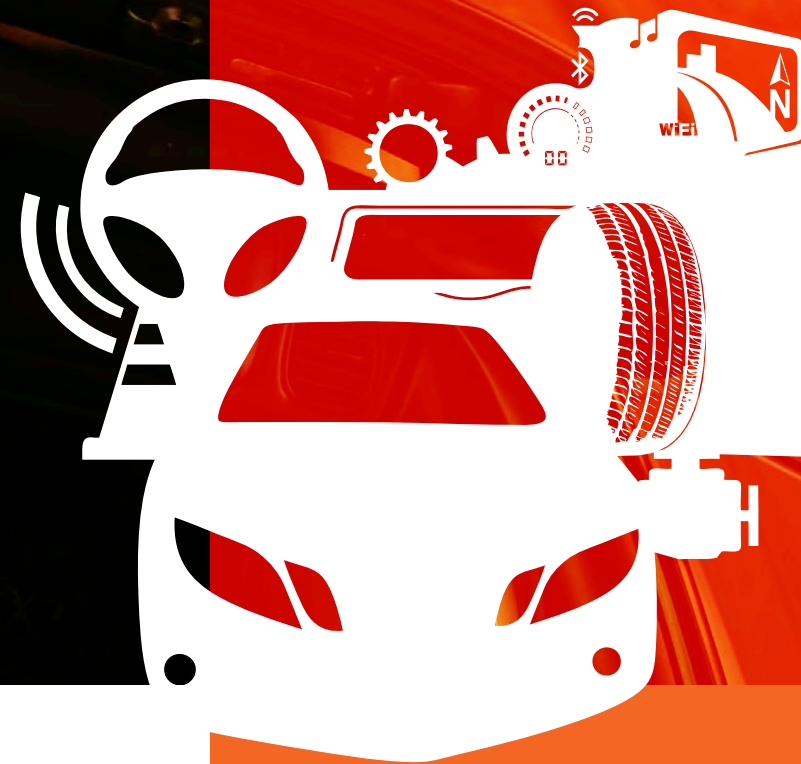
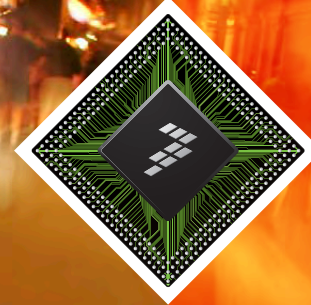


Automotive Solutions

Setting the pace for innovation



freescale.com/automotive

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Smart Automotive Technology

Today, automotive technology is experiencing a rapid evolution driven by four megatrends:

- Mobility for everyone
- Cleaner world for everyone
- Safety for everyone
- Everyone always connected

Vehicles are safer, more fuel efficient and more pleasant to drive than in any previous generation and they are now an extension of the owner's personal life style. Many of these advancements are due in large part to innovations in semiconductor technology.

Setting the Pace for Technology Leadership

Our broad portfolio of automotive MCUs, MPUs, analog integrated circuits and sensor solutions, supported by the appropriate ecosystem is helping you to innovate and develop your next-generation automotive solutions.

We help you to create the next breakthrough automotive designs for internal combustion powertrain and hybrid drivetrains, body electronic and gateways, chassis solutions, safety and driver assistance solutions, instrument clusters and infotainment solutions.

Transitions Ahead

Next-generation vehicles will require increased on-board computing power, more efficient analog components and smart actuators, deterministic, multiplexed networking throughout the vehicle as well as environment and behavior sensors for a safer, cleaner, connected and more comfortable ride.

Freescale technology will enable this vision, and we are continuously investing in new designs that will help our customers and partners redefine the vehicle.

This brochure provides an overview of Freescale automotive solutions. We encourage you to contact us to help define your next-generation design.

Programs

Automotive Quality

Building Better Products from Start to Ship

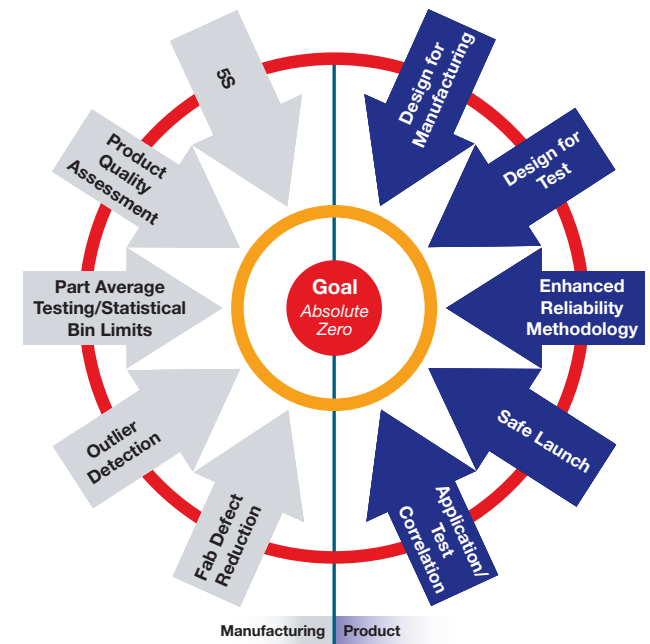
The Freescale Zero Defects methodology provides an elevated level of excellence, enabling the highest quality required by our automotive customers. In using it, we ensure that products receive optimum attention to detail in every phase of production, including design, wafer fabrication, assembly and test.

Discover more at [freescale.com/quality](https://www.freescale.com/quality)

Product Longevity

Freescale provides a product longevity program for the automotive market and will make a broad range of devices available for a minimum period of 15 years. Life cycles for participating Freescale products will begin at the time of product launch and will include the standard Freescale end-of-life notification policy. Freescale will manage the program through our own factories, outside foundries and other manufacturing resources. If it becomes necessary to transfer the production of a participating product to an alternate manufacturing facility, Freescale will re-qualify that product. These actions demonstrate our intention to provide supply stability to our customers and complete transparency regarding the guaranteed minimum remaining lifetime of our products.

Discover more at [freescale.com/productlongevity](https://www.freescale.com/productlongevity)



Functional Safety in Automotive

The automotive industry is under pressure to provide new and improved vehicle safety systems, ranging from basic airbag deployment systems to extremely complex advanced driver assistance systems (ADAS) with accident prediction and avoidance capabilities. These safety functions are increasingly carried out by electronics, and the International Standards Organization developed the ISO 26262 standard to enable the design of electronic systems that can prevent dangerous failures or control them if they occur.

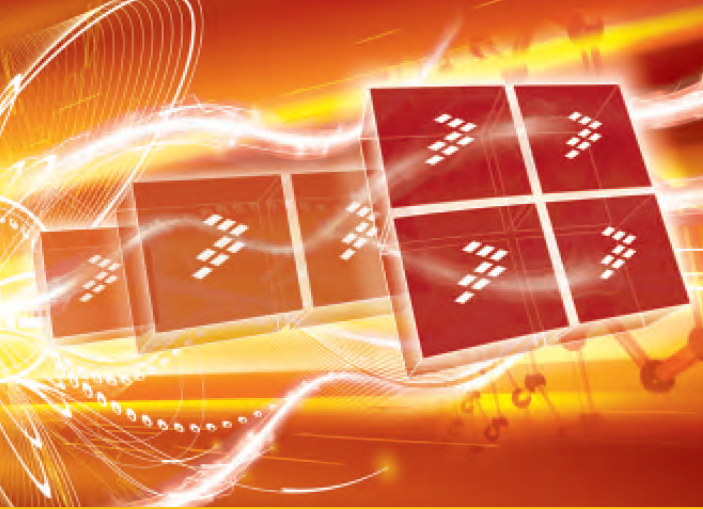
SafeAssure Program

The Freescale SafeAssure functional safety program provides system designers with easier identification of hardware and software designed to target functional safety applications. SafeAssure solutions are conceived to simplify system-level functional safety design and standard compliance and come with a rich set of enablement collateral facilitating failure analysis, hardware and software integration. Moreover, SafeAssure solutions provide a clear support interface to ensure that we are there to serve your needs at each step of the system design and compliance process.

The Freescale SafeAssure program supports the most stringent automotive safety integrity levels (ASILs) to help developers more easily attain system compliance. Whether your need is to attain ASIL A, B, C or D system compliance, the SafeAssure program identifies products that are targeted for use in the effective implementation of functional safety technologies.

Discover more at [freescale.com/SafeAssure](https://www.freescale.com/SafeAssure)





i.MX Applications Processors

Your interface to the world

Qorivva MCUs

Unleashing the power of automotive innovation

Hybrid Automotive Solutions

Rich applications in real time

Brands

i.MX Applications Processors

The most versatile platform for multimedia and display applications, Freescale ARM®-based i.MX processors deliver an optimal balance of power, performance and integration. i.MX solutions include processors based on ARM9™, ARM11™, ARM Cortex™-A8 and ARM Cortex™-A9 core technologies, and are powering applications across a rapidly growing number of consumer, automotive and industrial markets. In particular, i.MX 6 series processors enable auto infotainment and instrument cluster designers to re-create today's consumer technology experience in the car. As drivers adopt personal and home-based smart devices, automotive manufacturers are bringing a similar experience in-vehicle and these processors are purpose built to meet the demands of

connectivity, real-time data delivery, digital instrumentation, audio and multi-stream video while meeting automotive quality requirements.

freescale.com/iMX

Qorivva 32-bit MCUs

Qorivva automotive MCUs are designed with the highest level of compatibility, software and development tool re-use to maximize the design efficiency of our customers. The latest generation of Qorivva MCUs, based on Power Architecture® technology, is built using both 90 nm and 55 nm non-volatile memory (NVM) process for improved power efficiency and cost effectiveness and features innovative multicore architectures. Qorivva MCUs include leading-edge integration and performance capabilities, including configurable peripheral sets such as flexible timers and motor control systems. Digital

signal processing capabilities and advanced communication interfaces provide additional functionality. With these features, Qorivva MCUs provide the freedom to architect the ideal solution for a particular automotive application.

freescale.com/Qorivva

Hybrid Automotive Solutions

Hybrid R series automotive solutions offer a unique dual-core (ARM Cortex™-A5 + Cortex™-M4) architecture that handles both MCU and MPU tasks on a single chip. Generous 1.5 MB on-chip SRAM and multiple package options provide scalability from low-cost basic connected radios without external DRAM up to entry-level infotainment systems with dual displays and GPU-accelerated rich, compelling user interfaces. Hybrid automotive families introduce production-grade



S12 MagniV Mixed-Signal MCUs

Streamlining automotive engineering with smart analog integration

software for connected radio and cluster applications. Built upon auto-grade BSPs for Linux® and MQX™, our production-grade software is the ideal starting point for your radio and cluster designs.

freescale.com/Vybrid

S12 MagniV Mixed-Signal MCUs

The S12 MagniV portfolio helps simplify system design with easy-to-use, expertly integrated mixed-signal MCUs for automotive applications. Offering both monolithic and multi-die solutions, S12 MagniV devices are built on proven S12 technology, enabling software and tool compatibility across the entire portfolio. These rugged MCUs represent highly integrated subsystems that can be directly connected to a 12 V power supply. With the right blend of digital programmability and high-precision

analog, plus a portfolio of scalable memory options and featuring new monolithic devices based on the revolutionary LL18UHV technology, the S12 MagniV portfolio streamlines automotive design.

freescale.com/MagniV

Xtrinsic Sensing Solutions

Xtrinsic sensing solutions are based on more than 30 years of sensing history and are designed with the right combination of intelligent integration, logic and customizable software on the platform to deliver smarter, more differentiated applications. Freescale sensors that are classified under the Xtrinsic brand exhibit integrated algorithms or are integrated platforms with multiple sensors and a processor that provide a high degree of contextual awareness and decision making.

freescale.com/Xtrinsic

Xtrinsic Sensing Solutions

A new era of sensing experience

Freescale Analog Solutions

Freescale offers analog mixed-signal technology which includes monolithic ICs using proven high-volume SMARTMOS technology, combining analog, digital and power capabilities. Freescale system-in-package devices integrate power, SMARTMOS and MCU technologies. Our products provide a high level of integration and enable board footprint reduction, component count reduction, low keyoff current drain, ease of design, lower system cost and improved system performance. We have automotive-qualified products that support a wide variety of automotive applications such as body and gateway, active and passive safety, powertrain, alternator and battery management, window lift, lighting and infotainment.

freescale.com/analog

Our broad portfolio of automotive MCUs and processors, analog integrated circuits, and sensors solutions help you to move forward, faster. We enable you to create the next breakthrough automotive designs for powertrain and hybrid, body, chassis and safety, infotainment and instrument cluster, and in-vehicle networking applications.

Powertrain

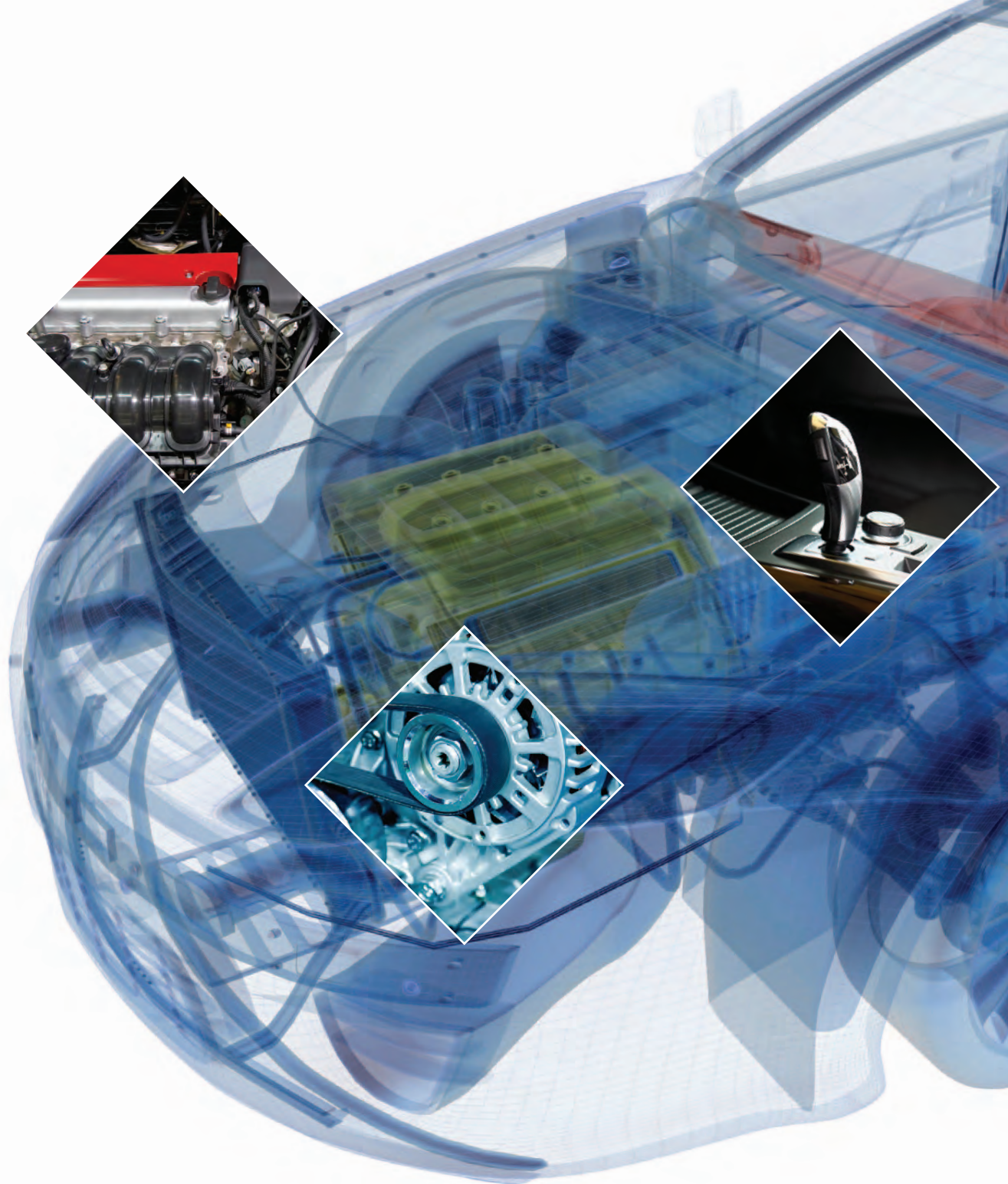
overview

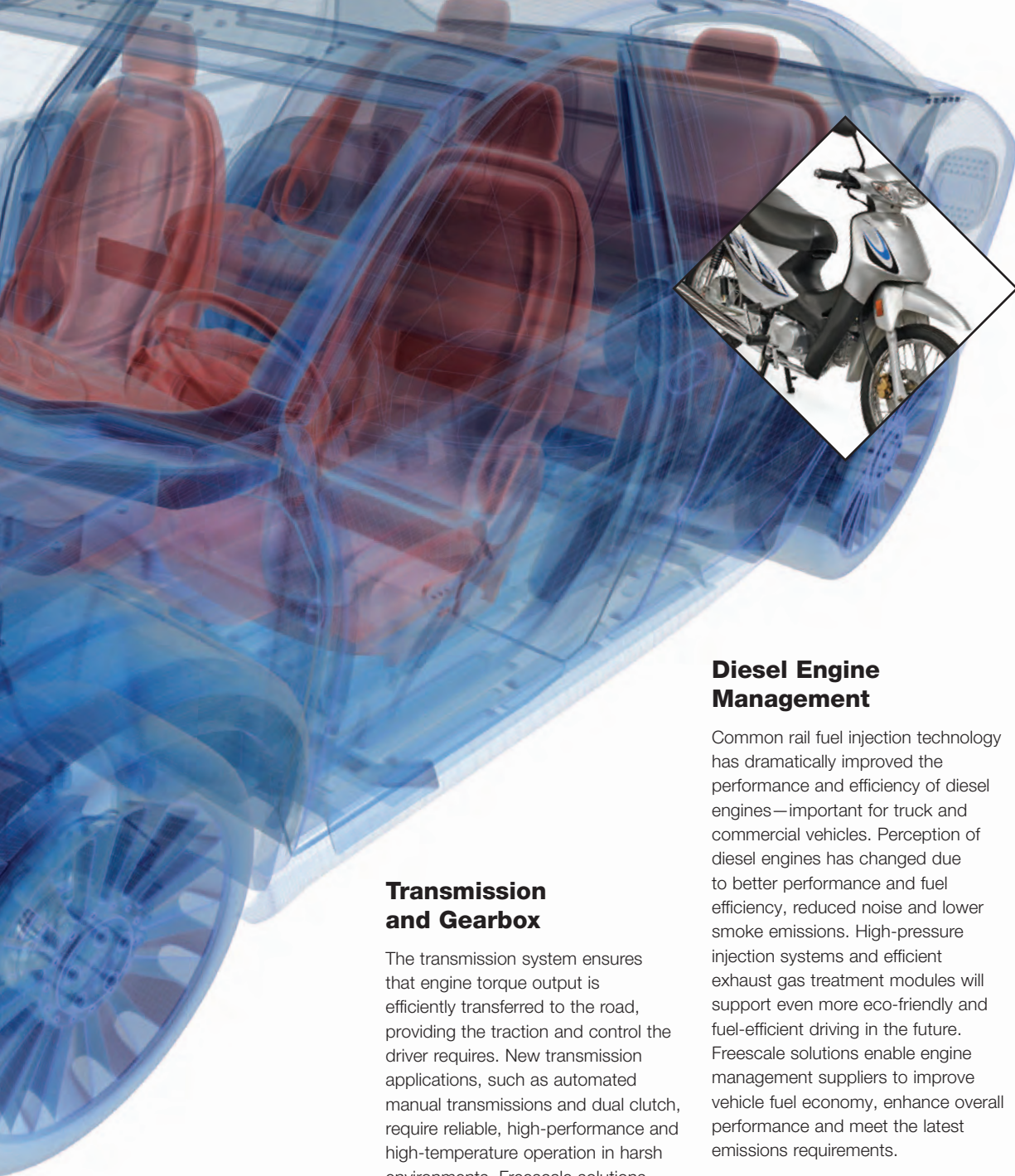
Gasoline Engine Management

Compliance with emissions standards is achieved with more efficient combustion in the engine and a combination of improvements among in-cylinder pressure control, better exhausted gas recirculation, friction reduction and control of pumps. Gasoline direct injection (GDI) technology will improve fuel efficiency by 20 percent due to the contribution of electronics. And cars equipped with turbochargers are expected to become even more prevalent in coming years. Our expertise and leadership in the powertrain market can help you develop the ultimate eco-friendly gasoline engine control system for future generations of vehicles.

Alternator Regulator

The programmable LIN alternator regulator device is designed to provide you with a complete system-on-chip solution to manage electrical parameters of an alternator with rotor excitation current up to 8 A, using high-side excitation technology and combined with a free-wheeling diode. This solution offers a high degree of programmability and can control and diagnose the alternator using a standard, robust LIN 1.3 protocol. It also includes a load response control, a thermal compensation combined with thermal protection and a self-start operation.





Transmission and Gearbox

The transmission system ensures that engine torque output is efficiently transferred to the road, providing the traction and control the driver requires. New transmission applications, such as automated manual transmissions and dual clutch, require reliable, high-performance and high-temperature operation in harsh environments. Freescale solutions are built to sustain stringent high-temperature requirements.

Diesel Engine Management

Common rail fuel injection technology has dramatically improved the performance and efficiency of diesel engines—important for truck and commercial vehicles. Perception of diesel engines has changed due to better performance and fuel efficiency, reduced noise and lower smoke emissions. High-pressure injection systems and efficient exhaust gas treatment modules will support even more eco-friendly and fuel-efficient driving in the future. Freescale solutions enable engine management suppliers to improve vehicle fuel economy, enhance overall performance and meet the latest emissions requirements.



Motorcycle Engine Control Unit and Small Engine Control

Motorcycle manufacturers are evolving from mechanically controlled to electronically controlled systems to meet stricter emissions regulations. Systems will need to remain cost effective during this transition versus carburetor design while also satisfying the space constraints of the embedded ECU. Freescale solutions offer high-quality, integrated, small-footprint, cost-effective solutions for this evolving market.

Electric Pumps, Motor Control and Auxiliaries

Electronically controlled fuel, oil and water pumps can deliver more accurate fuel and coolant flow and pressure within the engine environment and operate only when required. This helps ensure economical fuel management and optimal run temperatures for the most efficient engine operation.

Driving
best-in-class
engine control,
performance
and leading-
edge fuel
economy
as well as an
uncompromised
driving
experience

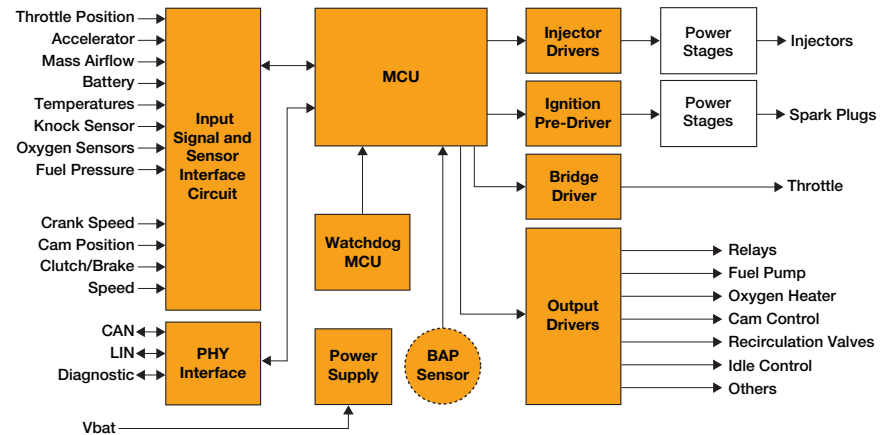
Powertrain

details

In-vehicle electronic control technology was first introduced in powertrain systems. Freescale has been there since the beginning of MCU implementation in vehicles and at every performance-enhancing milestone since. Built on industry-leading technology with Qorivva 32-bit MCUs and supported by Xtrinsic sensing solutions and SMARTMOS analog/mixed-signal ICs, Freescale provides enabling technologies to help system designers meet tomorrow's powertrain design challenges. Freescale technology allows designers to create powertrain applications that meet government regulations and consumers' requirements for cleaner, more fuel-efficient vehicles.

Discover more at freescale.com/powertrain

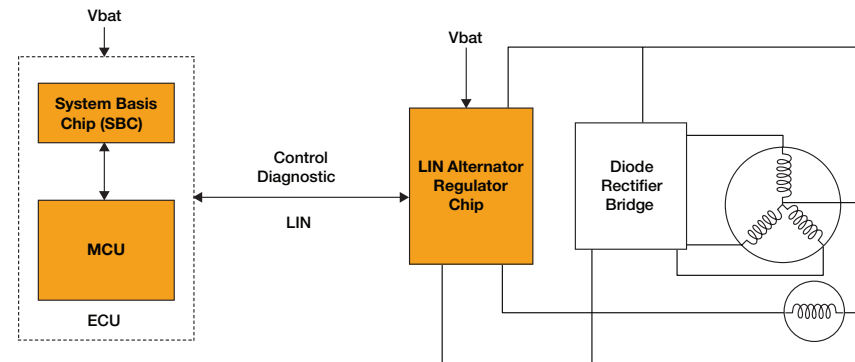
Gasoline Engine Management



Recommended Products

MCU	Qorivva 32-bit, S08 8-bit
Analog	SMARTMOS ASSP, SBC, H-bridges, ignition and injection pre-drivers
Sensor	Xtrinsic barometric air pressure sensor

Alternator Regulator

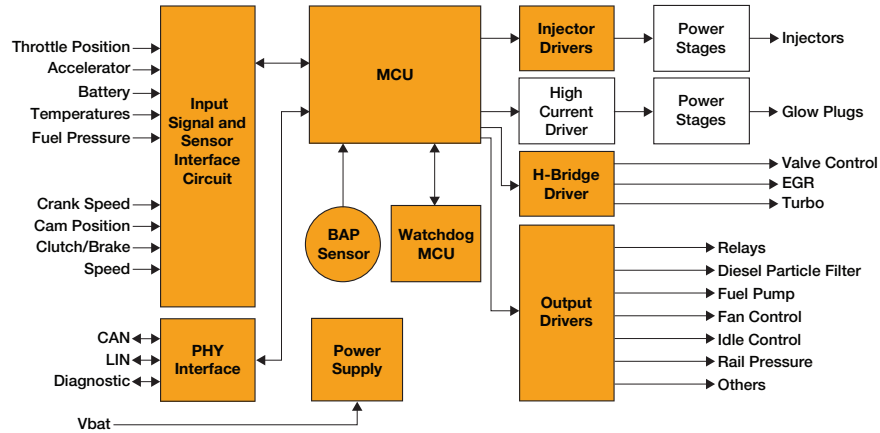


Recommended Products

MCU	Qorivva 32-bit
Analog	LIN alternator regulator interface chip, SBC

■ Freescale Technology □ Optional

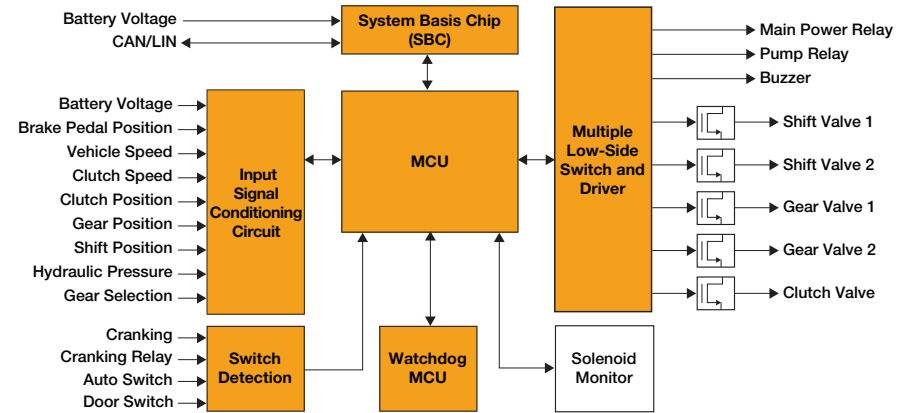
Diesel Engine Management



Recommended Products

MCU	Qorivva 32-bit, S08 8-bit
Analog	SMARTMOS ASSP, SBC, H-bridges, ignition and injection pre-drivers
Sensor	Xtrinsic barometric air pressure sensor

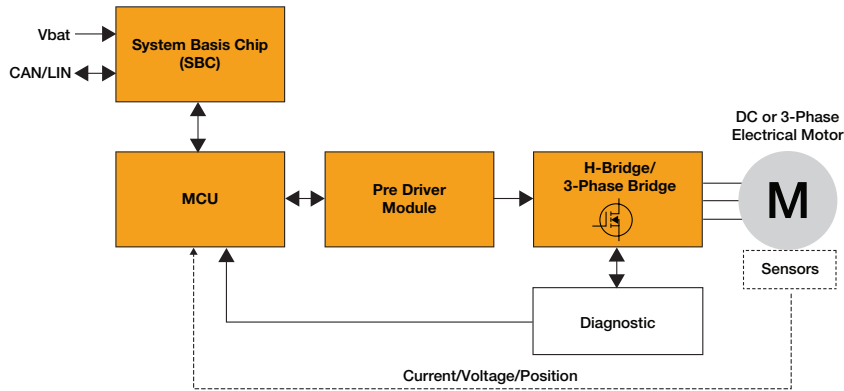
Transmission and Gearbox



Recommended Products

MCU	Qorivva 32-bit, S08 8-bit
Analog	SMARTMOS SBC, physical interfaces, switch detection low-side drivers

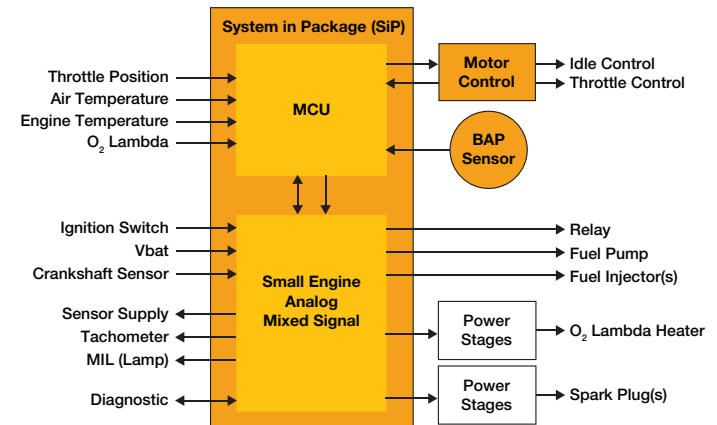
Electric Pumps, Motor Control and Auxiliaries



Recommended Products

MCU	S12 MagniV, S12 16-bit, S08 8-bit
Analog	SMARTMOS SBC, physical interfaces, pre-driver, H-bridges, 3-phase bridge

Motorcycle/Small Engine Control Unit

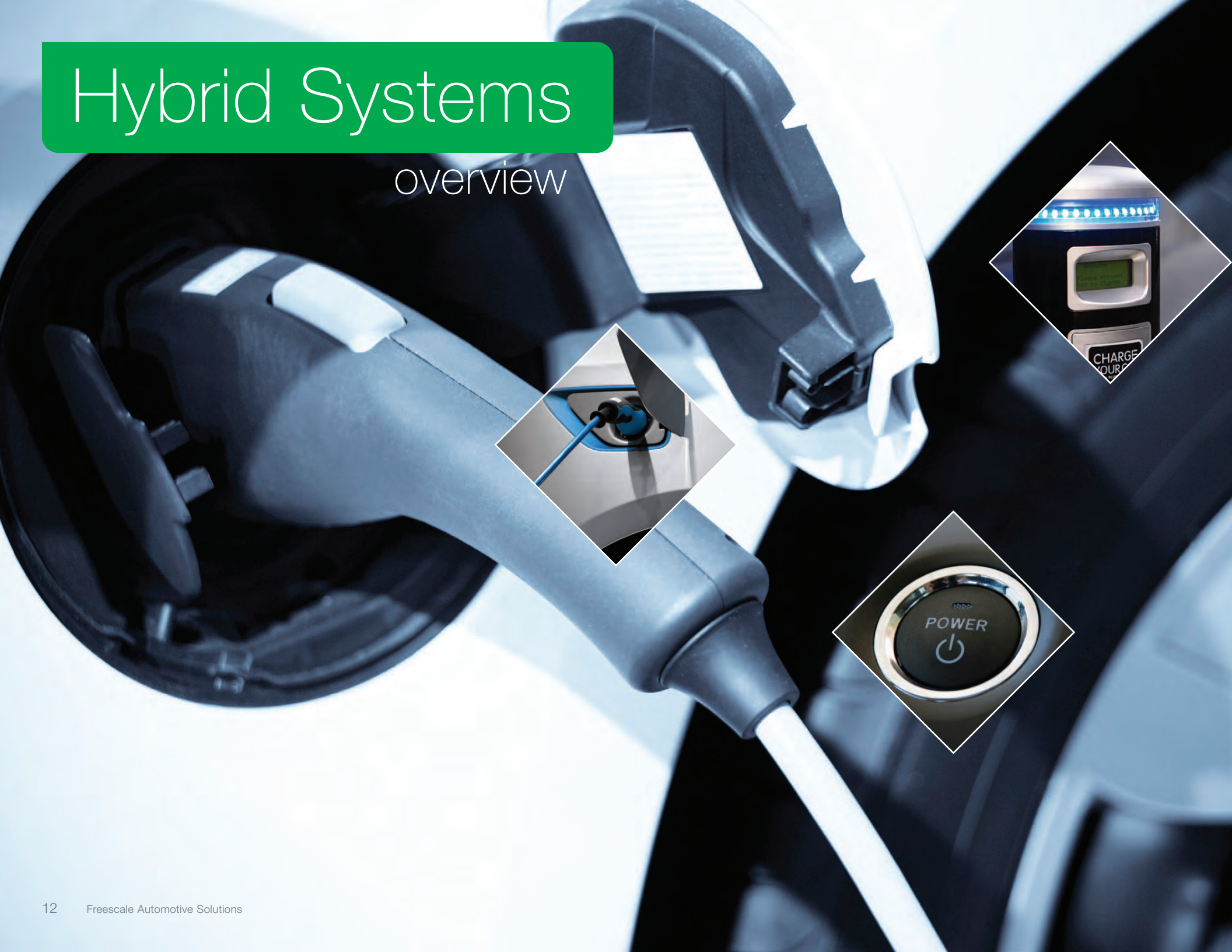



Recommended Products

MCU	S12 16-bit, system in package (MCU + analog)
Analog	Small engine IC and system in package, motor control IC
Sensor	Xtrinsic barometric air pressure sensor

Hybrid Systems

overview





Power the drive train, improve fuel economy, manage energy use and reduce emissions while recharging the battery

Inverter Controller for Hybrid Electric Vehicle (HEV)

A hybrid vehicle combines a downsized internal combustion engine and an electric motor (e-motor) to improve fuel economy and reduce emissions. Mild hybrid, full hybrid and plug-in hybrid are a common way to refer to the power breakdown capability of the electric motor and functionalities associated to it. For example, the torque of the electric motor in mild hybrid may assist the thermal engine at low speed, minimizing fuel consumption while the brakes regenerate the mechanical energy to electricity.

Converter and Charger for HEV

The AC/DC charger may be external or embedded into the vehicle. The charger interfaces with the battery management system which ensures a proper charge of electricity of the cells until it fulfills the high-voltage requirements. The high-voltage battery is essential to drive the traction motor(s) during operation. It also provides 12 V through a converter for the other electronic modules of the car. There are multiple options for charging modes (slow, mid and fast) and technology (wired or wireless) for this solution.

Stop/Start System for HEV

This system shuts the engine off instead of idling while burning fuel and restarts it instantly on demand. This is a particularly effective system in urban start/stop driving conditions where fuel consumption and CO₂ emissions can be reduced by up to 15 percent. Stop/start systems require power electronics that can handle high current during cranking and ensure reliability of engine cycles operating on/off at high temperatures. The power stage is connected to an intelligent electronic module to interface with the other elements of the car, body controller and engine management system.

Battery Monitoring

Battery management solutions are based on battery type. For lead acid batteries, an intelligent sensor combines the requirements of accurate measurement sensing with logic capability to bring decision making to the sensing solution. Electrified cars operate with higher voltage (28 to 450 volts) and are based on li-ion technology. Since battery management systems require different levels of control, several technical aspects need to be considered including cell balancing, isolation between the set of cells and the cluster, communication between each cluster, safe control of the chemistry and processing the algorithm to optimize battery life and reliability.

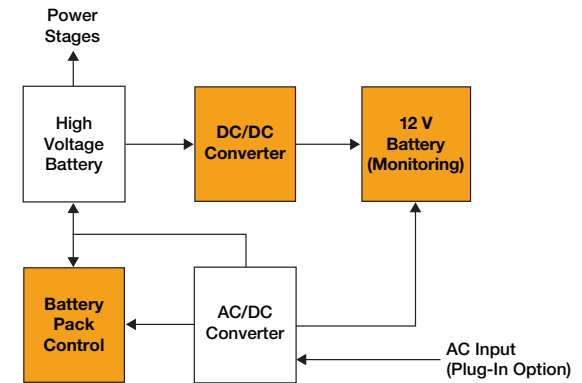
Hybrid Systems

details

A hybrid vehicle combines an internal combustion engine and a battery-powered e-motor to power the drivetrain, improving fuel economy and reducing emissions. Additionally, modules are required to control the electric traction motor, recharge the batteries and manage energy used to run the auxiliaries.

Discover more at [freescale.com/hybrid](https://www.freescale.com/hybrid)

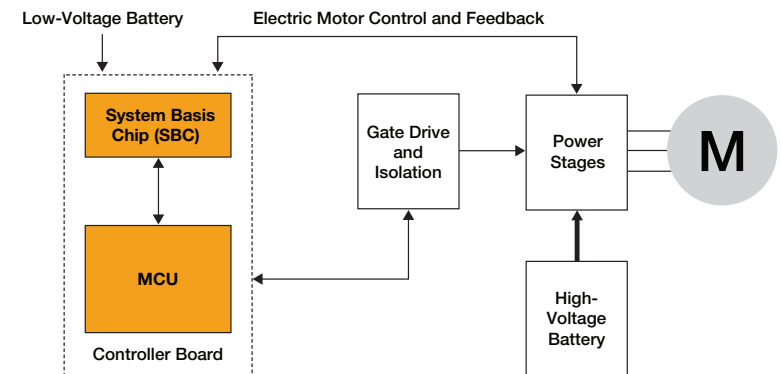
HEV Converter and Charger



Recommended Products

MCU	Qorivva 32-bit, S12 16-bit, S12 MagniV
Analog	SMARTMOS SBC, physical interfaces
Sensor	Xtrinsic battery sensors

HEV Inverter Controller

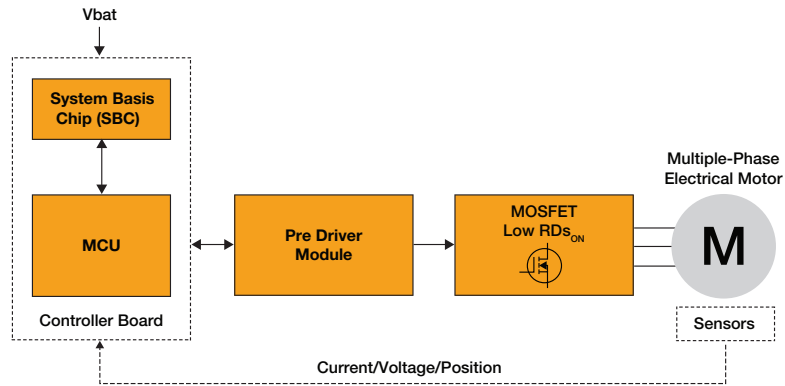


Recommended Products

MCU	Qorivva 32-bit, S12 16-bit, S12 MagniV
Analog	SMARTMOS SBC, physical interfaces, 3-phase driver

■ Freescale Technology
 Optional

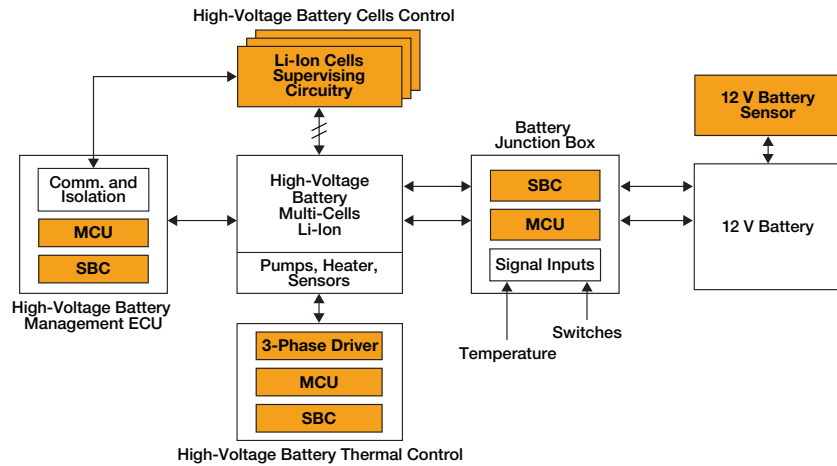
HEV Start/Stop System



Recommended Products

MCU	Qorivva 32-bit, S12 16-bit, S08 8-bit
Analog	SMARTMOS SBC, physical interfaces, 3-phase driver, MOSFET transistor

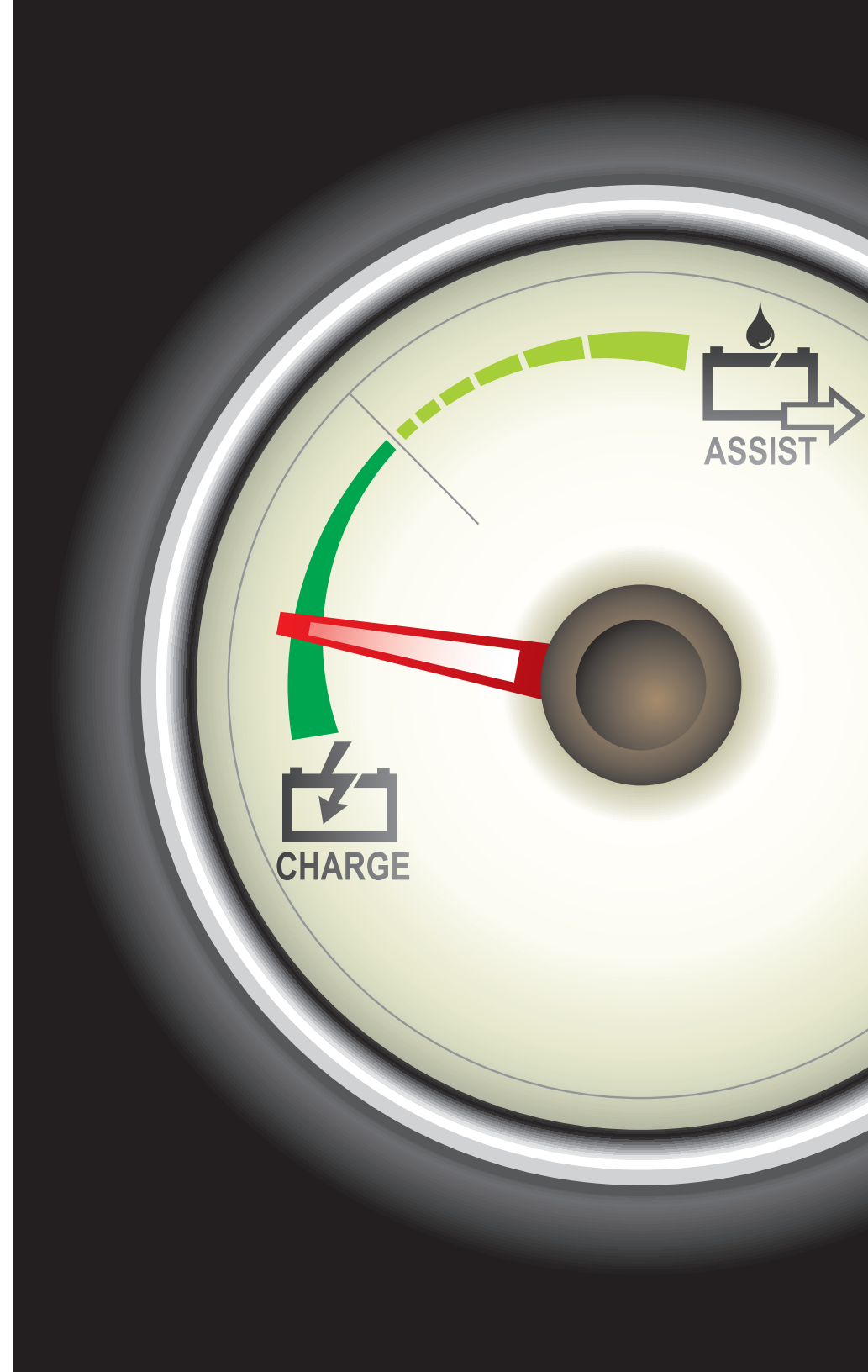
Battery Monitoring



Recommended Products

MCU	Qorivva 32-bit, S12 16-bit
Analog	SMARTMOS SBC, physical interfaces
Sensor	Xtrinsic battery monitoring sensors

■ Freescale Technology □ Optional



Chassis and Safety

overview



PSI5 and DSI Airbag Systems

The central component of an airbag system is a control unit that combines a 16- or 32-bit MCU with a set of local acceleration sensors. Depending on the complexity of the system, additional satellite sensors provide supplementary crash information via a standardized sensor bus, such as the peripheral sensor interface 5 (PSI5) or the distributed sensor interface (DSI). Processed sensor data is used to fire front, side and curtain airbags with specialized multichannel squib driver circuits. As an additional factor of safety, highly efficient switched-mode power supply components allow the system to keep operating for several hundred milliseconds if the battery connection is lost during an accident.

Braking and Stability Control

Electronic stability control systems help drivers maintain vehicle control. An MCU and a set of sensors measure vehicle lateral and longitudinal acceleration, yaw rate and the wheel brake system to maintain the vehicle's intended trajectory. Freescale enables active and passive safety systems, which can be networked by increasing computing power system. A dual-core MCU enables individual control of brake forces at each wheel while a sensor provides intuitive signal processing, including fault and overload diagnostic system alerts, to help keep the driver on the road.

Electric Power Steering (EPS)

EPS is favored over hydraulic power steering in most new vehicles. Eliminating the power steering pump can reduce weight and improve fuel economy. EPS offers greater handling and steering feel while improving vehicle safety by adapting the steering torque to the vehicle's speed and providing active torque in critical driving situations. The central electronic elements of today's EPS systems are modern 16- and 32-bit MCUs designed for safety-critical applications that provide enhanced computing power and specialized peripherals for complex electric motor control functions. Integrated power supply solutions are also important elements of a power steering control unit.

Active Suspension

Active suspensions are often found on today's high-end production sports and sedan cars, and feature vehicle level and damping control on all four corners. They offer an adjustable ride, optimized for comfort or handling performance by automatically adjusting the vehicle's wheel and chassis movements according to road conditions. A low g sensor mounted on each damper measures the displacement acceleration, while a 16- or 32-bit MCU with enhanced computing power and specialized peripherals for control functions enables individual control of the damper coefficient at each wheel.

Tire Pressure Monitoring System (TPMS)

TPMS solutions are a new standard for improved vehicle safety. Freescale utilizes its advanced integration techniques to provide a TPMS solution for real-time tire pressure monitoring and alerts the driver to improperly inflated tires. Freescale TPMS solutions are designed for the Federal Motor Vehicle Safety Standard 138 and car manufacturer requirements throughout the world. TPMS solutions are installed in a module on the wheel rims to provide independent, real-time air pressure, temperature and acceleration measurements for each tire that can be transmitted to the vehicle instrument cluster to instantly inform the driver.

Integrated systems that have helped put advanced chassis and safety systems on the road



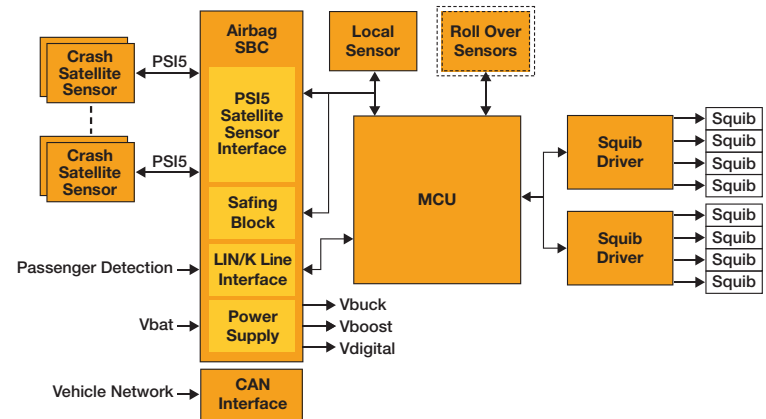
Chassis and Safety

details

Freescale has been continuously expanding its MCU, analog and sensor portfolio and by creating highly innovative integrated products that have helped put advanced chassis and safety systems on the road. Our portfolio includes advanced chipset solutions for increasing performance in high-volume braking and stability control, electric steering systems and for PSI5 and DSI communication protocol support in modern airbag systems. Our ongoing efforts to extend the capabilities of these systems include addressing the needs of system designers to achieve compliance with ISO 26262, and integrating sensor technologies into cost-efficient system-in-package solutions that deliver board-level functionality for automotive systems.

Discover more at freescale.com/chassisandsafety

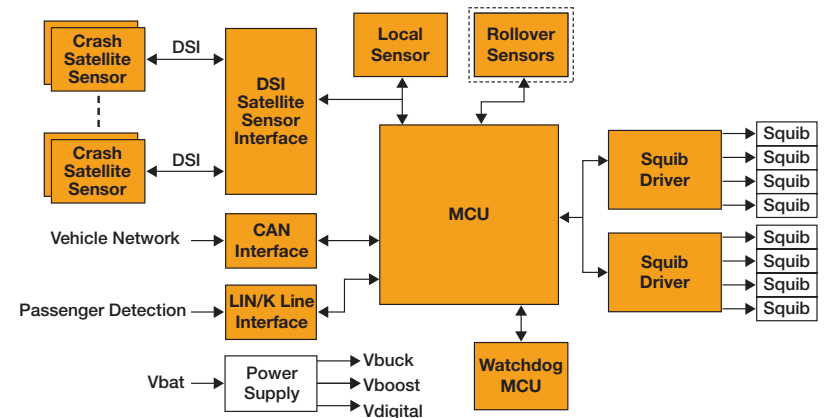
PSI5 Airbag System



Recommended Products

MCU	Qorivva 32-bit, S12 16-bit, S08 8-bit
Analog	SMARTMOS ASSP, SMARTMOS ASIC, SBC and squib drivers
Sensor	Xtrinsic inertial sensors and pressure sensors

DSI Airbag System

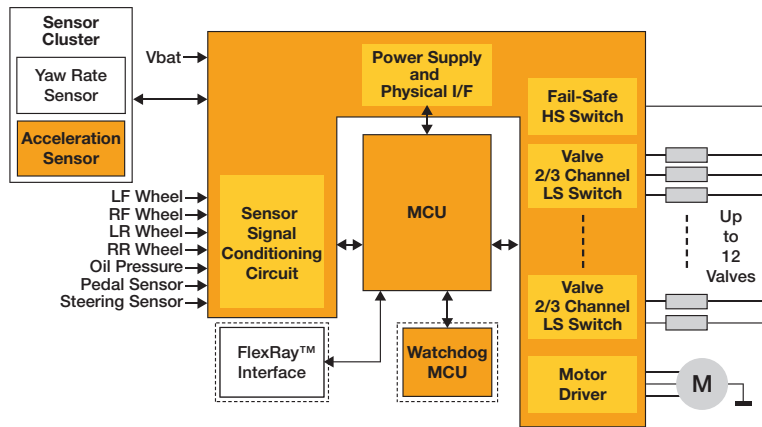


Recommended Products

MCU	Qorivva 32-bit, S12 16-bit, S08 8-bit
Analog	SMARTMOS ASSP, SBC and squib drivers
Sensor	Xtrinsic inertial sensors and pressure sensors

■ Freescale Technology □ Optional

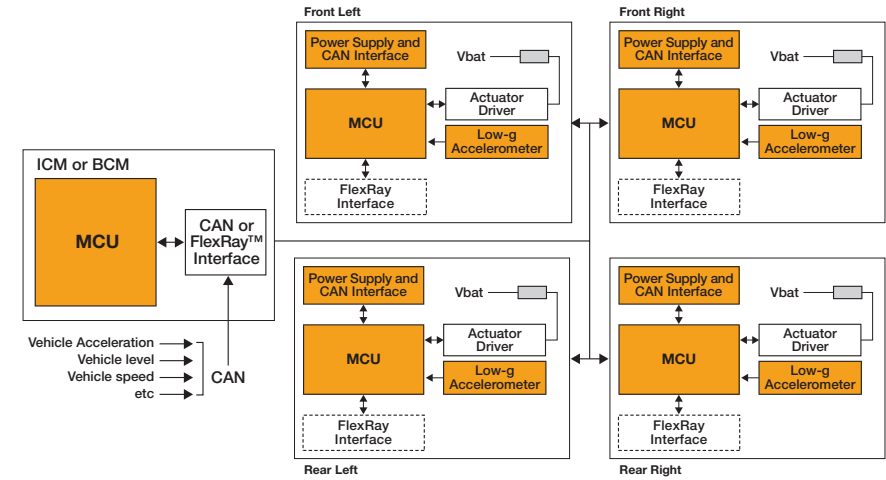
Braking and Stability Control



Recommended Products

MCU	Qorivva 32-bit, S12 16-bit, S08 8-bit
Analog	SMARTMOS ASIC, SBC, physical interfaces
Sensor	Xtrinsic inertial sensors

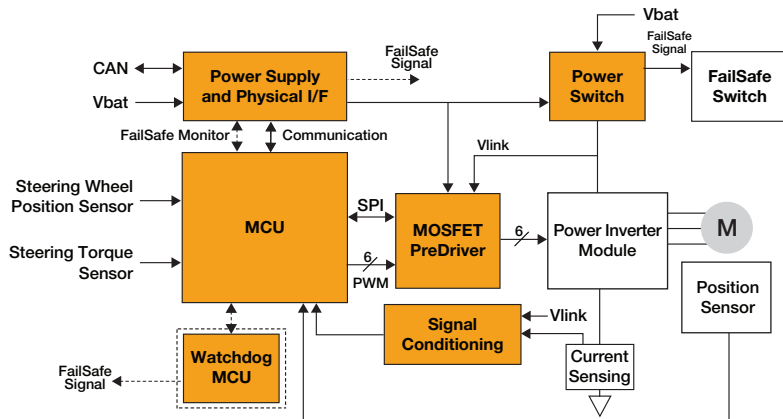
Active Suspension



Recommended Products

MCU	Qorivva 32-bit, S12 16-bit
Analog	SMARTMOS SBC, physical interfaces
Sensor	Xtrinsic inertial sensors

Electric Power Steering (EPS)

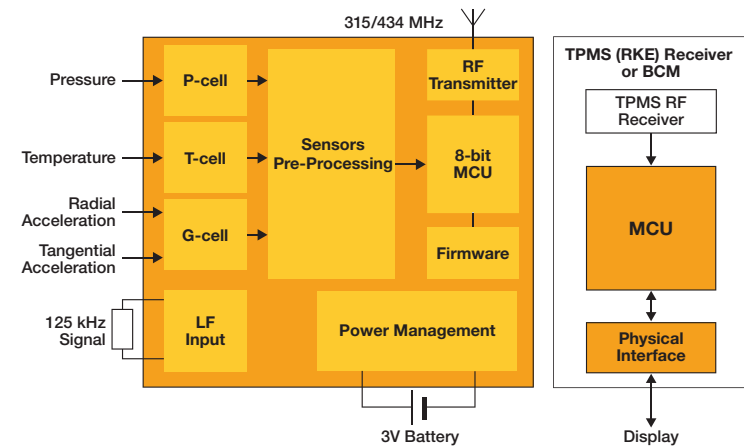


Recommended Products

MCU	Qorivva 32-bit, S12 16-bit, S08 8-bit
Analog	SMARTMOS SBC, physical interfaces, MOSFET pre-driver

■ Freescale Technology □ Optional

Tire Pressure Monitoring System (TPMS)



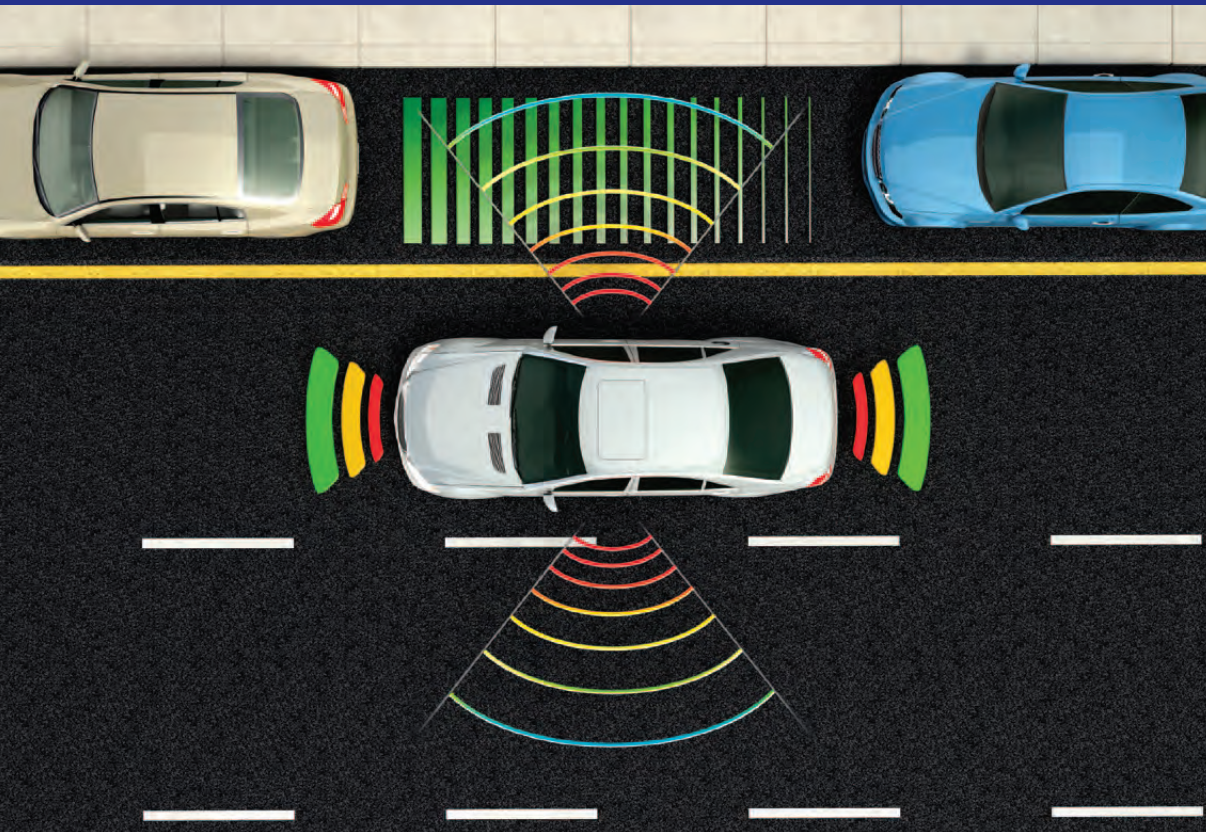
Recommended Products

MCU	Qorivva 32-bit, S12 16-bit, S08 8-bit
Analog	SMARTMOS SBC, physical interfaces
Sensor	Xtrinsic TPMS sensor

Advanced Driver Assistance Systems

overview

ADAS



Ethernet Rear-View Camera

Rear-view camera systems help drivers identify an object or a person behind a car, allowing the driver to back up safely and maneuver conveniently into parking spaces. In advanced systems, a high dynamic range megapixel camera is deployed using a cost-effective link with Ethernet and video compression over unshielded twisted pair cable.

Smart Rear-View Camera

Smart rear-view cameras analyze video content locally for object and people detection and support full local image processing and graphics overlay. The distance of objects can be measured and braking intervention can be triggered. The Freescale solution allows a very small form factor due to the high degree of integration and low power consumption.





Surround-View Park Assist

Multi-camera surround-view park assist systems capture and display on-screen the area surrounding the car. The perspective moves dynamically depending upon the trajectory of the car, allowing the driver to easily recognize all hazards around the car. Advanced systems use up to five high dynamic range megapixel cameras connected by a cost-effective link such as LVDS or Fast Ethernet. Video compression may be used to reduce the required communication bandwidth and simplify cabling requirements. In addition to the video and graphics processing, the MPU can also support the driver through object detection.

Front-View Camera

A highly integrated multicore MCU optimized with powerful DSP extensions analyzes the high-resolution video content and detects objects. Freescale solutions enable a cost-effective, multipurpose forward-looking camera for adaptive headlight control and lane departure warning or lane keeping.

77 GHz Radar System

77 GHz radar systems support adaptive cruise control, pre-crash protection and collision warning systems with and without automatic steering and braking intervention. Based on the detected and tracked objects, the vehicle's speed is automatically adjusted in response to the traffic ahead. In case of an imminent collision the emergency braking intervention can be initiated. The Freescale scalable radar solution supports manifold modulation schemes, allowing one radar sensor to be used for multiple safety applications.



Preemptive safety features provide convenience and safety for drivers

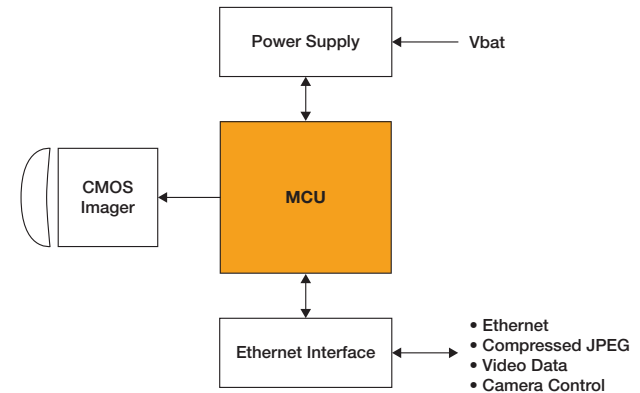
Advanced Driver Assistance Systems (ADAS)

details

ADAS provide support and safety for drivers, including adaptive cruise control, blind-spot monitoring, lane-departure warning and night vision. More advanced ADAS safety systems are predictive systems and designed to mitigate the impact of an accident or prevent an accident from happening in the first place, in some instances by taking partial control of the car's movement. These include collision avoidance systems that can automatically apply a car's brakes and lane-departure prevention to steer a vehicle back on track.

Discover more at freescale.com/ADAS

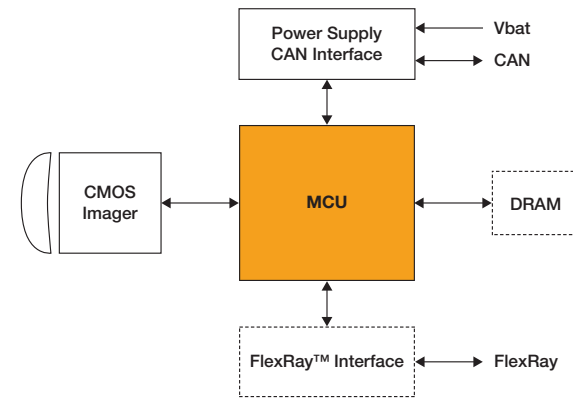
Ethernet Rear-View Camera



Recommended Products

MCU	Qorivva 32-bit
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Front-View Camera

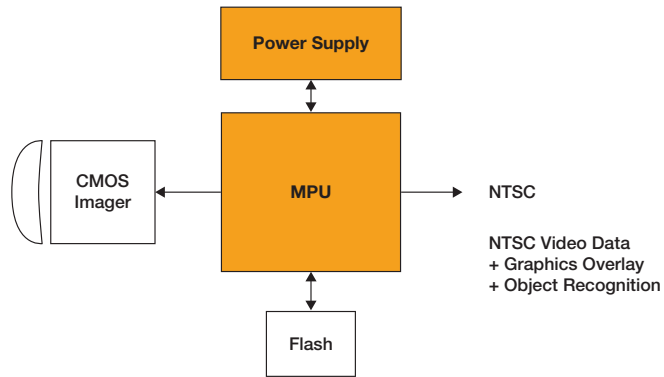


Recommended Products

MCU	Qorivva 32-bit
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■ Freescale Technology
 Optional

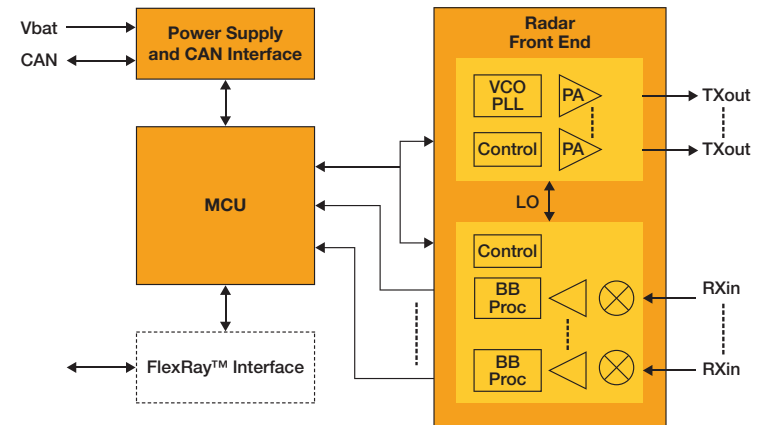
Smart Rear-View Camera



Recommended Products

MPU	Image cognition processors
Analog	SMARTMOS power management integrated circuit

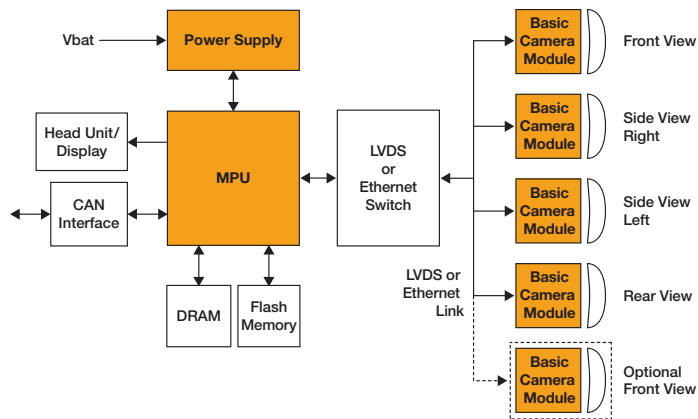
77 GHz Radar System



Recommended Products

MCU	Qorivva 32-bit
Analog	SMARTMOS SBC, physical interfaces
Sensor	Xtrinsic millimeter wave radar RF front end

Surround-View Park Assist



Recommended Products

MCU	Qorivva 32-bit
MPU	i.MX applications processor
Analog	SMARTMOS power management integrated circuit

Infotainment

overview



Low-End Infotainment Head Unit/Connected Radio

In-car audio systems are evolving from basic radio and CD systems to connected systems that play music from various sources. Customers now expect to plug in USB dongles, insert SD cards or to connect their Bluetooth® devices even in the low-end segment. The Freescale portfolio of ARM core-based MPUs offers a scalable set of product families to meet the needs of this specific segment and covers basic radio systems up to systems with USB, Bluetooth connectivity and enhanced hardware accelerated 2D graphics capabilities.

Mid/High-End Infotainment Head Unit

The complexity of infotainment systems is increasing at an exponential rate. In recent years, we have seen the addition of 2D/3D navigation systems, 3G/LTE wireless access, high-resolution color displays, speech recognition, USB and Bluetooth® connectivity. These systems are constantly connected to the car, to external devices and to the Internet. The amount of information to process and represent in a useful way is also increasing, requiring powerful and flexible hardware solutions with high-performance graphics capabilities and a large range of interfaces.

Secure
cloud and
mobile device
connectivity

Instrument Cluster

overview

Industry-leading, multi-GPU graphic solutions



Premium-Line Instrument Cluster

There is an increasing need for instrument cluster solutions that can be dynamically reconfigured to display content based on context and driver preferences while presenting the required information in a way that ensures safe driving. As digital instrument clusters rapidly take over traditional mechanical instrument clusters in vehicle design, they will provide a mix of both modern design and familiar/traditional realistic gauges. The Freescale i.MX families, with multiple integrated GPUs, are ideally suited for such realistic visual rendering along with the set of integrated peripherals that allow a direct connection to the rest of the car network.

Basic/Low-Line Instrument Cluster

Growth in emerging automotive markets has increased the need for simple and lower cost instrument cluster solutions. Freescale offers several cost-effective solutions based on its complete range of instrument cluster processors, integrating required interface features including the optimal set of on-chip features, package and memory options.

Mid/High-Line Instrument Cluster

Instrument cluster systems are rapidly evolving with the addition of color graphics to convey more complex information in a reconfigurable display. To address those requirements, Freescale offers a complete range of instrument cluster processors, integrated solutions with the ability to simultaneously drive classical analog gauges and TFT displays offering a rich graphics experience. Our MCU families provide a rich set of on-chip features, package and memory options to address this segment.



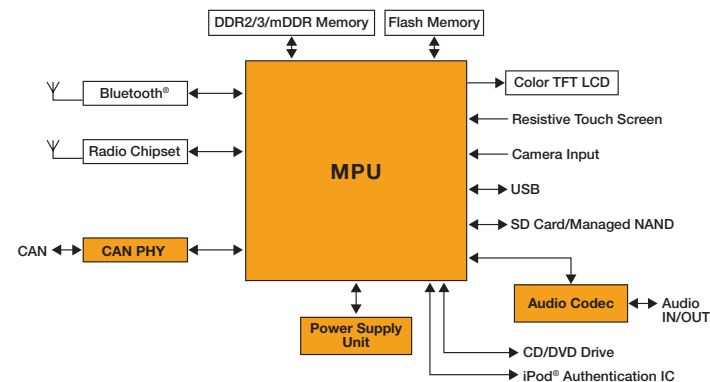
Infotainment

details

The automotive market is increasingly influenced by portable consumer electronic devices. Consumer expectations have driven a high growth rate for infotainment systems and high expectations for reduced design cycles and time to market. Automotive manufacturers and system suppliers face a challenge in keeping up with this rapid pace of change, while adhering to stringent automotive quality standards. Freescale provides proven automotive infotainment platform solutions to help designers meet those rapidly changing requirements.

Discover more at freescale.com/infotainment

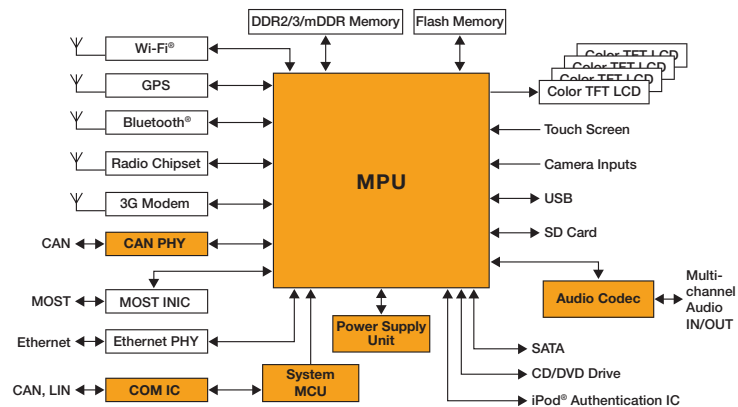
Low-End Infotainment Head Unit/Connected Radio



Recommended Products

MPU	i.MX applications processor, Vybrid R series controller solution
Analog	SMARTMOS physical interfaces, power management IC

Mid/High-End Infotainment Head Unit



Recommended Products

MPU	i.MX applications processor
MCU	Qorivva 32-bit
Analog	SMARTMOS physical interfaces, power management IC

■ Freescale Technology □ Optional

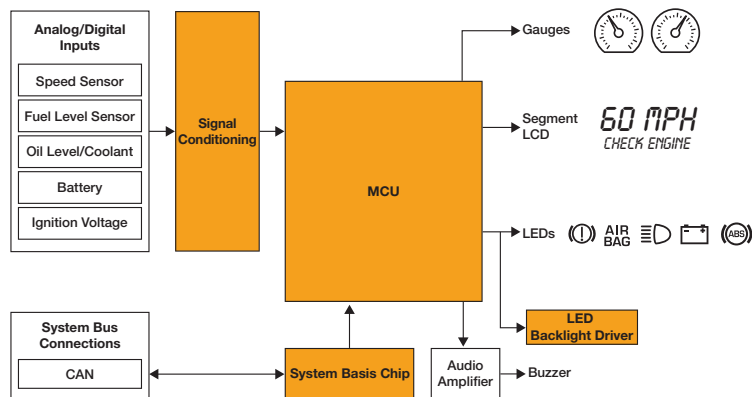
Instrument Cluster

details

The instrument cluster is the driver's primary data source, delivering information about the vehicle and engine status. These systems are rapidly evolving with the addition of color graphics to convey more complex information in a reconfigurable display. Freescale offers a complete range of instrument cluster processors, from 8-bit integrated solutions with analog gauge control up to high-performance 32-bit applications processors with integrated GPUs. All of our products are based upon our experience delivering the connectivity and quality required by the global automotive industry.

Discover more at freescale.com/instrumentcluster

Basic/Low-Line Instrument Cluster

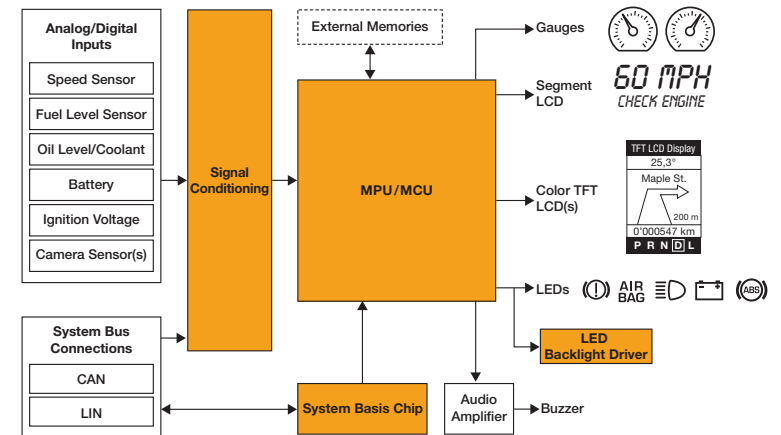


Recommended Products

MCU	S12 MagniV, S12 16-bit, S08 8-bit
Analog	SMARTMOS SBC, switch detection interface, output switch

Freescale Technology Optional

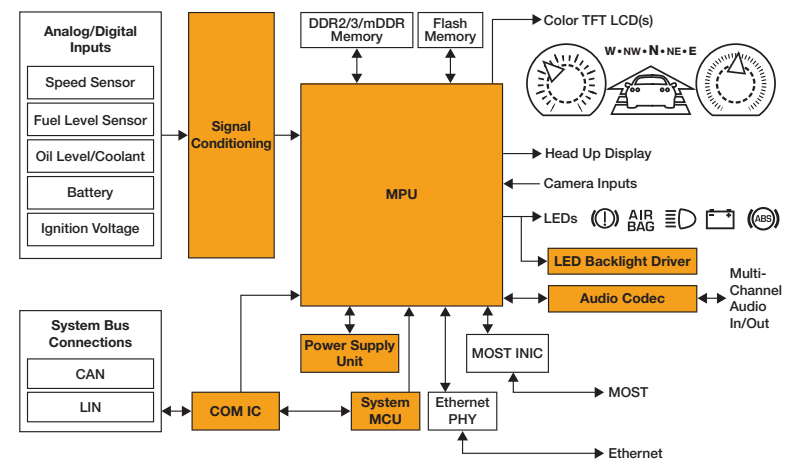
Mid/High-Line Instrument Cluster



Recommended Products

MPU	Vybrid R series controller solution
MCU	Qorivva 32-bit
Analog	SMARTMOS SBC, switch detection interface, output switch

Premium-Line Instrument Cluster



Recommended Products

MPU	i.MX applications processor
MCU	Qorivva 32-bit, S12 16-bit, S08 8-bit
Analog	SMARTMOS SBC, switch detection interface, output switch, power management IC

Body Electronics

overview



Central Gateway/ In-Vehicle Networking

The complexity of in-vehicle networking has led to the development of a variety of bus standards and protocols that are specific to their application domains, including LIN, CAN, FlexRay™, MOST and Ethernet. The central gateway is the information bridge between these communication domains. Also serving as the car's central interface for diagnostics and OEM end-of-line programming, hardware security features prevent unauthorized network access.

High-End Body Control Module

The high-end body control module is the central hub in modern car network architectures and maintains functions such as lighting, security and access control, comfort features for doors and seats and other convenience controls. Flexible and scalable silicon and software solutions enable platform designs that can easily be adapted to diverse market requirements.

Entry-Level Body Control Module

While the overall functionality is the same as on higher end body control modules, features are often downsized and implemented with optimized cost in mind. Flexible and scalable silicon and software solutions enable platform designs that can easily be adapted to varying market requirements.

Comfort, safety
and security
as well as high-
performance
computing and
in-vehicle
networking



Doors, Window Lift and Seat Control

These systems typically control several motors (window lift, door lock, mirror and seat adjustment) and are either sub-functions of the central body control module or distributed networked nodes. Freescale solutions enable designers to meet these diverse system requirements by providing the functionality and connectivity to complete the system solution.

Heating, Ventilation and Air Conditioning (HVAC)

HVAC systems are based on inputs from a variety of sensors, controlling different types of motors such as stepper motors for flaps and DC/BLDC blower fan motors. Freescale solutions enable designers to meet the needs of a variety of HVAC applications, combine physical network connection with power management and offer a complete system solution for several types of blower motors.

Lighting

Different types of lamps (e.g. halogen, xenon, LED) are used in a variety of lighting functions. Being a safety element for the driver but also a prime source of energy consumption, modern lighting systems are based on relay replacements for enhanced reliability and wiring harness reduction for weight and fuel savings. Freescale solutions address the requirements for diagnostics and fail-safe functionality found in modern lighting systems.

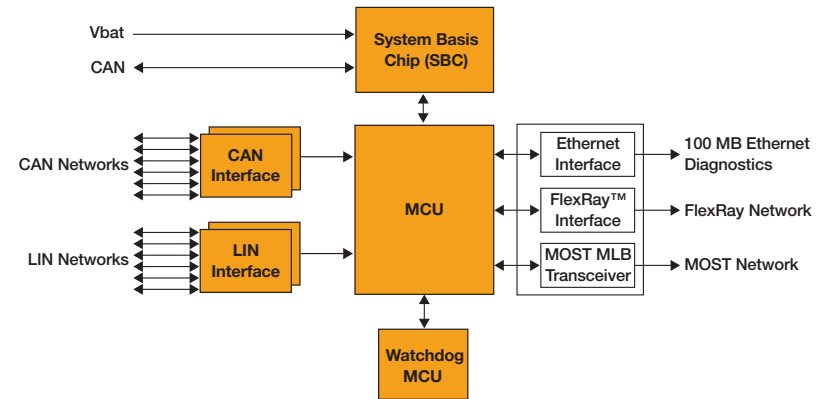
Body Electronics

details

Body electronics systems embrace a broad variety of applications inside the cabin, covering comfort, safety and security as well as high-performance computing and in-vehicle networking. Our rich portfolio of embedded 8-, 16- and 32-bit MCUs is at the heart of these applications, paired with a broad range of analog devices for power management and power switching. Along with comprehensive enablement support, Freescale offers complete solutions for body electronics applications.

Discover more at freescale.com/bodyelectronics

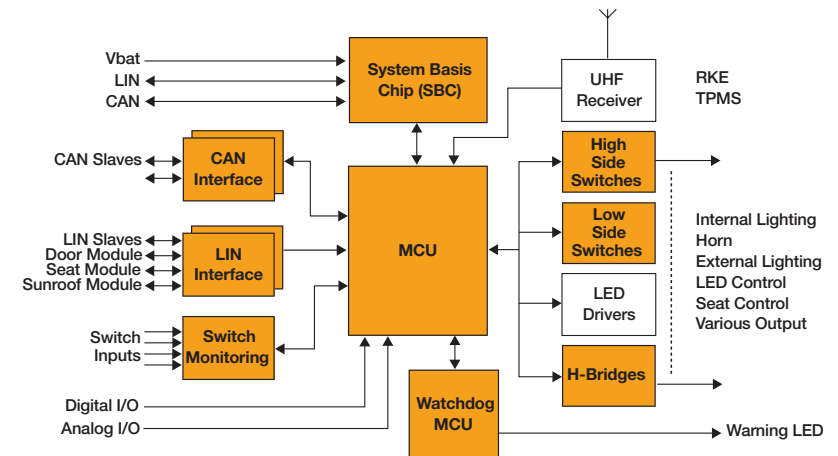
Central Gateway/In-Vehicle Networking



Recommended Products

MCU	Qorivva 32-bit, S08 8-bit
Analog	SMARTMOS SBC, physical interfaces

High-End Body Control Module

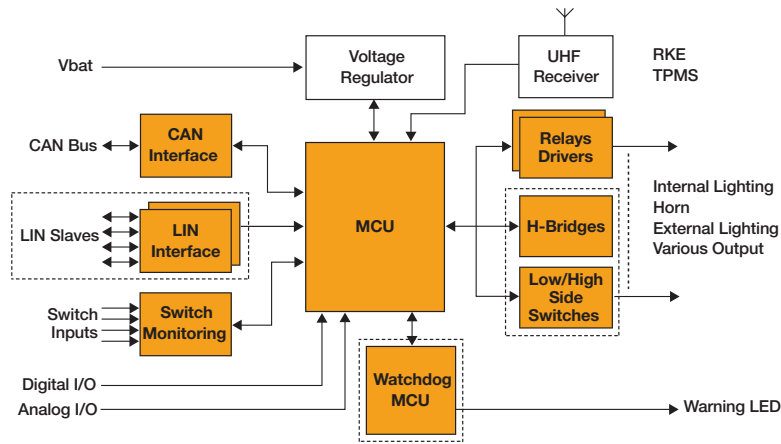


Recommended Products

MCU	Qorivva 32-bit, S12 MagniV 16-bit, S12 16-bit, S08 8-bit
Analog	SMARTMOS SBC, physical interfaces, input monitor, power switch, H-bridges

■ Freescale Technology □ Optional

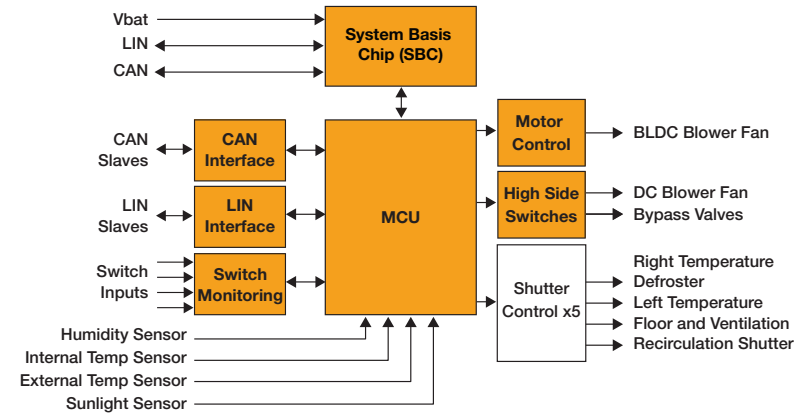
Entry-Level Body Control Module



Recommended Products

MCU	S12 16-bit, S08 8-bit
Analog	SMARTMOS physical interfaces, input monitor, power switch, H-bridges

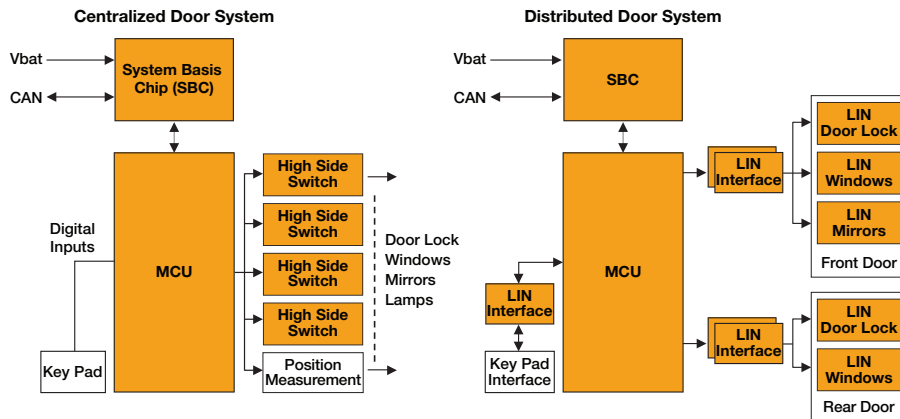
Heating, Ventilation and Air Conditioning (HVAC)



Recommended Products

MCU	Qorivva 32-bit, S12 MagniV 16-bit, S12 16-bit, S08 8-bit
Analog	SMARTMOS SBC, physical interfaces, input monitor, power switch, H-bridges

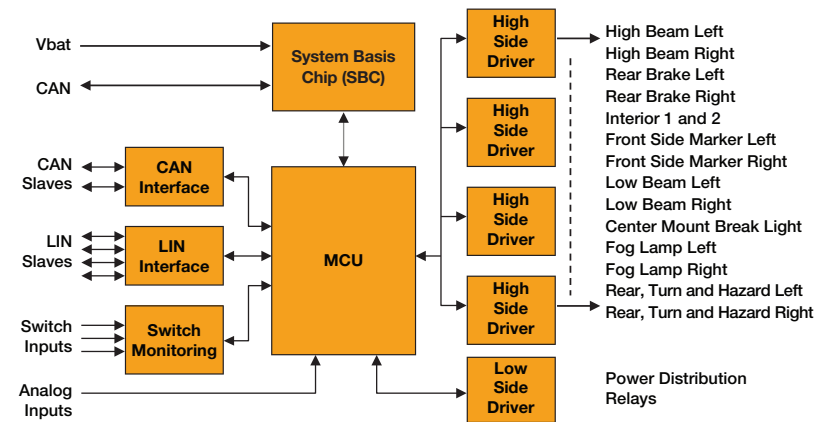
Doors, Window Lift and Seat Control



Recommended Products

MCU	Qorivva 32-bit, S12 MagniV 16-bit, S12 16-bit, S08 8-bit
Analog	SMARTMOS physical interfaces, input monitor, power switch, H-bridges

Lighting



Recommended Products

MCU	Qorivva 32-bit, S12 16-bit, S08 8-bit
Analog	SMARTMOS SBC, physical interfaces, input monitor, power switch

Ecosystem

software

Freescale software and development solutions take you beyond the silicon, helping to bring your embedded automotive applications to life. We equip design engineers with comprehensive solutions including the silicon, the software and tools, ecosystem solutions and reference boards that are the best fit for their needs—reducing design complexity and accelerating their time to market.

Discover more at freescale.com/autoecosystem

AUTOSAR

AUTOSAR software addresses the challenge of rising code complexity by providing an open automotive software architecture, jointly defined by automobile OEMs, suppliers and tool developers. AUTOSAR software supports the development of innovative yet standardized electronic systems that improve quality, performance, safety and environmental friendliness. It also helps simplify the process of updating software and hardware over the life of a vehicle.

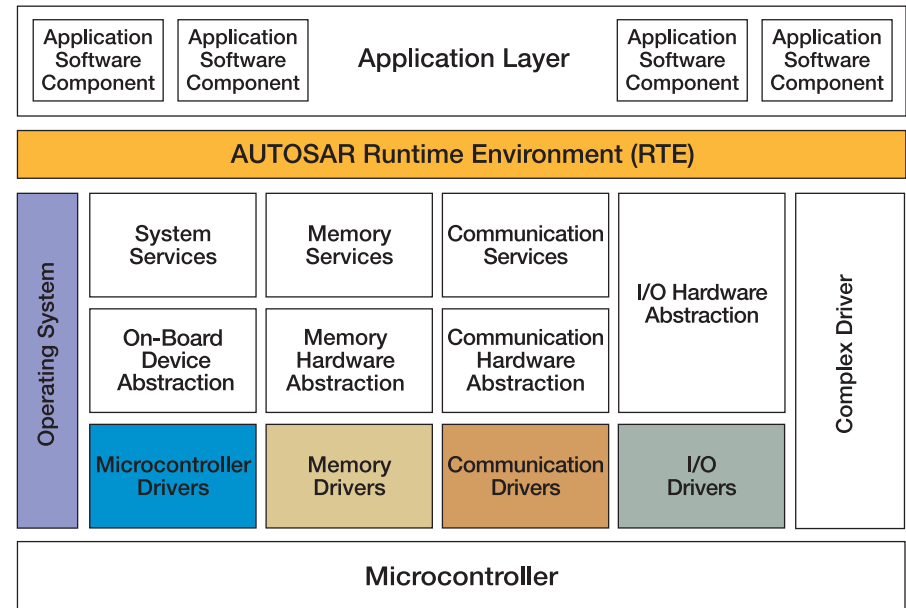
Freescale AUTOSAR-Compliant Software

While the industry trend is to work on the MCU abstraction layer (MCAL), Freescale is the only supplier to also offer an AUTOSAR OS. Through development of our own low-level software for our products, optimization can be achieved for each specific MCU family or even derivative. Freescale supports AUTOSAR versions 2.1, 3.0, 3.1, 3.2 and 4.0.

Third-Party AUTOSAR Platform Integration

Freescale works with all major third-party AUTOSAR software vendors to ensure a smooth and painless integration of the Freescale AUTOSAR-compliant software with third-party AUTOSAR software. Our objective is to enable our customers to save time by using pre-integrated AUTOSAR platform solutions offered by our third-party integration partners.

AUTOSAR Basic Software from Freescale



Ecosystem

development tools

Software Development Tools

CodeWarrior Development Studio

A complete integrated development environment that provides a highly visual and automated framework to accelerate the development of the most complex embedded applications.

Motor Control ToolBox

A graphical tool for configuring and auto generating all the necessary software, including initialization routines, device drivers and a real-time scheduler, to execute control algorithm(s) on Qorivva MCUs.

Runtime Software

Automotive Math and Motor Control Library Set

A precompiled library that provides a highly speed-optimized, intensively tested and easy-to-use solution for the rapid development of user motor control and general mathematical applications.

eTPU Development Suite

A stand-alone C cross compiler, preprocessor, assembler, linker, simulator and debugger for use with Qorivva MCU eTPU and eTPU2 products.

Freescale MQX Real-Time Operating System

Provides real-time performance within a small, configurable footprint and is designed to allow you to configure and balance code size with performance requirements.

Swell Software PEG Product Line (GUI)

Swell's PEG Pro, PEG+ and C/PEG product offering includes a graphical user interface (GUI) library for embedded development that works tightly with real-time operating systems.

Hardware Development Tools



i.MX Development Platform

The Smart Application Blueprint for Rapid Engineering (SABRE) platform for automotive infotainment offers a solid foundation for next-generation infotainment and driver information system platform designs. Powered by the i.MX 6 series of automotive applications processors, which scale from single-, dual- or quad-core implementations of the ARM Cortex-A9 core and integrate industry-leading graphics engines, the SABRE platform for automotive infotainment serves as a design launch pad that allows customers to rapidly innovate new products. The platform is supported by the Freescale Linux BSP as well as multiple third-party operating systems and reference implementations that allow fast time to market and rapid prototyping of next-generation automotive infotainment and driver information systems.

freescale.com/iMX



Tower System

Take your design to the next level with the award-winning Freescale Tower System. This modular development platform saves you months of development time now and in the future through rapid prototyping and tool reuse. Interchangeable and reusable modules, along with open source design files, make it easy to customize your design and reduce low level design giving you more time to focus on differentiated solutions.

freescale.com/Tower

StarterTRAK

The StarterTRAK series includes specifically chosen automotive Qorivva 32-bit MCU products with rich feature sets that address body and security, powertrain, infotainment and safety and chassis market segments. StarterTRAK enables faster time to market and offers a significant value at affordable prices.

freescale.com/StarterTRAK

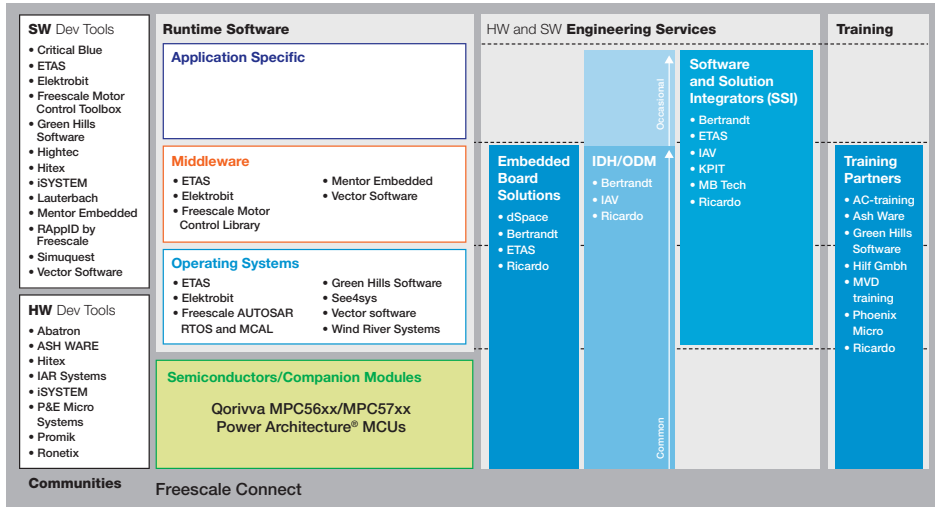
Professional Services

Freescale professional services can help you achieve your business goals while enabling you to concentrate your efforts on what you do best—developing superior products for your market. Our expertise in the automotive, industrial, networking and consumer electronics industries can support your design efforts through every phase of hardware and software development, assuring the quality of your products and the satisfaction of your customers. Contact your sales representative for more information.

Ecosystem

partners

Automotive in Powertrain and Hybrid Vehicle Systems EcoMAPS



Freescale Connect

The Freescale Connect partner program is your essential source for embedded designs based on Freescale solutions.

The program comprises a global network of independent engineering companies that offer the vital tools, software, technology, engineering services and training to speed your design. From reference boards to optimized software, Freescale Connect provides a powerful and comprehensive ecosystem that partners with you in making the world a smarter, more connected place.

Freescale EcoMAPS shows the major areas of the ecosystem surrounding Freescale silicon and describes how partners interact with customers' development process and end applications.

Discover more at freescale.com/partners



Technical Support and Social Media

Freescale takes pride in providing world-class support. Assistance is just a click away at **freescale.com/support**

Technical Information Center

Freescale engineers offer assistance online or over the phone to meet specific customer needs around the world.

Local Technical Support

Freescale field application engineers are located close to direct customers and are available for direct contact and customer visits.

FAQs

Our vast knowledge base of frequently asked questions (FAQs) is online to offer support 24 hours a day, seven days a week. It is updated and maintained by product experts.

Technical Documents Available at freescale.com

- Engineering bulletins
- Reference manuals
- Data sheets

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About Freescale

Freescale has been a market leader in the area of semiconductors for automotive applications for more than 30 years.

With our broad portfolio of MCUs, processors, analog components, sensors and professional software, we delivered more than 750 million integrated circuits to automotive customers globally in 2011. Our top priority is the continuous development of technical innovations of the highest quality, on a global level, together with our customers and partners, in order to address industry trends and demand.

For more information about our automotive solutions, visit freescale.com/automotive



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