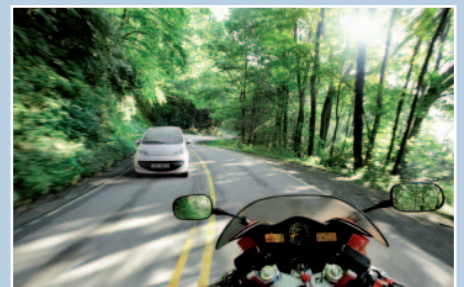
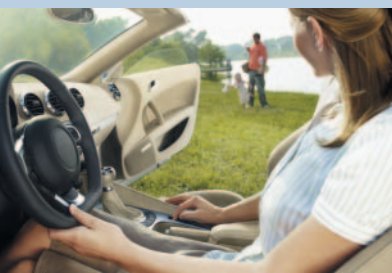




## Scalable and Highly Integrated

16/32-bit Microcontrollers for Automotive Applications







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# XC2000 Microcontroller Family – Scalable and Highly Integrated

Infineon's powerful XC2000 series is a new standard of 16/32-bit microcontrollers especially designed to address the requirements of automotive applications. Its three dedicated sub-families address different automotive application segments.

The increase in vehicle networking, improvement of energy efficiency and implementation of safety-critical systems such as airbag and power steering, demand enhancements to the CPU features and peripheral set.

The broad XC2000 product portfolio comprises a multiplicity of different products, offering design engineers the scalability to select a microcontroller with the optimal combination of memory, peripheral set, frequency, temperature and packaging – just the right microcontroller to match the application's feature and performance requirements. Compatibility within the families, even within different packages, allows an easy product change during and after the design cycle.

Software for Infineon's XC2000 microcontrollers can easily be used for various applications within a car manufacturer's different model platforms. All members of the same family are binary compatible and share the same development tools. Furthermore, the Infineon AUTOSAR library allows an easy integration of existing code into XC2000 programs.

## XC2000 at a Glance

High Level of Integration	Peripheral Highlights	Enhanced Communication
<ul style="list-style-type: none"><li>■ Embedded voltage regulator</li><li>■ EEPROM emulation</li><li>■ On-chip oscillator</li><li>■ Brown-out detection</li><li>■ Supply watchdog</li><li>■ Window watchdog</li></ul>	<ul style="list-style-type: none"><li>■ CCU6<ul style="list-style-type: none"><li>– Synchronization and counting capability for multiple modules</li><li>– Up to four independent modules available</li></ul></li><li>■ Enhanced ADC<ul style="list-style-type: none"><li>– 5V and 3.3V supply capability</li><li>– Up to 12-bit resolution</li><li>– Conversion time 600ns @ 80MHz</li><li>– 2 synchronizable modules</li></ul></li></ul>	<ul style="list-style-type: none"><li>■ MultiCAN<ul style="list-style-type: none"><li>– Up to six CAN nodes</li><li>– Up to 256 message objects</li></ul></li><li>■ USIC<ul style="list-style-type: none"><li>– UART, LIN, SPI, IIC, IIS</li><li>– Date buffering supported</li></ul></li><li>■ FlexRay™<sup>1)</sup><ul style="list-style-type: none"><li>– Up to two channels</li></ul></li></ul>

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





## Body & Convenience



### XC2200

#### Main Features

- Dedicated power-down features
- Multiple motor control features
- Up to six CAN nodes
- Up to 40 ADC channels
- Up to ten serial interfaces
- Scalable family
- Large range of supporting tools

#### Applications

- Central body module
- Central gateway
- HVAC
- Power operated systems
- Door/Seat module
- Lighting
- eCall
- Touch control

## Safety



### XC2300

#### Main Features

- Memory protection unit
- Cyclic redundancy check
- ECC on all memories
- Redundant modules (PWM, ADC etc.)

#### Applications

- Airbag
- Electric power steering (EPS)
- EHPS
- Low-end ABS/ESC
- Belt pretensioner
- Driver assistant systems

## Powertrain



### XC2700

#### Main Features

- Scalable family
- Industry leading, high-performance core
- Supports modern powertrain applications from entry level to advanced
- Large range of supporting tools

#### Applications

- Engine management (gasoline, diesel, LPG)
- Transmission management (AMT, ECAT, CVT)
- Auxiliary module management
- Hybrid applications



## XC2200

The XC2200 Family is a sub-family of the new scalable 16/32-bit XC2000 microcontroller series from Infineon, and addresses the increasing complexity of highly integrated body and gateway applications. Infineon currently provides XC2200 derivatives with 192KB to 832KB of Flash and optional EEPROM emulation, up to 82KB SRAM with a max. 100MHz CPU clock. Expanding the portfolio starting from 32KB up to 1.6MB of Flash memory while addressing even higher performance requirements with up to 138KB RAM and 128MHz, Infineon has further enlarged the family with pin-compatible MCUs. This makes the choice in favor of the XC2200 family a safe long-term decision, with Infineon's 130nm technology offering an additional performance boost at a competitive cost.

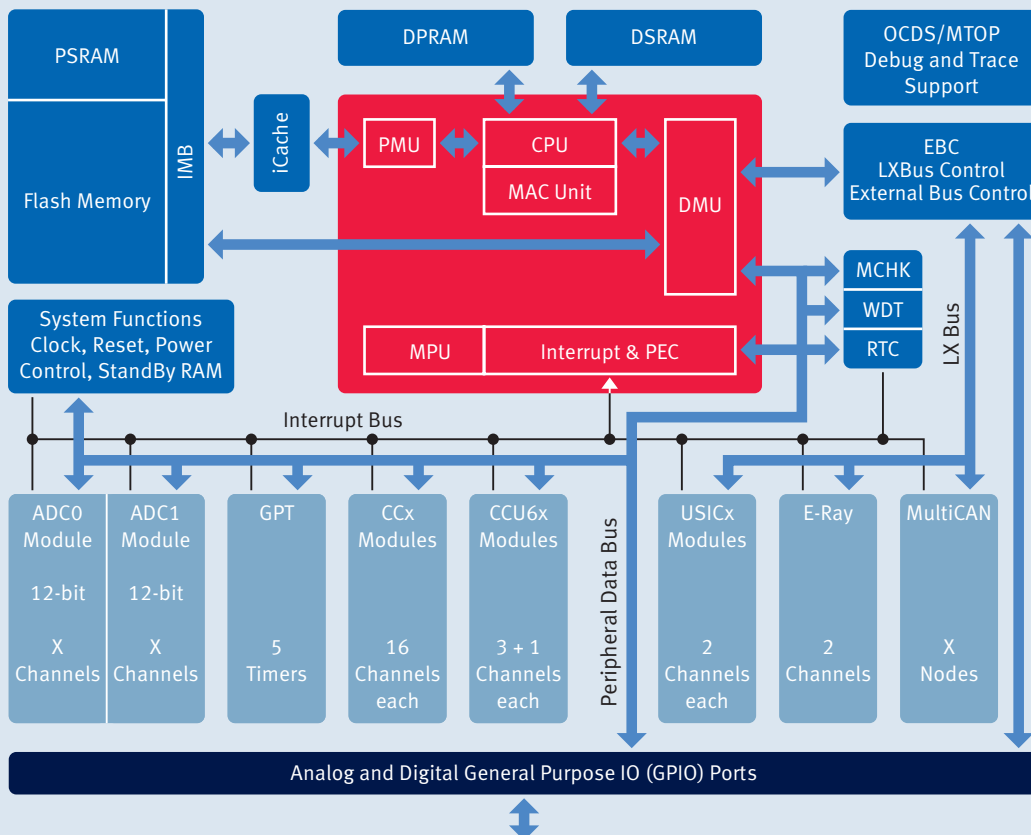
The XC2200 Family is optimized for low-end to high-end body applications. In order to comply with the AUTOSAR programming model that provides for hardware-independent software development, the controllers are equipped with a Memory Protection Unit (MPU). Today's available XC2200 devices address low- to mid-range gateway applications integrated into body controllers. Variants that have already been released to market enlarge the portfolio, offering a perfect fit for low-end body applications as well as a high-end central body module and gateway applications with integrated FlexRay channels. Furthermore, Infineon also offers a stand-alone FlexRay communication controller that can be easily added to the system.

## XC2200 Body Portfolio 130nm: 16/32-bit from Low-Cost to High-End

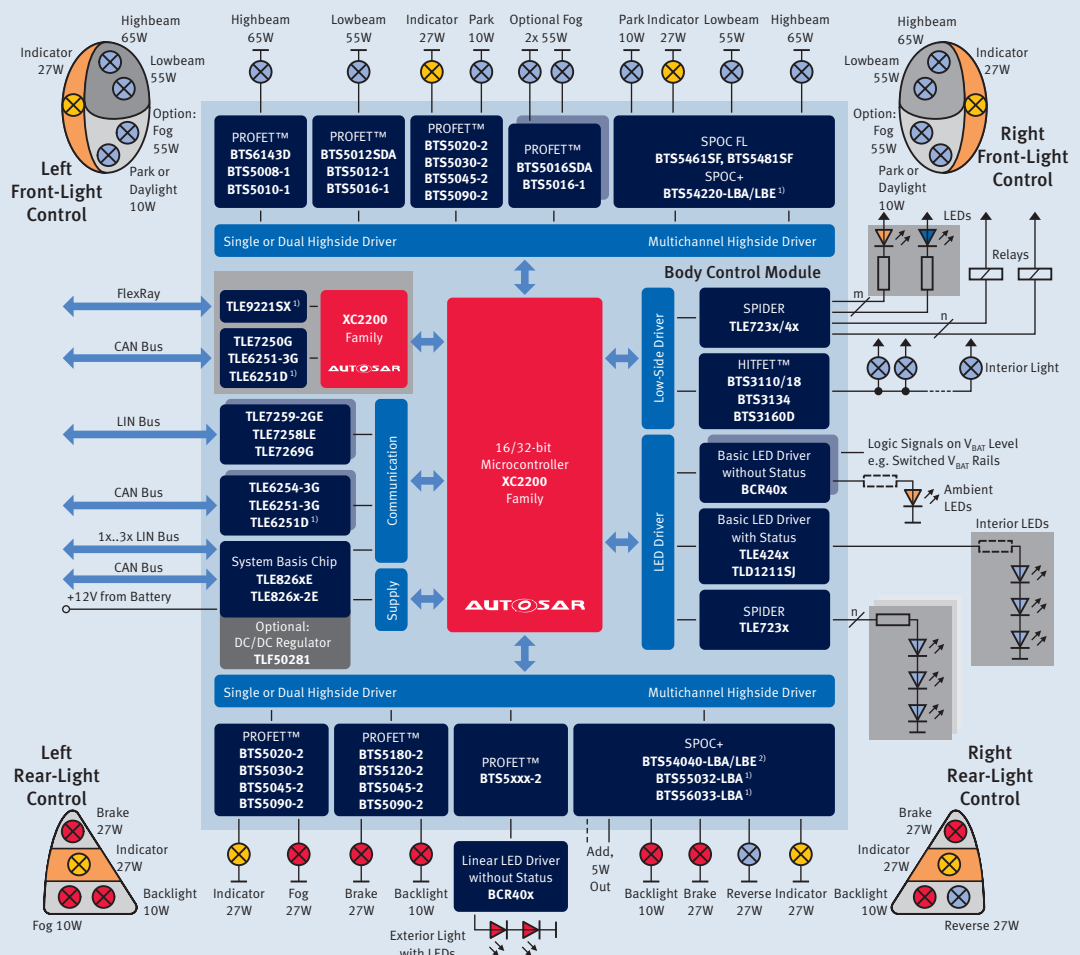
	TSSOP-38	VQFN-48	QFP-64	QFP-100	QFP-144	QFP-176
1.6MB					XC228xH 100MHz	XC229xH 100MHz
1MB				XC226xI 128MHz	XC228xH 100MHz	XC229xH 100MHz
384-768KB			XC223xM 80MHz	XC226xM 80MHz	XC226xI 128MHz	XC228xM 80MHz
384-704KB				XC226x 80MHz	XC228x 80MHz	
256KB			XC223xN 80MHz	XC226xN 80MHz		
128KB		XC222xL 66MHz	XC223xL 66MHz	XC226xN 80MHz		
64KB	XC221xU 40MHz	XC222xU 40MHz	XC223xL 66MHz			
32KB	XC221xU 40MHz	XC222xU 40MHz				

■ Instruction Cache  
■ FlexRay™ Optional

## XC2200 Block Diagram



## Application Example



## BCM & Gateway

Body Control Module (BCM) application comprising internal and external lighting systems, as well as control of relays and voltage rails and further comfort functions such as door and wiper control. The central gateway manages all internal interfaces (i.e. motor management, in-car entertainment, dashboard or convenience control) and communication with external interfaces for after-sales software updates.

### Key Features

- 128–1600KB Flash with emulated EEPROM
- Up to 138KB SRAM
- Up to six CAN with 256 MO
- Up to 40 ADC channels
- Up to 48 PWM channels
- Up to ten serial interfaces

### Benefits

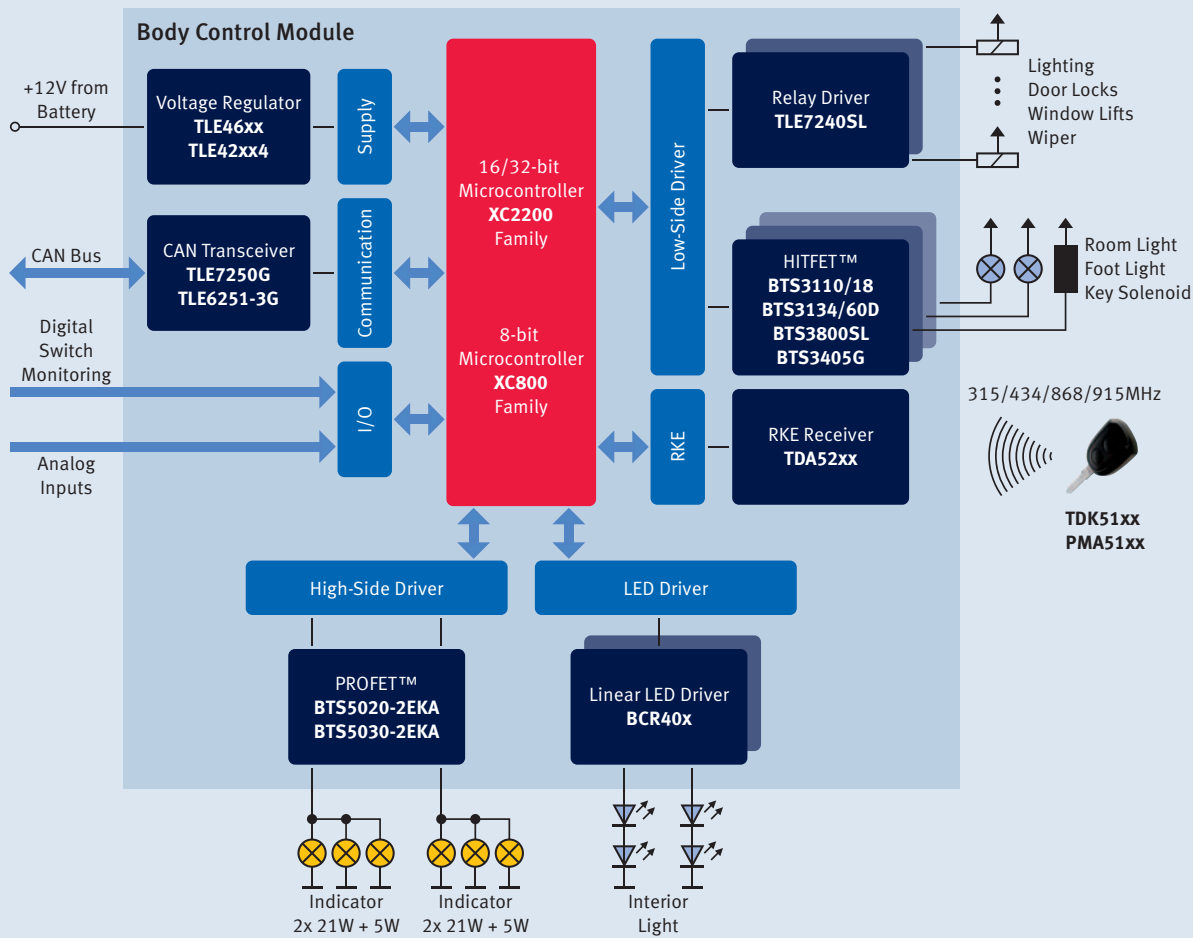
- Light bulb supervision without CPU load
- CAN gateway functionality without CPU load
- Fully scalable over package and memory
- Flexible power concept
- Memory Protection Unit (MPU) to fulfill AUTOSAR requirements
- Supports ASIL requirements

1) In development, samples available

2) In development



## Application Example



## Low Cost Body Control Module

The low-cost body control module solution is perfectly suited to the ultra low-cost car market as well as the 2-/3-wheeler motorcycle market, supporting basic light functionality, car access and relays controlling door, wiper and further auxiliary functions.

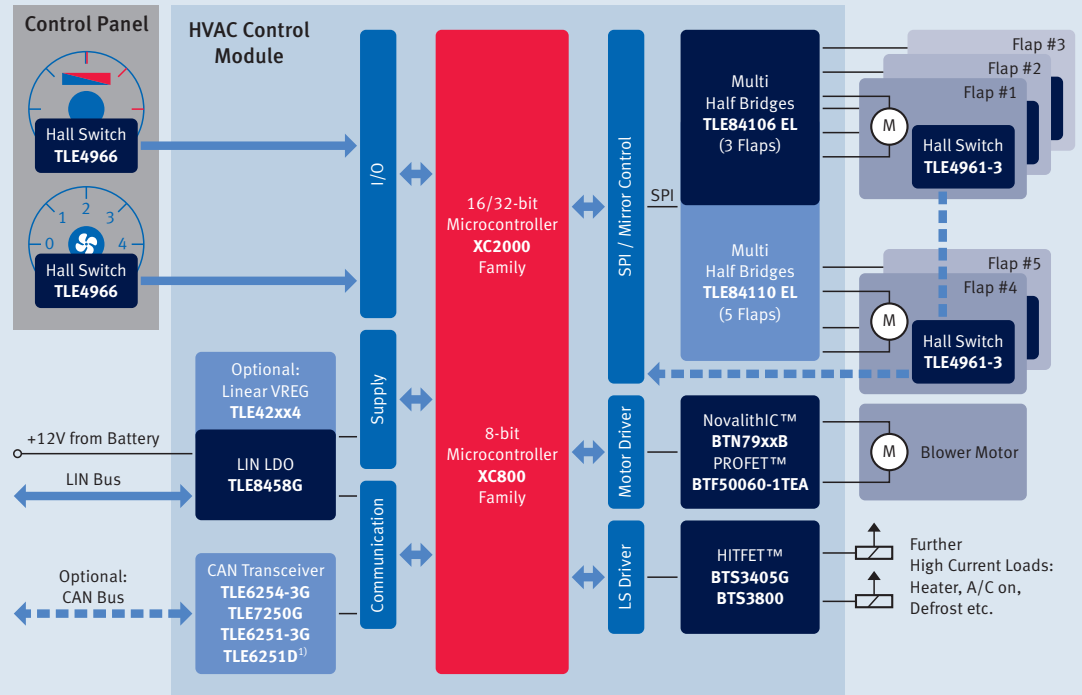
### Key Features

- Low cost XC2200 series 32–160KB flash with emulated EEPROM
- Optimized peripheral set
  - Up to 12KB RAM
  - Up to 2 CAN nodes
  - Up to 4 serial interfaces
- Optimized pin out 49 I/O in QFP64
- Cost optimized packages TSSOP38/QFN48/QFP64

### 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 semi-conductors (PROFET™+) improves system reliability
- Full integration of load protection and diagnostics reduces PCB area and improves the design quality

## Application Example



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

Balancing comfort and fuel efficiency is very important in automotive air conditioning. Reduced fuel consumption can be achieved via demand-oriented climate regulation. This could be covered by fresh air regulation (recirculating air operation) or the use of brushless DC motors in fans, for example.

### Key Features

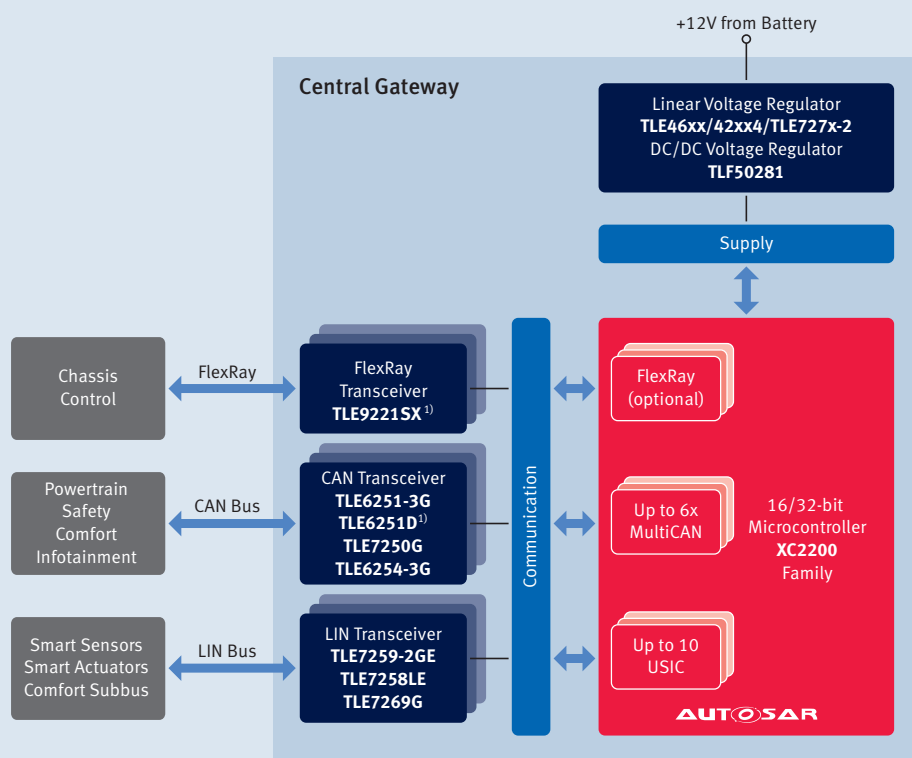
- 64–768KB Flash with emulated EEPROM
- Up to three CAN
- Up to 24 ADC channels with up to 12-bit resolution
- Up to 32 PWM channels
- Up to eight serial interfaces

### Benefits

- CAN gateway functionality without CPU load
- Highly flexible serial interfaces (USIC), suitable as LIN, SPI, IIC, UART, IIS
- Fully scalable over package and memory
- High-performance CPU for ripple count algorithm
- High-speed ADC: 650ns conversion cycle

<sup>1)</sup> In development, samples available

## Application Example



## Gateway

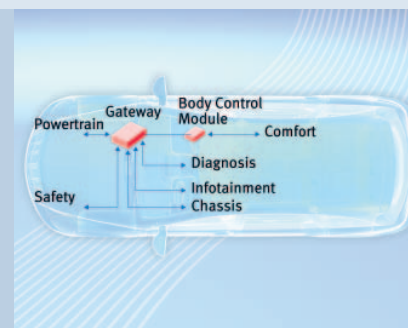
The central gateway handles the data transfer between several domains in car electronics (i.e. motor management, in-car entertainment, dashboard or convenience control) as well as communication with external interfaces for after-sales software updates. The growing complexity of electronic architecture increasingly calls for a dedicated gateway module rather than a BCM integrated one.

## Key Features

- 32–1600KB Flash with emulated EEPROM
- Up to 136KB SRAM
- Up to six CAN with 256 MO
- Flexible ADC channels
- Flexible PWM channels
- Up to ten flexible serial interfaces including LIN
- Up to two FlexRay channels

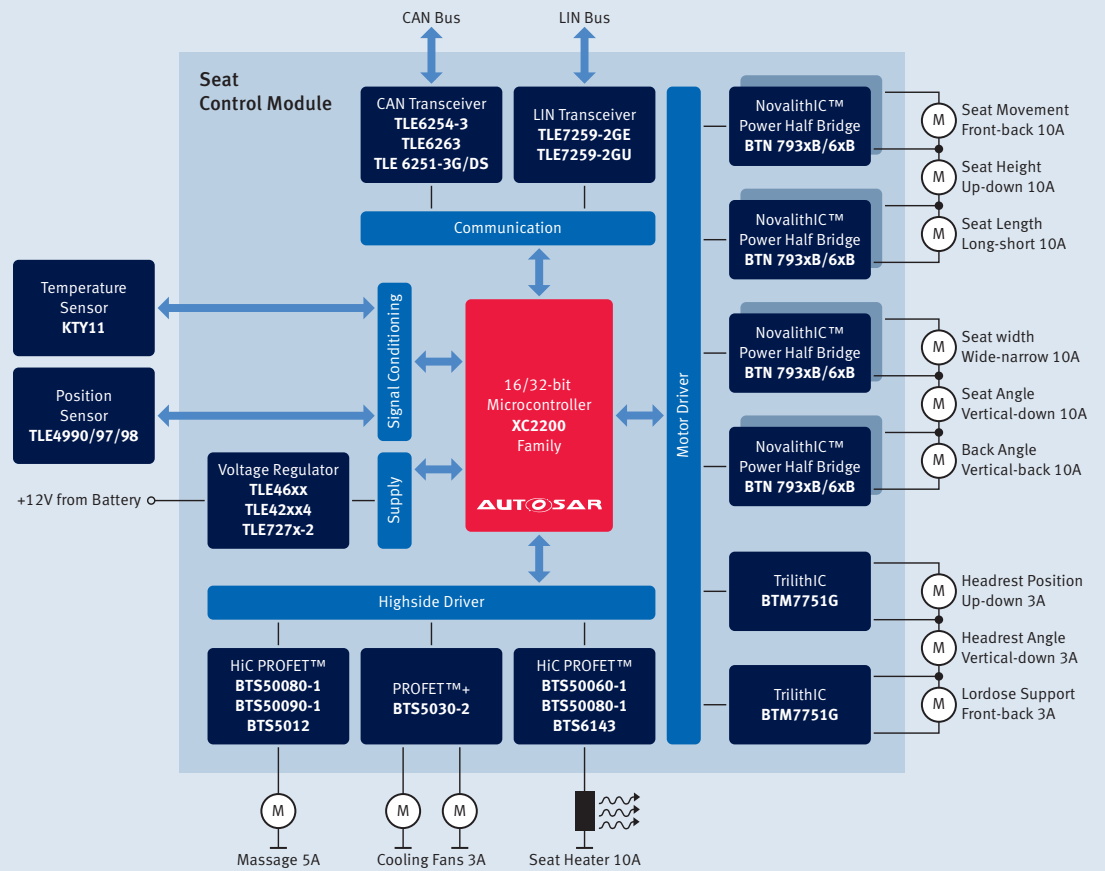
## Benefits

- CAN gateway functionality without CPU load
- Up to six CAN nodes from 64- to 176-pin
- Fully scalable over package and memory
- Flexible power concept
- Memory Protection Unit (MPU) to support AUTOSAR requirement



<sup>1)</sup> In development, samples available

## Application Example



## Seat Control

Compared with the purely manual control of seats, electrically-controlled seat positions provide a higher level of comfort to the driver. In order to enable seat memory functionality, the ECU for seat control is connected to central body functions via CAN or LIN bus. On the output stages, a seat control module needs to control a lot of DC or stepper motors.

### Key Features

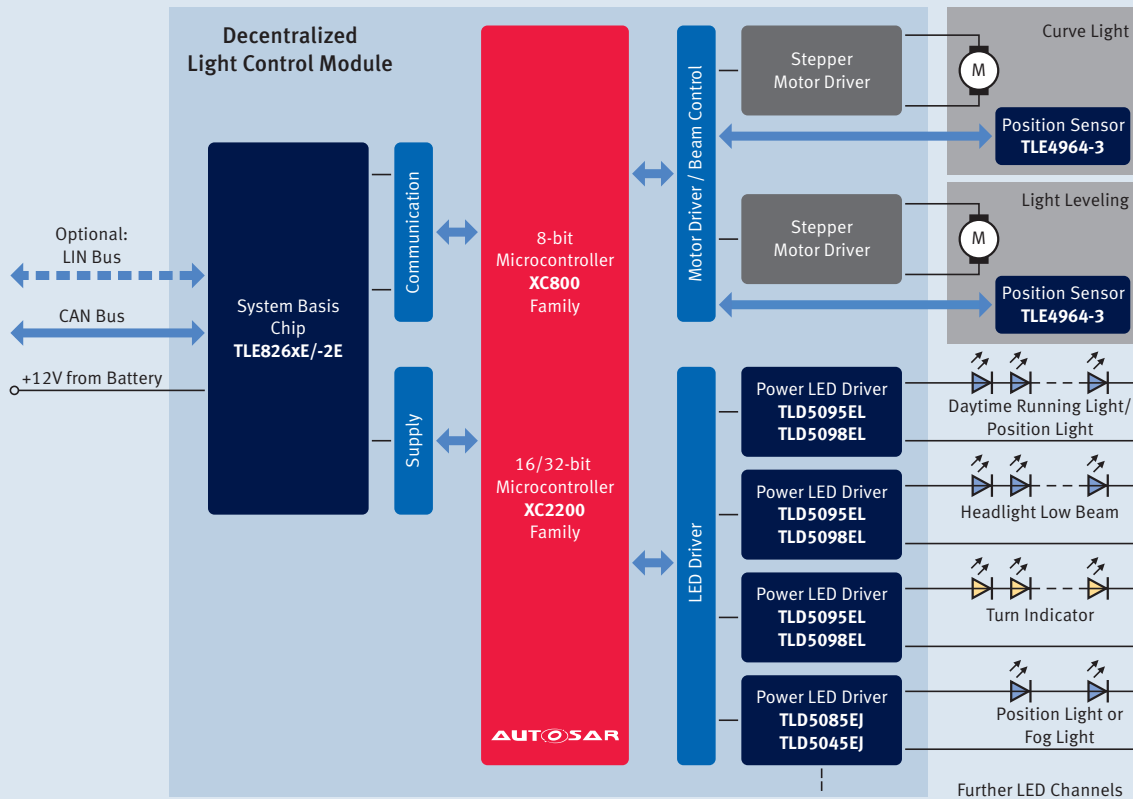
- 32–320KB Flash with emulated EEPROM
- Up to two CAN
- Up to six flexible serial interfaces including LIN
- Up to 16 ADC channels with up to 12-bit resolution
- Up to 32 PWM channels
- Low space packages
- Up to four CCU6 units

### Benefits

- Motor drive modules CCU6
- Highly flexible serial interfaces (USIC), suitable as LIN, SPI, IIC, UART, IIS
- Fully scalable over package and memory
- High-performance CPU for ripple count algorithm
- High-speed ADC: 650ns conversion cycle



## Application Example



## Decentralized Front Light Module

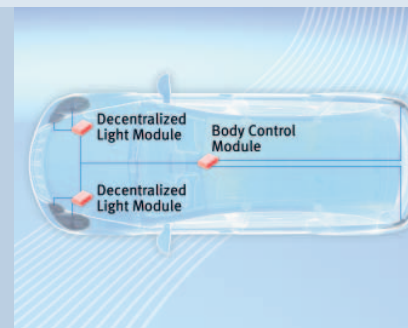
Decentralized front light modules are used if the control of light functions is transferred to separate ECUs close to the front light modules. It combines functions to control LEDs and stepper motor control for advanced front light control (AFS). In order to establish AFS functionality, it needs to process information regarding the vehicle speed, steering angle and further vehicle parameters usually distributed via CAN bus.

### Key Features

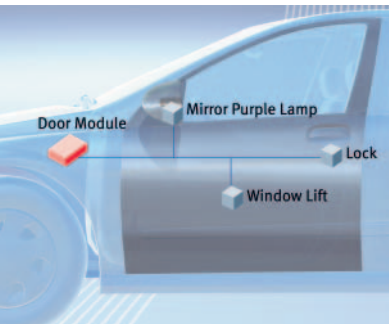
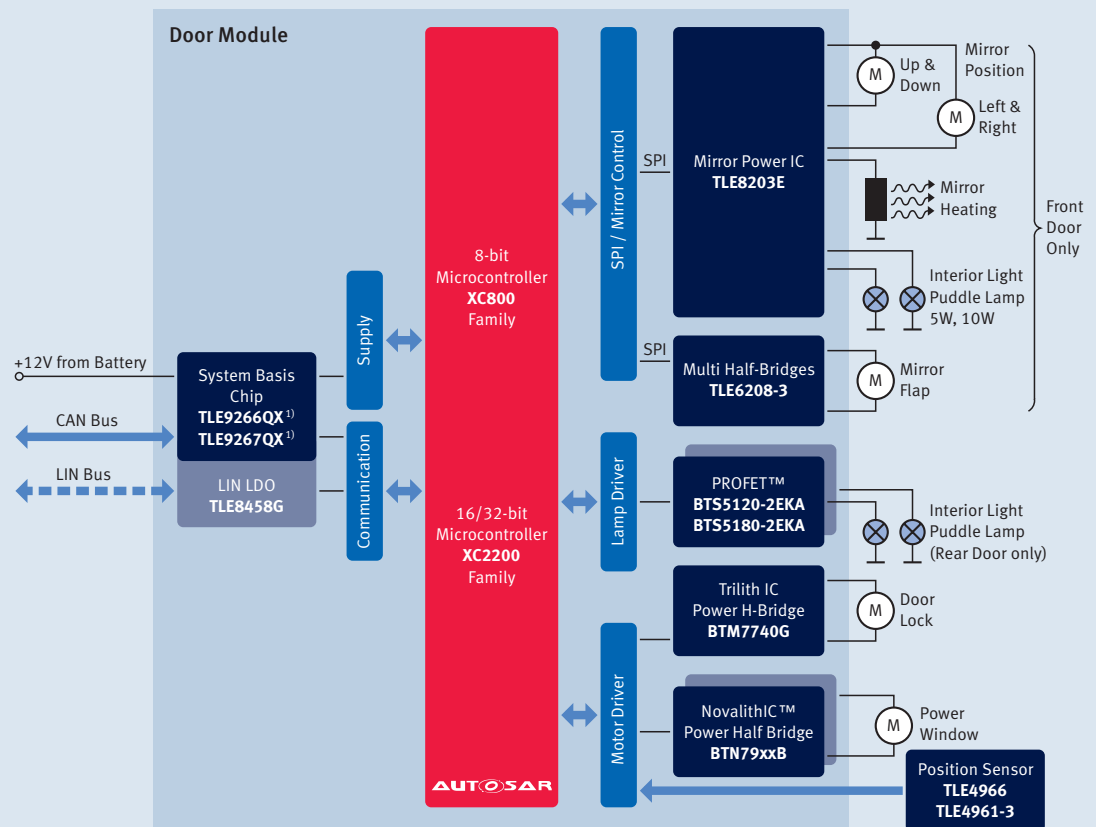
- 32–768KB Flash with emulated EEPROM
- Up to six CAN
- Up to ten flexible serial interfaces including LIN
- Up to 24 ADC channels with up to 12-bit resolution
- Up to 32 PWM channels
- Low space packages
- Up to four CCU6 units

### Benefits

- Light bulb supervision without CPU load
- Motor drive modules CCU6
- Supports all kinds of lighting systems: HID, LED, etc.
- Fully scalable over package and memory
- Flexible power concept
- Memory protection unit (MPU) to fulfill AUTOSAR requirement
- High-speed ADC: 650ns conversion cycle
- Supports ASIL requirements



## Application Example



## Full Featured Door Module Including Door Lock and Mirror Control

Growing functionality in the doors (electrical window lift, central door lock, electrical mirrors, switch panels) often leads to the use of a dedicated door module. There is a wide scalability visible to establish a door module, e.g. dependent on vehicle architecture (centralized vs. decentralized load control), as well as the driver, passenger and rear doors.

### Key Features

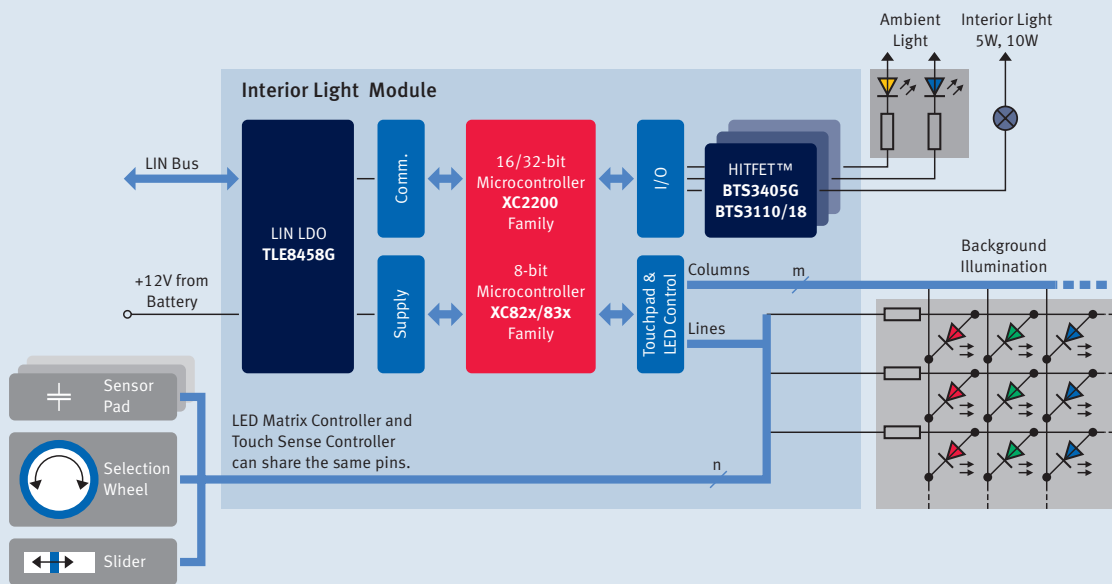
- 32–768KB Flash with emulated EEPROM
- Up to six CAN
- Up to ten flexible serial interfaces including LIN
- Up to 24 ADC channels with up to 12-bit resolution
- Up to 32 PWM channels
- Low space packages
- Up to four CCU6 units

### Benefits

- Energy-saving mode with second power domain for cyclic wake-up
- Motor drive modules CCU6
- Highly flexible serial interfaces (USIC), suitable as LIN, SPI, IIC, UART, IIS
- Fully scalable over package and memory
- High-performance CPU for ripple count algorithm
- High-speed ADC: 650ns conversion cycle

<sup>1</sup>) In development, samples available

## Application Example



## Interior Light Control with Capacitive Touch Sensor

Infineon's capacitive touch sense principle is realized using the relaxation oscillator topology. It provides an optimized and easy-to-use implementation controlled with a dedicated functional unit of the microcontroller. With multiplex operations through the same pins, combination with further controlling functions is applicable, like control of an LED matrix used in automotive interior lighting.

### Key Features

- Up to 38 touch pads
- Low cost XC2200 series 32–160KB flash with emulated EEPROM
- Optimized peripheral set
  - Up to 12KB RAM
  - Up to 2 CAN nodes
  - Up to 19 A/D channels
  - Up to 24 PWM channels
  - Up to 4 serial interfaces
- Optimized pin out 49 I/O in QFP64
- Cost optimized packages TSSOP38/QFN48/QFP64

### Benefits

- Replacing mechanical switches offers high system cost savings
- Enables the efficient design of HMIs with up to 20 touch buttons
- Robust and reliable touch sense control in noisy environments in combination with multiple coverage options like acrylic glass (~2mm)
- Low pin count and cheap single layer PCB solutions
- Combined control and drive of displays or stepper motors with up to 50mA
- Optimized SW library for touch sense control in ROM





## XC2300

The XC2300 microcontroller family is specifically designed for use in vehicle safety applications, targeting airbag systems and electronic power steering applications. The XC2300 family provides a 32-bit performance and a rich peripheral feature set required for present and future safety applications demanding a fast reaction time, redundancy and flexibility.

The members of the XC2300 family feature between 64KB and 1.0MB of Flash memory to fit both, cost-sensitive airbag systems and highly complex safety systems, such as power steering, low-end chassis control and sensor clusters. Five different package options from low 38-pin to high 144-pin are available with a rich variety of features, such as integrated FlexRay.

For safety-critical applications such as airbags, steering or braking, the highest degree of reliability is an absolute must for all system components. All components of the XC2300 family are specifically designed to fulfill these stringent safety requirements, and include a set of safety-relevant features, such as hardware Error Correction Code (ECC) on all memories, memory protection, feature redundancy and several control mechanisms, including a Cyclic Redundancy Code Check (CRC). These features are essential for XC2300 products to support a system that meets the requirements of IEC 61508 or ISO 26262.

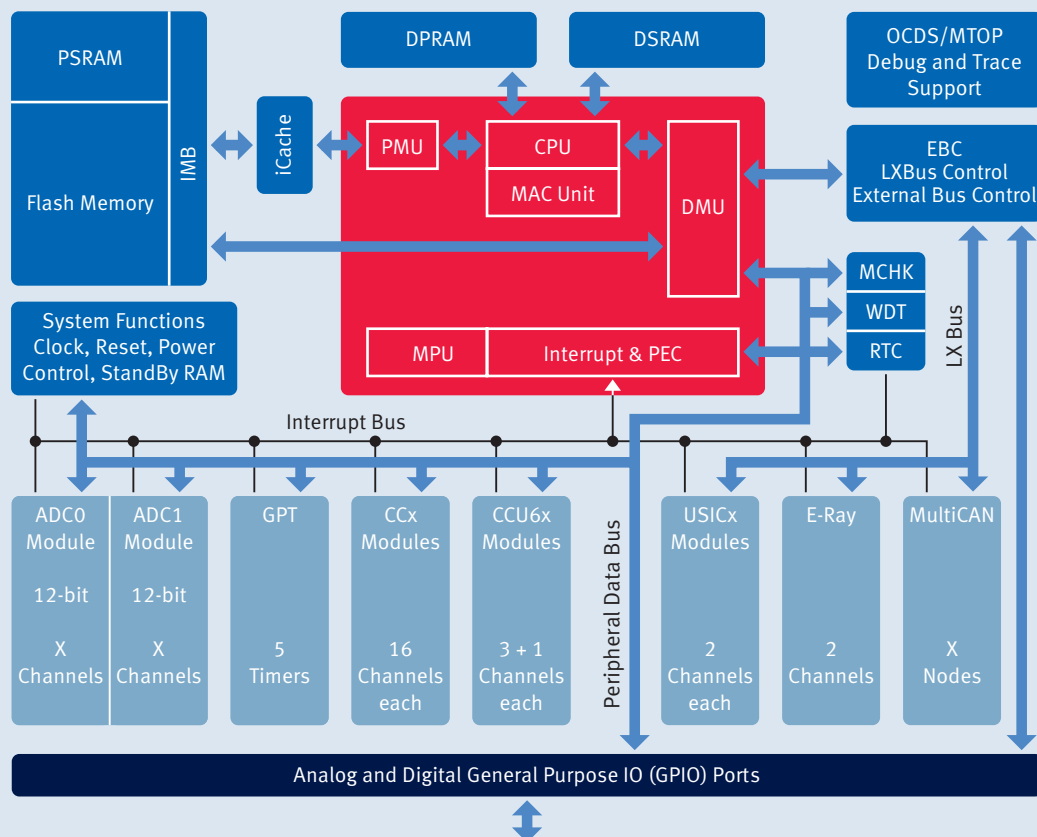


## XC2300 Safety Portfolio: 16/32-bit from Low-Cost to High-End

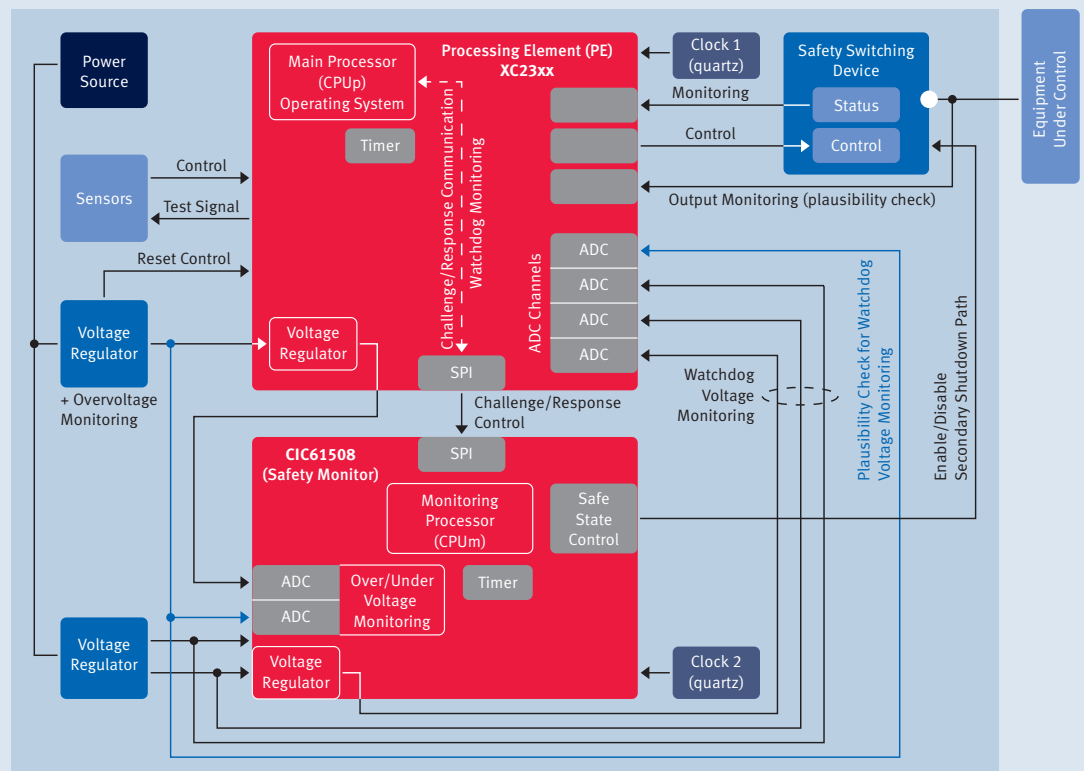
	38 Pin	48 Pin	64 Pin		100 Pin		144 Pin		
1MB						XC236xE 80-128MHz		XC238xC 80-100MHz	XC238xE 80-128MHz
768KB					XC236xA 66-80MHz	XC236xE 80-128MHz	XC238xA 66-80MHz	XC238xC 80-100MHz	XC238xE 80-128MHz
512KB				XC2336A 20-80MHz	XC236xA 66-80MHz	XC236xE 80-128MHz	XC238xA 66-80MHz		XC238xE 80-128MHz
384KB				XC2336A 20-80MHz	XC236xA 66-80MHz		XC238xA 66-80MHz		
256KB				XC2336B 20-80MHz	XC236xB 40-80MHz				
128KB		XC232xD 20-66MHz	XC233xD 20-66MHz	XC2336B 20-80MHz	XC236xB 40-80MHz				
64KB	XC2310S 20-40MHz	XC2320S 20-40MHz	XC233xD 20-66MHz						

■ Instruction Cache  
■ FlexRay™ Optional

## XC2300 Block Diagram



## Safety Related Systems (SRS)



## XC2300 and CIC61508 Cost-Optimized Safety Computing Platform

### SIL Supporting Key Features

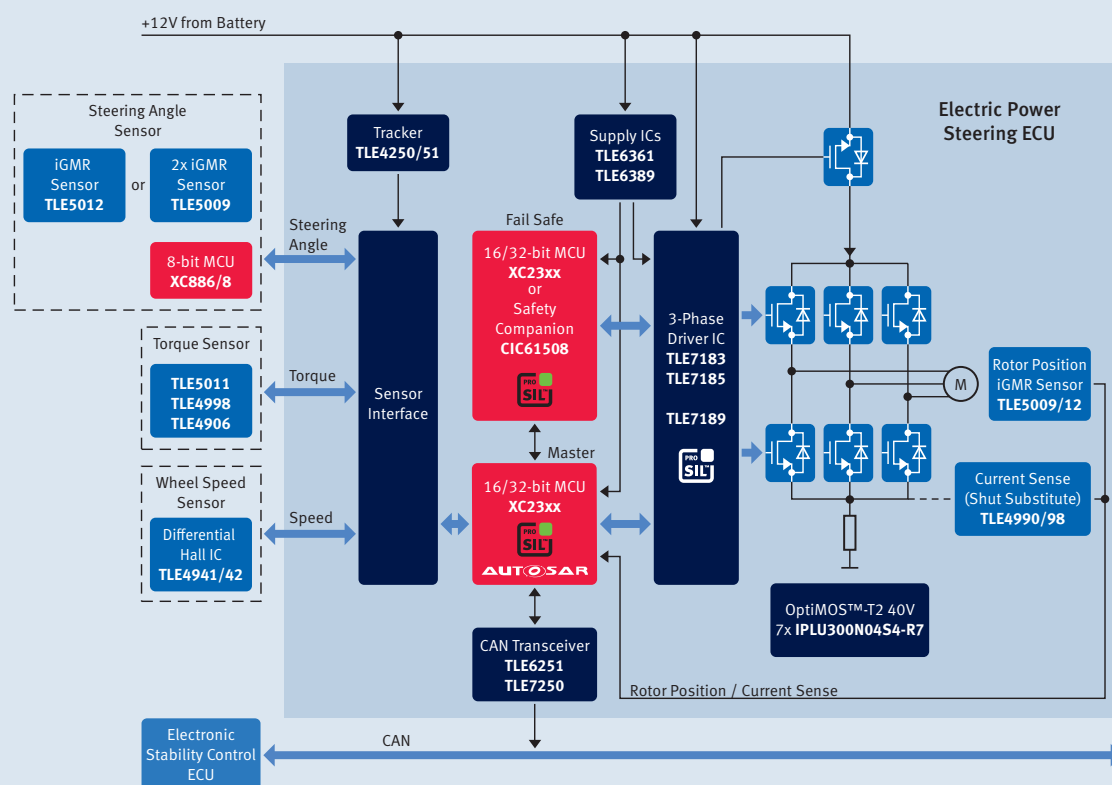
- Robust monitoring channel with up to 3 selectable safety control paths
  - Internal test scheduler/sequencer
  - Supply monitor
  - System shut down
- Monitoring of processor functionality to ensure correct computation of user's process Monitoring software
  - Self tests software covering CPU, memories and peripherals
  - Integration path for user defined application tests
  - Redundant switch-o path
- Independent safety monitor software
  - Task monitor (scheduling, timing protection)
  - Data Verification Unit

### Customer Benefits

- Fast time to market due to Infineons proven in use safety concept
- Comprehensive safety documentation
- Intelligent error management avoids false alarm and therefore reduced FIT/DPPM rate
- Scalable platform guarantees optimized cost-performance ratio to support ASIL-requirements



## Application Example



## Electric Power Steering (EPS)

The high variety of different electric power steering systems demands a rich scalability of performance and different feature sets on the microcontroller side to address the dedicated systems requirements. The rich portfolio of the XC2300 family offers a cost-optimized fit for all system requirements, whether a simple Electro Hydraulic Power Steering (EHPS) system or a complex EPS application requiring high-performance and specific interfaces such as FlexRay.

## Key Features

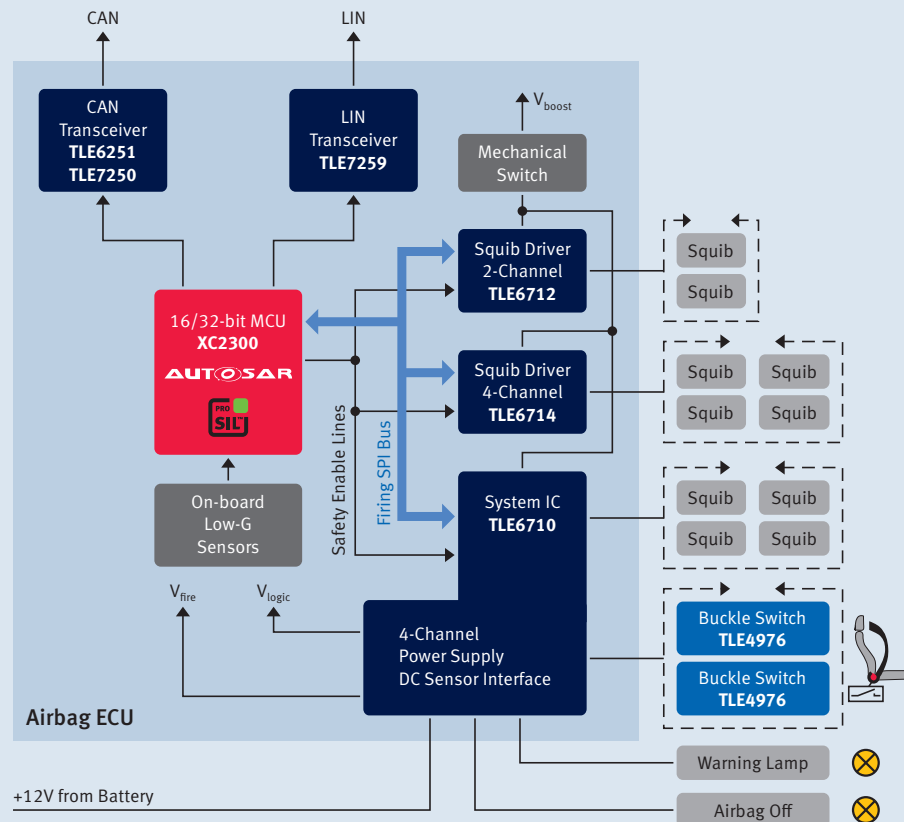
- Up to 128MHz system performance
- 128–1088KB Flash with EEPROM emulation
- Up to 90KB SRAM
- Dual ADC (10-/12-bit) with highest resolution
- Up to three CAN, up to eight serial interfaces
- FlexRay
- Dedicated safety features (MPU, CRC, ECC)
- 100- to 144-pin package

## Benefits

- High scalability enables optimized price-product choice
- Excellent price-performance ratio
- Low power consumption (58mA @ 80MHz over full temperature range)
- Enables system cost savings (e.g. in power supply circuits)
- Hardware safety features support implementation in safety-critical applications
- Supports ASIL requirements



## Application Example



## Airbag System (Basic)

The XC2300 family offers a perfect product fit for airbag applications. Its wide scalability and excellent price-performance ratio enables the system supplier to choose the cost-optimized product that best suits the specific system requirements.

### Key Features

- 64–1088KB Flash with EEPROM emulation
- Up to 90KB SRAM
- Dual 10/12-bit ADC (with broken wire detection)
- Up to three CAN, up to six interfaces (e.g. queued SPI)
- FlexRay optional
- Dedicated safety features (MPU, CRC, ECC)
- 48- to 144-pin package

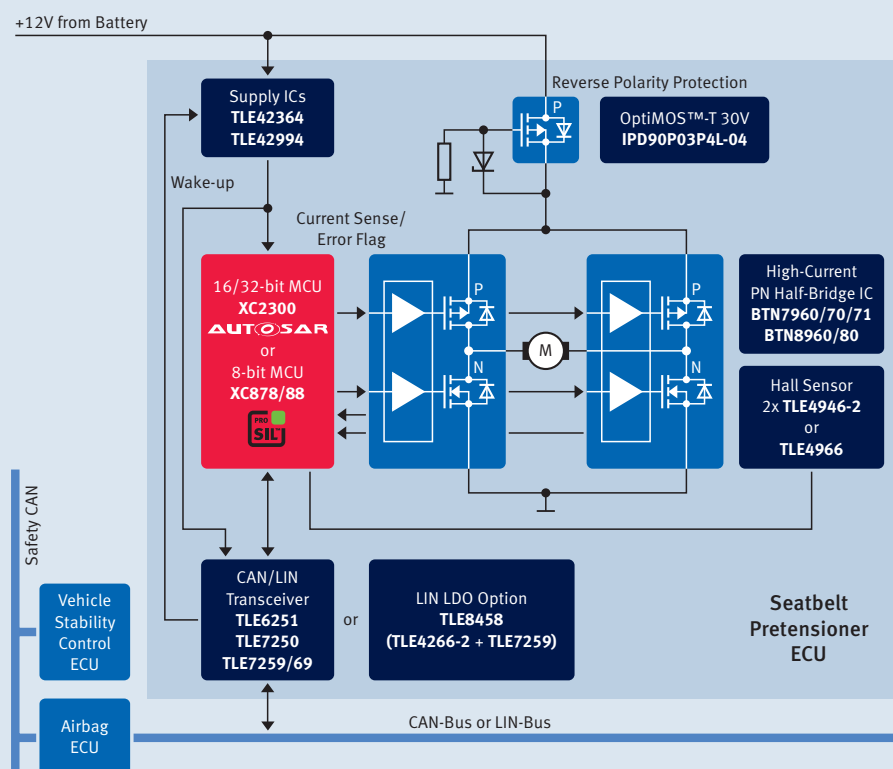
### Benefits

- High scalability supports low-end to high-end airbag applications
- Excellent price-performance ratio
- EEPROM emulation enables event data recording, no external EEPROM required
- Low power consumption (58mA @ 80MHz over full temperature range)
- Enables system cost savings (e.g. in power supply circuits)
- Hardware safety features support implementation in safety-critical applications
- Supports ASIL requirements





## Application Example



## Reversible Seatbelt Pretensioner

The XC2300 family offers a perfect product fit for all kinds of belt-pretensioner applications. Its wide scalability of low-end products and their cost-optimized feature sets give system suppliers the opportunity to choose the best-fit product in this low-end safety application.

## Key Features

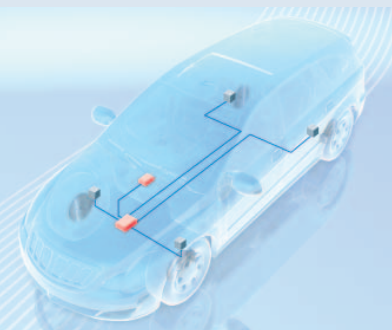
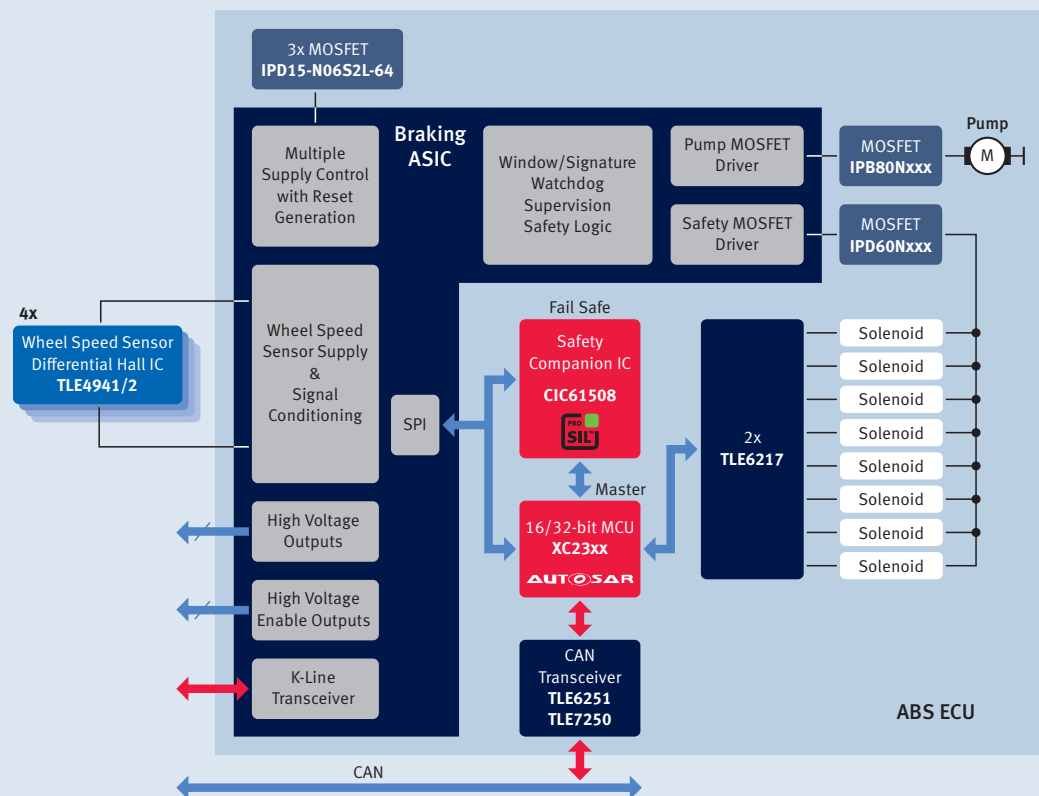
- 64–576KB Flash with EEPROM emulation
- Up to 50KB SRAM
- Up to two CAN, up to six serial interfaces
- 38- to 64-pin package

## Benefits

- High scalability enables optimized price-product choice
- Excellent price-performance ratio
- Low power consumption (20mA @ 20MHz over full temperature range)
- Enables system cost savings (e.g. in power supply circuits)
- Supports ASIL requirements



## Application Example



## ABS

The XC2300 family offers a perfect product fit for low-end braking applications or braking systems for emerging markets. The wide scalability of its products and their cost-optimized feature sets give system suppliers the opportunity to choose the best-fit products in a very cost-sensitive application.

### Key Features

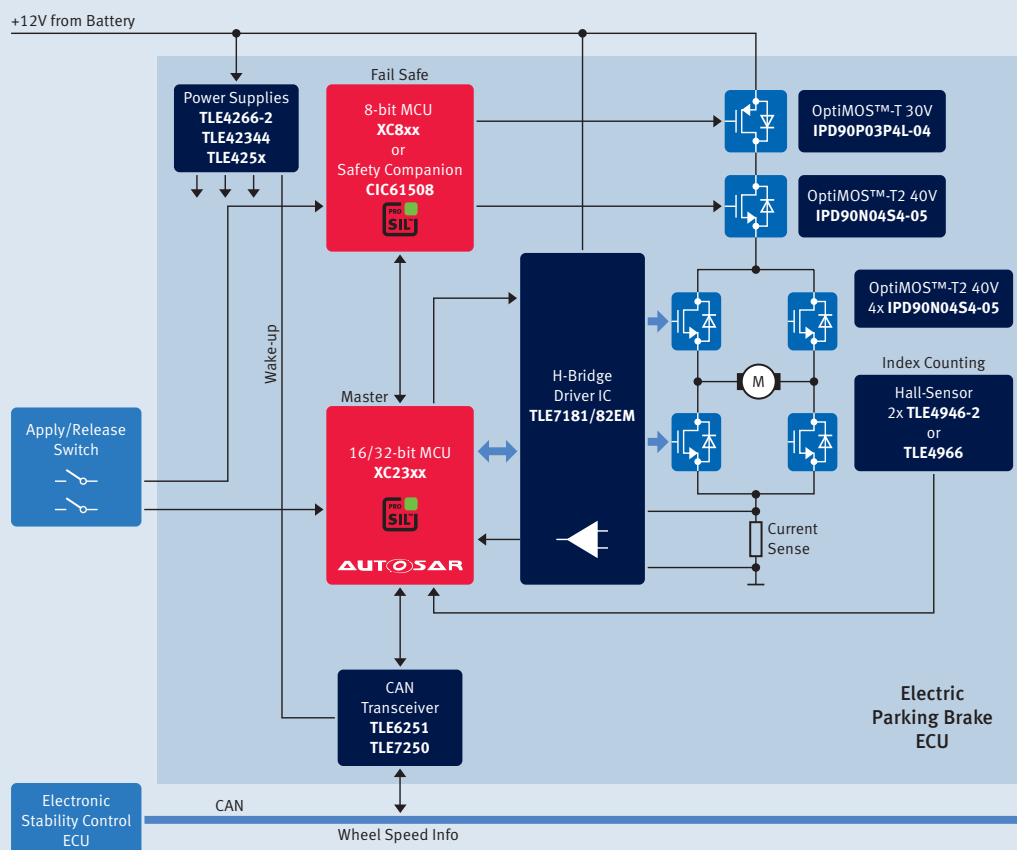
- Up to 128MHz
- 64–1088KB Flash with EEPROM emulation
- Up to 90KB SRAM
- Dual 10/12-bit ADC
- Up to three CAN, up to eight serial interfaces
- FlexRay optional
- Dedicated safety features (MPU, CRC, ECC)
- 100- to 144-pin package

### Benefits

- Optimized fit for price-sensitive braking applications
- Excellent price-performance ratio
- Low power consumption (58mA @ 80MHz over full temperature range)
- Enables system cost savings (e.g. in power supply circuits)
- Supports ASIL requirements



## Application Example



## Electric Parking Brake

The XC2300 family offers a perfect product fit for Electric Parking Brake applications. It's broad scalability and the cost-optimized feature set not only enable system designers to develop low-cost systems, but also offer enough headroom to integrate additional functionality or AUTOSAR requirements at a low-cost and in small packages. Furthermore, the dedicated safety features in this family reduce the integration effort in this safety-critical application.

## Key Features

- 64–576KB Flash with EEPROM emulation
- Up to 50KB SRAM
- Dedicated safety features (MPU, CRC, ECC, peripheral redundancy)
- Small package size (38- to 64-pin)
- Excellent price-performance ratio
- Low power consumption (20mA @ 20MHz over full temperature range)
- Low quiescent current
- Realization of system cost savings (e.g. in power supply circuits)
- Hardware safety features support implementation in safety-critical applications
- Supports ASIL requirements

## Benefits

- High scalability enables an optimized price-product choice





## XC2700

The XC2700 family of microcontrollers with a 32-bit performance allows system designers to build cost-effective electronic engine controls in motorcycles, entry-level automobiles and other small engines around the world in order to comply with future emission standards.

The XC2700 family is based on the industry-leading C166SV2 high-performance microcontroller core with up to 128MHz. It also integrates key peripherals such as memory, voltage regulator and interfaces to reduce the overall system cost. This also means that software that has been developed on existing C166 controllers can be easily reused on the new family.

With 38- to 176-pins, the XC2700 family provides a scalable package range from lower-cost to higher-performance. Designers can easily move up and down the performance curve to design optimized engine control systems for motorcycles, entry-level cars as well as similar applications such as marine engines. Compatibility, scalability and a maximum re-use within the XC2700 family provide customers a variety of products and functions, covering both today's and tomorrow's application needs.

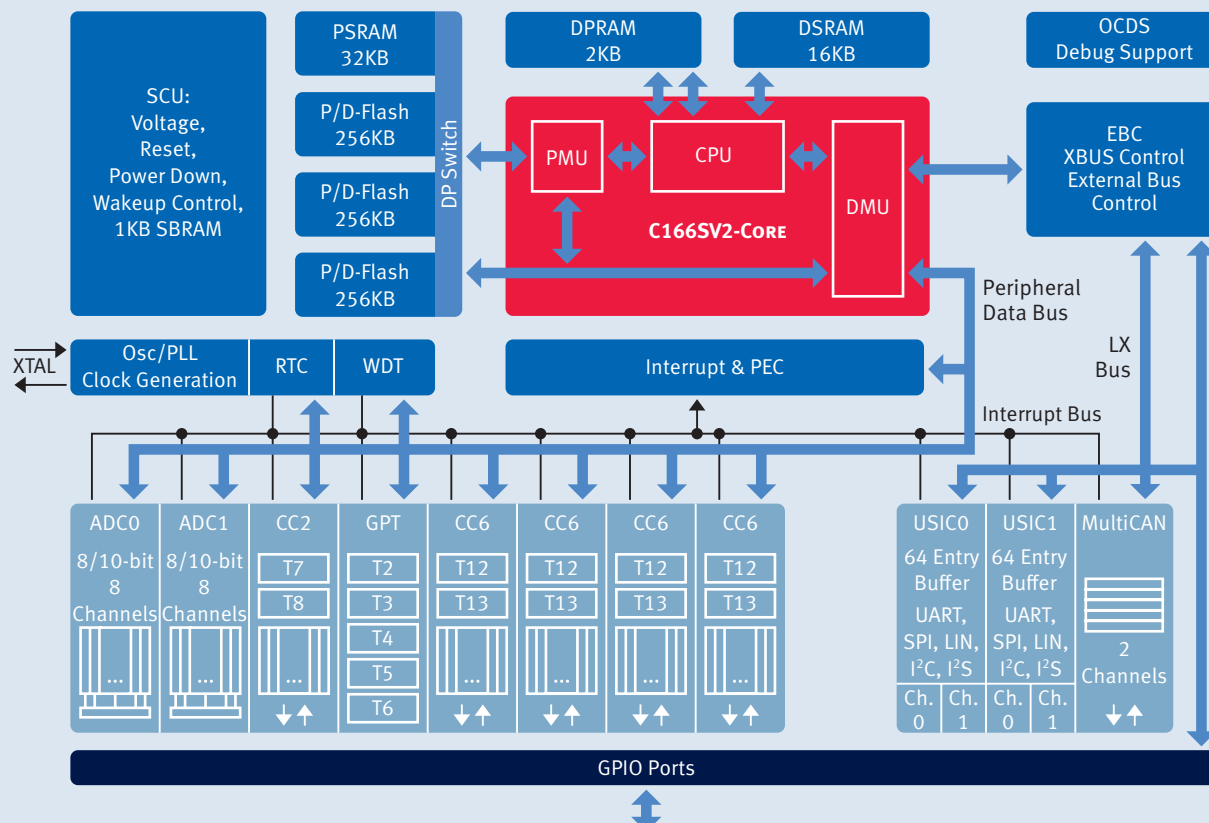
The high integration and performance of the XC2700 microcontroller family allows electronic engine control to be implemented in low-cost vehicles, providing more efficiency and significantly reduced emissions. The XC2700 microcontroller family is the perfect fit for value-driven powertrain applications.

The large range of available support, tools and software as well as Infineon's extensive experience in powertrain applications, allow engineers to achieve an optimum time-to-market.

# XC2700 Powertrain Portfolio: 16/32-bit from Low-Cost to High-End

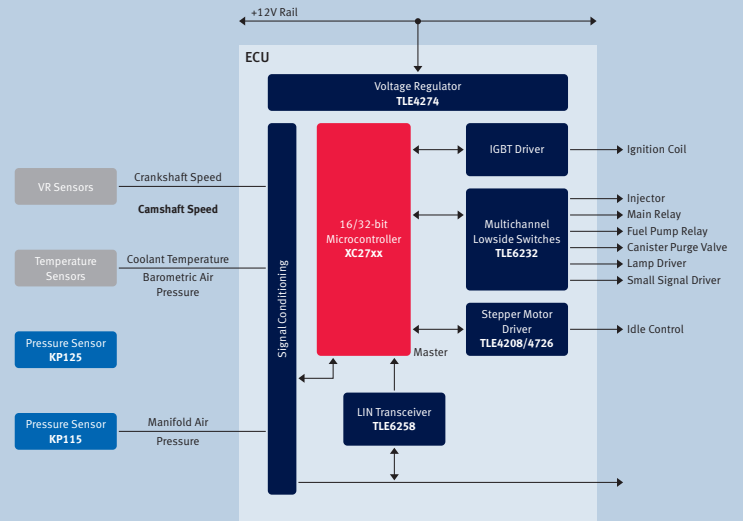
	TSSOP-38	VQFN-48	QFP-64	QFP-100	QFP-144	QFP-176	BareDie
1536KB					XC2787X 100MHz	XC2797X 100MHz	
1024KB				XC2768X 128MHz	XC2788X 128MHz		
768KB				XC2765X 80MHz	XC2785X 80MHz		XC2705U 80MHz
704KB				XC2766X 66MHz	XC2786X 66MHz		
256KB			XC2734X 80MHz	XC2764X 80MHz			
128KB		XC2723X 40MHz	XC2733X 40MHz				
64KB	XC2712X 40MHz	XC2722X 40MHz					

## XC2700 Block Diagram



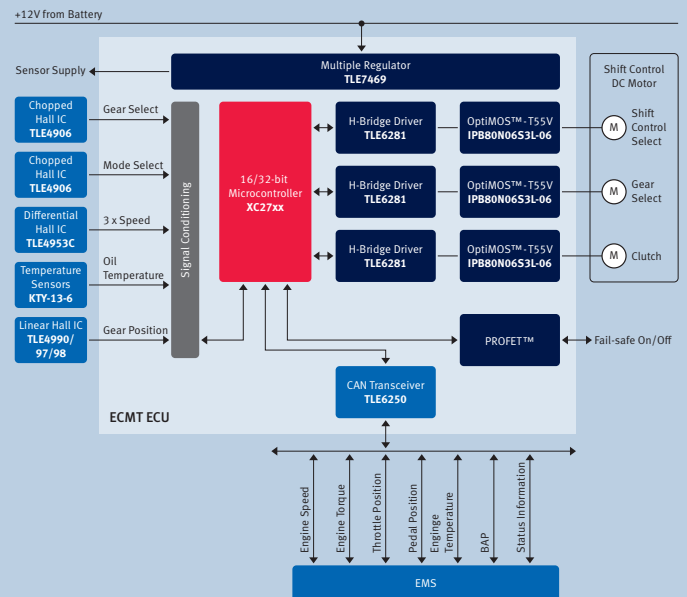
## Small Engine Management

The next generation of small combustion engines requires more functions to comply with emission regulations, performance requirements and comfort expectations. Especially in the low-cost market for two- and three-wheelers, as well as ultra low-cost cars, the 16/32-bit XC2700 microcontroller is the product of choice for many customers. With a performance of up to 128MHz, there is enough headroom to qualify a engine up to Euro 5 emission standards.



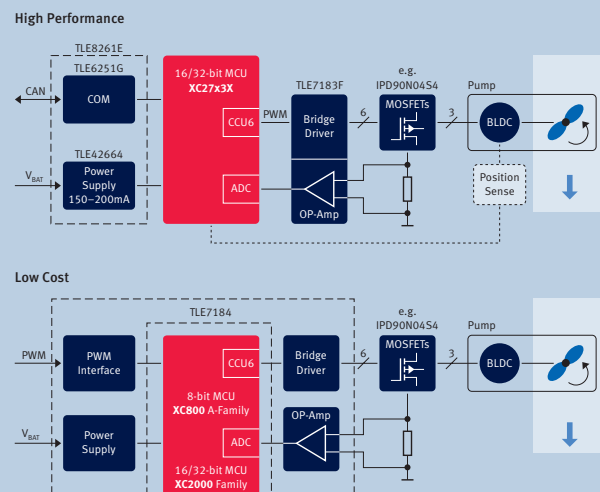
## Transmission Management

Efficient transmissions are a major contributor to improved fuel efficiency and to provide a relaxed driving experience. Automatic transmissions, such as eCVT and eAMT, are becoming increasingly attractive for smaller cars. The XC2700, with up to 1.6MB of embedded Flash provides the set-up for efficient transmission management.



## Advanced Auxiliaries

“Power on demand” is the trend for state-of-the-art powertrain peripheral aggregates across all automotive segments. Fuel pumps, water pumps or ventilation and air management are consuming energy. Optimizing the efficiency of these aggregates significantly reduces emissions and improves performance. Save 1 liter of gasoline and produce about 2.4kg CO<sub>2</sub> less!





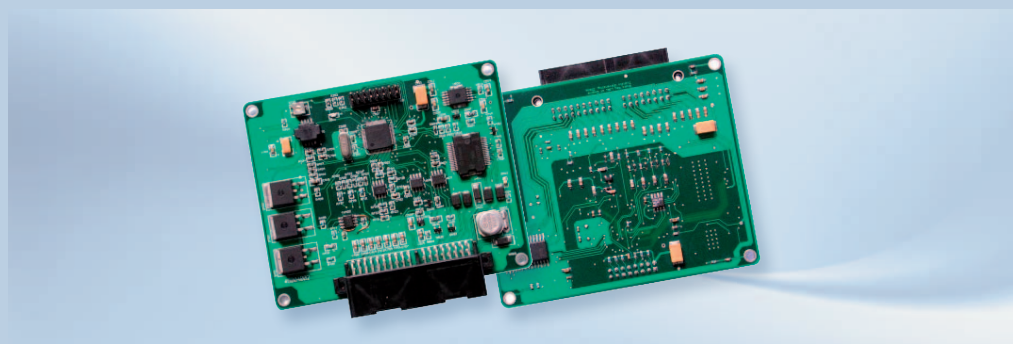
With the XC2700 family you are choosing modern and future oriented microcontrollers dedicated to powertrain applications.

#### Key Features

- 40–100MHz CPU
- 128–1600KB Flash
- Highly-flexible serial interfaces (USIC), suitable as LIN, SPI, IIC, UART, IIS
- On-chip MultiCAN interface
- Multi-functional general purpose timer
- Capture/compare units
- Synchronous A/D converters
- Single power supply
- 64- to 176-pin packages
- Temperature range: -40°C to +125°C

#### Benefits

- Scalable family, enabling value-driven 2/3/4-wheeler powertrain applications
- Based on industry-leading C166sV2 high-performance microcontroller core
- Supported by a large range of development tools

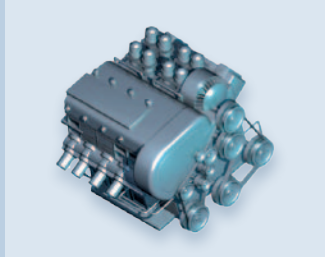


Electronic Fuel Injection (EFI) is becoming more reliable and less expensive thanks to widespread usage. At the same time, carburetors are becoming less available and more expensive. Even marine applications are adopting EFI as its reliability improves. Virtually all internal combustion engines, including motorcycles, low-cost cars and outdoor power equipment, may eventually use some form of fuel injection.

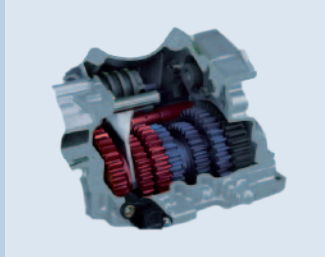
The XC2700 product family supports all features for a reliable, modern and cost-effective system.

The XC2700 features offer the perfect fit to increase efficiency, reduce emissions and improve comfort.

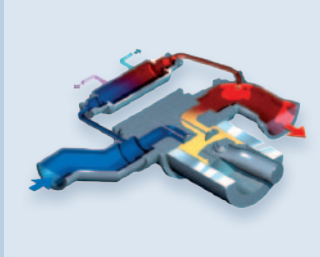
#### Engine Management



#### Transmission Management



#### Auxiliary Management



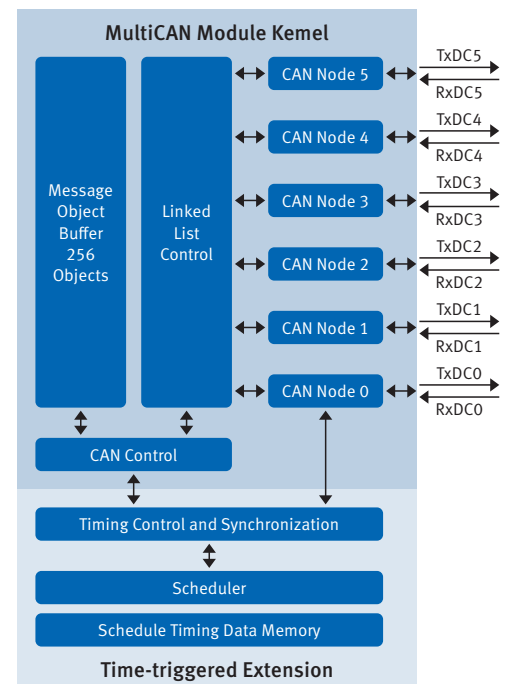
# Enhanced Communication

## 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 XC2000's enhanced MultiCAN module.

### MultiCAN Features

- Full CAN with active CAN 2.0B
- Up to six independent CAN nodes
- Up to 256 message objects
- Programmable acceptance filtering
- Data transfer rate up to 1MB/s, individually programmable for each node
- Powerful analysis capability
- FIFO data handling support
- Automatic gateway support
- Flexible interrupt handling



## Universal Serial Interface (USIC)

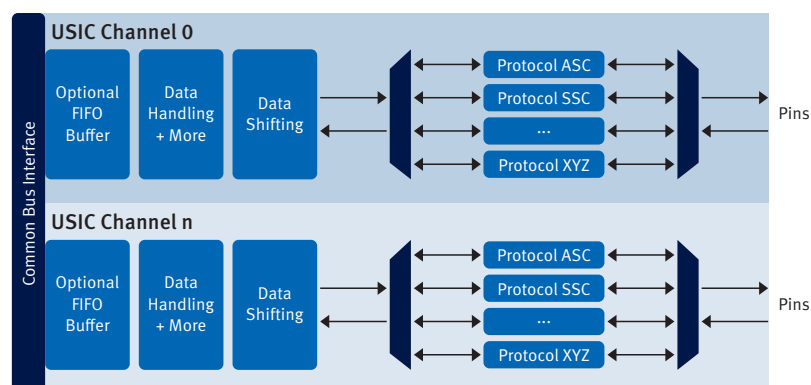
Designers can now configure universal serial interfaces in accordance with their system requirements. No matter whether UART, SSC (SPI compatible), LIN, IIC or IIS, any interface is possible after a quick adjustment to the USIC module.

### Each USIC Channel

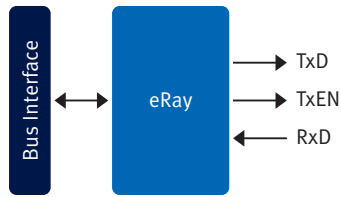
- Is capable of handling UART, SPI, LIN, IIC and IIS
- Is individually configurable (incl. baud rate generation)
- Handles full duplex data transfers
- Has programmable RX and TX FIFOs
- Can be reprogrammed on the fly without chip reset

### A USIC Module

- Is a cluster of two independent, identical USIC channels
- Up to five USIC modules are available (= 10 channels)

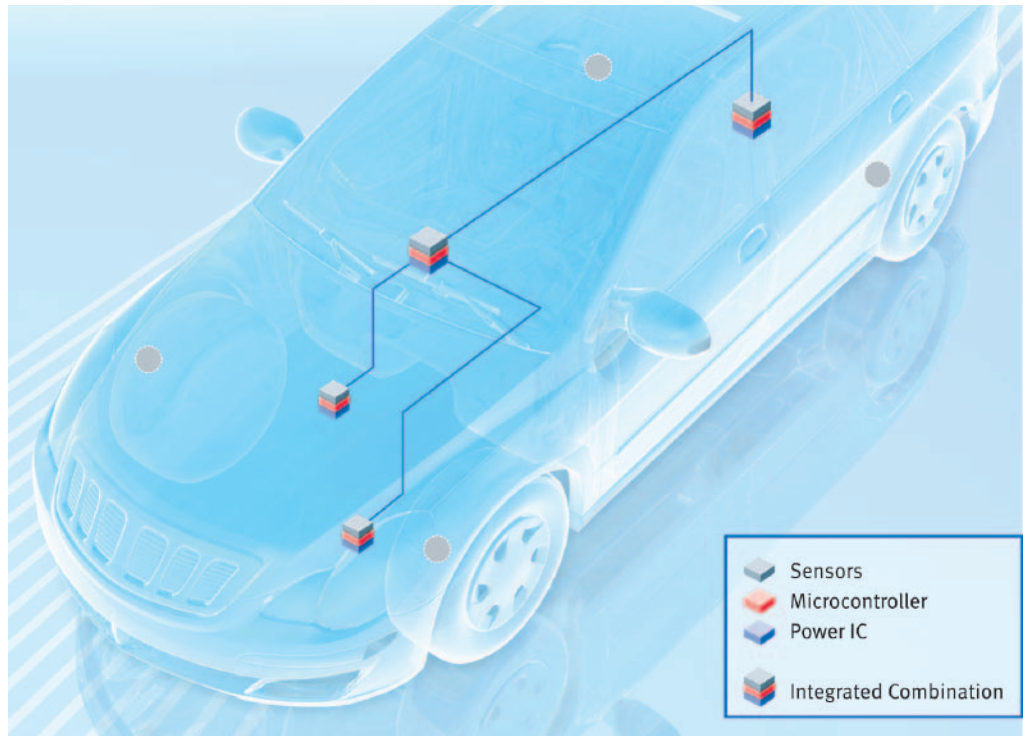


## FlexRay™<sup>1)</sup>



### Constant Current Supply

- Embedded FlexRay™ module available
- Module based on eRay IP
- Follows FlexRay™ specification 2.1
- Flexible operation features
- Support of 16/32-bit adoption
- Support of XC2000 PEC



### Integrated FlexRay™ Solutions

#### XC2000 Fully Integrated, Most Powerful Automotive Microcontroller

- Up to 128MHz
- FlexRay™ integrated
- Up to 1.6MB eFlash
- XC2200 optimized for high-end body applications
- XC2300 optimized for safety
- XC2700 optimized for low-end engine control

### Discrete FlexRay™ Solutions

#### Infinion CIC-310 – FlexRay™ Companion IC – Fits Perfectly With

#### Infinion XC2200 Microcontrollers

- Power-down features and communication interface options for body applications

#### Infinion XC2300 Microcontrollers

- Safety features and redundancies for safety-relevant applications such as power steering and airbag

#### Infinion XC2700 Microcontrollers

- Powerful motor control features for low-end engine control

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

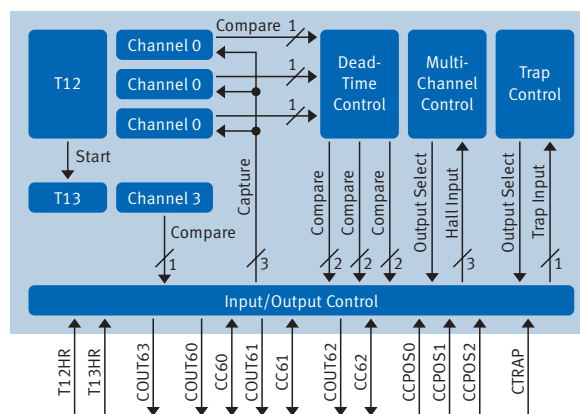
# Peripheral Highlights

## CCU6E – High-performance PWM

Consists of a 16-bit timer block (T12) with three capture/compare channels and another 16-bit timer block (T13) with one compare channel. The T12 channels can generate up to six PWM signals or accept up to 6 capture triggers. The T12 channels can be used to control up to three half bridges with automatic dead-time generation. They can jointly generate control signal patterns to drive AC motors or inverters. Sinusoidal or space vector modulation can be easily implemented. Special operating modes support the control of brushless DC motors using hall sensors or back EMF detection. Furthermore, block commutation and control mechanisms for multi-phase machines are also supported.

### CCU6E Features

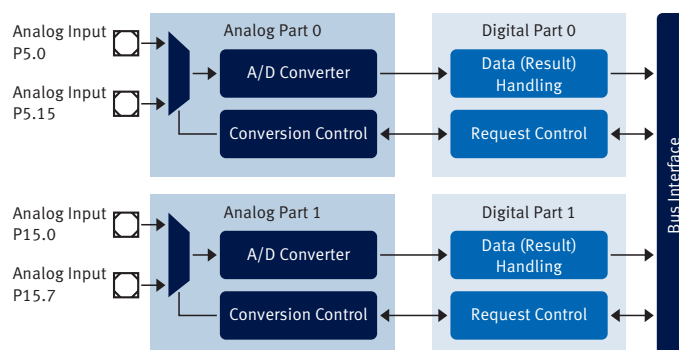
- Capture for time measurement
- Compare for PWM generation
- Burst for additional modulation
- Single-shot for flexible signal generation
- Multi-channel for unipolar machines
- Block commutation for brushless DC drives



## Enhanced Analog-Digital Converter (ADC)

### Two Synchronizable A/D converters with

- A total of up to 40 channels
- Up to 12-bit resolution,  $\pm 2$  LSB
- Conversion time down to 1.2 $\mu$ s
- Data reduction pre-processing
- Result accumulation, limit check
- External or internal trigger events and automatic conversion sequencing



# Performance Boost with Instruction Cache – XC2000 at its Best

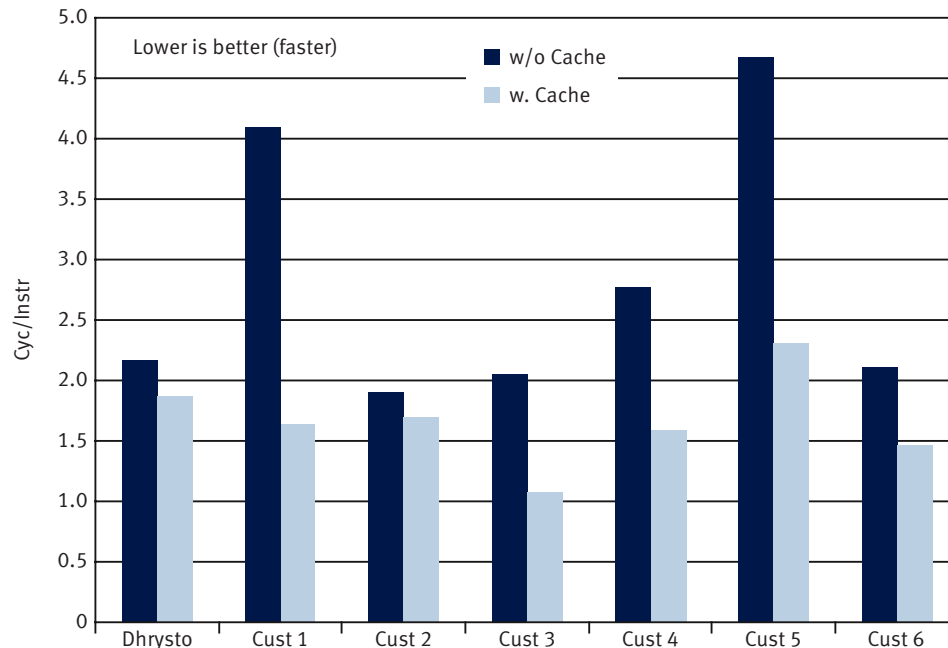
The instruction cache (iCache) integrated on the XC2000 family's new high-end devices offers a strong performance boost.

- 30% performance boost expected through iCache only
- Additional frequency improvement of up to 128MHz generates an additional performance improvement of approximately 50%
- iCache Flash memory mapping is family-compatible and allows easy software porting
- XC2000 family compatibility

These devices are geared toward automotive applications that require a higher range of performance or the potential for future performance improvements. These target applications are:

- Body Control Module (BCM)
- Communication Gateway
- Airbag
- Electric Power Steering (EPS)
- Low-end Engine Management (EMS)
- Low-end Transmission

## Benchmark with divers Customer Application Codes



# AUTOSAR

## Infineon...

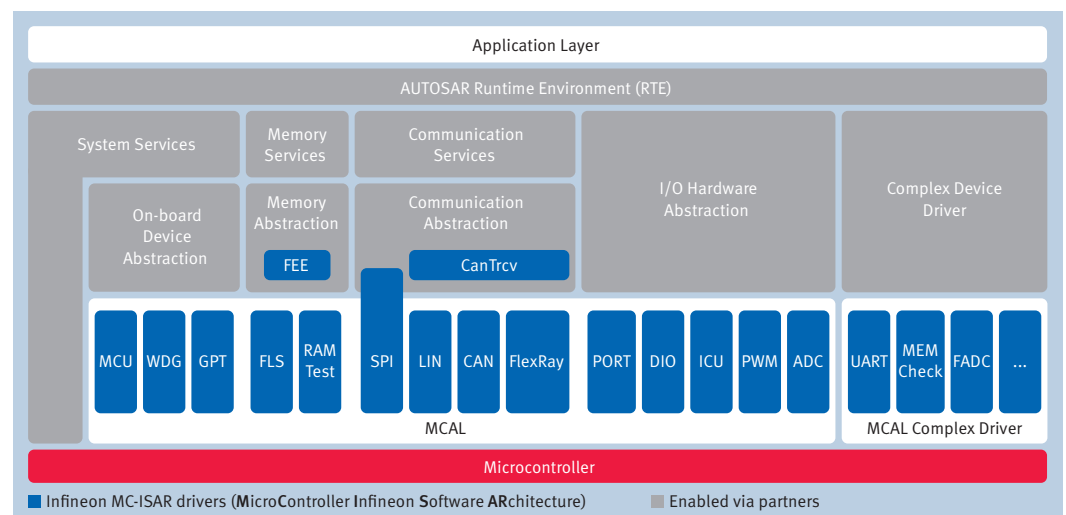
- Has been contributing to AUTOSAR since 2004
- Provides AUTOSAR solutions for its microcontrollers
- Offers AUTOSAR-compliant low-level drivers: MC-ISAR
- Enables partners to provide the complete AUTOSAR basic software

## Supported Infineon product families

- XC2200
- XC2300
- XC2700

## Automotive-oriented

- Early implementation of MC-ISAR in 2005
- MC-ISAR will be implemented for additional microcontrollers
- CMM level 3-certified and standardized software process applied
- Microcontroller modules designed for flexible configuration via AUTOSAR





# Starter Kits and Evaluation Boards

## DAP miniWiggler



High-performance and cost-efficient debugging tool

## XC2000 Starter kit



## UConnect XC2000



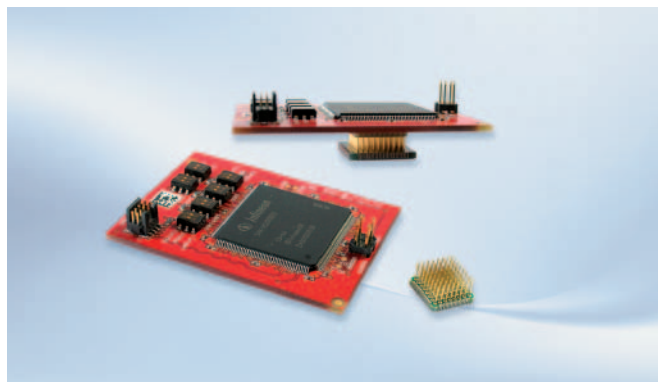
The UConnect XC2000 is a low-cost Starter Kit that provides full evaluation capability for the new XC2000 16-bit family of microcontrollers. The kit includes development toolchains, demos, a EB TRESOS studio for driver configuration and tutorials for quick installation and ease-of-use. The Uconnect USB stick comes with a CAN extension board.

## DAVE™ Drive Kit



Uses the full power of Infineon's microcontroller. For example, it generates optimized FOC code for XC2000 using a Vector computer, something which usually requires expert knowledge in both motor control and assembler programming. By making DAVE™ Drive available as a free download, customers of all sizes can quickly implement advanced motor control techniques using Infineon's powerful components for motor control.

## Emulation Adapter



## XC2300 SafeTkit



# DAVE™ – Digital Application Virtual Engineer



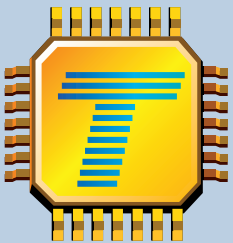
DAVE™ helps you to program the Infineon microcontroller of your choice, by offering intelligent wizards that configure the chip to work the way you need it and automatically generate C-code with appropriate driver functions for all of the on-chip peripherals and interrupt controls.

DAVE™ interacts directly with the free development tools and full version from TASKING and Keil.

To use DAVE™, you need the DAVE™ mother system and the DIP file for your specific Infineon microcontroller.

Download DAVE™ from [www.infineon.com/dave](http://www.infineon.com/dave) .

## Free Development Tools TASKING VX-Toolset Lite

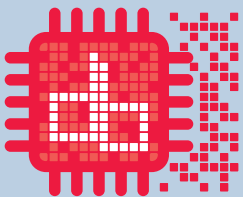


The free and easy-to-use VX-Toolset Lite for C166 is based on the new high-performance TASKING VX-Toolset for C166, which is the perfect choice for any new C166 project as well as any existing C166 project that requires additional code performance (code size or speed). The migration of existing applications has delivered improvements of 45% on code size and 25% on code speed. The VX-Toolset Lite has limited performance options for easy entry, and is ideal for projects that do not require all high-performance features.

The VX-Toolset Lite provides many powerful features from the full version of the toolset, while also providing a lot of easy-to-use features – similar to DAVE™ Bench – for making software development very easy:

- Eclipse-based IDE enhanced with easy-of-use features like Active Project
- Full-feature debugger and simulator to test code with a target hardware
- Support for Infineon's miniWiggler and Starter Kits
- Import Wizard and refresh option for Infineon DAVE™ projects
- C-Compiler to support the XC2000 family and XE166 family
- Efficient programming of the microcontroller's MAC unit in C language, not available with any other compiler
- Keil C166 and TASKING Classic C166 import Wizard that helps to convert project settings and source code
- Includes many sample projects for getting started quickly
- Integrated support for programming Flash memory

Register and download from [www.infineon.com/dave-bench](http://www.infineon.com/dave-bench).



# Development Support/Tool Partners

## XC2000 Integrated Compiler Development Environment

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**Altium**

Classic C166 and Viper VX166



## Emulator/Debugger Development Systems

---



## Programmer/Programming Software

---



**MEMTool**



**TASKING**

## Operating System & Software

---



**ETAS**

DSP-Lib



## Simulation/Modelling/Rapid Prototyping

---



## Auto Code Generation Tools

---



## Calibration/Measurement

---



**ETAS**



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- 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)

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# Feature Overview XC2000 Family

	Core		Flash		SRAM					SB RAM	CAN	ADC	Universal Serial Interface [USIC channels] <sup>1)</sup>	Capture/Compare Units [CCU] <sup>2)</sup>			FlexRay	Package	Temperature (T <sub>ambient</sub> )
	Core	Frequency	Program Flash	Data Flash	Σ SRAM	Program [PS RAM]	Data Mem [DS RAM]	Dual Port [DP RAM]	Trace Mem for MCDS	Standby	Channels	Channels		CCU 1	CCU 2	CCU 6			

## Feature Overview XC2200 for Body & Convenience

I-Series	C166SV2	128	512-1024	64	90	64	24	2		8	6 max.	24	10 max.	0	1	4	2 max.	LQFP-100/ LQFP-144	-40°C to +125°C
H-Series	C166SV2	100/80	1024-1536	64	106/ 138	112	24	2	4	8	6 max.	24/ 30/40	10 max.	1	1	4	2 max.	LQFP-144/ LQFP-176	-40°C to +125°C
M-Series	C166SV2	80/66	384-768	64	50	32	16	2		8	6 max.	16/24	8 max.	0	1	4	–	LQFP-64/ LQFP-100/ LQFP-144	-40°C to +125°C
(-)Series	C166SV2	80/66	384-704	64	82	64	16	2		1	5 max.	16/24	6 max.	0	1	4	–	LQFP-100/ LQFP-144	-40°C to +125°C
N-Series	C166SV2	80/66/ 40	128-256	64	34	16	16	2		8	6 max.	9/16	6 max.	0	1	2	–	LQFP-64/ LQFP-100	-40°C to +125°C
L-Series	C166SV2	40/66	32-128	32	12	6	4	2			2 max.	10/19	4	0	1	2	–	VQFN-48/ LQFP-64	-40°C to +125°C
U-Series	C166SV2	40	32/64		8	4	2	2			–	7/10	2	0	1	1	–	TSSOP-38/ VQFN-48	-40°C to +125°C

## Feature Overview XC2300 for Safety

E-Series	C166SV2	80-128	512-1024	64	90	64	24	2		8	3 max.	24 max.	6 max.	0	1	4 max.	2 max.	LQFP-100/ LQFP-144	-40°C to +125°C
C-Series	C166SV2	80-100	768-1024	64	138	112	24	2	4	8	3	24	8	0	1	4	2 max.	LQFP-144	-40°C to +125°C
A-Series	C166SV2	66-80	384-768	64	50	32	16	2		8	3 max.	24 max.	6 max.	0	1	4 max.	–	LQFP-64/ LQFP-100/ LQFP-144	-40°C to +125°C
(-)Series	C166SV2	66-80	384-512	64	66	48	16	2		1	3 max.	24 max.	6 max.	0	1	2 max.	–	LQFP-100/ LQFP-144	-40°C to +125°C
B-Series	C166SV2	20-80	128-256	64	34	16	16	2		8	3 max.	16 max.	6 max.	0	1	2	–	LQFP-64/ LQFP-100	-40°C to +125°C
D-Series	C166SV2	20-66	32-128	32	12	6	4	2			1 max.	9	4	0	1	2	–	VQFN-48/ LQFP-64	-40°C to +125°C
S-Series	C166SV2	20-40	32-64		8	4	2	2			–	9 max.	2	0	1	1	–	TSSOP-38/ VQFN-48	-40°C to +125°C

1) USIC: can be configured as UART, LIN, SPI/QSPI, I<sup>2</sup>C, I<sup>2</sup>S

2) CCU: used for PWM, D/A





# Feature Overview XC2000 Family

	Core		Flash		SRAM					SB RAM	CAN	ADC	Universal Serial Interface [USIC channels] <sup>1)</sup>	Capture/Compare Units [CCU] <sup>2)</sup>			FlexRay	Package	Temperature (T <sub>ambient</sub> )
	Core	Frequency	Program Flash	Data Flash	Σ SRAM	Program [PS RAM]	Data Mem [DS RAM]	Dual Port [DP RAM]	Trace Mem for MCDS	Standby	Channels	Channels (10bit, 1.2µs)		CCU 1	CCU 2	CCU 6			
Feature Overview XC2700 for Powertrain																			
8X-Series	C166SV2	128	1024	64	90	64	24	2			3	24	6	0	1	4	2 max.	LQFP-100/ LQFP-144/ LQFP-176	-40°C to +125°C
7X-Series	C166SV2	100	1024- 1536	64	106/ 138	112	24	2	4	8	3	24/30	6	1	1	4	2 max.	LQFP-144/ LQFP-176	-40°C to +125°C
6X-Series	C166SV2	66	704	64	82	64	16	2		1	2	16/24	4	0	1	4	–	LQFP-100/ LQFP-144	-40°C to +125°C
5X-Series	C166SV2	80	512/768	64	50	32	16	2		8	2	9/16/ 24	6	0	1	4	–	LQFP-64/ LQFP-100/ LQFP-144	-40°C to +125°C
4X-Series	C166SV2	80	256	64	34	16	16	2		8	2	9/16	4	0	1	2	–	LQFP-64/ LQFP-100	-40°C to +125°C
3X-Series	C166SV2	66	128	32	12	6	4	2			2	10/19	4	0	1	2	–	VQFN-48/ LQFP-64	-40°C to +125°C
2X-Series	C166SV2	40	64		8	4	2	2			0	7/10	2	0	1	1	–	TSSOP-38/ VQFN-48	-40°C to +125°C

1) USIC: can be configured as UART, LIN, SPI/QSPI, I<sup>2</sup>C, I<sup>2</sup>S

2) CCU: used for PWM, D/A

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