper-resistant secured MCU along with sophisticated cryptographic hardware modules and further peripherals, such as a random number generator. Advanced hardware security technology, which includes internal memory and bus encryption as well as shielding and sensors provides protection against physical and logical attacks.



1) Functions: > 90 functions

- > Key generation, signature, en-/decryption
- > Life cycle key management, authorization, sessions, key duplication
- > Secure logging, secure time, secure boot, field-update

Algorithms: ECC (P-256, BN-256), RSA, AES, SHA-1, SHA-2, HMAC

Protocols:

- > ECDSA, ECDAA, ECDH, FIPS186-3
- > RSASSA_PKCS1v1, RSASSA_PSS, RSAEP, RSAES_OAEP, RSAES_PKCSV1

Functional diagram

The OPTIGA™ TPM SLI 9670 provides a full secured and security-certified ready-to-use solution according to the latest TCG specification including the chip firmware, TPM application and host software.



AURIX™ for automotive security

AURIX™ security hardware

Infineon's AURIX™ 32-bit microcontroller family, with its embedded Hardware Security Module (HSM), is a perfect fit for automotive applications where secure on-board communication is required. Infineon not only offers a scalable portfolio of compatible AURIX™ devices with integrated HSM, but also the necessary software packages and support services. Furthermore, a best-in-class solution for automotive security can be achieved by combining AURIX™ microcontrollers with an Infineon embedded SIM (eSIM) and Infineon tamper-proof secure elements (TPM).

AURIX™ Hardware Security Module (HSM)

HSM provides a secure computing platform, consisting of a 32-bit CPU, special access-protected memory for storing the cryptographic keys and unique subscriber identifiers and dedicated hardware accelerators for the various automotive security use cases. A firewall separates HSM from the rest of the AURIX™ microcontroller.

The AURIX™ hardware security module offers a highly flexible and programmable solution based on:

- › Crypto and algorithm agility via software to support customer-specific solutions powered by a 32-bits CPU
- › AIS31-compliant True Random Number Generator (TRNG) with high random entropy over lifetime
- › State-of-the-art AES-128 hardware accelerator matching performance for automotive protocols
- › State-of-the-art PKC ECC 256 hardware accelerator for asymmetric encryption (only 2nd generation AURIX™ HSM)
- › State-of-the-art HASH SHA2-256 hardware accelerator for hashing (only 2nd generation AURIX™ HSM)
- › Secured key storage provided by a separated HSM-SFLASH portion. Alternative secure key storage feasible in dedicated HSM-PFLASH sections.

Customer benefits

- › **Secured platform** – HSM provides a secured platform, separated from the rest of the microcontroller by a firewall, thereby creating a trusted execution environment.
- › **Security standard compliance** – AURIX™ HSM fulfills SHE HIS and EVITA Medium standards, while the 2nd generation AURIX™ HSM supports up to Full EVITA. In addition to fulfilling the aforementioned standards, HSM generations provide additional functionalities.
- › **Backward compatibility** – AURIX™ security solutions are backward compatible with the security SHE HIS implementations in previous TriCore™ based microcontroller families. Furthermore, the 2nd generation AURIX™ HSM is backward compatible with the 1st generation HSM.
- › **Security differentiation** – customized secure OEM or tier1 crypto apps can be processed within a trusted HSM execution environment, therefore allowing an independent HSM-specific software code review with reference to the huge application host software from multiple parties. This helps to harden the security level by reliably avoiding potential security backdoors.
- › **Convergence of security and safety** – AURIX™ microcontrollers address both functional safety as well as IT-security requirements, making sure they are properly integrated and don't conflict with one another.
- › **Secured failure analysis** – AURIX™ HSM offers a 256-bit password for debugger access protection to prevent unauthorized access to the debugging resources.

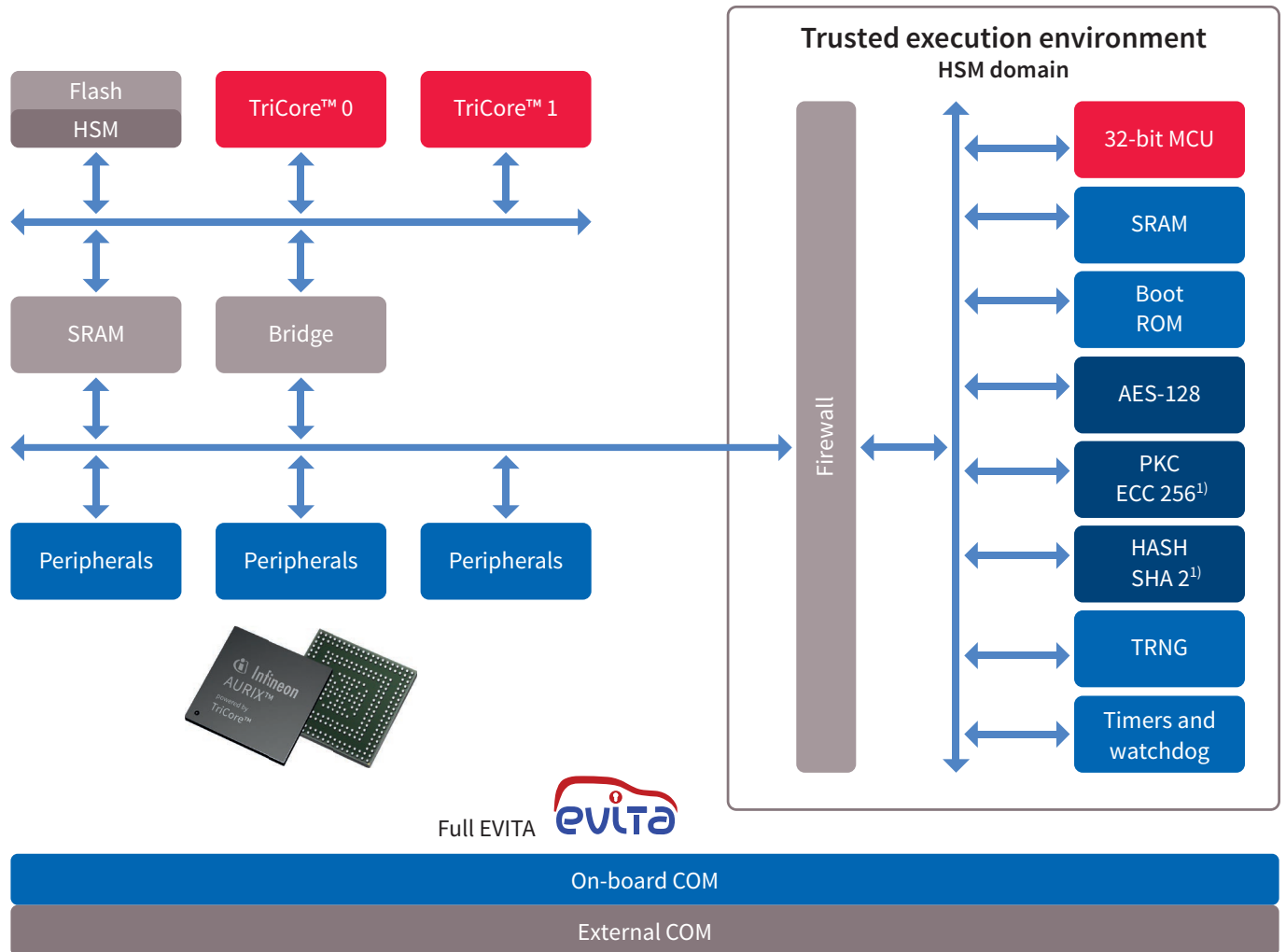
Typical use cases

- › Secured boot
- › Secured on-board communication
- › Software Over the Air (SOTA) updates
- › IP and tuning protection
- › Diagnostics via OBD/protected FAR flow/debug protection
- › Immobilizer



AURIX™ for automotive security

AURIX™ hardware security module –
anchor of trust thanks to separated logical protection domain



1) Only TC3xx

HSM domain creates a trusted execution environment

- > 32-bit ARM*) MCU separated by security firewall
- > Background integrity checks of host application

Root of trust functions

- > Integrity monitoring
 - Secure boot, on-the-fly checks
- > Secure key storage
 - Protected data and program flash
- > Strong key generation
 - AIS31-compliant True Random Number Generator (TRNG)
- > Crypto accelerators
 - Symmetric: hardware AES-128
 - Asymmetric: hardware ECC-256, SHA-2



*) ARM is trademarks of ARM Limited, UK



Infineon's AURIX™ 32-bit microcontroller family offers a wide portfolio of compatible devices with an embedded Hardware Security Module (HSM), which offers cost-efficient solutions for all typical automotive security applications. The SHE+ driver controls the hardware security peripheral in the HSM domain and interacts with the TriCore™ host core. SHE+ comes with

the AUTOSAR CRY interface for integrating the HSM security features into an automotive application, including interface to AUTOSAR, communication from TriCore™ to HSM and vice versa, key storage functionality and security peripheral drivers.



	SHE HIS	HSM SHE+ TC2xx	TC3xx crypto driver via partners
Key management	10 keys	20 keys	Configurable
Symmetric data encryption/decryption	hardware-based AES-128-bit (ECB, CBC)	•	•
MAC generation/verification	(optional)	•	•
Safe MAC verification	–	•	•
Random number management	SHE PRNG	•	•
Secure boot	(optional)	•	•
Debug access	–	Enhanced by HSM debug options	Enhanced by HSM debug options
Other SHE services	•	•	•
Asymmetric encryption/decryption	–	–	software-based RSA1024 software-based ECC256

Typical applications	Tuning protection 	Immobilizer  Secure-on-board communication 	Possible extensions, depending on specific tier 1/OEM use case
Key management	•	•	•
Symmetric data encryption/decryption	•	•	•
MAC generation/verification	•	•	•
Safe MAC verification		(optional)	(optional)
Random number management	•	•	•
Secure boot	(optional)	(optional)	(optional)
Debug access	(for development)	(for development)	(for development)
Other SHE services	•	•	•
Asymmetric encryption/decryption	•	•	•



Functional safety – ISO 26262



ISO 26262 defines the development of electric and electronic automotive systems with regard to their functional safety. The aim of this standard is to reduce possible hazards caused by the failure and malfunction of such systems. The safety requirements for the development process depend on the ASIL rating of the target application and can range from ASIL A to ASIL D. Applications such as steering or braking systems are rated with the highest ASIL D level. A failure in such a system can lead to an out-of-control vehicle, possibly resulting in fatal injuries.

All newly developed parts, which are addressing a certain safety goal will be based on an ISO 26262-compliant development flow, thereby allowing direct use in all safety-rel-

evant applications. Devices which are developed prior to the ISO 26262 as a QM part can nevertheless be used in ISO-compliant systems as outlined in part 8 clause 13 of the standard. In such cases, it is mandatory “to provide evidence of the suitability of hardware components and parts” for use in ISO-compliant systems and also to provide failure modes, their distribution and diagnostic capability.

To support our customers as they strive to achieve the highest ASIL on system level, Infineon provides PRO-SIL™ ISO 26262-ready products the necessary support for qualification of existing pre-ISO 26262 products, , and fully PRO-SIL™ ISO 26262-compliant products the future:

What does ISO 26262 compliant mean?



Infineon PRO-SIL™ ISO 26262-compliant safety sensors fulfil the properties required by the ISO 26262 (Automotive Safety) Standard. PRO-SIL™ ISO 26262-compliant product development follows a product specific safety plan defined by Infineon. The product development follows the Infineon V-model based development lifecycle which encompasses all ISO 26262 required activities and work products related to the product scope. Product relevant safety requirements and required metrics are captured and verified through the development of the product, this includes the product safety concept and ultimately a product safety case which provides the argumentation and evidence showing achievement of the defined safety requirements and process compliance, including all essential supporting processes.

An independent functional safety management organization supports the ISO 26262 conform safety lifecycle.

For ISO 26262-compliant products a Safety Manual and a Safety Analysis Summary Report can be delivered to our customers* in addition to Infineon standard documentation:

Moreover Infineon offers expert support for system integrators to achieve the required ASIL on system level. Infineon's activities result in a simplified integration in safety-related applications.

What does ISO 26262 ready mean?



ISO 26262 ready

Infineon PRO-SIL™ ISO 26262-ready sensors are developed according to Infineon's sophisticated Automotive Development and Quality Standards. For ISO 26262-ready products additional functional safety analysis will be provided. ISO 26262-ready enables our customers to use Infineon's (QM) products in safety related applications.

For ISO 26262-ready products Safety Manual and a Safety Analysis Summary Report can be delivered to our customers* in addition to Infineon standard documentation. These reports are provided to customers to serve as building block for their system level safety concept. Moreover Infineon offers expert support for system integrators to achieve the required ASIL on system level. Infineon's activities result in a simplified integration in safety-related applications.

Infineon PRO-SIL™



The functional complexity and levels of integration of real-time, safety-critical applications continue to increase.

Norms such as IEC 61508 and ISO 26262 mandate more robust products and functional safety concepts in automotive and industrial applications.

Infineon's PRO-SIL™ trademark designates Infineon products, which contain SIL-supporting (Safety Integrity Level) features. The SIL-supporting features are intended to assist the overall system design in attaining the desired SIL (according to IEC 61508) or A-SIL (according to ISO 26262) level for safety systems with high efficiency. Products with the PRO-SIL™ label will help you to select Infineon products for safety-relevant (automotive) systems.



Infineon's next level of zero defect program

On the way to zero-defect products and services

The most valuable aspect of cars is the people they carry. Therefore, safety should never be compromised. This is the most important consideration for everybody involved in making automobiles – from the smallest suppliers to the manufacturers themselves. As car components become more and more complex, and as the number of control units in vehicles increases, the likelihood of a product failure becomes greater. Quality performance is a key differentiator for automotive market success. Our target of Zero-Defect means:

- › No quality events
- › Defect-free product launches
- › Automotive product quality of zero failed parts per million
- › Low non-conformance costs
- › Highest quality image in the market
- › More business due to satisfied customers

No compromise when it comes to quality

Infineon established the most comprehensive quality program called “AUTOMOTIVE EXCELLENCE” in the semiconductor industry in 2003. The continuation of the successful “Automotive Excellence” program is “NEXT LEVEL of ZERO DEFECT”. The Program is founded on four pillars: people, products, processes and production. Due to our “no compromise” policy in all four pillars our program really works. Our employees truly live the credos of Zero Defect, considering the highest quality requirements and understanding the importance of prevention. They are trained to deeply understand the tools and methods used to avoid deviations and to solve problems by addressing both technical and systemic root causes.

On the way to zero-defect products

On the way to zero-defect products, some examples:

- › BEAR (Back End Automation Roadmap) project reduces manual handling“
- › Top5 Defects Reduction in Backend” deeply addresses technical and systemic root causes
- › Quality Firewall: Subproject “Highest outgoing product quality by intelligent outlier screening”
- › Extend “Next Level of Zero Defect” into supplier base

“Next Level of Zero Defect” is your competitive advantage

Many of our partners have expressed their satisfaction with the quality of our products and the way we execute “Next Level of Zero Defect”.

- › „Honor Quality Award Toyota Hirose“ received in 2010 for zero defect quality for last four years. Infineon is the First non- Japanese company that received this honour in this highest level category.
- › 7 quality awards in 2004, 2006, 2007, 2008, 2009, 2010 and 2011 from Toyota's Hirose plant.
- › “Supplier Performance Award” for the year 2008 and “Automotive Supplier of the Year 2009, 2010 and 2011” from Continental
- › “Excellent Supplier Award 2008” from Hitachi Cable Japan

Our quality is clearly seen as the industry benchmark by almost all of our automotive customers.



Where to buy

Infineon distribution partners and sales offices:

www.infineon.com/WhereToBuy

Service hotline

Infineon offers its toll-free 0800/4001 service hotline as one central number, available 24/7 in English, Mandarin and German.

- › Germany 0800 951 951 951 (German/English)
- › China, mainland 4001 200 951 (Mandarin/English)
- › India 000 800 4402 951 (English)
- › USA 1-866 951 9519 (English/German)
- › Other countries 00* 800 951 951 951 (English/German)
- › Direct access +49 89 234-0 (interconnection fee, German/English)

* Please note: Some countries may require you to dial a code other than "00" to access this international number.
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