Driving the Future of Automotive Electronics

Automotive Application Guide




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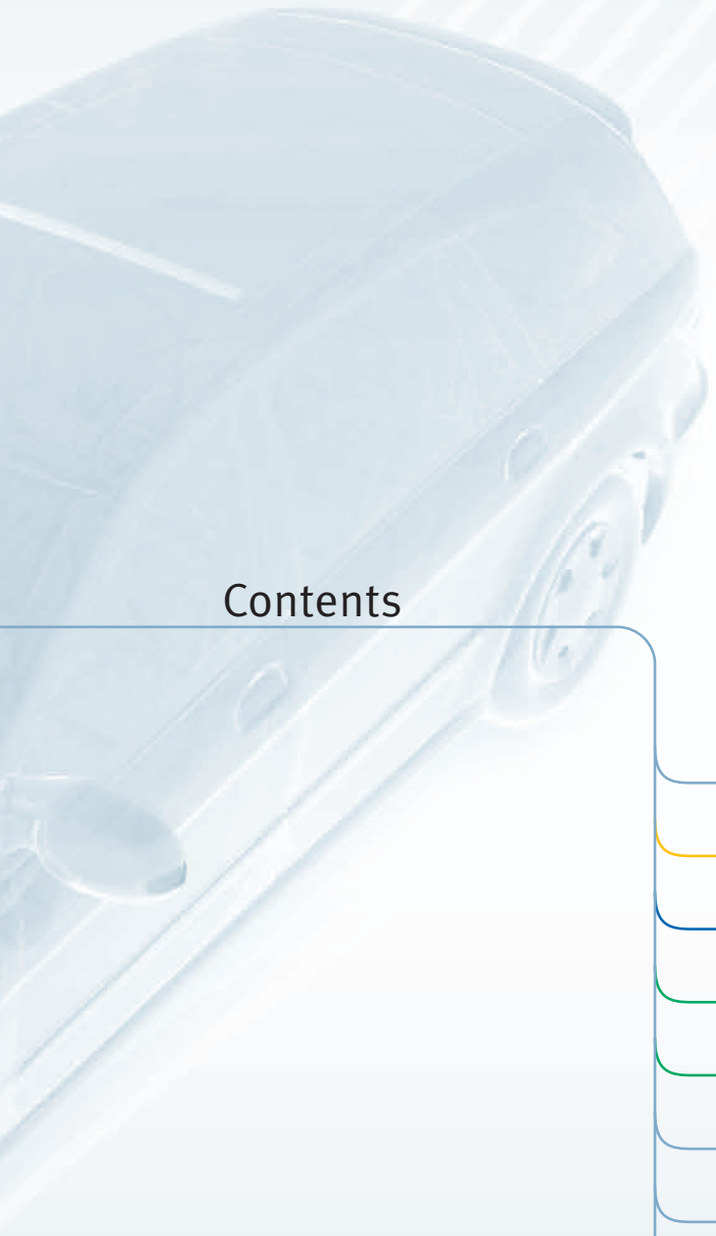

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Driving the Future of Automotive Electronics

Infineon Technologies 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, 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.

Reducing road fatalities

Stakeholders in road traffic worldwide are looking for ways to reduce road fatalities. The automotive industry actively contributes to road safety by developing and evolving technologies that reduce the likelihood or impact of accidents. For example, it is working to improve reactive features such as 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 happens.

Infineon is continually optimizing the chipsets that enable the safety features designed to reduce the number of road accidents. We lead the field in many safety innovations, including tire pressure sensor systems and RADAR.

Paving the way for more sustainable mobility choices

In an increasingly 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 increasing 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.

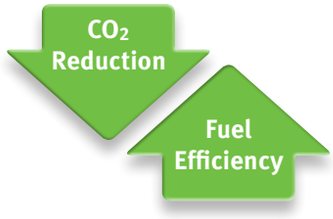
Meeting increased data security demands

As system complexity increases in cars, so too does the volume of data to be processed and distributed. Automakers therefore need to ensure that information is processed securely and protected against external access and manipulation (e.g. car tuning, 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 take automotive data security to the next level.

With our components delivering cost-effectiveness, high efficiency and power density, Infineon is driving the future of automotive electronics and paving the way for market-viable and affordable electromobility.

Approaching Functional Safety requirements

The increasing number of electronic systems leads to more and more considerations for functional safety of the vehicle systems. Infineon has adopted the ISO Standard 26262 to design the appropriate products but also to set up the appropriate processes for developing such products.



Green arrows indicate specific systems which can contribute to reducing CO_2 emissions and increasing fuel efficiency.

The listed figures refer to the following baselines:

CO_2 reduction in g/km:
160g CO_2/km on average European cars (2007)

CO_2 reduction in g/km:
85g CO_2/km on average Asian motorcycle (2010)

Fuel efficiency standard in the US:
54.5 mpg (miles per gallon)
CAFE 2025

Safety Applications

Electronics play a key role in improving road safety. Nowadays, both customer demands and government legislation continue to improve traffic safety. In addition electric power steering is a good example of how safety application perfectly combines with increased fuel efficiency and enhanced comfort.

Infineon is one of the few broadband suppliers 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 of four decades in automotive experience – means we are ideally positioned to help customers overcome their key challenges.

These challenges include ongoing application optimization plus 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 efficiently reach the desired Automotive Safety Integrity Level (ASIL) certification, Infineon has already introduced its PRO-SIL™. This trademark clearly marks the products which contain SIL-supporting features. The Infineon PRO-SIL™ concept includes safety focused organization and business processes to generate hard and software safety features including safety documentation.

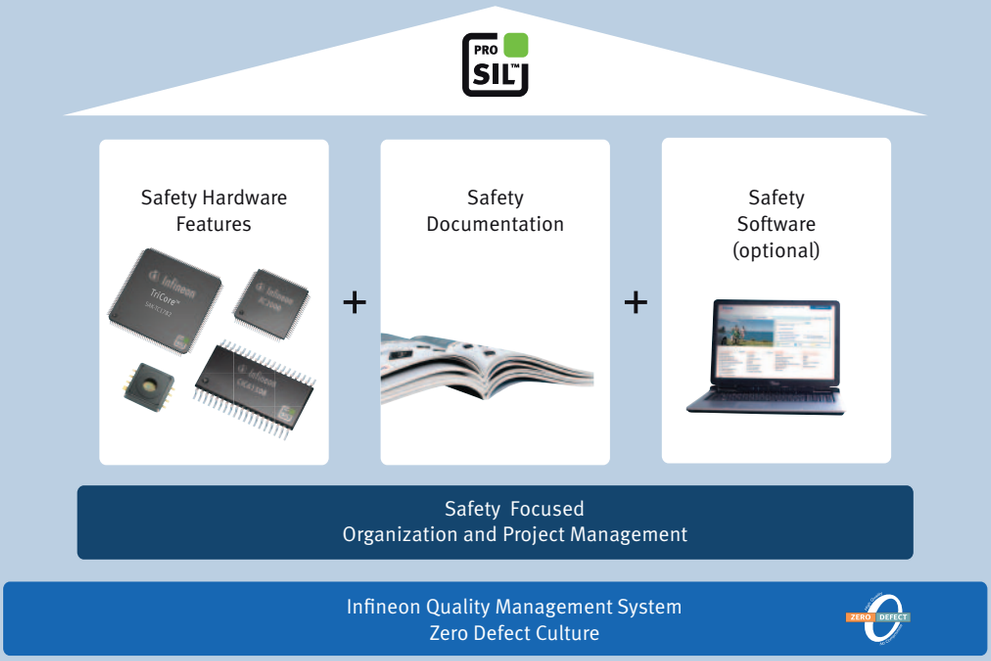
The functional complexity and levels of integration of real-time safety-critical applications continue to increase exponentially. In addition, the product life cycle of these applications has to meet stringent safety standards. The ISO 26262 mandates more robust and comprehensive product development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

Infineon's PRO-SIL™ concept enables efficient ISO 26262 compliant safety application development. Across the full certification spectrum from Automotive Safety Integrity Levels ASILA to ASILD, our end-to-end PRO-SIL™ approach will help you with the assurance that Infineon hardware, software and functional safety concepts meet your design and compliance needs.

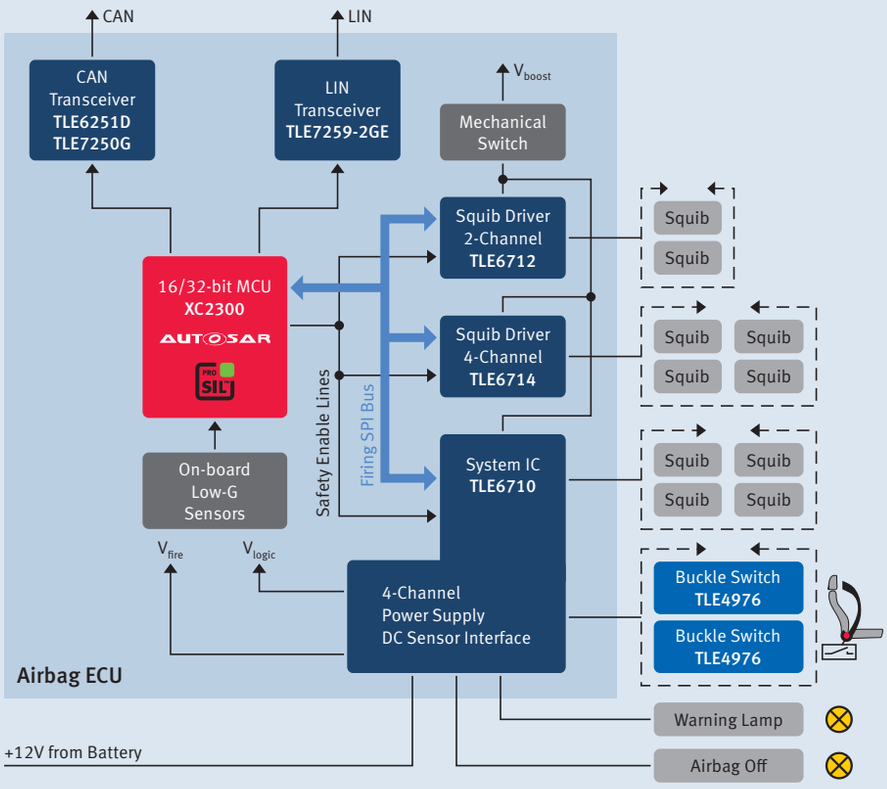
PRO-SIL™ Highlights

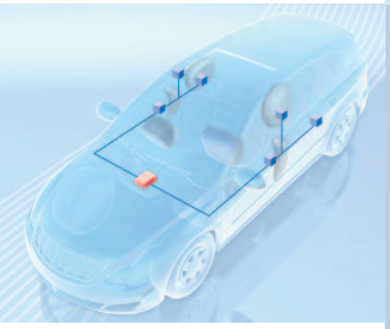
- Broad hardware portfolio from sensors to microcontrollers, along with analog and power management ICs providing SIL-supporting features.
- For ISO 26262 PRO-SIL™ products, safety concepts are in place to enable the required safety measures, testing, monitoring and diagnostics capabilities for your safety architecture.
- Comprehensive safety software packages for integration are in place, such as the SafeTlib software for Infineon's AURIX™ microcontroller family.
- Full range of support services – from consulting and design advice, including training, documentation and technical support – can be provided.
- Safety-focused organization and project management based on Infineon's Zero Defect Program, Safety Culture and Quality Management System are in place.

Infineon's PRO-SIL™ logo guides you to our products (HW, SW, Safety Documentation) with SIL-supporting features. These products will simplify the implementation of customers' system design and improve time-to-market in achieving the desired functional safety level compliance.



Airbag System (Basic)





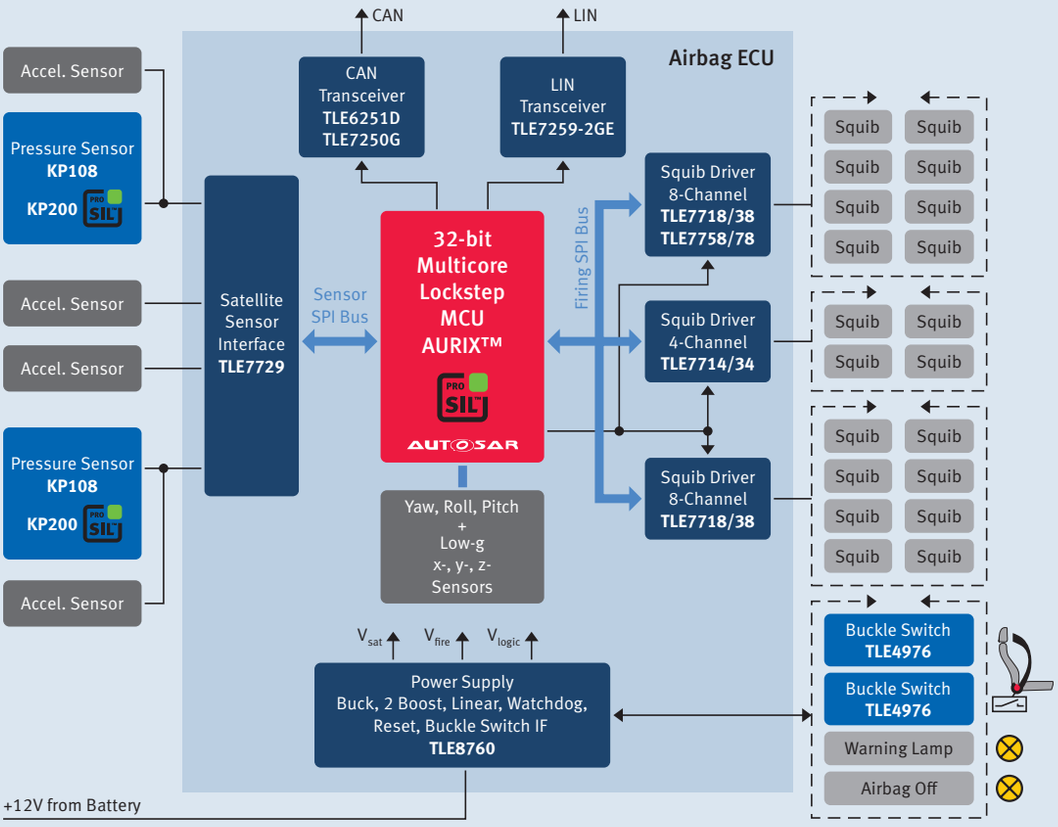
System Benefits

- Infineon's chipset for basic airbag systems supports low-cost designs for emerging markets
- The 16/32-bit microcontroller offers a 32-bit performance at the cost of a 16-bit system
- Dedicated mixed-signal airbag ASSPs provide flexibility and scalability for up to ten firing loops

Suggested Products

Product	Description
XC23xx	Powerful 16/32-bit microcontroller family with dedicated safety features (PRO-SIL™)
TLE6712/14	Squib driver ICs for two, four loops
TLE6251D/TLE7250G	CAN transceivers
TLE7259/TLE7259-2GE	LIN transceiver
TLE4976	Hall switches for buckle switch applications

Airbag System (Advanced)



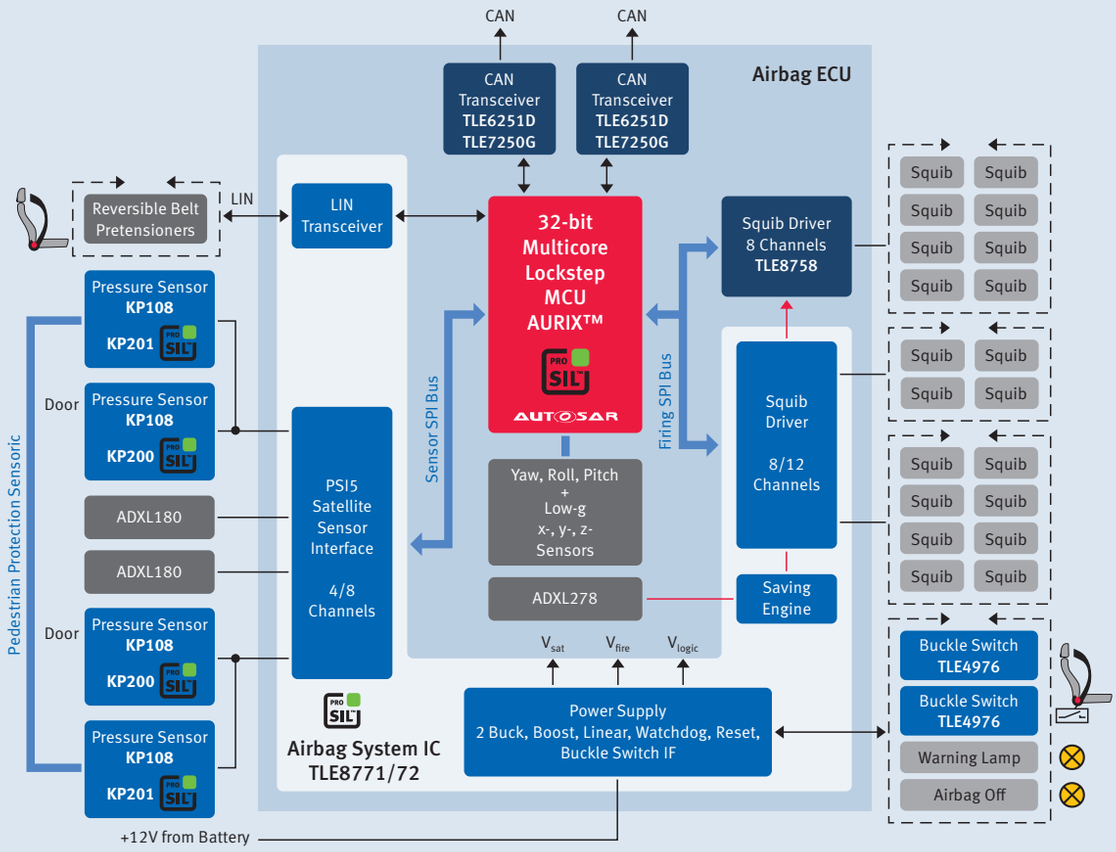
System Benefits

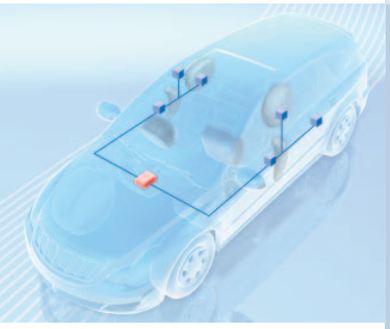
- Infineon's broad product spectrum supports scalability and flexibility for building systems with 4 up to more than 20 firing loops
- Full range of airbag ASSPs ranging from pressure sensors for side crash detection to driver and transceiver ICs
- High performance 32-bit AURIX™ MCU family with dedicated safety functions ranging from single core up to two cores with lock step mode
- AURIX™ 32-bit multicore architecture includes encapsulation features to support freedom of interference of multiple applications
- Availability of AUTOSAR 4.x
- The parts are optimized in terms of system interoperability as well as best price/performance

Suggested Products

Product	Description
AURIX™	32-bit high performance microcontroller family ranging from single core up to multiple core implementations (PRO-SIL™)
TLE7714/34/18/38/58/78	Airbag deployment ASSPs
TLE7729	Airbag satellite receiver
TLE6251D/TLE7250G	CAN transceivers
TLE7259/TLE7259-2GE	LIN transceiver
KP108	Application-specific sensor for side airbag pressure sensing
KP200	Application-specific sensor for side airbag pressure sensing; fully PSI5-compliant (PRO-SIL™)
TLE4906/76	Hall switches for buckle switch application

Airbag System (Integrated)





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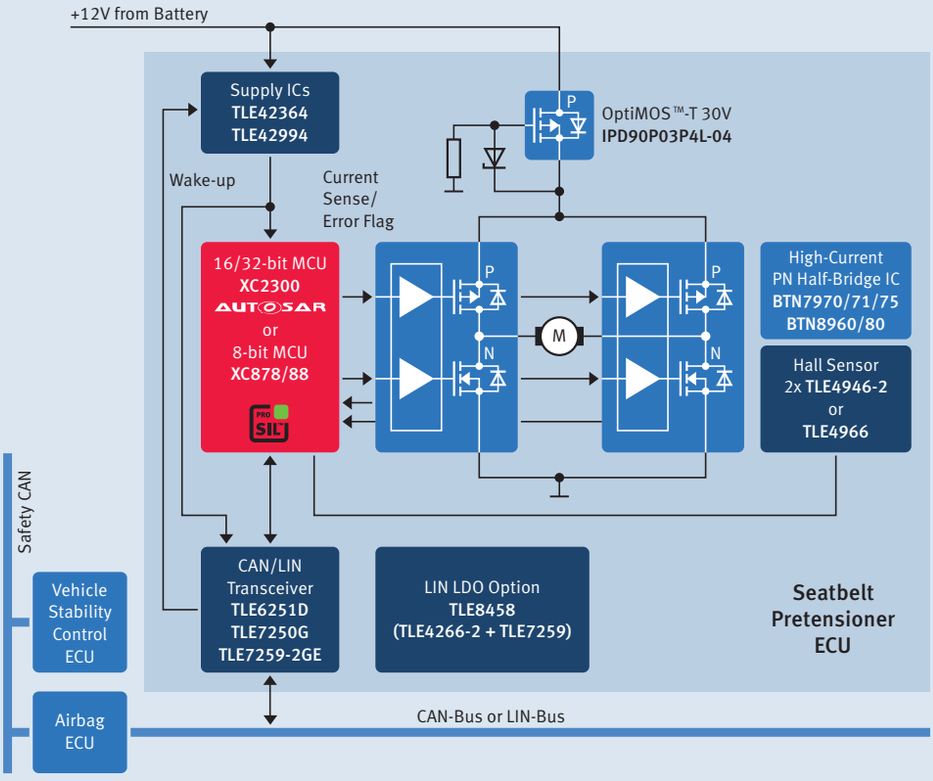
Suggested Products

Product	Description
AURIX™	32-bit high performance microcontroller family ranging from single core up to multiple core implementations (PRO-SIL™)
TLE6251D/TLE7250G	CAN transceivers
TLE4976	Hall switches for buckle switch application
TLE8771/72	Airbag System IC including power supply, PSI5 interface, LIN transceiver, 8 or 12 squib drivers
KP180	Application-specific sensor for side airbag pressure sensing
KP200	Application-specific sensor for side airbag pressure sensing; fully PSI5-compliant (PRO-SIL™)
KP201	Application-specific sensor for pedestrian protection sensing (PRO-SIL™)

Reversible Seatbelt Pretensioner



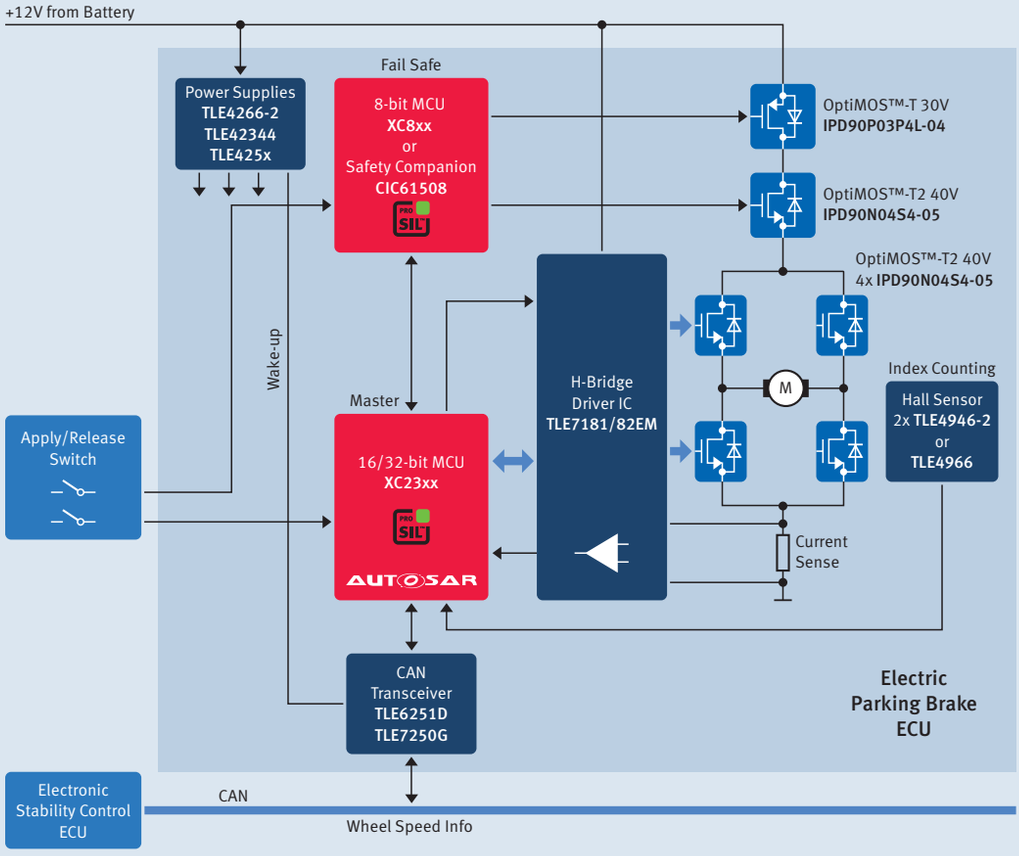
System Benefits

- 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 in normal use
- Safety experts predict that reversible seatbelt pretensioners will become mainstream in the future
- This illustration shows the partitioning of an Infineon system solution for this application which includes supply, microcontroller, sensor, power and communication ICs

Suggested Products

Product	Description
XC2300	Powerful 16/32-bit microcontroller family with dedicated safety features (PRO-SIL™)
TLE6251D/TLE7250G	CAN transceivers
TLE7259-2GE	LIN transceiver
TLE4946-2/TLE4966	Hall switches for position/rotation sensing
Supply ICs	Linear voltage regulators, DC/DC converters
BTN79xx/BTN89xx	High current PN half bridge ICs
TLE4946/TLE4966	Hall sensors for rotor index counting

Electric Parking Brake



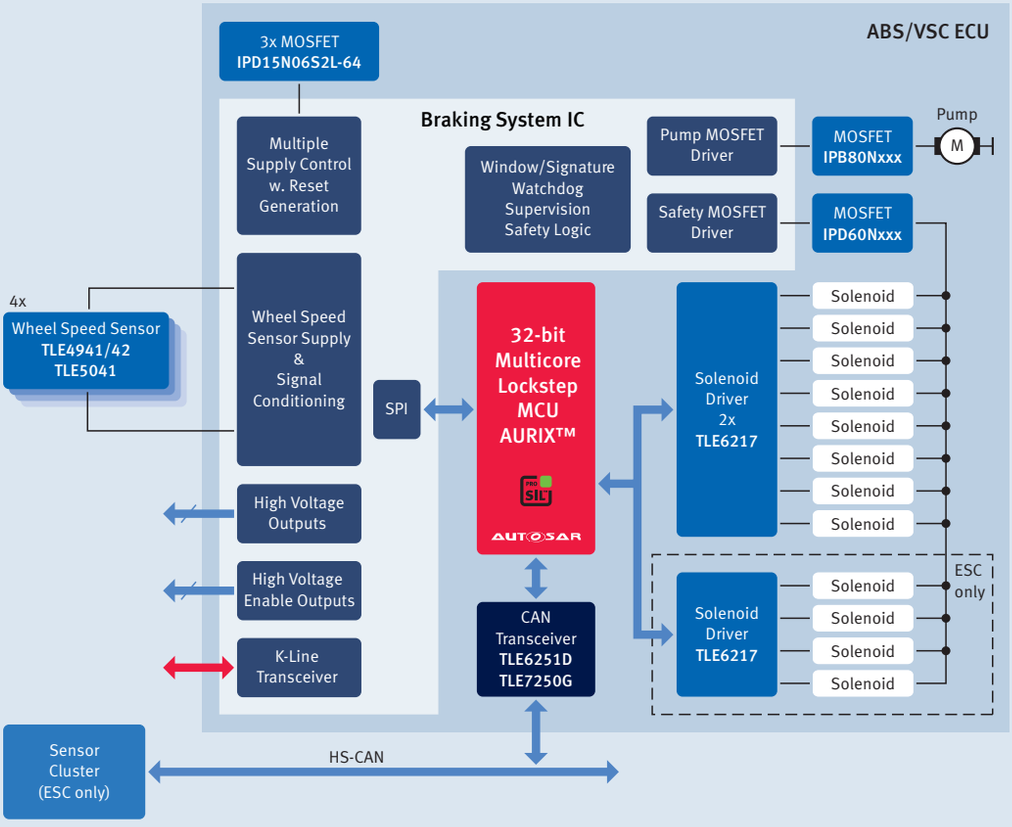
System Benefits

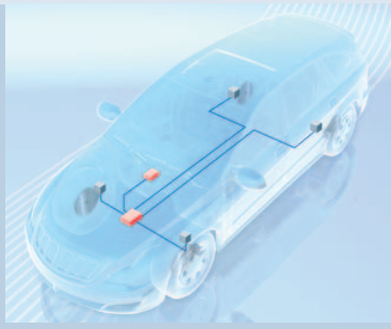
- The electric parking brake provides many more comfort and convenience features to drivers than the standard mechanical system
- Hill hold, launch control, roll-away prevention
- These convenience features are also safety-relevant, so they must be implemented using safety-capable hardware (according ISO 26262)

Suggested Products

Product	Description
XC2300	Powerful 16/32-bit microcontroller family with dedicated safety features (PRO-SIL™)
XC8xx	8-bit microcontroller family with dual-cycle 8051 core (PRO-SIL™)
CIC61508	Safety companion IC
TLE7181/82	H-Bridge driver ICs
TLE6251D/TLE7250G	CAN transceivers
IPD90N04S4-05	OptiMOS™-T 40V n-channel MOSFET family
TLE4946/66	Hall sensors for rotor index counting

Braking ECU System





System Benefits

- Scalability over Flash, RAM, performance and peripherals leads to an optimized cost-performance fit
- Proven safety concept to support ISO 26262 validated by 3rd party
- Innovative supply concept leads to best-in-class power consumption and saves external component costs
- The AURIX™ multicore architecture includes encapsulation features to support freedom of interference of multiple applications
- Availability of AUTOSAR 4.x

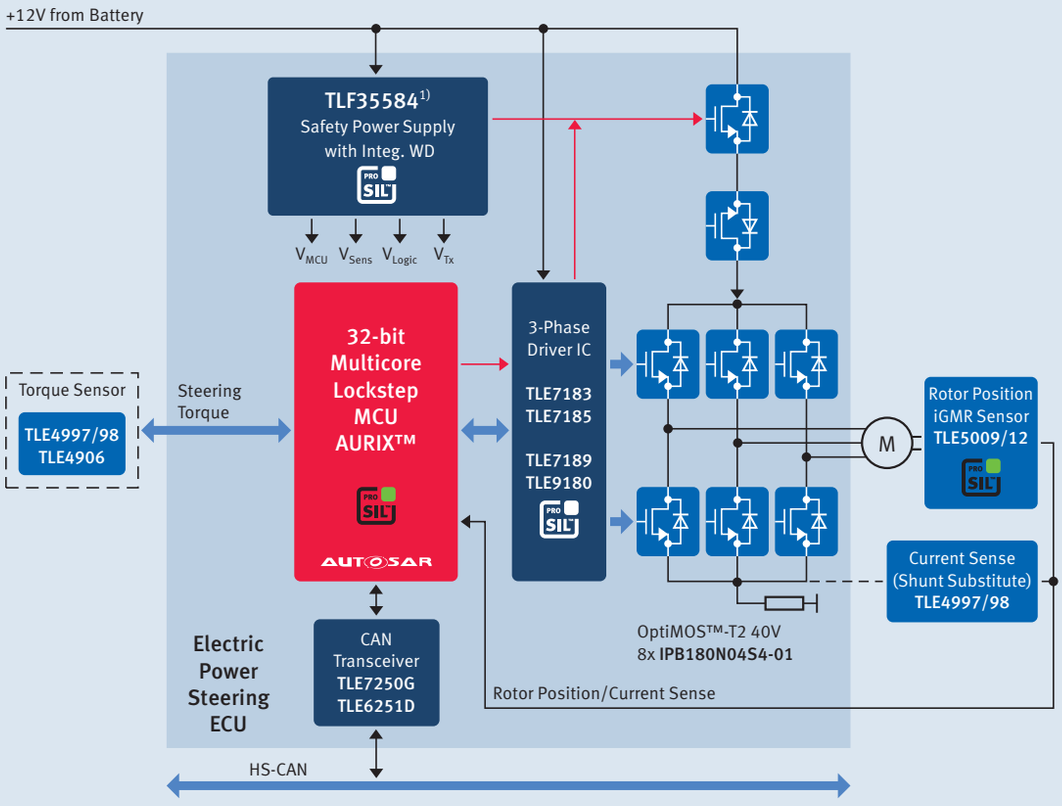
Suggested Products

Product	Description
AURIX™	High-performance 32-bit multicore microcontroller family (PRO-SIL™)
TLE6251D, TLE7250G	CAN transceivers
TLE6217	Quad solenoid driver
IPD60Nxxx	OptiMOS™ n-channel MOSFET family
TLE4941/42, TLE5041	Wheel speed sensors

CO_2 Reduction
5.9 g/km

Fuel Efficiency
1.3 mpg

Electric Power Steering (EPS)



System Benefits

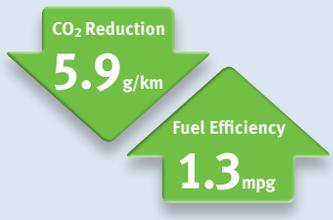
- EPS increases fuel efficiency by approximately 3% while improving car handling, driving experience and comfort
- These EPS systems combine a compact design and reduced mounting costs with the ability to be adapted by software to suit diverse car models as well as dedicated driving modes
- EPS is the steering technology needed to enable advanced driver assist systems such as side-wind compensation, lane assist/keeping and parking aid assist systems
- Infineon has over ten years of experience in this exciting application and provides the full range of ICs, from sensor to microcontroller, from bridge driver to world-class MOSFETs

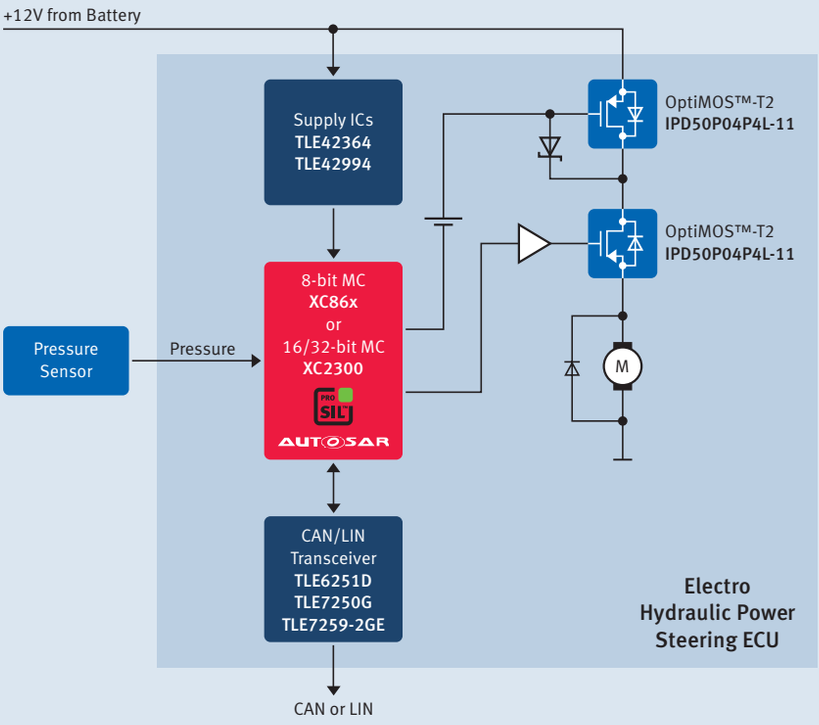
Suggested Products

Product	Description
AURIX™	High-performance 32-bit multicore microcontroller family (PRO-SIL™)
TLF35584[1)]	System power supply with integrated watchdog (PRO-SIL™)
TLE718x	3-phase bridge driver IC family for EPS
TLE9180	3-phase bridge driver IC for EPS (PRO-SIL™)
TLE6251D/TLE7250G	CAN transceivers
TLE9221SX	FlexRay transceiver
IPB180N04S4-01	OptiMOS™-T 40V n-channel MOSFET family, optimized for EPS applications
TLE499x	Linear hall sensor family for torque and current sensing
TLE5009/12	iGMR sensors for rotor position sensing

1) In development

Electro Hydraulic Power Steering (EHPS)





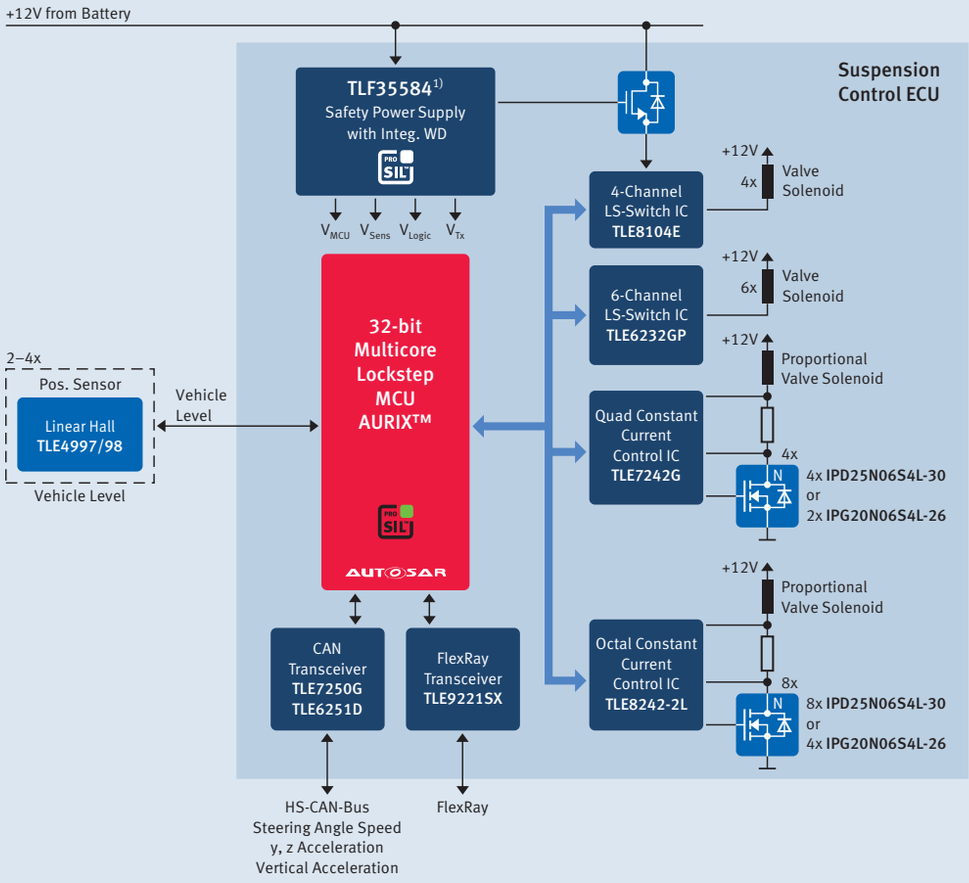
System Benefits

- EHPS substitutes the belt-drive of conventional hydraulic power steering systems with an electric pump motor
- EHPS enables demand-controlled operation of the steering system, therefore optimizing fuel efficiency and CO_2 emissions by approximately 3%
- EHPS generates fuel-efficiency benefits that are almost on a par with those of EPS, but at a minimum cost
- EHPS systems are therefore very attractive for the low-cost car segment, where advanced assist functionality is not mandatory

Suggested Products

Product	Description
XC2300	Powerful 16/32-bit microcontroller family with dedicated safety features (PRO-SIL™)
XC86x	8-bit microcontroller family with dual-cycle 8051 core
Supply ICs	Linear voltage regulators, DC/DC converters
TLE6250D/TLE7250G	CAN transceivers
TLE7259-2GE	LIN transceiver
IPD50P04P4L-11	OptiMOS™-T2 40V p-channel MOSFET family

Suspension Control



System Benefits

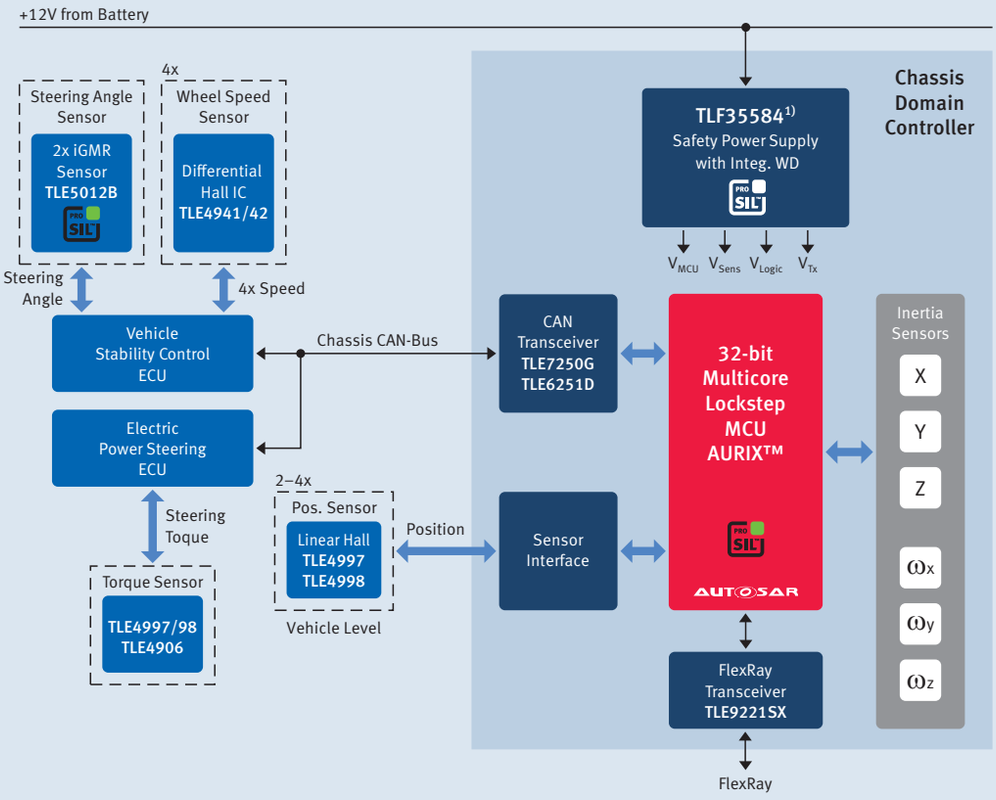
- Advanced suspension systems originally used in high-end sports and luxury cars are now prevalent in the mid-market car segment
- By adapting both the vehicle's car level and damping characteristics, these systems significantly improve car comfort, handling performance and driving safety
- Thanks to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

Suggested Products

Product	Description
AURIX™	High-performance 32-bit multicore microcontroller family (PRO-SIL™)
TLF35584[1)]	System power supply with integrated watchdog (PRO-SIL™)
TLE6232GP	6-channel low-side switch IC
TLE8104E	4-channel low-side switch IC
TLE7242G	Quad constant current pre-driver IC
TLE6251D/TLE7250G	CAN transceivers
TLE9221SX	FlexRay transceiver
TLE8242-2L	Octal constant current pre-driver IC
TLE4997/98	Linear hall sensors for vehicle level sensing

1) In development

Chassis Domain Control



System Benefits

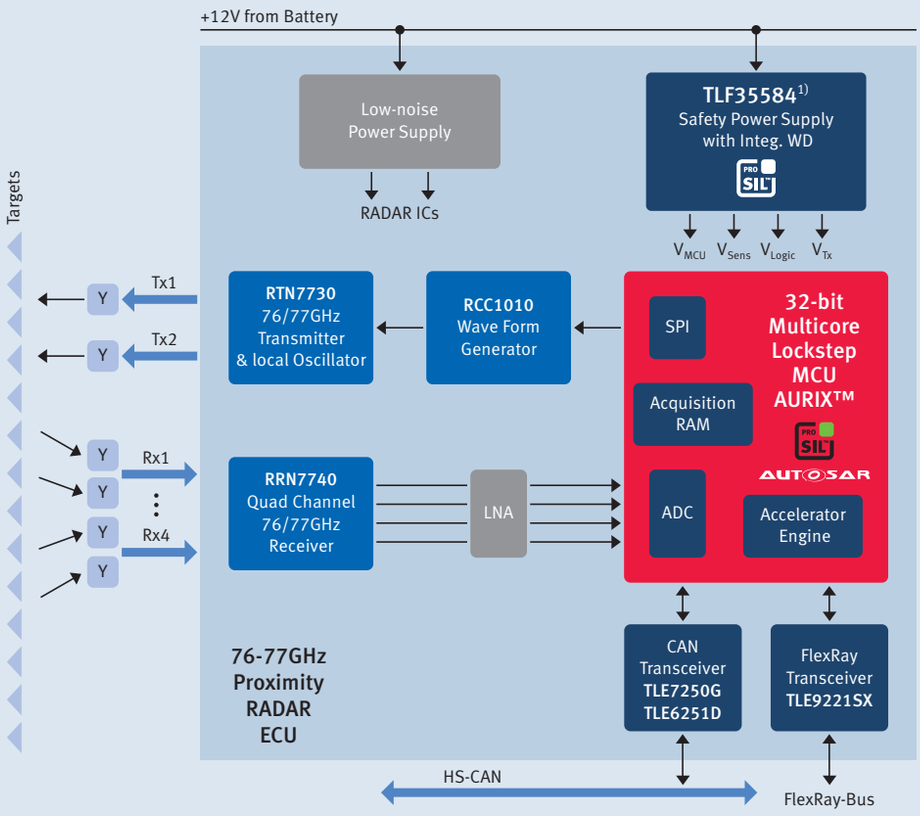
- The chassis domain control approach provides a high-performance, scalable and safe computing platform which already includes the sensor-cluster with all its multi-axle inertia sensors
- This approach allows a cost-efficient x-check and fusion of the inertia sensor signals, as well as highly-efficient and safe computing of the vehicle dynamic model
- Consequently, the chassis domain control unit is a promising approach to perfectly coordinate functions like VSC, semi-active suspension and drivetrain, especially when four-wheel drive with torque vectoring is required
- The AURIX™ multicore architecture includes encapsulation features to support freedom of interference of multiple applications
- Availability of AUTOSAR 4.x

Suggested Products

Product	Description
AURIX™	High-performance 32-bit multicore microcontroller family (PRO-SIL™)
TLF35584 1)	System power supply with integrated watchdog (PRO-SIL™)
TLE6251D/TLE7250G	CAN transceivers
TLE9221SX	FlexRay transceiver
TLE5012	iGMR Sensor with integrated 8-bit microcontroller
TLE4997/98	Linear hall sensors

1) In development

Long/Mid Range RADAR 77GHz



System Benefits

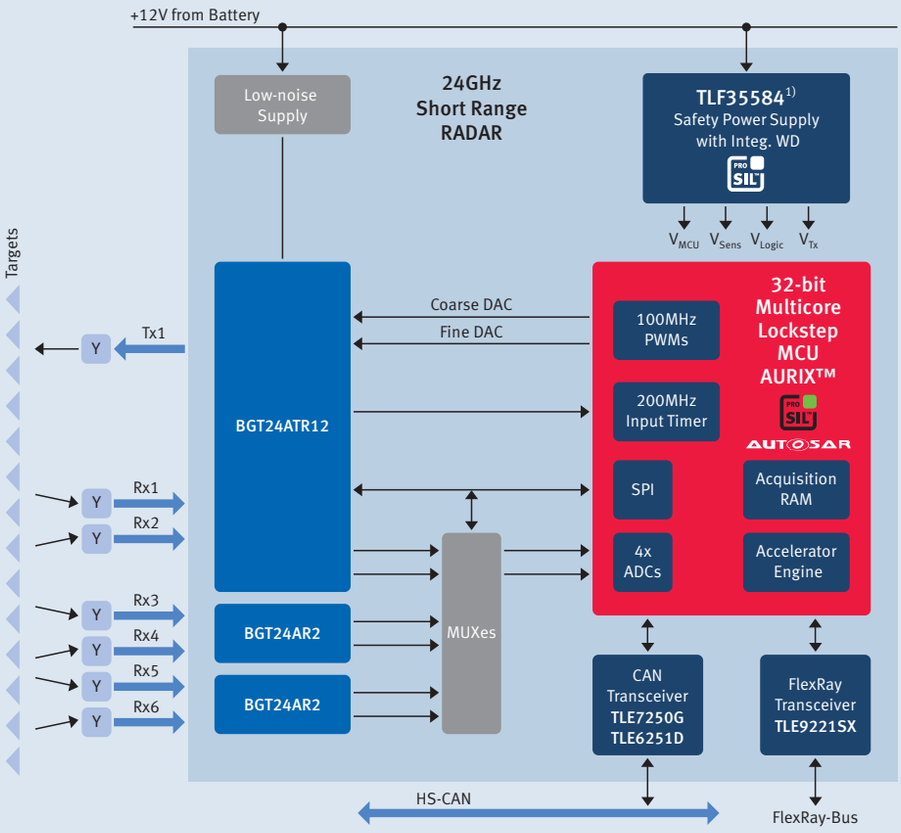
- Infineon's AURIX™ 32-bit Multicore ADAS derivative offers a dedicated feature set for RADAR applications which in many cases makes additional DSP, external SRAM and external ADC ICs obsolete. This results in a cost efficient short range RADAR implementation
- The RADAR System IC (RASIC™) series consists of a group of highly-integrated functions for the 76–77GHz for automotive long and midrange RADAR systems
- 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 are its high-frequency capability and robustness, which make it suitable for automotive environments over the full temperature range up to full automotive qualification according to AEC-Q100

Suggested Products

Product	Description
AURIX™	Powerful 32-bit multicore microcontroller family with dedicated ADAS features (PRO-SIL™)
TLF35584[1)]	System power supply with integrated watchdog (PRO-SIL™)
TLE6251D/TLE7250G	CAN transceivers
TLE9221SX	FlexRay transceiver
RTN7730	76/77GHz RADAR 2 channel transmitter IC
RRN7740	76/77GHz RADAR 4 channel receiver IC
RCC1010	Wave form generator IC

1) In development

Short Range RADAR 24GHz



System Benefits

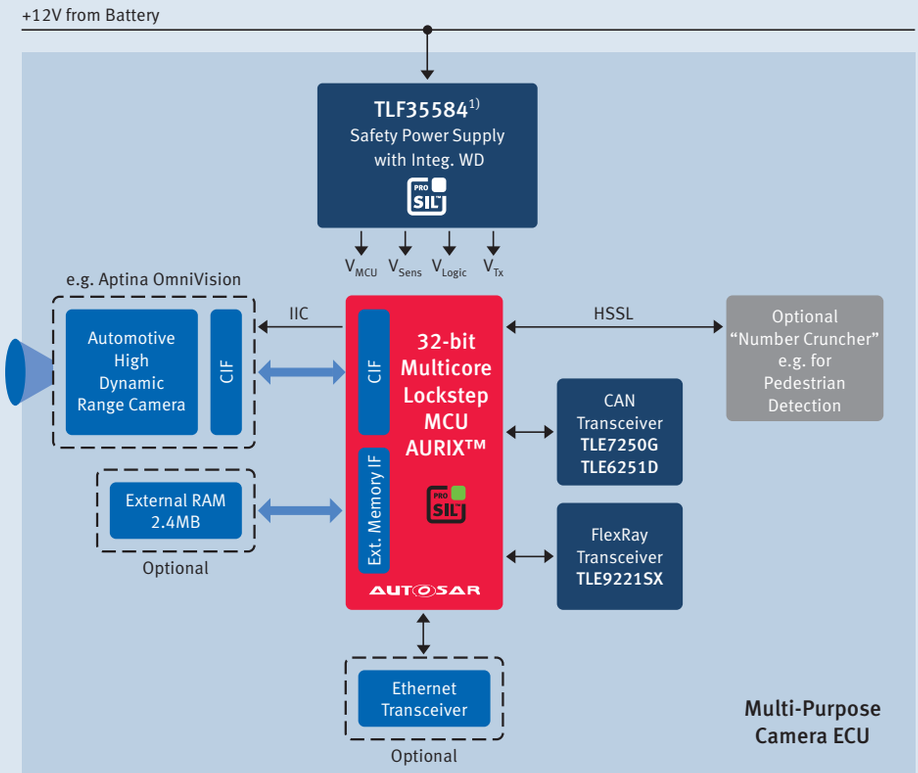
- Infineon's AURIX™ 32-bit Multicore ADAS derivative offers a dedicated feature set for RADAR applications which in many cases makes additional DSP, external SRAM and external ADC ICs obsolete. This results in a cost efficient short range RADAR implementation.
- The Infineon 24GHz Transceiver is a highly integrated, SPI controlled solution comprising 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 the SiGe based technology Infineon is the first big market player who offers a competitive solution with a long term roadmap approach for any kind of Short Range RADAR ADAS applications.

Suggested Products

Product	Description
AURIX™	Powerful 32-bit multicore microcontroller family with dedicated ADAS features (PRO-SIL™)
TLF35584[1)]	System power supply with integrated watchdog (PRO-SIL™)
TLE6251D/TLE7250G	CAN transceivers
TLE9221SX	FlexRay transceiver
BTG24AR2	24GHz RADAR 2-channel receiver IC
BGT24ATR12	24GHz RADAR 1 channel transmitter 2-channel receiver IC

1) In development

Multi-Purpose Camera Configuration



System Benefits

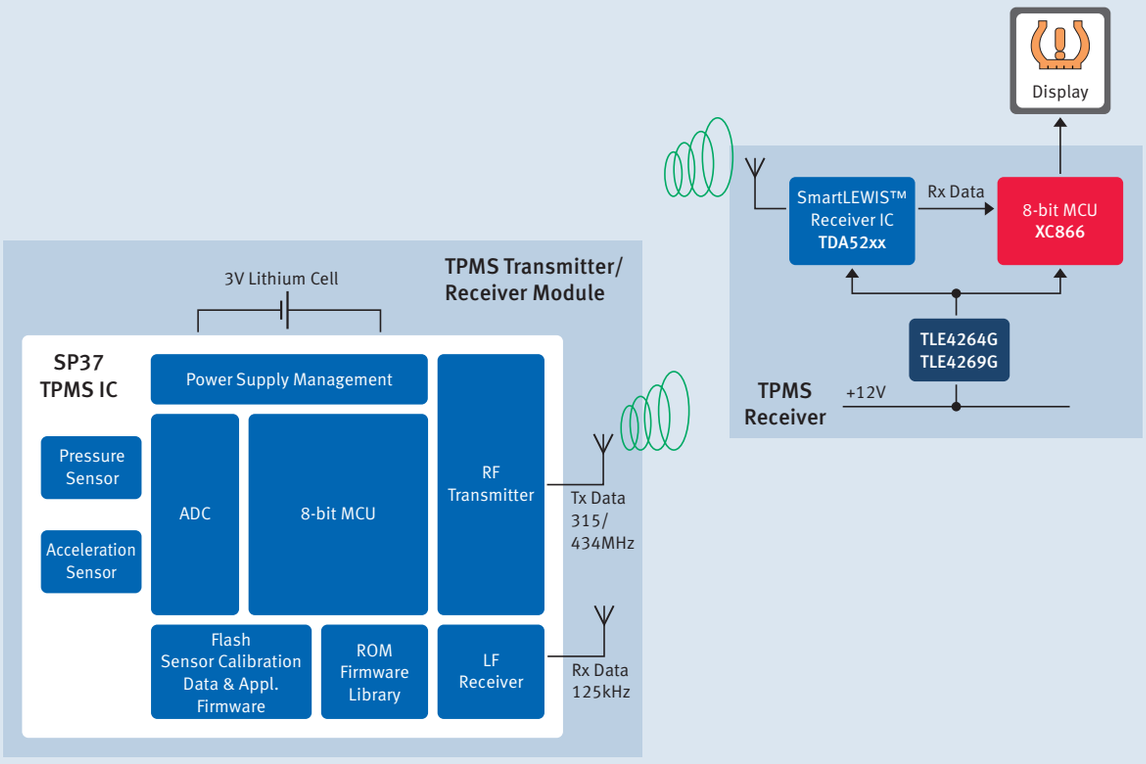
- High scalability option allows a dedicated performance feature fit for multiple camera applications from single automatic high beam systems up to multi-function systems (lane departure warning, forward collision warning, traffic sign recognition, pedestrian recognition etc.)
- High integration leads to reduced complexity
- Support for ISO 26262 decisions such as emergency braking
- Innovative supply concept leads to best-in-class power consumption
- The AURIX™ multicore architecture includes encapsulation features to support freedom of interference of multiple applications
- Availability of AUTOSAR 4.x

Suggested Products

Product	Description
AURIX™	High-performance 32-bit multicore microcontroller family (PRO-SIL™)
TLF35584[1)]	System power supply with integrated watchdog (PRO-SIL™)
TLE6251D/TLE7250G	CAN transceivers
TLE9221SX	FlexRay transceiver

1) In development

Tire Pressure Monitoring System (TPMS)

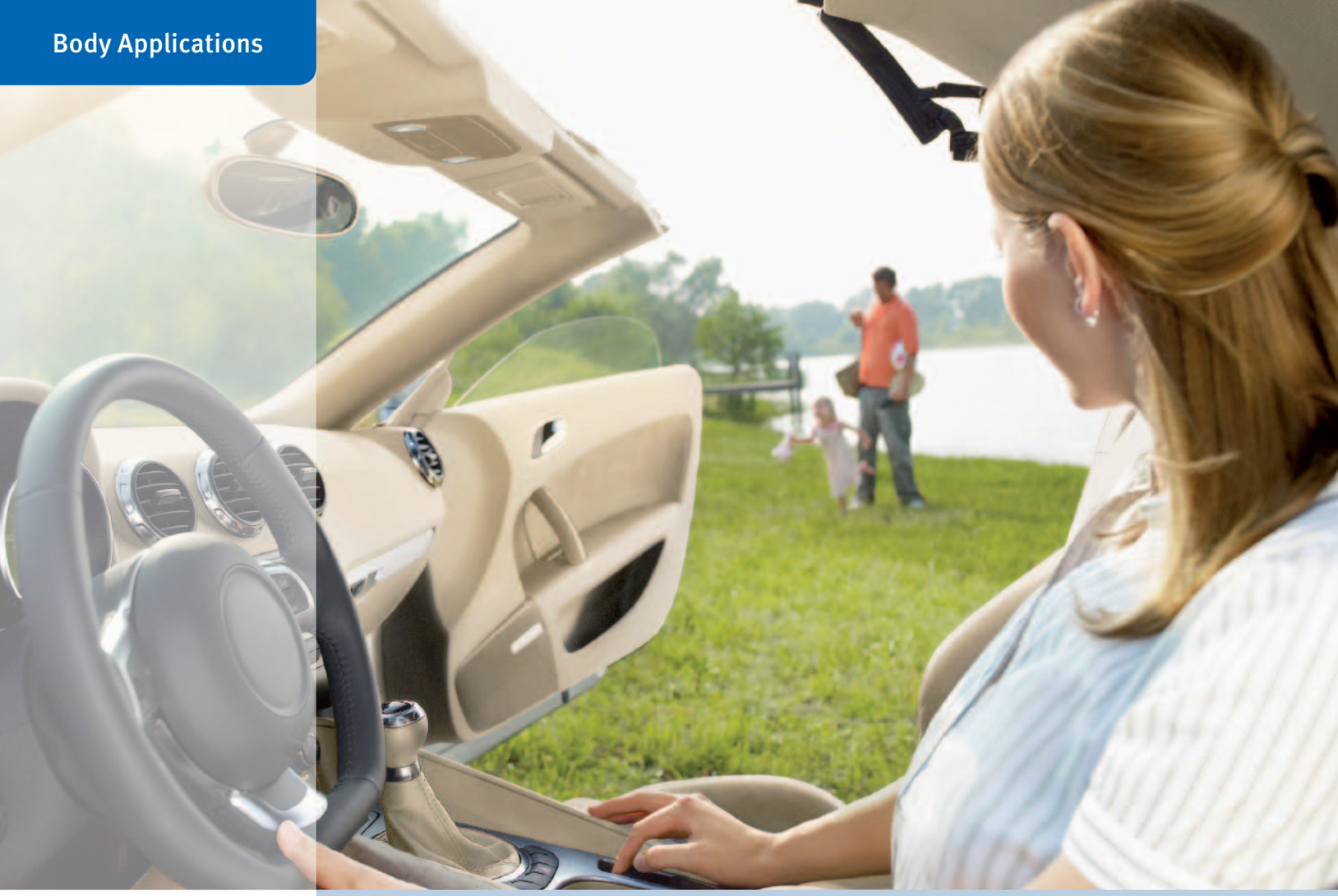


System Benefits

- 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/CO_2 emissions
- TPMS is already mandatory in the USA. In EU and Korea legislation requires TPMS also from Nov 2012/Jan 2013 on
- Infineon's TPMS IC SP37 provides
  - Various surveillance functions ensuring reliable measurements
  - Pre-calibrated pressure sensor system for instant use
  - Fully packaged sensor system proven to withstand harsh automotive environments
  - Microcontroller-based architecture enables flexible system design
  - High integration level to reduce overall system component count
  - Increases tire lifetime by up to 30%

Suggested Products

Product	Description
XC8xx	8-bit microcontroller family with dual-cycle 8051 core
Supply ICs	Linear voltage regulators, DC/DC converters
TDA52xx	SmartLEWIS™ RX autonomous receiver
TDK51xx	Wireless control transmitter
SP37	Highly integrated TPMS with integrated microcontroller and RF transmitter for pressure ranges 450kPa, 900kPa, 1300kPa (Trucks)



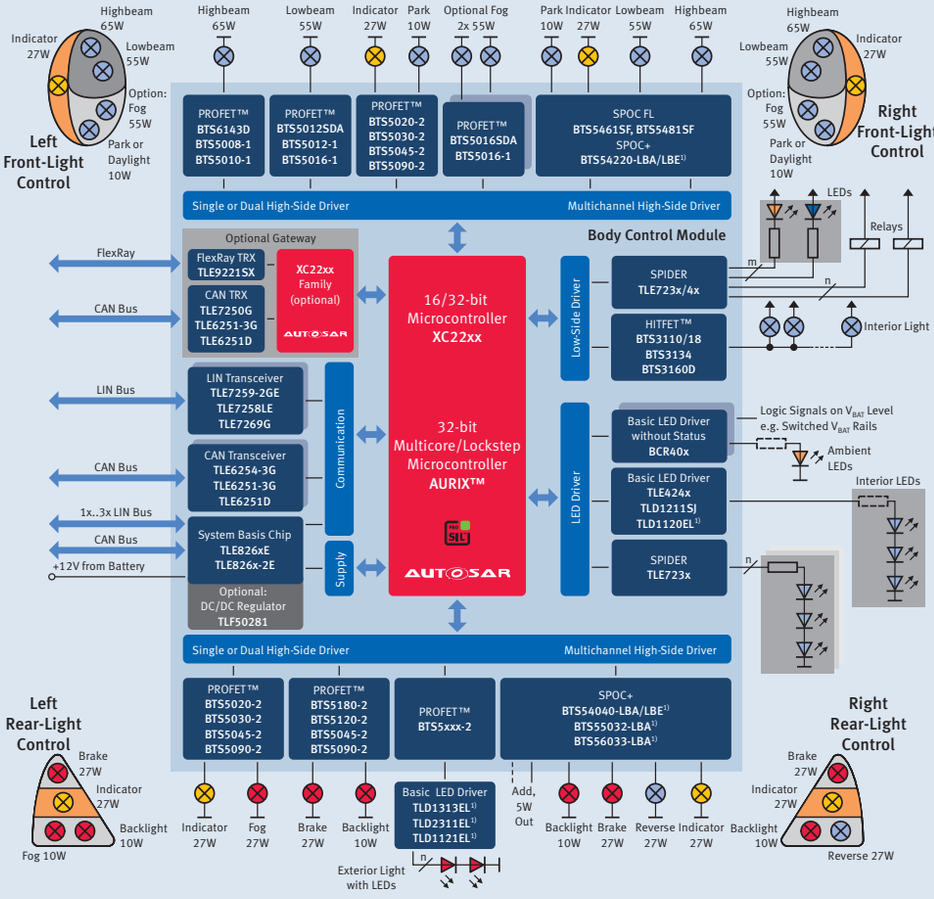
Body Applications

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. Our powerful 16/32-bit XC2200 family and our low-cost 8-bit XC800 family deliver all the intelligence required at the heart of today's automotive body systems. The new TriCore™ based AURIX™ family provides enough performance as well as dedicated safety and security features for upcoming domain electronics modules. As one example, a **High-Feature Body Control Module with integrated Gateway** functionality is shown.

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 **Door Electronics Module** and the **HVAC control module.** Further modules reveal the growing trend toward decentralized modules at the point of load, for example a **Front Light Module** and a **Smart Window Lift Module.**

You will also see some new electronic module designs reflecting the latest functional and architectural advances. One prominent example is a **Power Distribution System** for high-current applications supporting the trend to 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 man-machine interface to that featured in the latest consumer electronics devices. Finally, our **Roof Control Module** proposal now incorporates decentralized **RGB based lighting** for an enhanced mood lighting enabling brand specific night drive experience.

Central Body Control Module



System Benefits

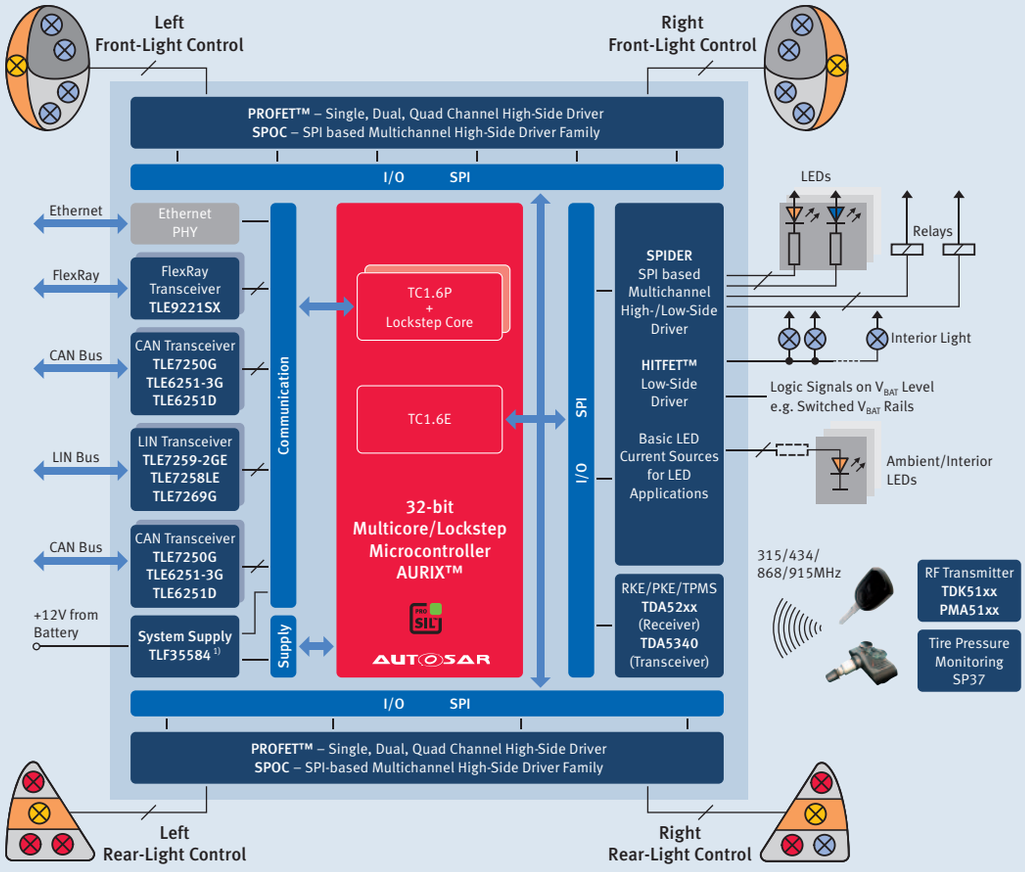
- Reduced board space due to integrated functionality
- Protected load control with sophisticated diagnostic features
- Supports the “Limp Home” functional safety concept
- High scalability and benchmark short-circuit robustness of power semiconductors (PROFET™)
- Supports a smooth transition to LEDs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

Suggested Products

Product	Description
AURIX™	Scalable 32-bit TriCore™ microcontroller family from single to multicore (PRO-SIL™)
XC22xx	16/32-bit microcontroller family with dedicated body features
Supply ICs	Voltage regulators, DC/DC converters
SPIDER, HITFET™	Single and multi-channel protected high- and low-side switches
Basic LED Driver	Linear current sources for LED applications
SBCs, Network Transceiver	System basis chips, CAN, LIN and FlexRay transceiver
PROFET™ SPOC+ – SPI Power Controller	Single and multi-channel protected high-side switches

1) In development, samples available

High Feature Body Control Module



System Benefits

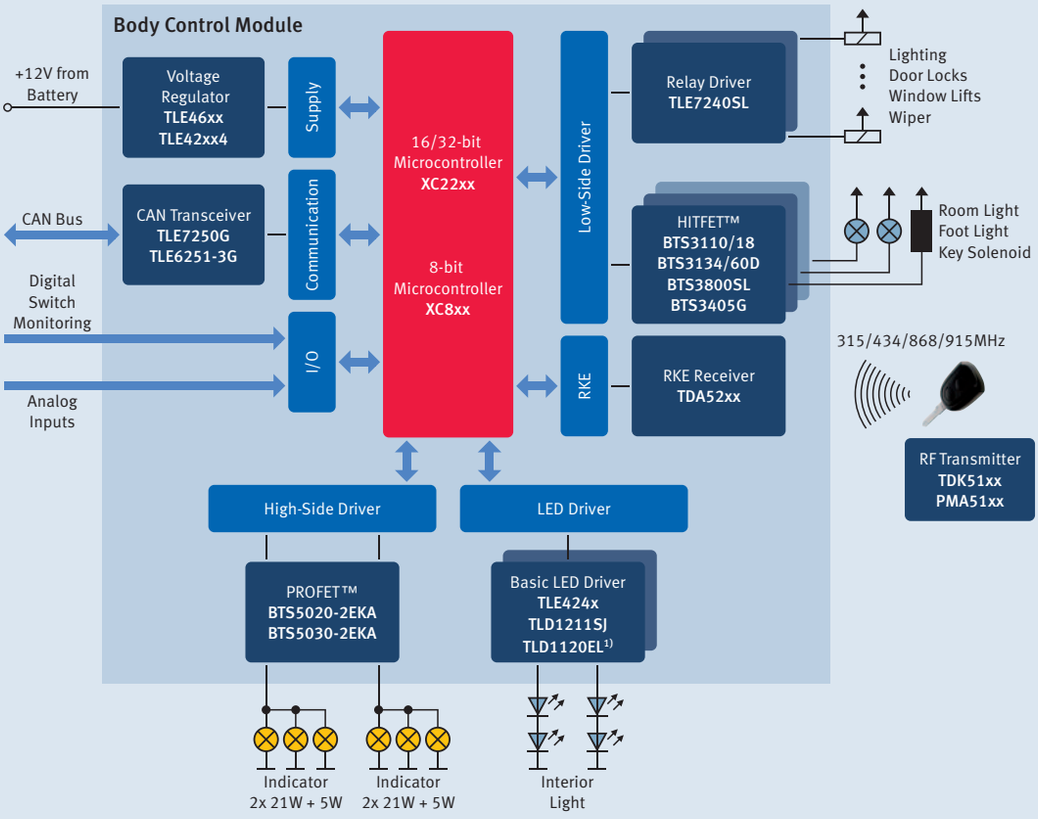
- The AURIX™ multicore concept enables integration of two applications into one device.
- Encapsulation feature allows software development without interference for multiple applications
- ISO 26262 conformance to support safety requirements up to ASIL-D
- Availability of AUTOSAR 4.x
- Very high integrated functionality enables reduced board space
- All features of a classic Body Control Module available, included protected load control with sophisticated diagnostics

Suggested Products

Product	Description
AURIX™	Scalable 32-bit TriCore™ microcontroller family from single to multicore (PRO-SIL™)
Supply ICs	Voltage regulators, DC/DC converters
SPIDER, HITFET™	Single and multi-channel protected high- and low-side switches
Basic LED Driver	Linear current sources for LED applications
Network Transceiver	CAN, LIN, FlexRay transceiver
PROFET™, SPOC	Single and multi-channel protected high- and low-side switches
TDA52xx, TDK51xx, PMA51xx	Chipset for remote keyless entry and tire pressure monitoring applications

1) In development

Low-Cost Body Control Module



System Benefits

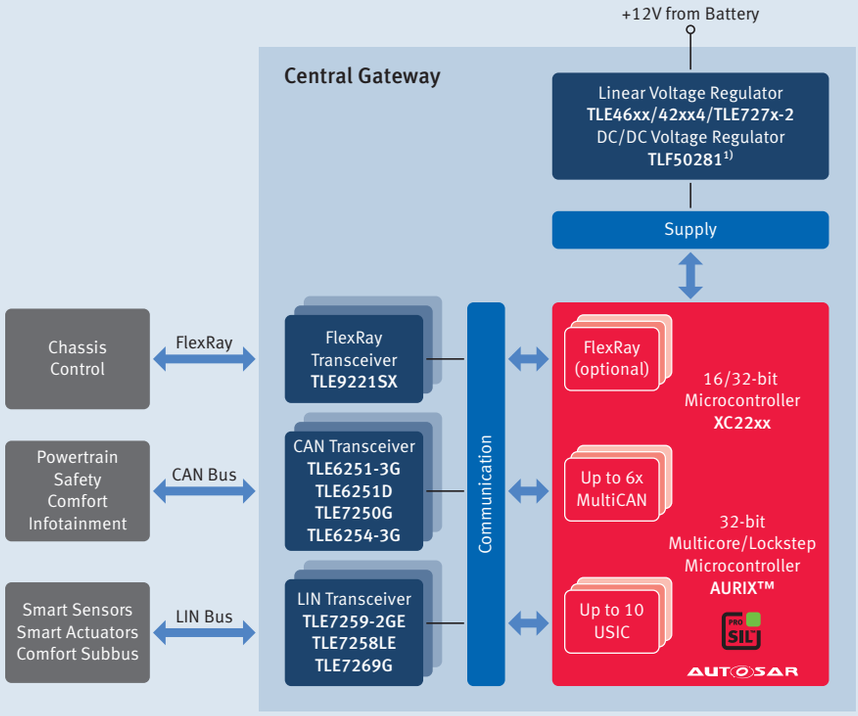
- One single-module solution for the car body electronics
- Scalability of the devices increases the re-use grade and the flexibility of the design
- Benchmark short-circuit robustness of power semiconductors improves system reliability (PROFET™)
- Full integration of load protection and diagnostics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

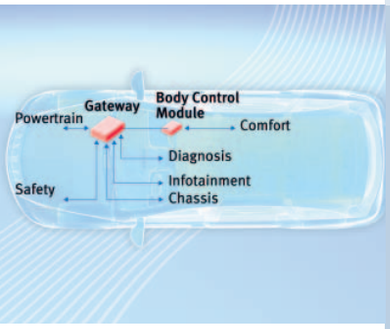
Suggested Products

Product	Description
XC22xx , XC8xx	16/32-bit and 8-bit microcontroller families with dedicated body features
Supply ICs	Linear voltage regulators, DC/DC converters
SPIDER, HITFET™	Single and multi-channel protected high- and low-side switches
Basic LED Driver	Linear current sources for LED applications
Network Transceiver	CAN and LIN transceiver
PROFET™	Protected high-side switches
TDA52xx, TDK51xx	Chipset for remote keyless entry applications

1) In development , samples available

Gateway





System Benefits

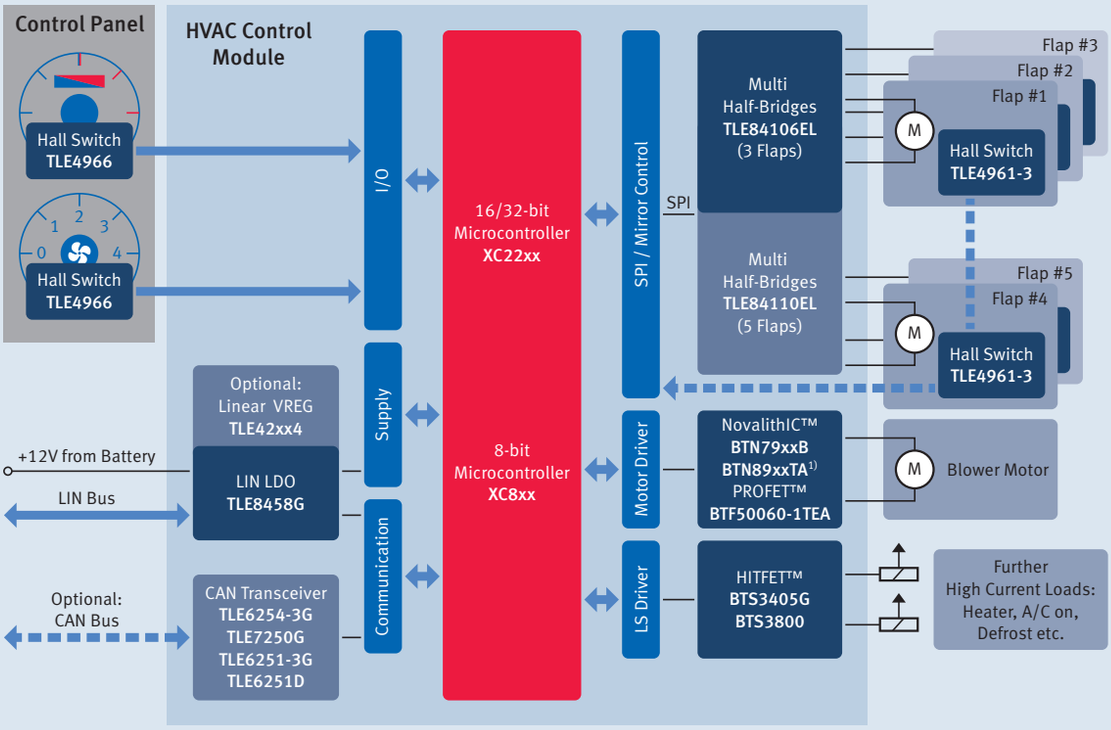
- Scalable microcontroller with up to 6 CAN interfaces and up to 10 USIC modules for LIN interfaces
- CAN gateway functionality without CPU load
- Fully scalable over package from 64 to 176 pin and memory
- Memory protection unit (MPU) to satisfy AUTOSAR requirement
- Wide range of voltage supply ICs

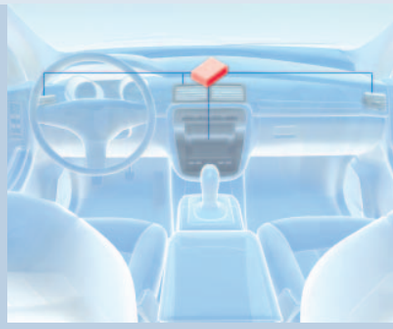
Suggested Products

Product	Description
AURIX™	Scalable 32-bit TriCore™ microcontroller family from single to multicore (PRO-SIL™)
XC22xx	16/32-bit microcontroller family with dedicated body features
Supply ICs	Voltage regulators, DC/DC converters
Network Transceiver	CAN, LIN and FlexRay transceiver

1) In development, samples available

HVAC Control Module
Low to Mid-End/Manual + Semi-Automatic





System Benefits

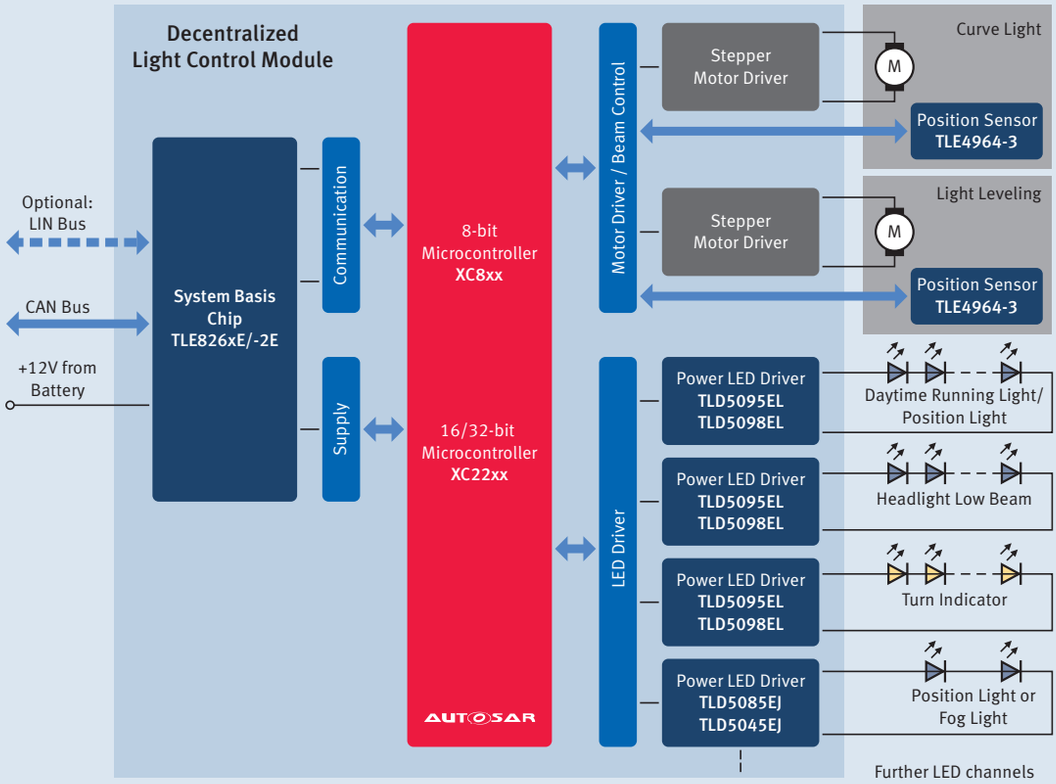
- High-performance, scalable microcontroller family for various classes of HVAC control algorithms
- Integrated motor control with diagnostics
- Dedicated multi half-bridge devices for flap motor control with potentiometer feedback
- Powerful half-bridge devices (NovalithIC™) with high-frequency PWM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

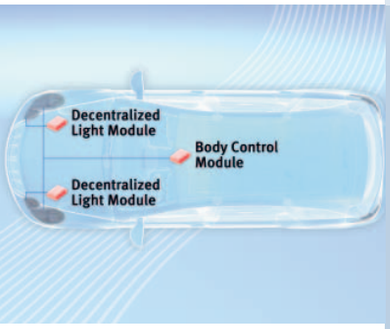
Suggested Products

Product	Description
XC22xx, XC8xx	16/32-bit and 8-bit microcontroller families with dedicated body features
Supply ICs	Linear voltage regulators, DC/DC converters
LIN LDO, Network Transceiver	CAN and LIN transceiver
HITFET™	Protected low-side switches
TLE49xx	Hall switches
NovalithIC™, Multi Half-Bridges	Integrated motor control. Powerful half-bridge devices (NovalithIC™) with high-frequency PWM capability for the blower control.
PROFET™	Protected high-side switch

1) In development, samples available

Decentralized Front Light Module





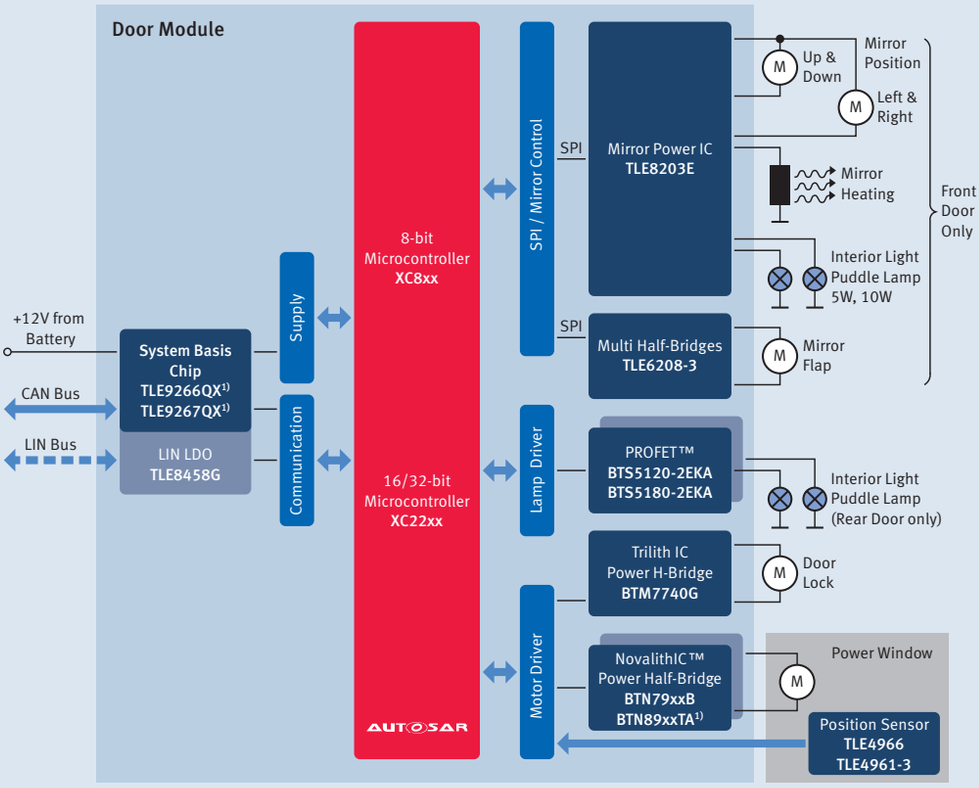
System Benefits

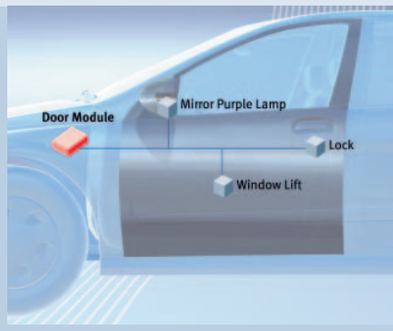
- Automotive LED drivers for high brightness LED's
- LED driver ICs supporting various DC/DC topologies (buck, boost, SEPIC)
- Microcontroller peripherals support light control with low CPU load
- System basis chips combine supply, network transceiver and supervision functions in a monolithic device

Suggested Products

Product	Description
XC22xx, XC8xx	16/32-bit and 8-bit microcontroller families with dedicated body features
SBCs, Network Transceiver	System Basis Chips, CAN and LIN transceiver
Power LED Driver	DC/DC converter & controller for high power LED Lighting

Full Featured Door Module Including Door Lock and Mirror Control





System Benefits

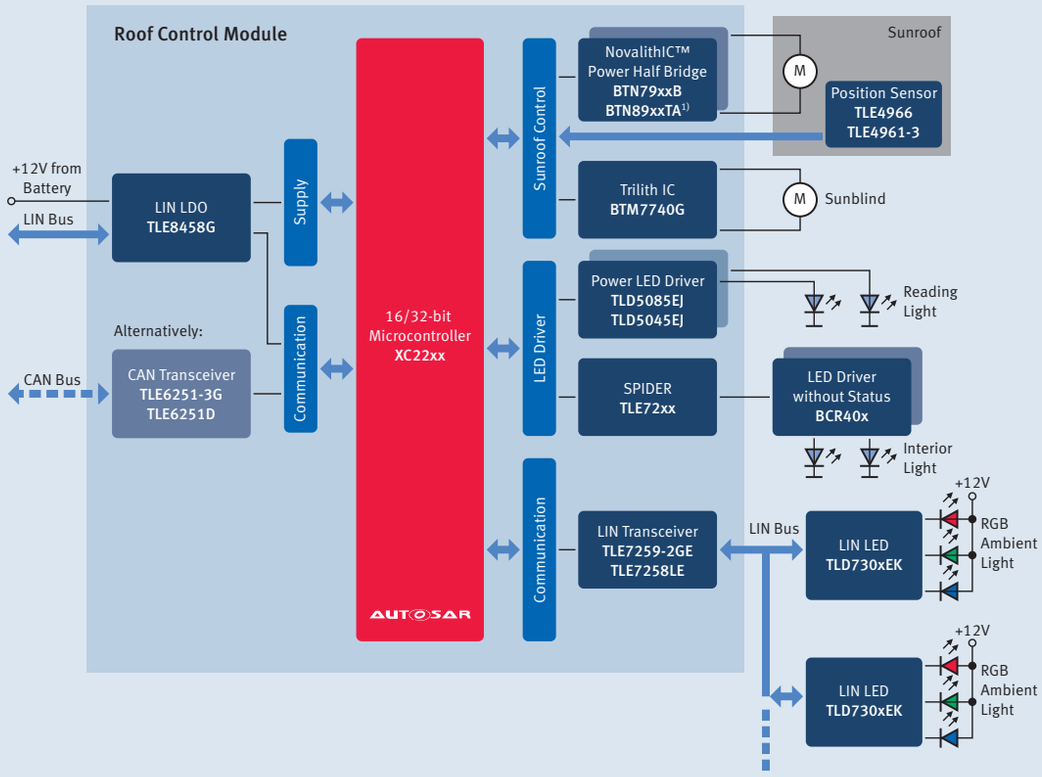
- System-in-a-package solutions for high-power integrated and protected motor control
- Reduced board space due to integrated functionality
- Door module IC integrating several functions in a single device as an option
- Dedicated solutions for rear door also available

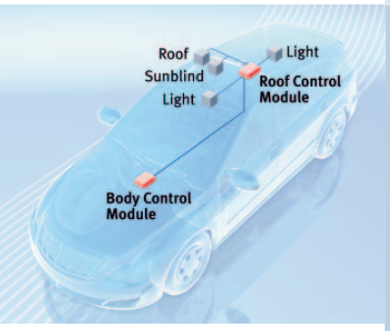
Suggested Products

Product	Description
XC22xx, XC8xx	16/32-bit and 8-bit microcontroller families with dedicated body features
SBCs, LIN LDO, Network Transcevier	System Basis Chips, CAN and LIN transceiver
PROFET™	Protected high-side switches
Trilith IC, NovalithIC™	Integrated motor control
TLE8203E	Mirror power IC
TLE49xx	Hall switches – magnetic field sensors with discrete output signal

1) In development, samples available

Roof Control Module
with Interior & Ambient Light Control





System Benefits

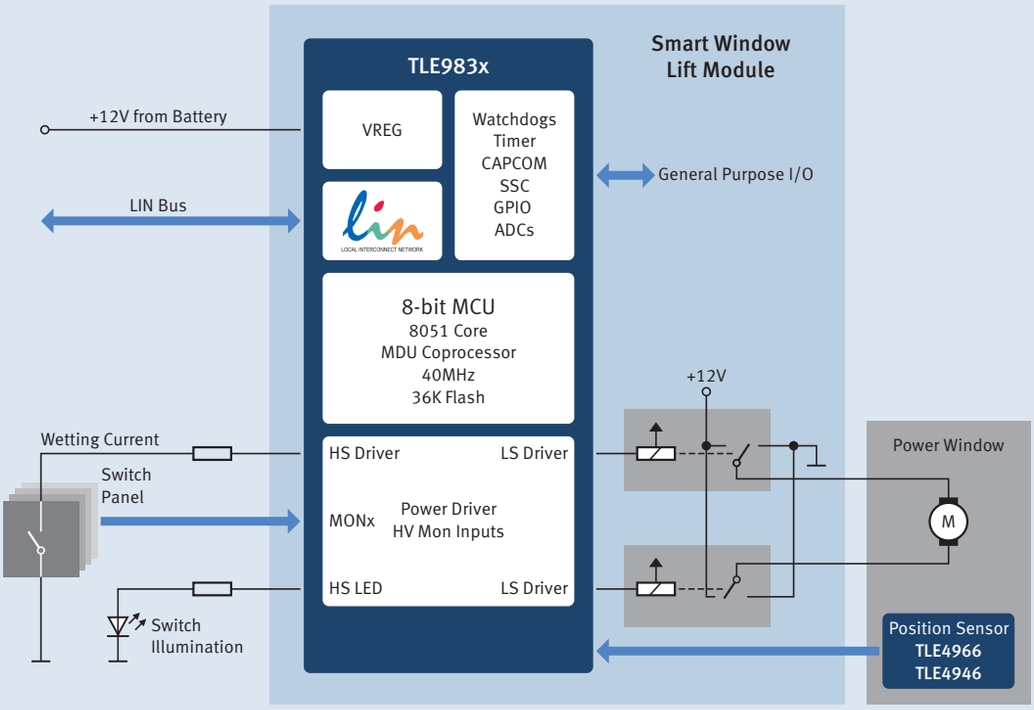
- Integrated motor control with diagnostics
- Automotive LED drivers for high brightness LED's
- High Performance MCU supporting ripple count algorithms
- Dedicated LIN slave devices for RGB ambient lighting

Suggested Products

Product	Description
XC22xx	16/32-bit microcontroller family with dedicated body features
LIN LDO, Network Transceiver	CAN and LIN transceiver
LIN LED Driver	Smart LED control system-on chip for multi-color and RGB lighting
Power LED Driver	DC/DC converter & controller for high power LED lighting
SPIDER	Multi-channel protected high- and low-side switches
TLE49xx	Hall switches – magnetic field sensors with discrete output signal

1) In development, samples available

Smart Window Lift Module
Roof Control Module



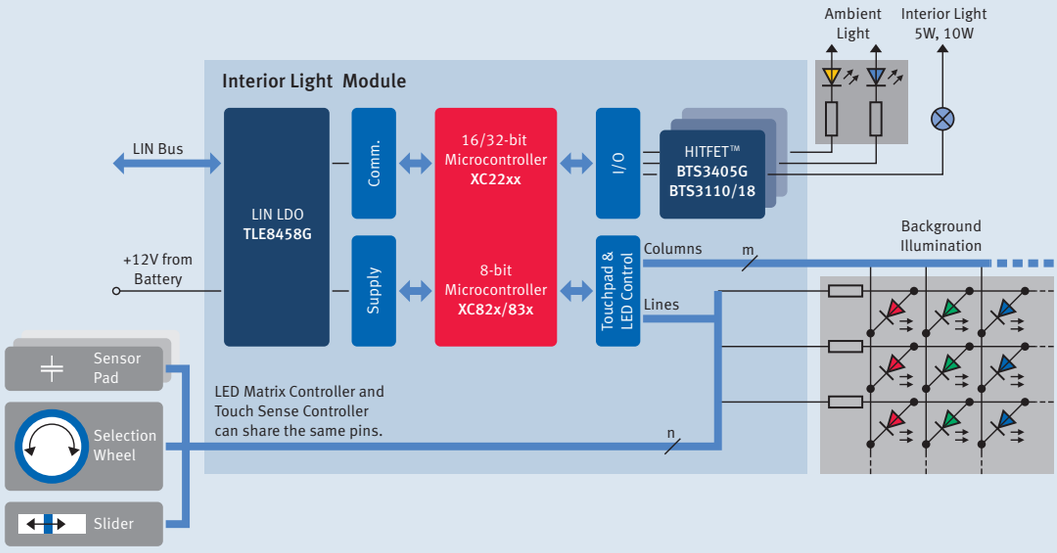
System Benefits

- High-performance XC800 microcontroller core
- Integrated battery level functionality (voltage regulator, LIN transceiver, switch inputs)
- Cyclic Sense and Cyclic Wake-up capability in order to save average current consumption
- Package with very small form factor saves PCB board space
- Intelligent power saving modes including stop sleep and sleep mode
- Single die solution improves module reliability

Suggested Products

Product	Description
TLE983x	Smart window lift system IC with integrated LIN interface
TLE49xx	Hall switches – magnetic field sensors with discrete output signal

Interior Light Control with Capacitive Touch Sensor



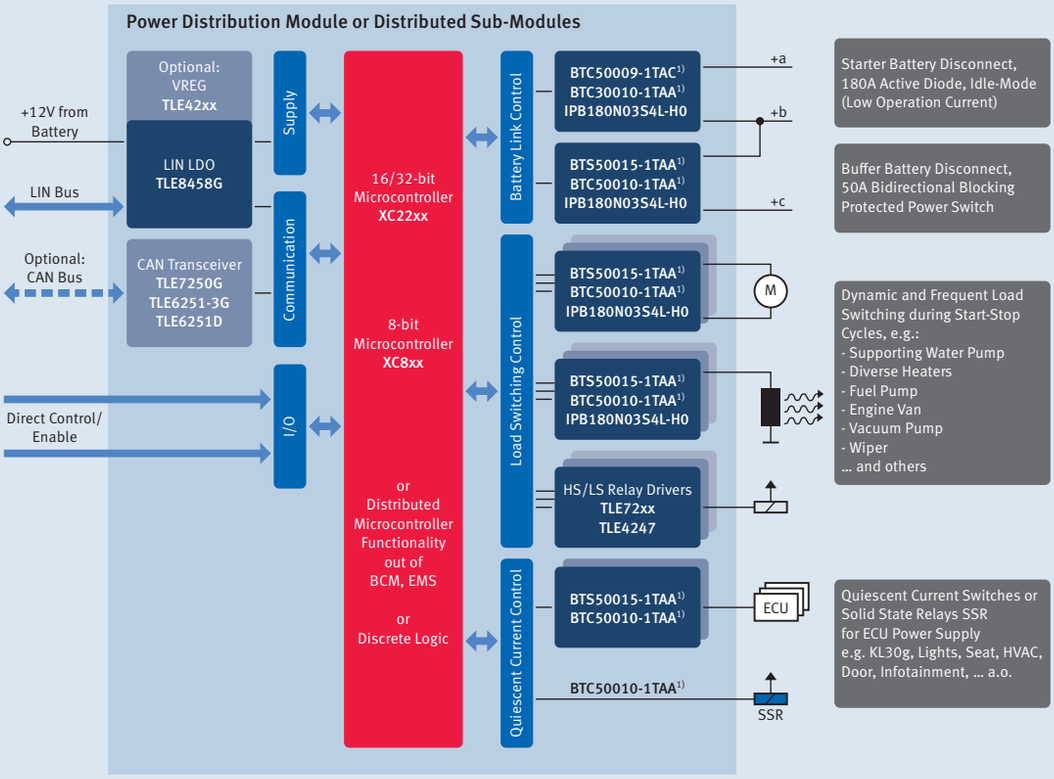
System Benefits

- 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 like acrylic glass (~2mm)
- Enables the efficient design of HMIs with up to 20 touch buttons
- Low pin count and cheap single layer PCB solutions (a 12-button keypad can be realized with only 5 pins)
- High feature integration: combined control and drive of displays or stepper motors with up to 50mA
- Easy and flexible implementation: optimized SW library for touch sense control in ROM leaves Flash memory and CPU resources for customer-specific solutions

Suggested Products

Product	Description
XC22xx, XC8xx	16/32-bit and 8-bit microcontroller families with dedicated features for haptic/capacitive touch/LED control
LIN LDO	Voltage regulator with integrated LIN transceiver
HITFET™	Smart Low-Side Switches

Power Distribution for Start-Stop Systems with Dual Battery Approach



System Benefits

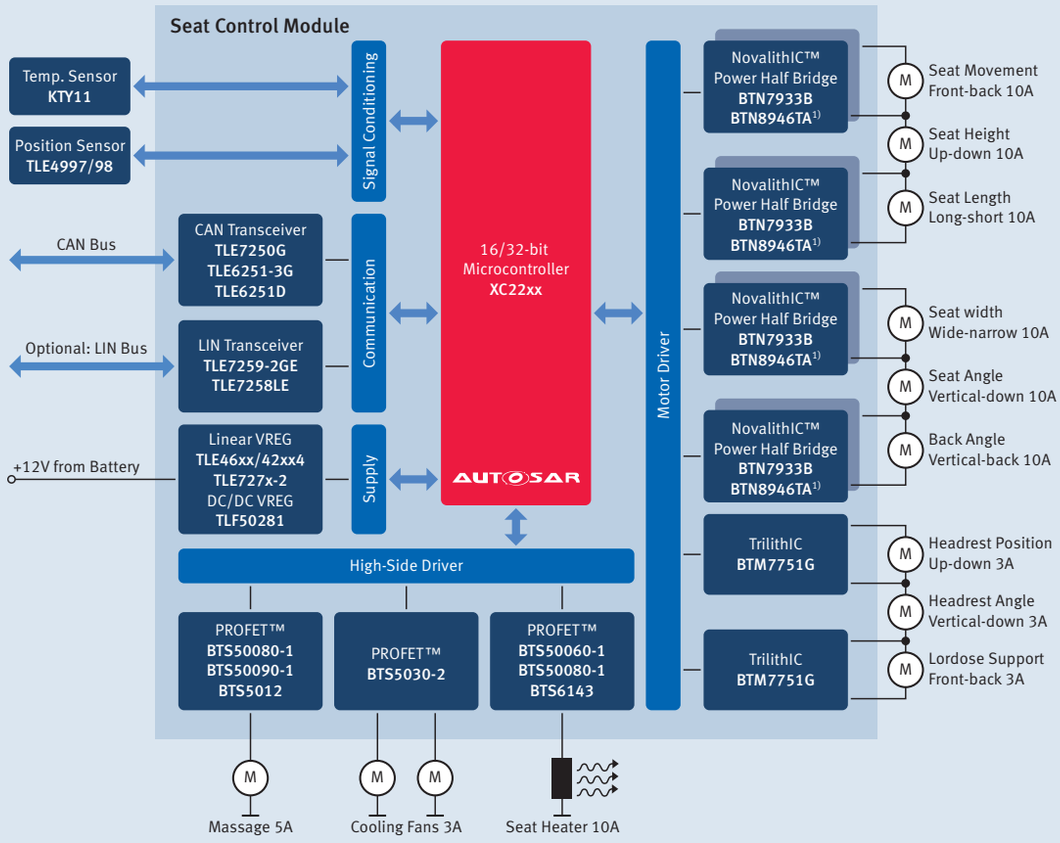
- Smart high-current, high-power switching
- Sophisticated diagnostic features
- Bidirectional blocking power switches
- Active diode functionality
- Semiconductor relay functionality with alternative fuse
- Solid State Relay (power switch inside relay housing)
- Smart relay driver, optional with constant current control
- Idle mode, operation current in µA range while power switch active
- High scalability of power semiconductors
- Alternative protection modes: smart or fuse protection
- High number of switching activations, negligible aging
- Extreme low-ohmic power switches with low power losses
- Current input control for long control wires

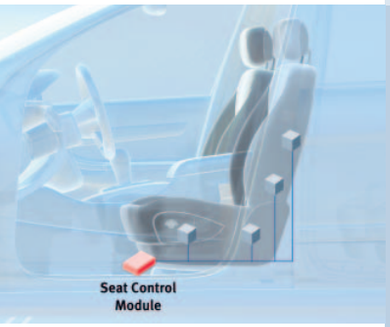
Suggested Products

Product	Description
XC22xx	16/32-bit microcontroller family
XC8xx	8-bit microcontroller family
Supply ICs	Voltage regulators, DC/DC converters
LIN LDO, Network Transceiver	System Basis Chips, LIN and CAN transceivers
Power PROFET™ BTS500xx	Protected power high-side switch
ConnectFET BTC500xx	Connecting power high-side switch
ConnectFET Companion BTC300xx	Power MOSFET to be switched parallel to ConnectFET
SPIDER	Protected multi-channel high-side and low-side switches
TLE4247	Constant current relay driver
SSR	Solid state relay (power switch inside relay housing)
OptiMOS™-T2 IPBxxS4	Automotive trench power MOSFET

1) In development, samples available

Seat Control Module





System Benefits

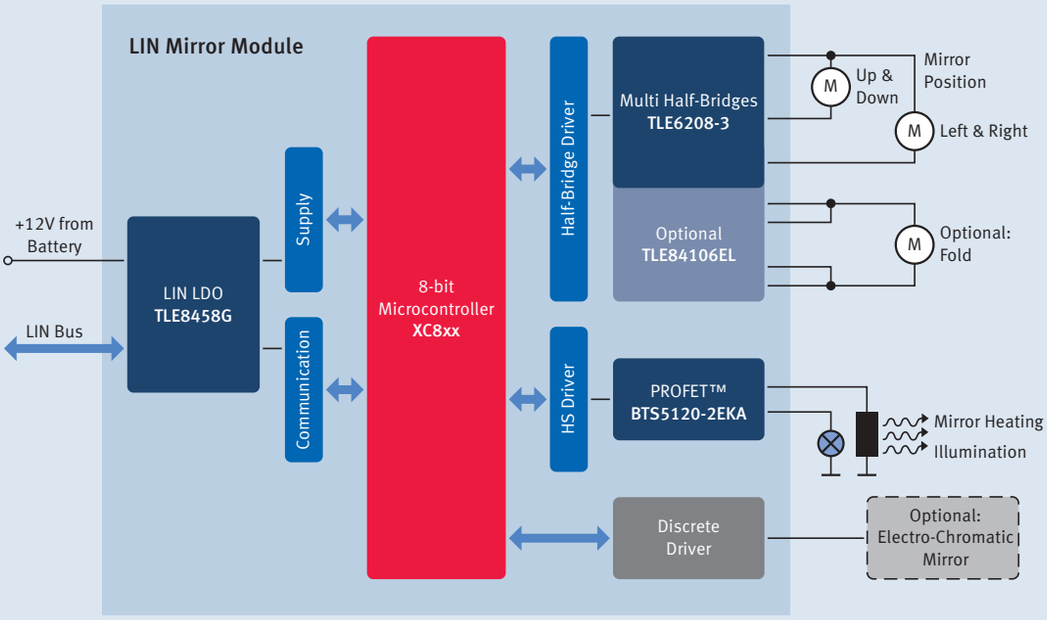
- System-in-a-package solutions for high-power integrated and protected motor control
- Reduced board space due to integrated functionality
- Protected load control with sophisticated diagnosis features

Suggested Products

Product	Description
XC22xx	16/32-bit microcontroller family with dedicated body features
Supply ICs	Linear voltage regulators, DC/DC convertes
Network Transceiver	CAN, LIN and FlexRay transceiver
PROFET™	Protected high-side switches
NovalithIC™, TrilithIC	Integrated motor control solutions with diagnostics
TLE499x	Linear hall sensors – magnetic field sensors with linear output signal

1) In development, samples available

Decentralized Mirror Module



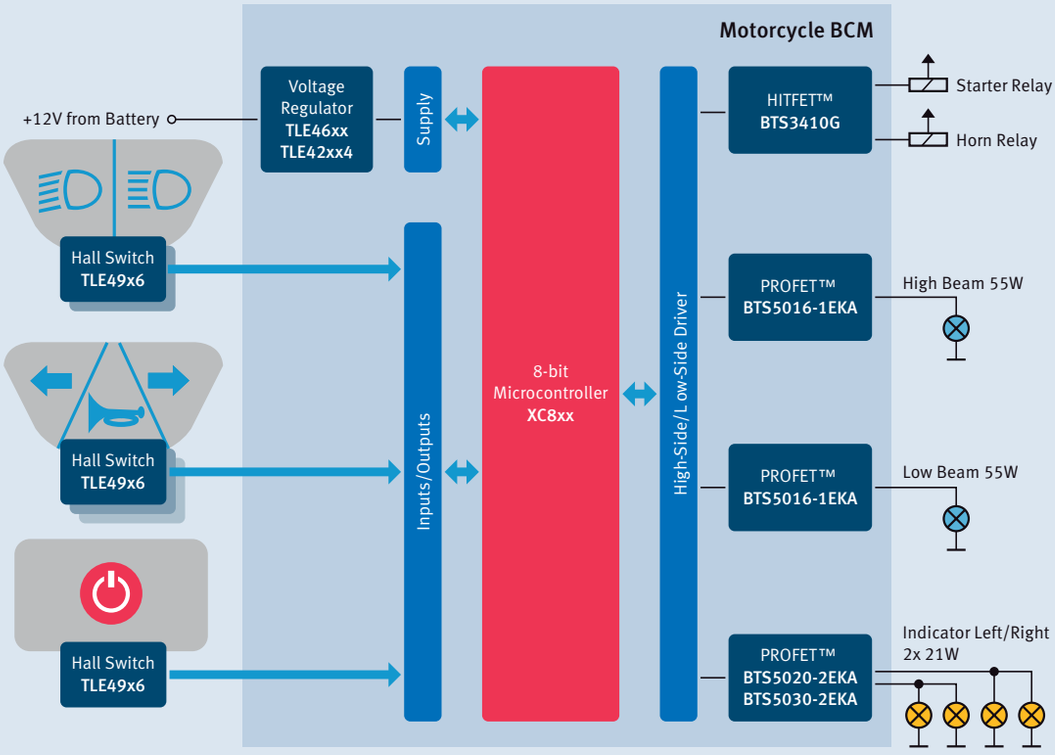
System Benefits

- 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	Description
XC8xx	Scalable, low-cost 8-bit microcontroller family
LIN LDO, Network Transceiver	CAN and LIN transceiver
PROFET™	Protected high-side switches
Multi Half-Bridges	Integrated motor control

Small BCM for 2-Wheelers



System Benefits

- Compact design for basic control functions
- Protected load control and diagnostics capability
- Automotive grade quality and reliability

Suggested Products

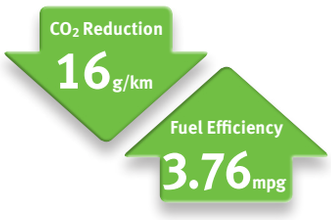
Product	Description
XC8xx	8-bit microcontroller family with dedicated body features
Supply ICs	Voltage regulators, DC/DC converters
PROFET™	Single- and multi-channel protected high-side switches
HITFET™	Single- and multi-channel low-side switches

Powertrain Applications

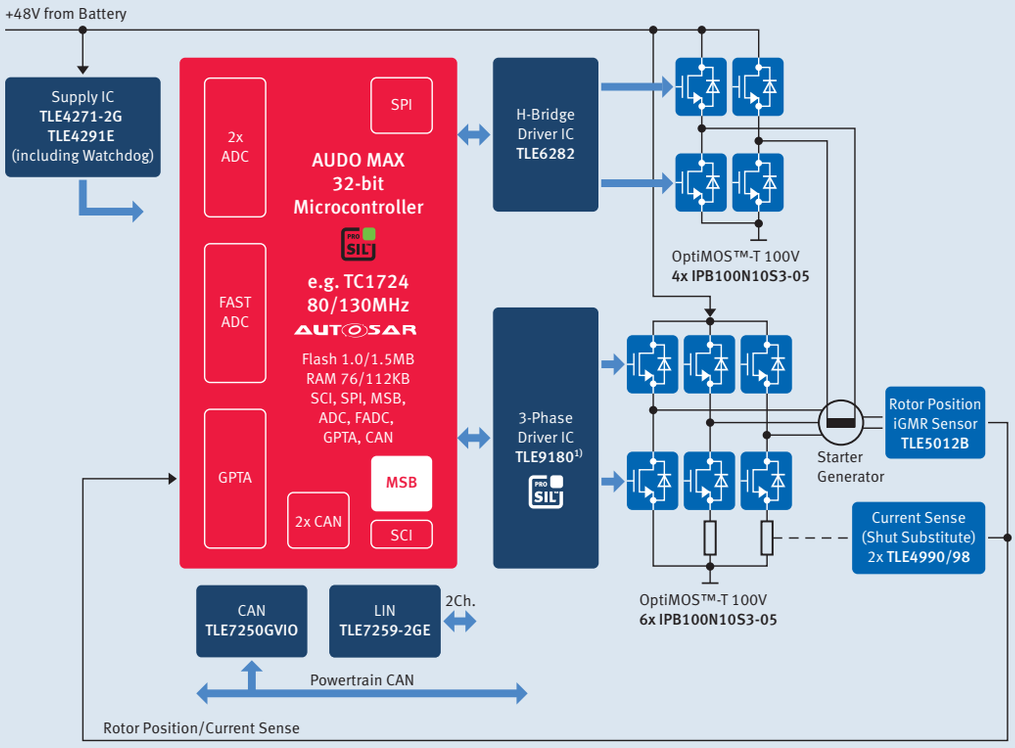
The powertrain market is driven by the need to reduce the carbon footprint of cars through affordable, efficiency-enhancing innovations. Concrete measures include downsizing engines, reducing injection losses and increasing after-treatment efficiency. On the transmission side, carmakers are looking to 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 leading in automotive semiconductors, Infineon has cornered over 30% of the market for cam, crank and transmission sensing, over 34% of the market for powertrain microcontrollers and almost 20% of the market for power modules. Our position as innovation leader, coupled with long-term 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. These cover the full sensor spectrum from position and current to barometric and manifold pressure applications. This is supported by a full 8-bit, 16-bit and 32-bit automotive-certified microcontroller portfolio. The Infineon range is rounded off by actuators for H-bridges targeted at throttle & EGR control, multi-channel low-side switches, power supplies and CAN/LIN/FlexRay transceivers.

Looking ahead toward the electrification and hybridization of powertrains, we are actively supporting this transition with reference solutions for charger and battery management systems, as well as inverter systems.



48V Micro-Hybrid (Start/Stop and High-Efficiency Generator)



System Benefits

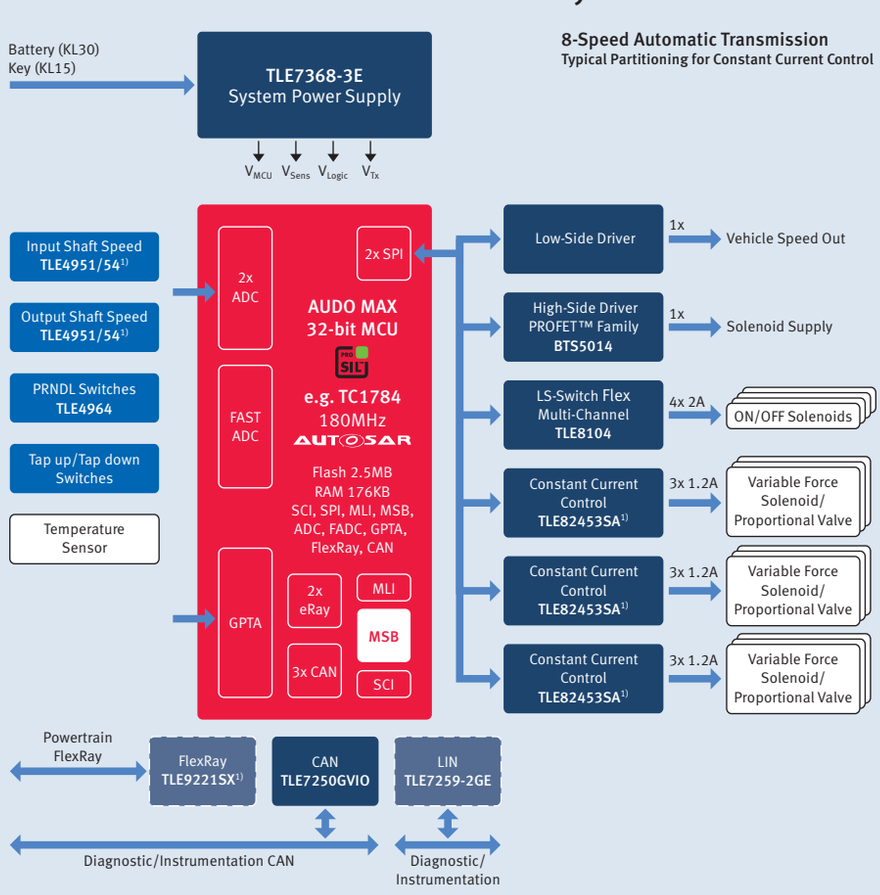
- Full range of products ranging from voltage regulators, transceivers, sensors, microcontrollers and smart power drivers.
- Leading-edge OptiMOS™ MOSFET technology combined with a robust package to deliver best in-class performance and outstanding current capacity
- Higher alternator efficiency thanks 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	Description
TC172x	Cost optimized TriCore™ 32-bit microcontroller with dedicated motor control features
TLE9180¹⁾	3-phase bridge driver IC (PRO-SIL™)
TLE7250GVIO	High speed CAN transceiver
TLE42xx	5-V low drop fixed voltage regulator
IPB100N10S3-05	N-channel 100V MOSFET, optimized for high current motor applications
TLE499x	Linear hall sensor family for current sensing
TLE5012B	iGMR sensor for angle and rotor position sensing

1) In development, samples available

Automatic Transmission – Hydraulic Control



CO_2 Reduction
1.6 g/km

Fuel Efficiency
0.34 mpg

System Benefits

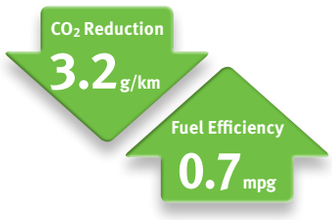
- Full range of products ranging from voltage regulators, transceivers, sensors, micro-controllers and smart power drivers
- Valve actuator ICs supporting highest precision current control
- Optimized sensors providing enhanced disturbance immunity (e.g. vibration) and direction detection
- High-temperature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

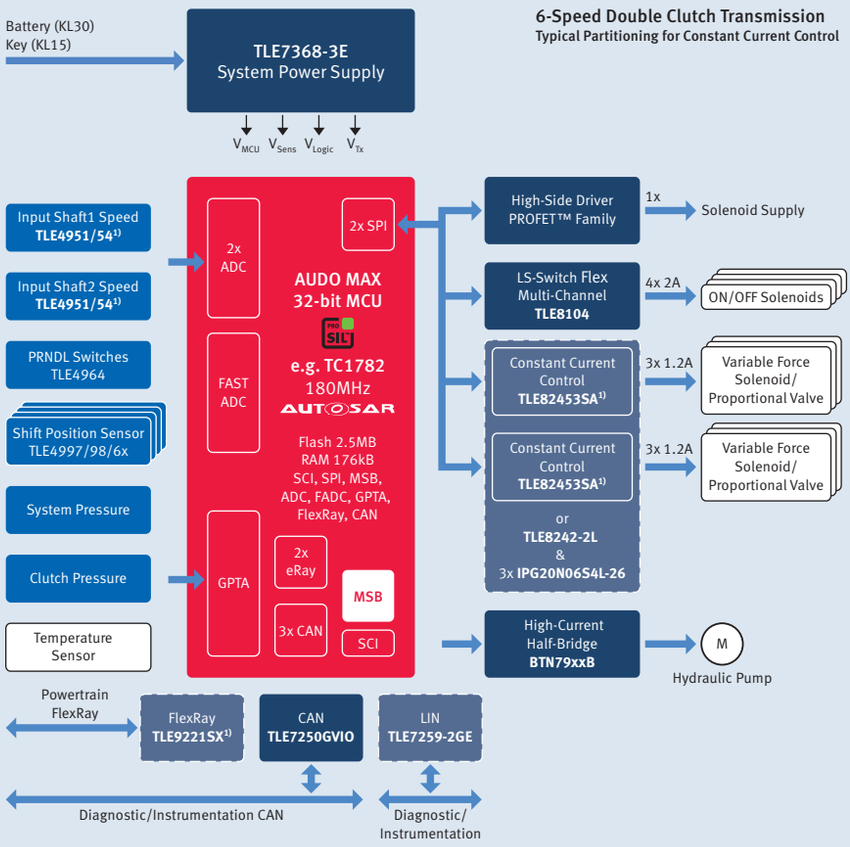
Suggested Products

Product	Description
TC17xx, TC2xxx	TriCore™ 32-bit microcontroller family, optimized for high demanding powertrain applications
TLE7368-3E	High efficient system power supply
TLE82453SA¹⁾/ TLE8242-2L	Integrated transmission ICs for precise variable force or constant current solenoid control
PROFET™	Smart high-side switches
TLE49xx	Robust and flexible transmission speed and position sensors

1) In development, samples available

Wet Double Clutch Transmission





System Benefits

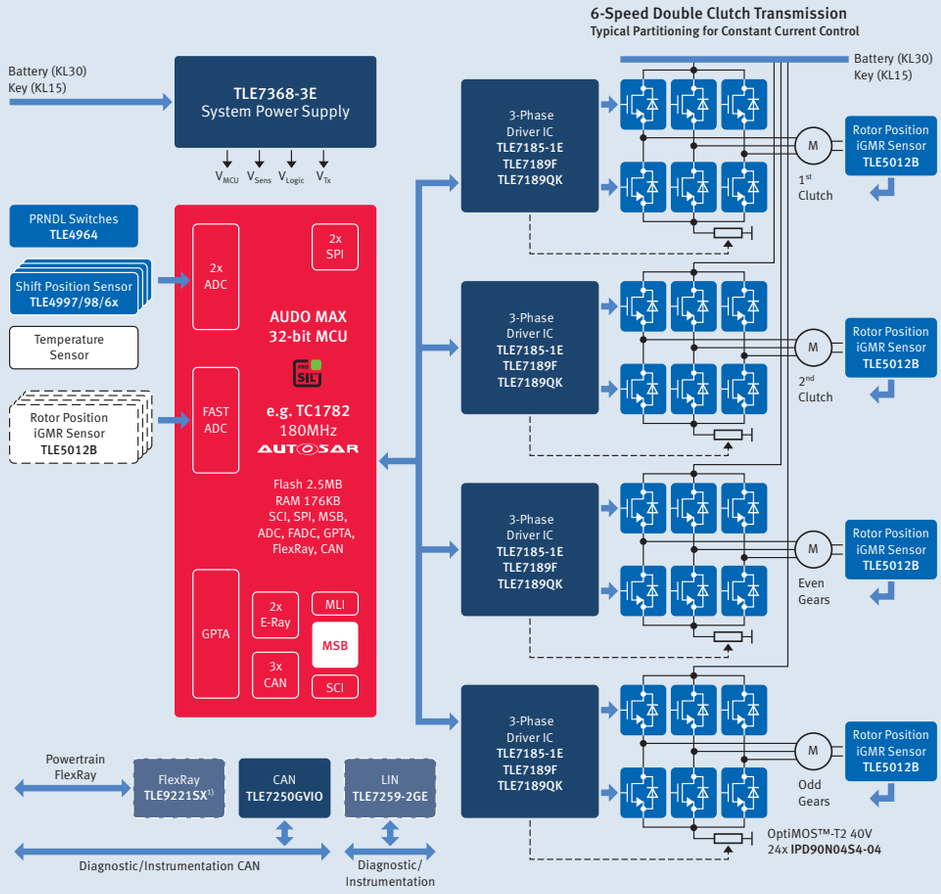
- Full range of products ranging from voltage regulators, transceivers, sensors, microcontrollers and smart power drivers
- Valve actuator ICs supporting highest precision current control
- Optimized sensors providing enhanced disturbance immunity (e.g. vibration) and direction detection
- High temperature bare die IC supporting integrated transmission control up to the highest torque rate
- Fuel saving e.g. 2% from 160g to 156.8g CO_2/km

Suggested Products

Product	Description
TC17xx, TC2xxx	TriCore™ 32-bit microcontroller family, optimized for high demanding powertrain applications
TLE7368-3E	High efficient system power supply
TLE82453SA 1)/ TLE8242-2L	Integrated transmission ICs for precise variable force or constant current solenoid control
PROFET™	Smart High-Side Switches
IPG20N06S4L-26	Dual N-Channel 60V MOSFET in Super S08 package, offering significant PCB area savings
TLE49xx	Robust and flexible transmission speed and position sensors

1) In development, samples available

Dry Double Clutch Transmission



CO_2 Reduction **3.2** g/km

Fuel Efficiency **0.7** mpg

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 to deliver 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
- Fuel saving e.g. 2% from 160g to 156.8g CO_2/km

Suggested Products

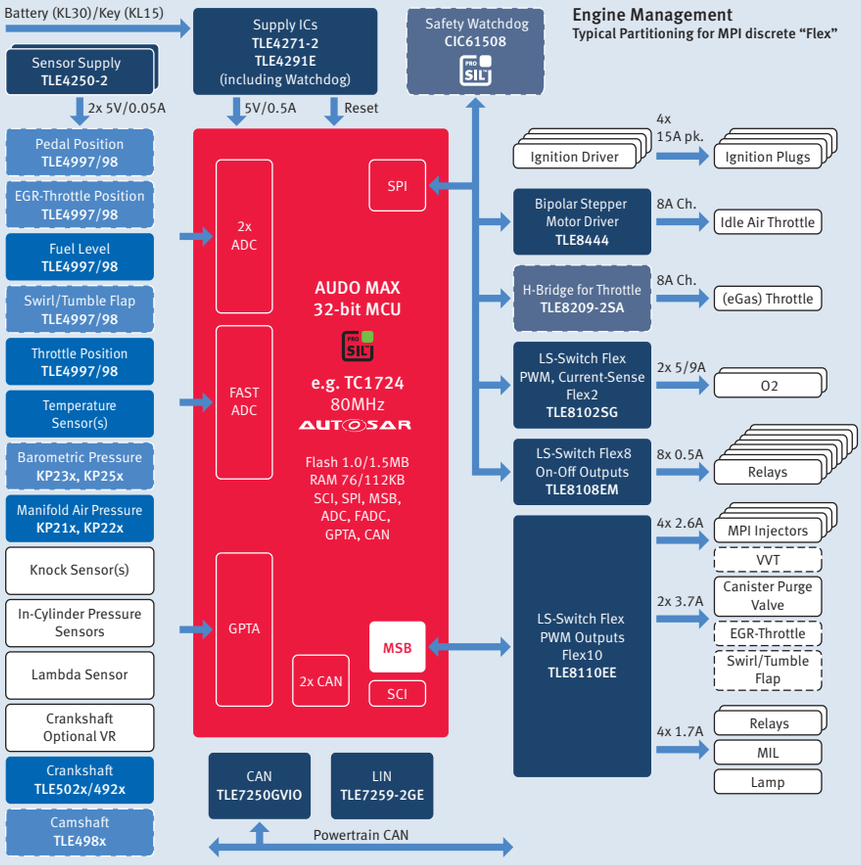
Product	Description
TC17xx, TC2xxx	TriCore™ 32-bit microcontroller family, optimized for high demanding powertrain applications
TLE7368-3E	High efficient system power supply
TLE718xx	Broad portfolio of automotive 3-Phase Bridge Driver IC for precise motor control; full functionality down to 5.5V
IPD90N04S4-04	N-channel 40V MOSFET, optimized for high current motor applications
TLE5012B	iGMR sensor for angle and rotor position sensing

1) In development, samples available

CO_2 Reduction 16 g/km

Fuel Efficiency 3.76 mpg

Gasoline Multi-Port Injection



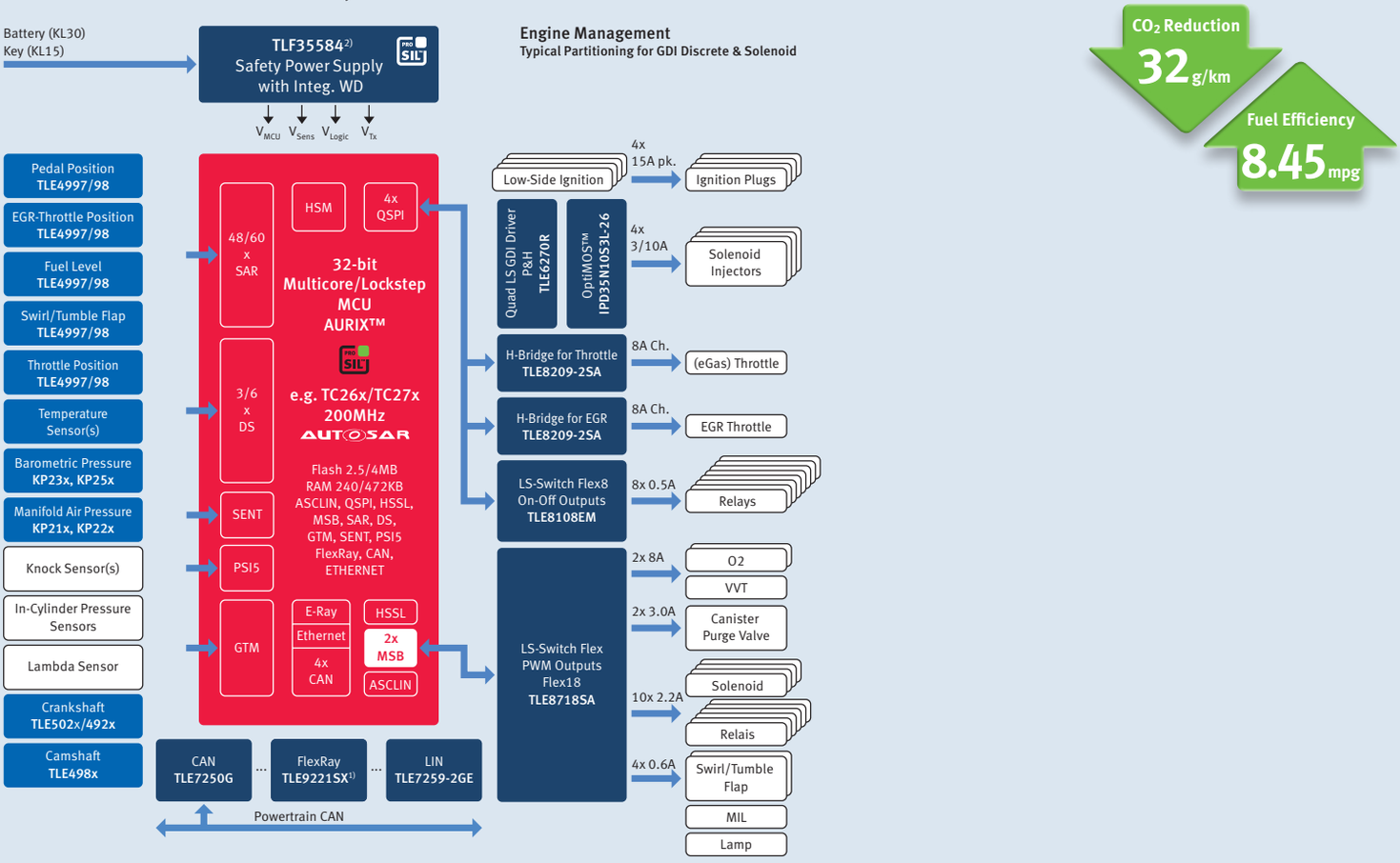
System Benefits

- Flexible and scalable product portfolio tailored to the cost and performance needs of the mid-end and entry segment
- Industry benchmark in embedded real-time performance facilitates pumping loss reduction, knock detection and efficient after-treatment (e.g. reduces fuel consumption by 10% from 160g to 144g CO_2/km)
- Conforming with upcoming emission legislation at maximized fuel efficiency with even more driving pleasure, the new sensor families provide enhanced measurement precision (e.g. ignition control, misfire detection)

Suggested Products

Product	Description
TC172x	Cost optimized TriCore™ 32-bit microcontrollers, single voltage supply (PRO-SIL™)
TLE7250GVIO/TLE7259-2GE	New CAN/LIN transceivers
TLE8209-2SA	New exhaust gas recirculation (EGR) and electronic throttle control (ETC) driver
TLE81xx	Scalable FLEX smart multi-channel low side switch family designed for powertrain applications
TC42xx	5-V low drop fixed voltage regulator
TLE5xxx, TLE4xxx, KP2xx	Broad portfolio of pressure (MAP & BAP), cam- & crankshaft as well as position sensors

Gasoline Direct Injection



CO_2 Reduction 32 g/km

Fuel Efficiency 8.45 mpg

System Benefits

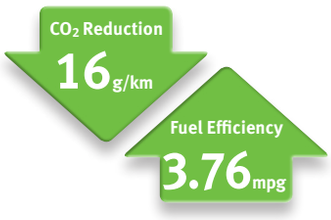
- Flexible and scalable product portfolio tailored to the performance and real-time needs of the premium and value segment
- Conforming with the latest emission legislation at the highest possible fuel efficiency and maximum fun to drive (e.g. 20% fuel saving from 160g to 128g CO_2/km)
- Benchmark-setting real-time performance facilitates down-sizing, direct injection, turbo charging and highly-efficient after-treatment
- New sensor families provide enhanced measurement precision (e.g. ignition control, misfire detection)

Suggested Products

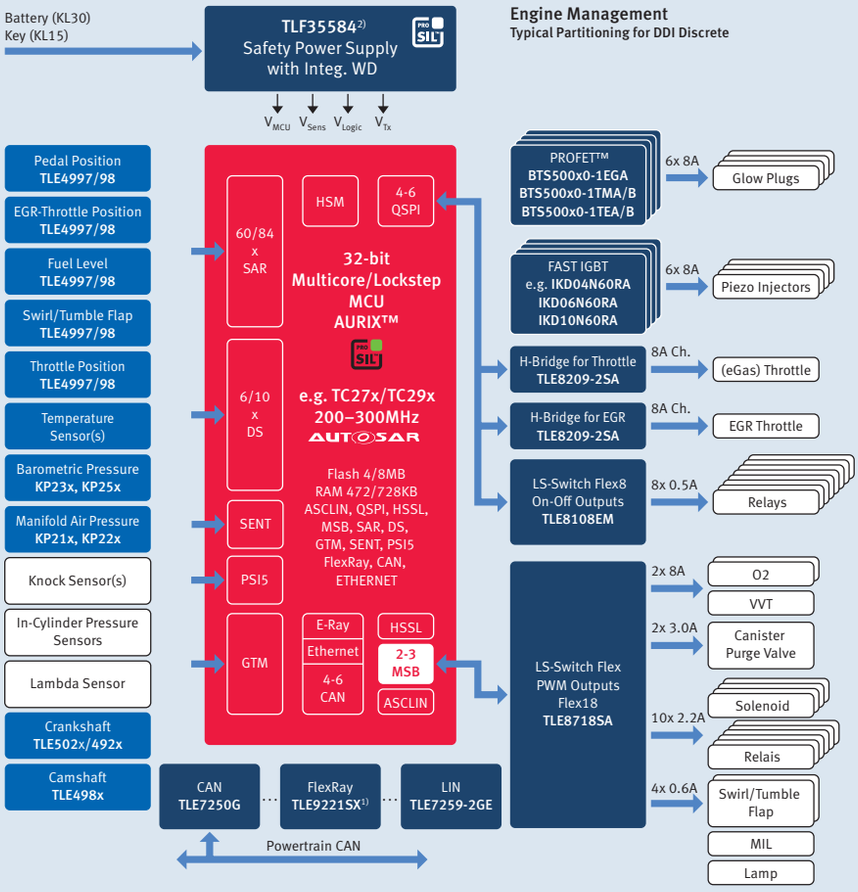
Product	Description
AURIX™	32-bit multi-core TriCore™ microcontroller family, optimized for high demanding powertrain applications (PRO-SIL™)
TLF35584[2)]	High efficient system power supply (PRO-SIL™)
TLE725x/TLE9221SX[1)]	New CAN/LIN/FlexRay transceivers
TLE8209-2SA	New exhaust gas recirculation (EGR) and electronic throttle control (ETC) driver
TLE81xx	Scalable FLEX smart multi-channel low side switch family designed for powertrain applications
TLE8718SA	Smart 18-channel low-side switch with Micro Second Channel
TLE5xxx, TLE4xxx, KP2xx	Broad portfolio of pressure (MAP & BAP), cam- & crankshaft as well as position sensors

1) In development, samples available

2) In development



Diesel Direct Injection



System Benefits

- Large and scalable product portfolio tailored to the performance needs of the entire diesel segment
- Meeting upcoming emission legislation at maximum fuel efficiency with the highest driving pleasure (e.g. fuel saving by 10% from 160g to 144g CO_2/km)
- 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

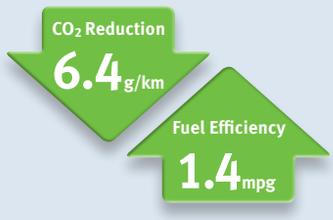
Suggested Products

Product	Description
AURIX™	32-bit Multicore TriCore™ microcontroller family, optimized for high demanding powertrain applications (PRO-SIL™)
TLF35584[2]	High efficient system power supply (PRO-SIL™)
TLE725x/TLE9221SX[1]	New CAN/LIN/FlexRay transceivers
TLE8209-2SA	New exhaust gas recirculation (EGR) and electronic throttle control (ETC) driver
TLE81xx	Scalable FLEX smart multi-channel low side switch family designed for powertrain applications
TLE8718SA	Smart 18-channel low-side switch with Micro Second Channel
TLE5xxx, TLE4xxx, KP2xx	Broad portfolio of pressure (MAP & BAP), cam- & crankshaft as well as position sensors

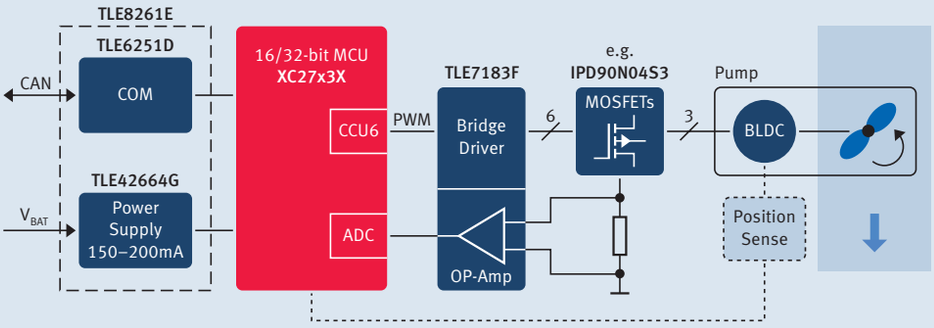
1) In development, samples available

2) In development

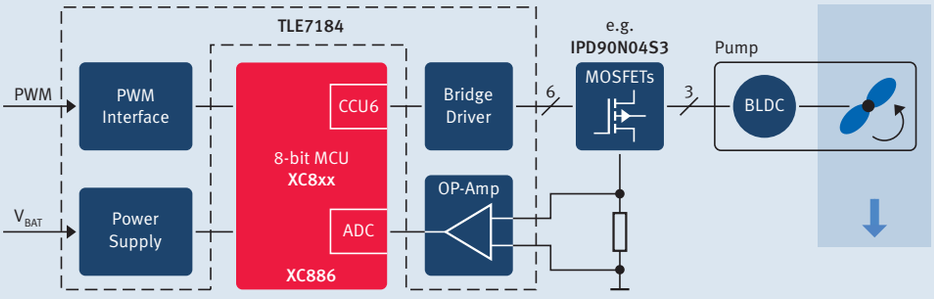
Electric Water Pump



High Performance



Low-Cost

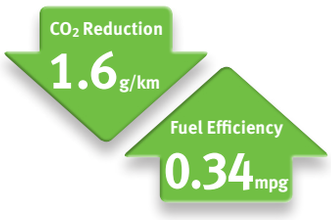


System Benefits

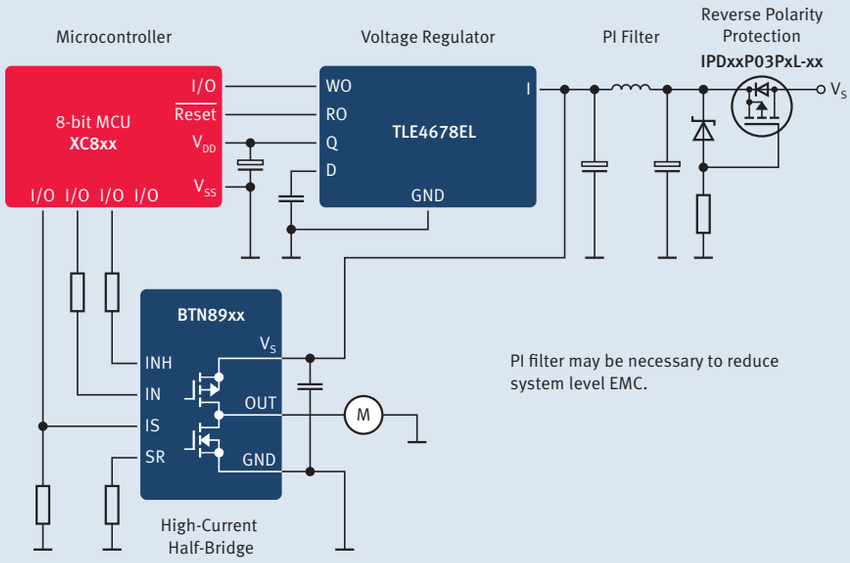
- Large and scalable product portfolio tailored to the performance & budget needs
- Fuel saving of > 4% e.g. from 160g to 154g CO_2/km
- Improved thermal control of engine
- Enhanced pump efficiency
- Reduces power consumption

Suggested Products

Product	Description
XC27xx	C166 compatible 16-bit microcontroller powertrain family (up to 1MB Flash at 128MHz performance)
XC8xx	8051 compatible automotive 8-bit Microcontrollers
TLE6251D	New CAN transceiver
TLE718x	High current 3-phase bridge driver ICs
TLE826x	Monolithic integrated System Basis Chips (SBC) in enhanced power packages
TLE42xx	Low dropout fixed voltage regulator



Fuel Pump



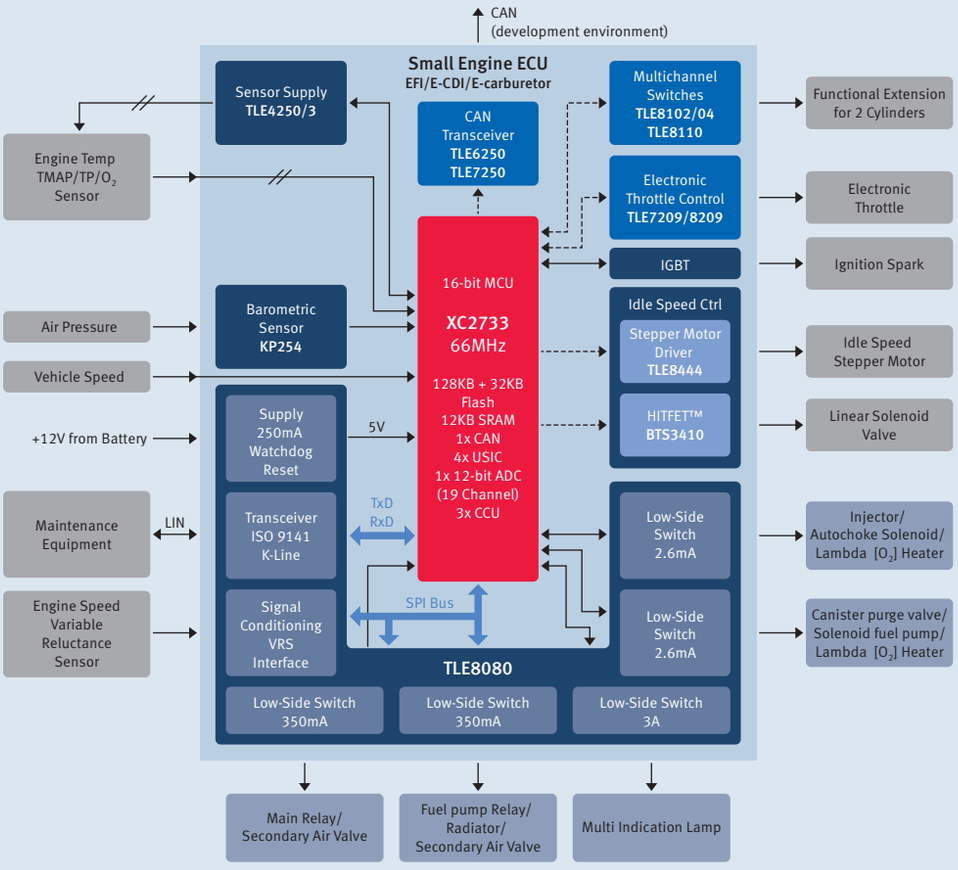
System Benefits

- Large and scalable product portfolio tailored to the performance & budget needs
- Fuel saving of > 1% e.g. from 160g to 158.4g CO_2/km
- Lower hydrocarbon emissions
- Increased lifetime

Suggested Products

Product	Description
XC8xx	8051 compatible automotive 8-bit Microcontrollers
BTN89xx	NovalithIC™ integrate high current PN half bridge family
TLE46xx	Low dropout fixed voltage regulator

Small 1-/2-Cylinder Combustion Engine



CO_2 Reduction 17 g/km

Fuel Efficiency 16 mpg

System Benefits

- Scalable chip-set solutions supporting EFI, e-carburetor and CDI system approaches
- Highest feature density in smallest package supporting smallest form factor
- Single device TLE8080EM solution to manage the entire electronic power interface of an one cylinder combustion engine
- Scalable and an easy-to-use XC2700 family supporting easy to implement up- and down-grade options for functional enhancement or cost optimization
- CO_2 reduction 17g/km; fuel efficiency increase 16mpg

Suggested Products

Product	Description
XC2733	C166 compatible high-performance 16-bit MCU (up to 150kB Flash at 66MHz performance)
TLE7209/8209	Electronic throttle control driver
TLE810x/8110	Multichannel switches
TLE8444	Stepper motor driver
TLE8080EM	The power system chip for 1- and 2-cylinder small engine management
TLE42xx	Low dropout fixed voltage regulator
KP254	Barometric air pressure sensors (BAP)

(H)EV Applications

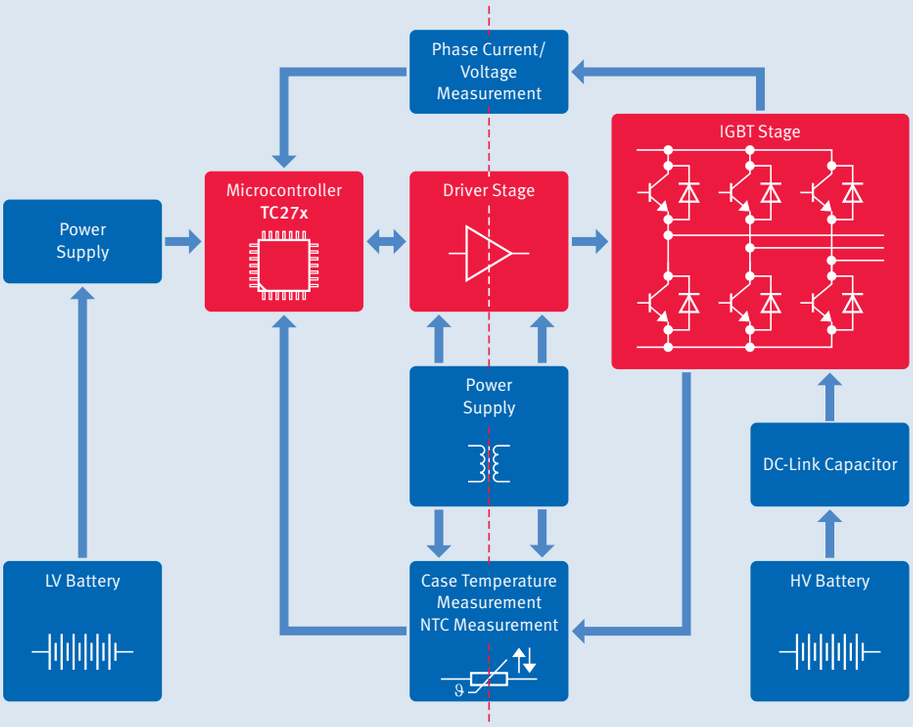
Although electric drivetrains are already more energy-efficient than combustion models, further improvements are still required. Infineon delivers various chips and modules that can play a valuable role in minimizing power losses, maximizing power savings and boosting performance. As a leading supplier 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.

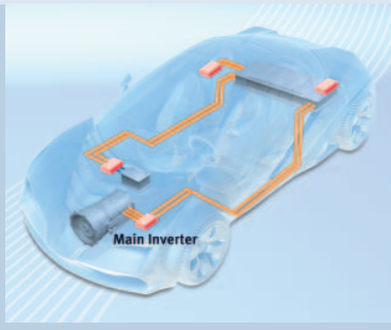
As the world leader in advanced power and automotive electronics, Infineon has the broadest product portfolio for high-efficiency electric drivetrain designs. Combining affordability with ecology, our electromobility solutions help to significantly reduce the overall system cost of powertrain and electronics, increase mileage and improve battery efficiency. Carmakers and system suppliers can rely on best-in-class semiconductor products from Infineon Technologies to drive new innovations. For example, active cell balancing developed by Infineon extends the life and capacity of batteries by at least 10 percent. 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.

(H)EV – Main Inverter





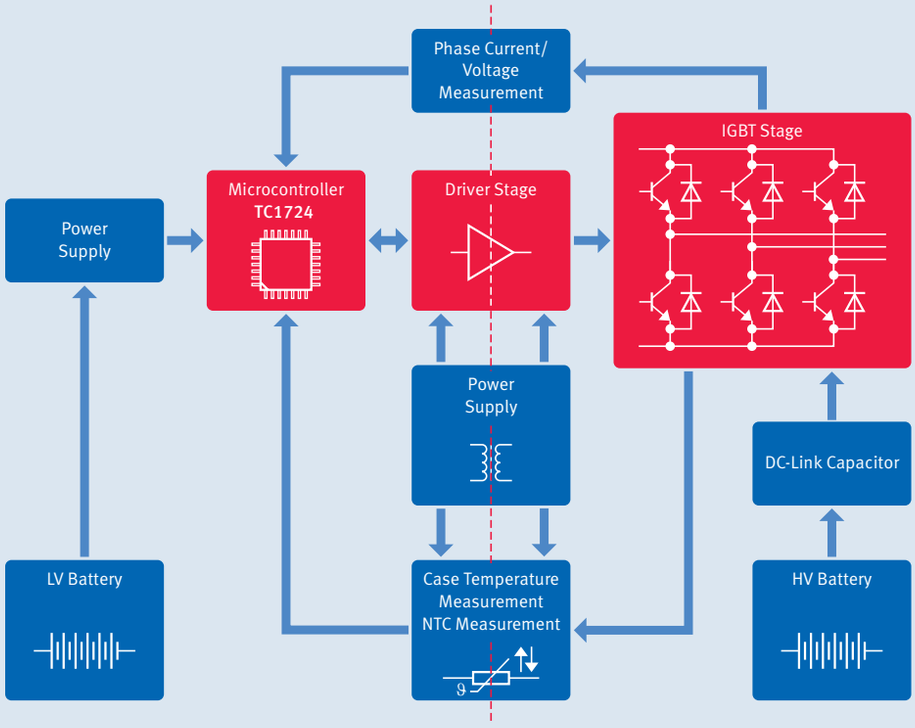
System Benefits

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

Suggested Products

Product	Description
AURIX™ TC27x	High-Performance 32-bit multicore lockstep microcontroller
2ED020I12FA (Driver Stage)	Automotive EiceDRIVER™, dual-channel isolated IGBT Driver for 650V/1200V IGBTs
1ED020I12FTA (Driver Stage)	Automotive EiceDRIVER™, single-channel isolated IGBT Driver, two-level turn-off for 650V/1200V IGBTs
1ED020I12FA2 (Driver Stage)	Automotive EiceDRIVER™, single-channel isolated IGBT Driver for 650V/1200V IGBTs
HybridPACK™ 2 (IGBT Stage)	IGBT power module with 600A and 800A/650V and 400A/1200V for power ratings up to 100kW
HybridPACK™ 1 Pin-Fin (IGBT Stage)	IGBT power module with 400A / 650V for power ratings up to 50kW; 1200V IGBT power module on request
HybridPACK™ 1 (IGBT Stage)	IGBT power module with 200A or 400A/650V for power ratings up to 20kW; 1200V IGBT power module on request

(H)EV – Auxiliary Inverter



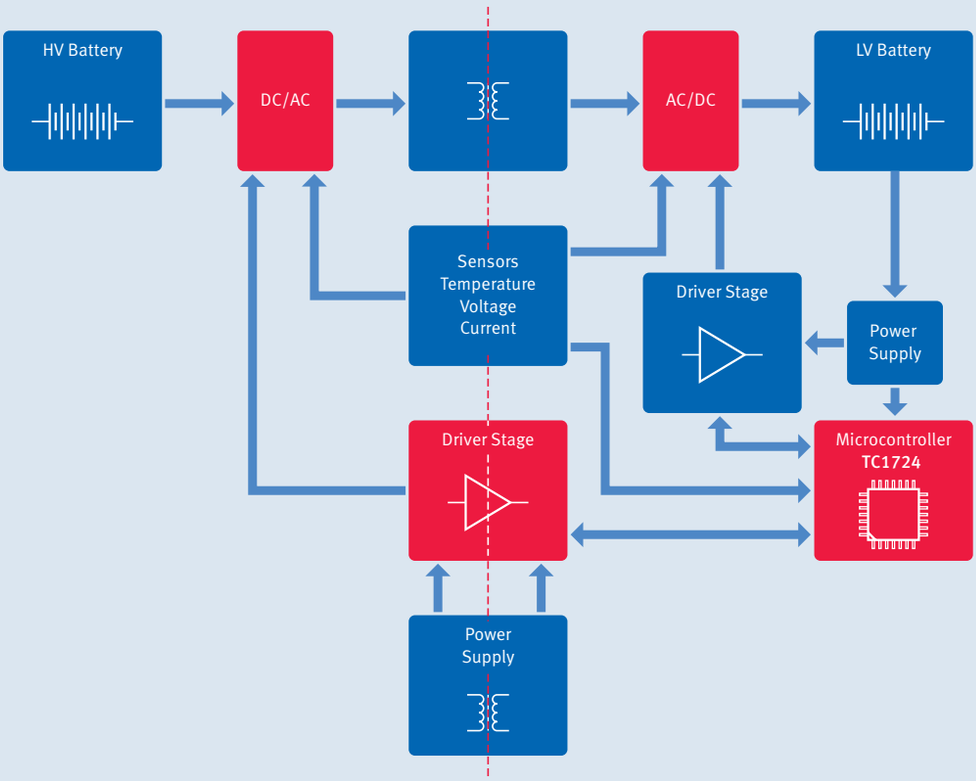
System Benefits

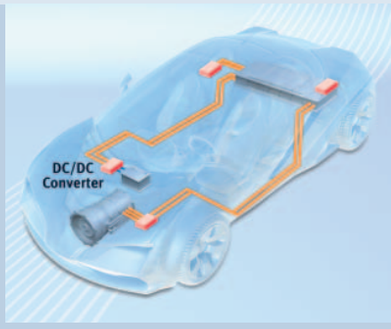
- Fully automotive-qualified product portfolio including both power module and discrete solutions
- Isolation-integrated in gate driver
- Highly-efficient 3-phase drives due to very low conducting losses even at high switching frequencies
- Wide range of 16 and 32-bit microcontroller solutions dedicated to (H)EV applications
- Evaluation Kit available to reduce system development time

Suggested Products

Product	Description
TC1724	32-bit TriCore™ microcontroller
2ED020I12FA (Driver Stage)	Automotive EiceDRIVER™, dual-channel isolated IGBT Driver for 650V/1200V IGBTs
1ED020I12FTA (Driver Stage)	Automotive EiceDRIVER™, single-channel isolated IGBT Driver, two-level turn-off for 650V/1200V IGBTs
1ED020I12FA2 (Driver Stage)	Automotive EiceDRIVER™, single-channel isolated IGBT Driver for 650V/1200V IGBTs
IKxxxN60TA	IGBT discretes from 20A to 75A, 600V with soft, fast recovery anti-parallel EmCon HE diode
Easy 2B Automotive (IGBT Stage) FS75R07W2E3_B11A	IGBT power module with 75A for power ratings up to 10kW. 1200V IGBT power module on request
Easy 1B Automotive (IGBT Stage) FS50R07W1E3_B11A	IGBT power module with 50A/650V for power ratings up to 6kW. 1200V IGBT power module on request

(H)EV – Auxiliary HV/LV DC/DC





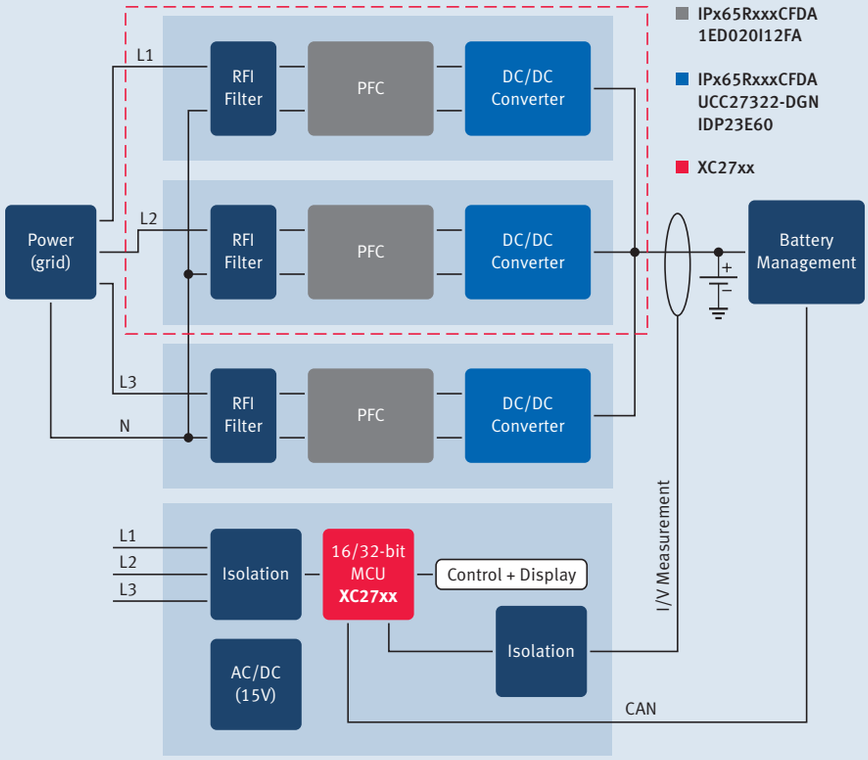
System Benefits

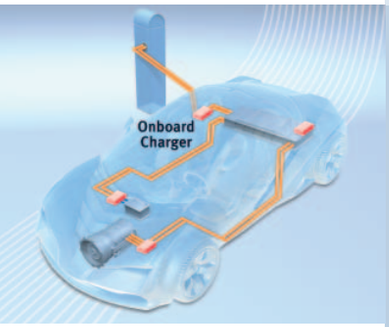
- Fully automotive-qualified product portfolio including both power module and discrete solutions
- Supports a wide range of highly-efficient conversion topologies (including bidirectional)
- Compact design with the highest power density
- Very low switching losses at high switching frequencies
- Isolation-integrated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

Suggested Products

Product	Description
TC1724	32-bit TriCore™ microcontroller
2ED020I12FA (Driver Stage)	Automotive EiceDRIVER™, dual-channel isolated IGBT Driver for 650V/1200V IGBTs
1ED020I12FA2 (Driver Stage)	Automotive EiceDRIVER™, single-channel isolated IGBT Driver for 650V/1200V IGBTs
IPx65RxxxCFDA	650V CoolMOS™ discrete high-voltage MOSFETs with fast body diode
Easy 1B Automotive	H-Bridge with High-Speed IGBT 3 and Rapid Diode 650V for switching frequencies up to 100kHz

(H)EV – AC/DC (Battery Charger)





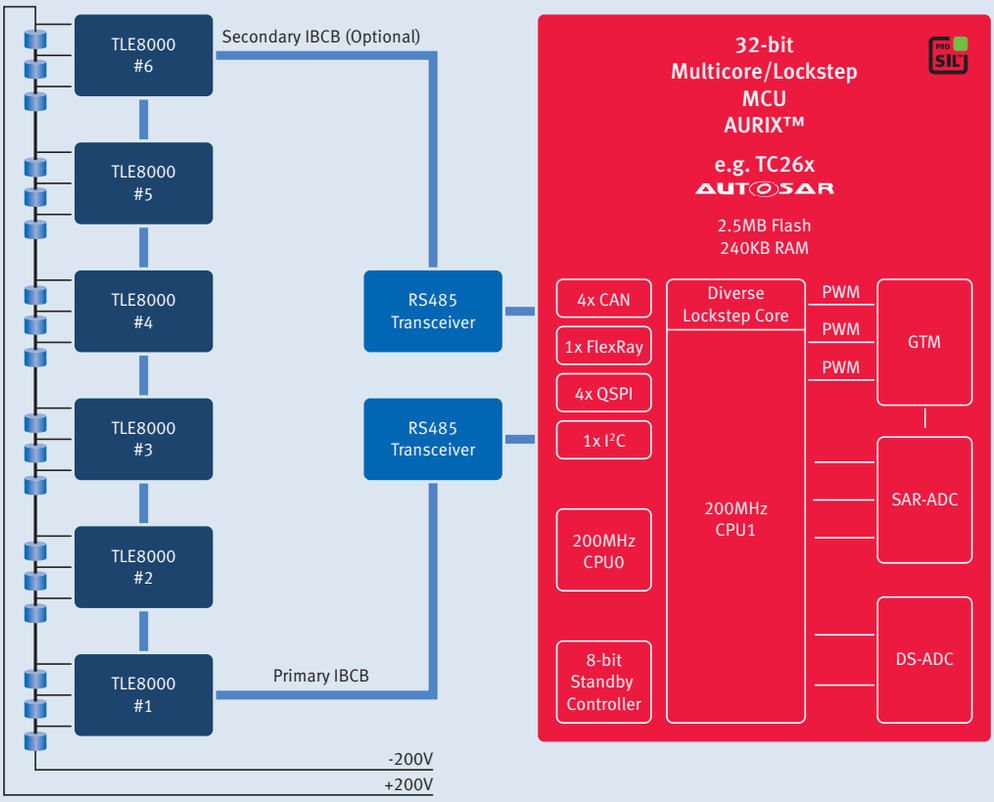
System Benefits

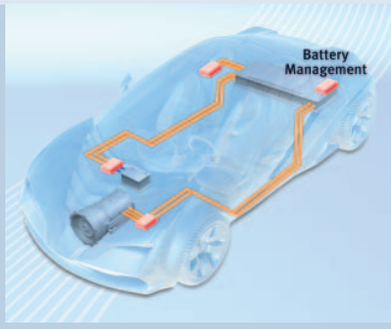
- Suitable for plug-in hybrid and EV
- Integrated Power-Factor Correction (PFC)
- Galvanic isolation
- Wide range of input and output voltages
- Adjustable current limits
- Automotive standard communication (CAN)
- Modular concept enables 1 to 3-phase AC power supply

Suggested Products

Product	Description
XC27xx	16/32-bit microcontroller family
CoolMOS™ (IPx65RxxxCFDA)	High-voltage automotive MOSFETs for low-power charging solutions (overnight)
Easy 1B/2B Automotive	Flexible power module solution for low-power charging solutions
HybridPACK™1 (High-power charging)	Power module solution

(H)EV – Battery Management System





System Benefits

- ISO 26262 ASIL-C/D (for AURIX™)
- Active & passive balancing
- IBCB network architecture
- Ring topology in event of failure
- Very accurate measurement paths for voltage and temperature
- Balancing & monitoring over long parking period (passive balancing)
- Fast balancing up to 5A (Active balancing)

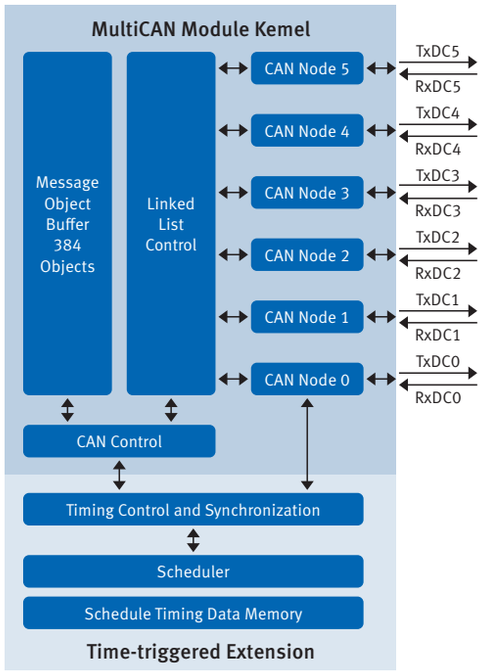
Suggested Products

Product	Description
AURIX™ TC26x	High-Performance 32-bit multicore lockstep microcontroller
TLE8000	Battery balancing IC

Enhanced Communication

MultiCAN

Complex applications increasingly require intelligent communication via the CAN network. A CAN gateway and FIFO are only two examples of what can easily be implemented with the enhanced MultiCAN module.



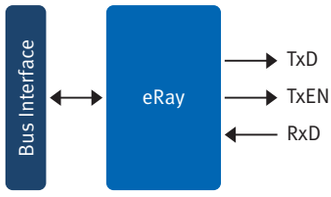
MultiCAN Features

- Full CAN with active CAN 2.0B
- Up to 6 independent CAN nodes
- Up to 384 message objects
- Programmable acceptance filtering
- Data transfer rate up to 1Mbit/s, individually programmable for each node
- Powerful analysis capability
- FIFO data handling support
- Automatic gateway support
- Flexible interrupt handling
- CAN FD (with flexible data rate)

FlexRay™

Features & Benefits

- Conformance with FlexRay protocol
- Specification V2.1
- Data rates of up to 10Mbit/s on each channel
- Up to 128 configurable message buffers
- 8KB of message RAM
- ERAY IP
- Supports demand for higher bandwidth (where CAN is bottleneck)
- Enables new vehicle partitioning concepts such as domain control
- Deterministic bus system (supports safety applications)



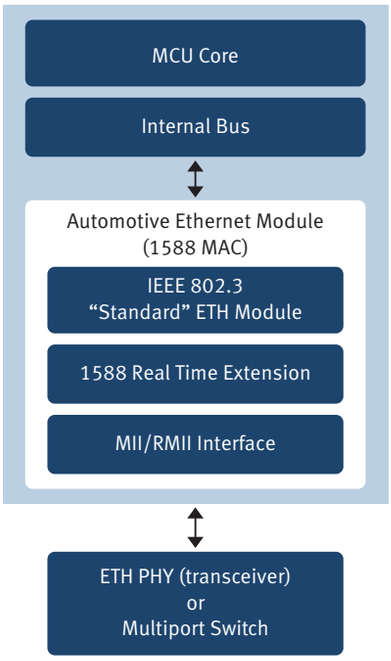
Constant Current Supply

1) FlexRay™ is a trademark of the FlexRay Consortium and used under license.

Ethernet

Features & Benefits

- MAC integrated in µC
- IEEE 802.3-2002 for Ethernet MAC standard compatible module with support of IP, TCP/IP, UDP
- Real-time stamping support (IEEE 1588-2008) for clock synchronization
- Standard MII and RMII interfaces to PHY
- Fast Ethernet w/ 100MBit
- Integrated DMA controllers
- 4k Tx/Rx 32-bit wide buffer
- Compliant to AUTOSAR 4

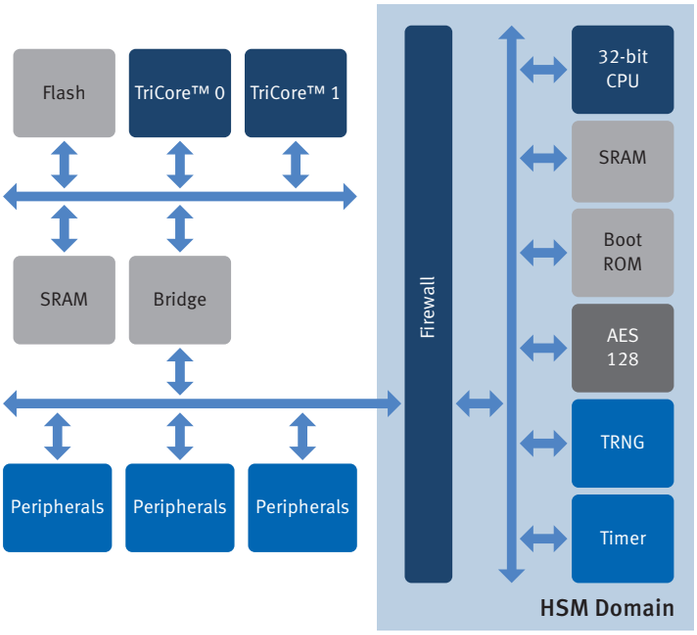


Peripheral Highlights

Hardware Secure Module (HSM)

Features & Benefits

- **32-bit processor** with up to 100MHz CPU speed
  - MPU (Memory Protection Unit)
  - Protected memory to store the cryptographic code & keys
- **AES-128** Hardware Accelerator for symmetric block ciphers
  - Support following crypto standards: ECB, CBC, CTR, OFB, CFB, GCM & XTS
- **T**rue **R**andom **N**umber **G**enerator (**TRNG**) to generate 128-bit random numbers

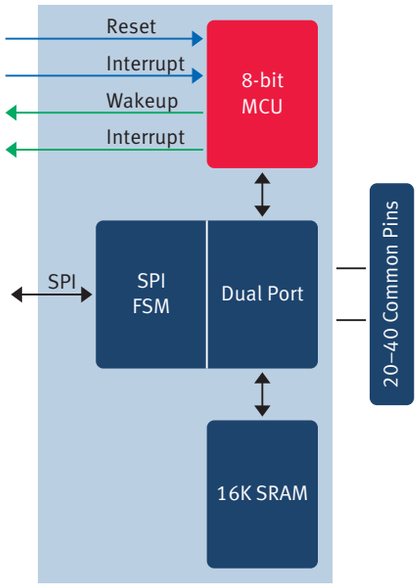


Peripheral Highlights

Standby Control Unit for Low Power

Features & Benefits

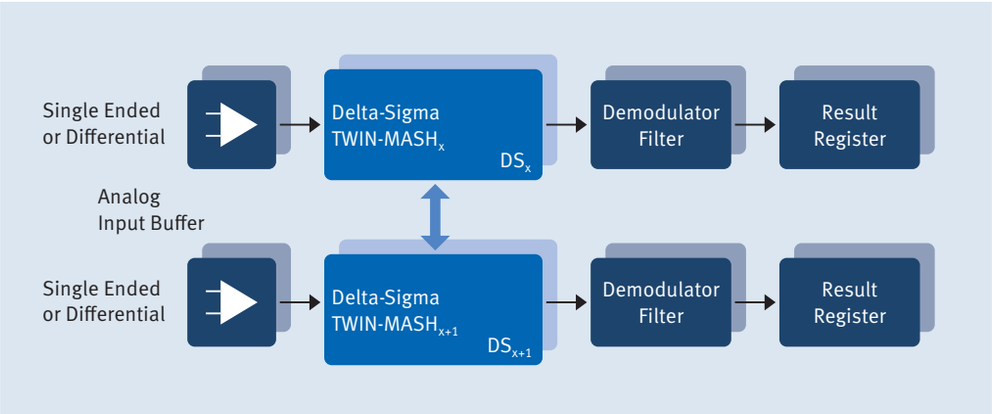
- Standby domain
  - 64KB ~ 128KB Standby RAM (TC1.6E DSPR)
  - Wake-up support
  - 2 internal clock sources – 100kHz & 100MHz oscillator
- Low power modes: Flexible Clock and Power gating to switch µC into sleep and standby modes
- Support pretended networking
- Current consumption
  - 100kHz Sleep mode ~ 50µA
  - 20MHz Active mode < 5mA
  - Typical active for 1% time results in average ~ 50µA



Delta Sigma ADC

Features & Benefits

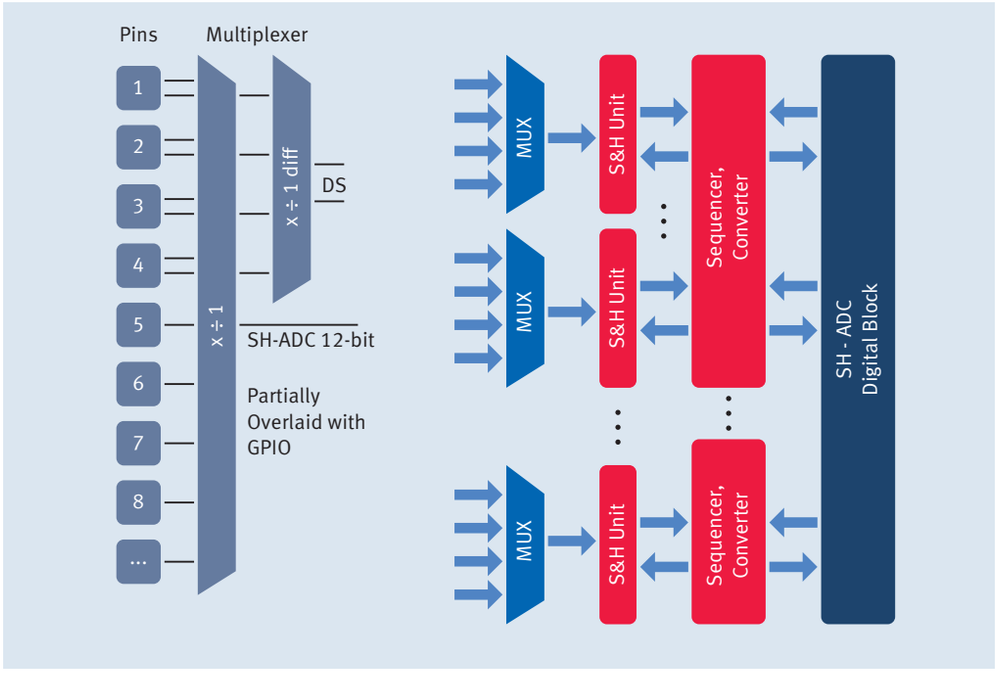
- Scalable High Signal-to-Noise Ratio
  - 74–80 dB (12–13 ENOB) for 100kHz – 30kHz signal input bandwidth in MASH1-1-1
- Supported OSR = 16-256
- FIR HW filter off-loads processor
- Optional connection to external galvanic decoupled modulators
- Adaptation of signal input bandwidth between 10kHz to 100kHz
- Programmable output sampling rates from 30kHz to 300kHz
- Replacement of Fast ADC



Enhanced Analog & Digital Converter (ADC)

Features & Benefits

- 12-bit SAR ADCs with conversion time < 1µs
- Flexible source HW/SW trigger and arbitration capabilities
- Flexible service request generation
- Master/Slave capability for up to 4 kernels
- Pins partially overlaid with GPIO
- Built-in safety features (MUX and SAR selftest, broken wire detection)

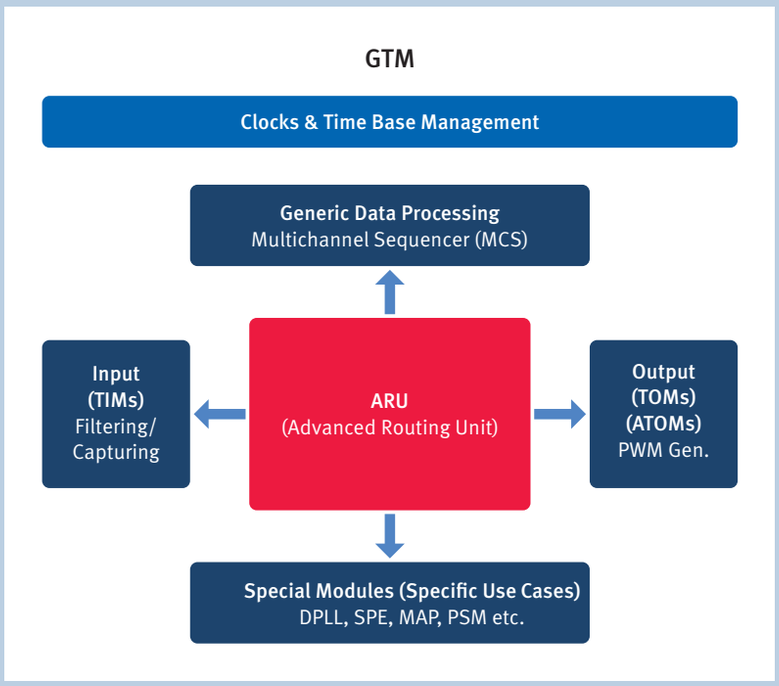


Peripheral Highlights

Generic Timer Unit (GTM)

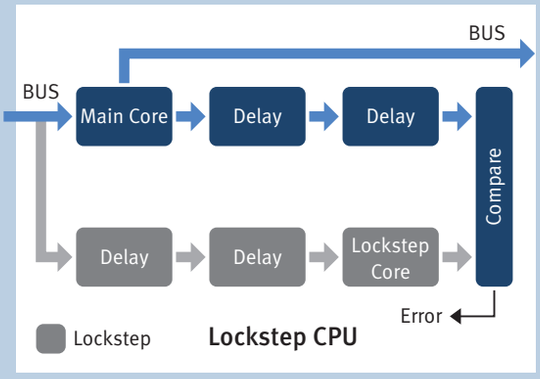
Features & Benefits

- Objective: heavily unload the CPU(s) from time critical tasks
- GTM uses dedicated hardware processing blocks, working in parallel without influencing each other
- No CPU interrupts required even for complex algorithms
- All processing blocks are arranged around the Advanced Routing Unit (ARU) which transfers data
  - From the input capture unit to the first signal processing block
  - From one signal processing block to the other
  - From the last signal processing block to the output compare unit



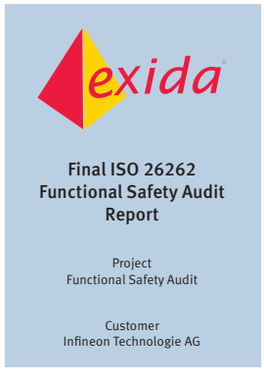
Infineon® Diverse Lockstep Concept

- Lockstep architecture designed to control and mitigate common cause factors
  - Physical isolation
  - Instruction-level execution diversity: 2-cycle delay
  - Circuit-level design&timing diversity
- Layout-level diversity
- Diversity controlled and verified by state-of-the-art design methods
- Special design of clock&reset networks
- Careful design of lockstep comparator
- Main core and diverse lockstep core run the same software in parallel to detect computational errors
- Like normal locksteps, both cores are physically separated and have a time delay between their execution
- Diverse Lockstep core has been additionally transformed to provide architectural hardware diversity and further reduce common cause failures



AURIX™ (HW and SW) Development According to ISO 26262 Process

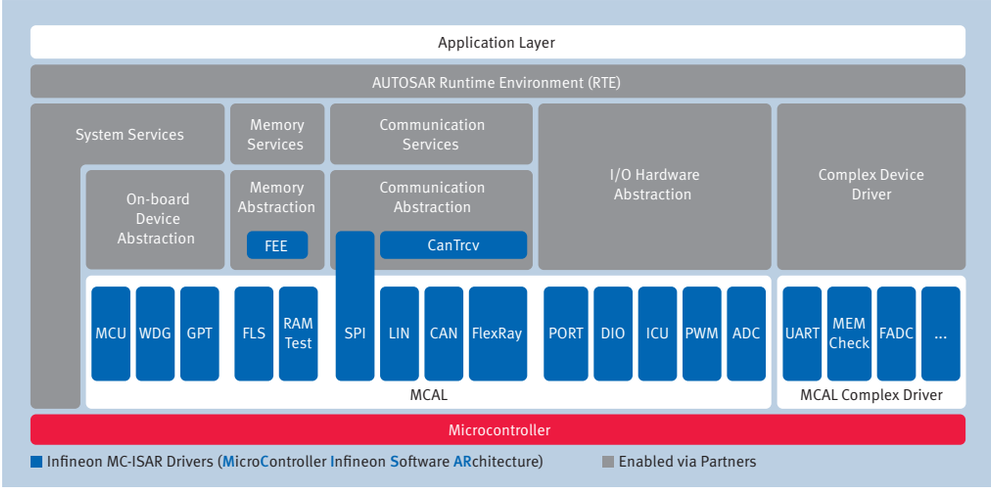
- Independent Functional Safety Management established at Infineon
- Compliance certificate available
  - SDHB to ISO 26262 Gap Analysis performed by Exida
  - Close-the-gap activities performed by Infineon
  - Exida has issued a compliance certificate (Jan 2012) for Infineon HW and SW development processes for building systems up to ASIL-D



Embedded Software

Infineon AUTOSAR MCAL Drivers

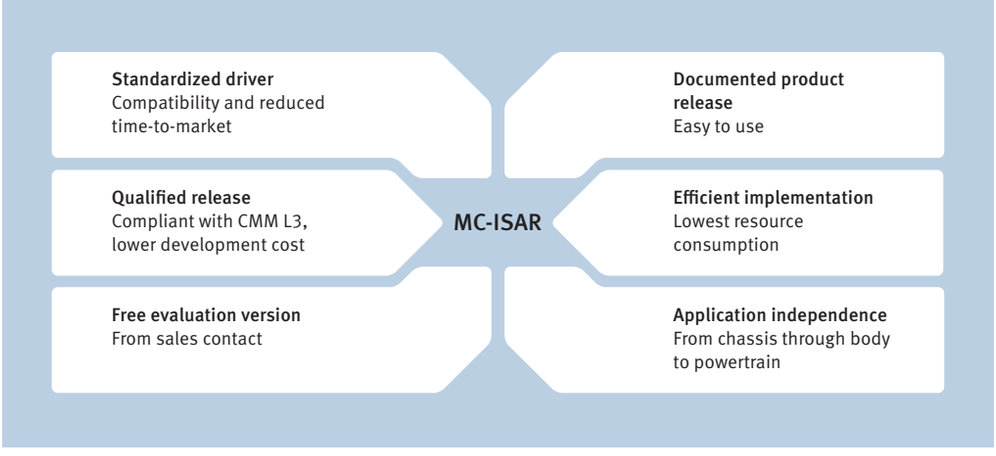
MC-ISAR Product Overview



MC-ISAR	MicroController – Infineon Software ARchitecture
MC-ISAR:	MCU, WDG, GPT, SPI, PORT, DIO, ICU, PWM, ADC
MC-ISAR COM Basic:	CAN, CanTrcv, LIN
MC-ISAR COM Enhanced:	FlexRay, Ethernet
MC-ISAR MEM:	FLASH, FEE
MC-ISAR MCAL CD:	UART, MEMCheck, FADC, ect. for TriCore™

- Supported AUTOSAR releases and devices
  - V2.0: AUDO NG (TC1796, TC1766)
  - V2.1, V3.0: XC2287, AUDO Future (TC1797, TC1767), AUDO S
  - V3.1, V3.2: XC2000, AUDO MAX
  - V4: AUDO MAX
  - V3.2, V4.03: AURIX™
    - ISO 26262 support
- Complex driver for non-standardized modules (for TriCore™)
- CMM L3 process
- AUTOSAR BSW suite via partners: Electrobit, Vector, KPIT
- Delivery packages include: source code, user manual, Tresos configuration tool

MC-ISAR Product Overview



Infineon's MC-ISAR eMotor Driver

3–Phase Motor Control for Mass Production

Electrical 3-phase motors, such as PMSM (Permanent Magnetic Synchronous Motors) and BLDC (Brushless DC) motors, are used across the automotive application domains (e.g. chassis control, (H)EV inverter, dry double clutch transmission etc.).

Feature Highlights

- Control PMSM motors via Field Oriented Control (FOC), including Space Vector Modulation SVM
- Control BLDC motors via Block Communication (BC)
- Mixed control of FOC/BC motors
- Integrated with AUTOSAR drivers
- Supports safety applications

Sensors in FOC Mode

- Hall sensors/Incremental encoder
- Direct resolver mode (without resolver IC)
- Resolver mode (with resolver IC)
- Sensorless FOC
- Current Measurement: 3 phases, 2-phase parallel and sequential, DC link sequential

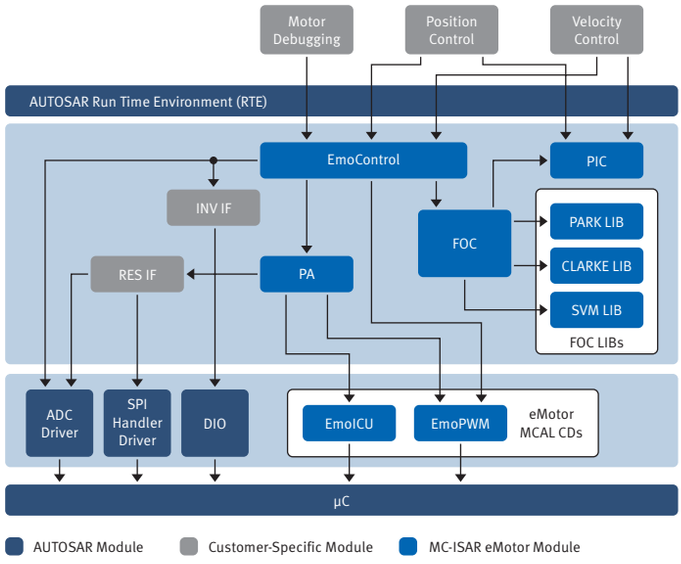
MC-ISAR eMotor Benefits

- Developed for mass production, off-the-shelf implementation
- Limited software outlay
- Direct resolver mode (no external resolver IC), reduced system cost
- Compliant to ISO 26262 process and CMM level 3
- Seamless configuration under the same configuration tool for AUTOSAR MCAL driver
- Easy to use

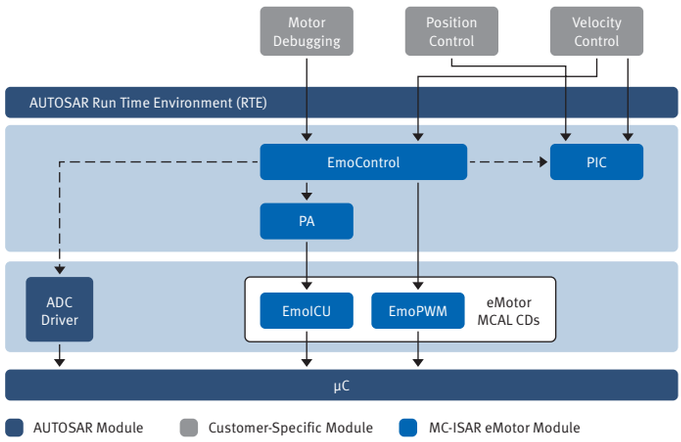
Sensors in BC Mode

- Hall sensors
- Sensorless via back EMF
- Current Measurement: DC link single

FOC Mode



BC Mode



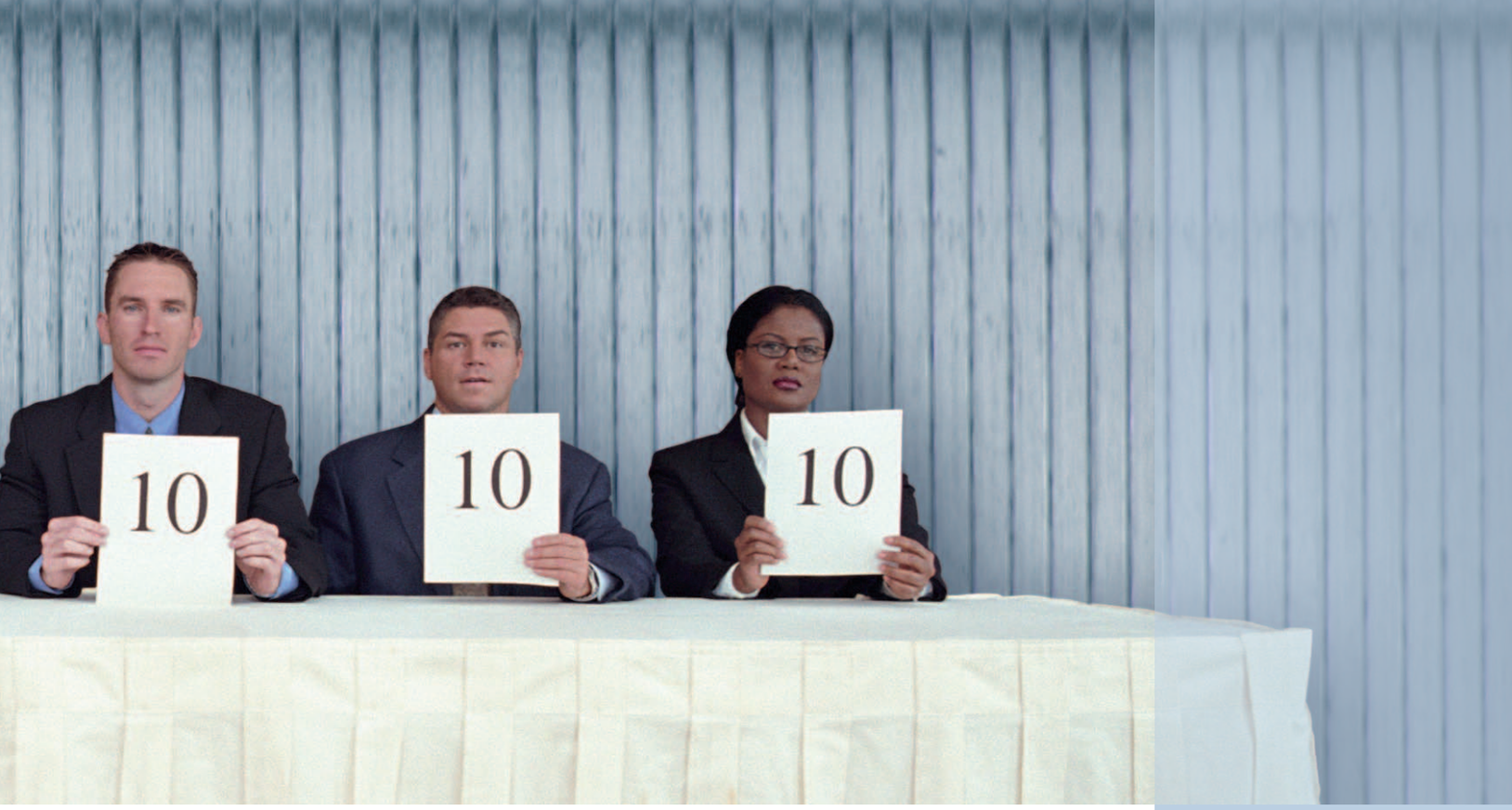
Infineon's Next Level of Zero Defect Program – On the Way to Zero Defect Products and Services

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 (BackEnd 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

Ask Infineon. Get connected with the answers.
Where you need it. When you need it.

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

Our global connection service goes way beyond standard switchboard services by offering qualified support on the phone. Call us!

- 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, please visit www.infineon.com/service for your country!

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