Infineon Technologies - TC233LP32F200NACKXUMA1 Datasheet

Welcome to E-XFL.COM

What is "Embedded - Microcontrollers"?

"Embedded - Microcontrollers" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	TriCore™
Core Size	32-Bit Single-Core
Speed	200MHz
Connectivity	CANbus, FlexRay, LINbus, QSPI
Peripherals	DMA, WDT
Number of I/O	78
Program Memory Size	2MB (2M x 8)
Program Memory Type	FLASH
EEPROM Size	128K x 8
RAM Size	192K x 8
Voltage - Supply (Vcc/Vdd)	3.3V
Data Converters	A/D 24x12b
Oscillator Type	External
Operating Temperature	-40°C ~ 125°C (TA)
Mounting Type	Surface Mount
Package / Case	100-TQFP Exposed Pad
Supplier Device Package	PG-TQFP-100-23
Purchase URL	https://www.e-xfl.com/product-detail/infineon-technologies/tc233lp32f200nackxuma1

Evolution of TriCore™ generations

In 1999, Infineon launched the first generation of the AUDO (**AU**tomotive unifie**D** process**O**r) family. Based on a unified RISC/MCU/DSP processor core, this 32-bit TriCore™ microcontroller was a computational power horse. And the company has evolved and optimized the concept ever since – culminating in what is now the fifth TriCore™ generation.

The TriCore™ success story continues with the introduction of the AURIX™ multicore family. AURIX™ combines easy-to-use functional safety support, a strong increase in performance and a future-proven security solution in a highly scalable product family.

With its high real-time performance, embedded safety and security features, the TriCore™ family is the ideal platform for a wide range of automotive applications such as the control of combustion engines, electrical and hybrid vehicles, transmission control units, chassis domains, braking systems, electric power steering systems, airbags and advanced driver assistance systems. TriCore™-based products also deliver the versatility required for the industrial sector, excelling in optimized motor control applications and signal processing. Infineon's broad product portfolio allows engineers to choose from a wide range of memories, peripheral sets, frequencies, temperatures and packaging options. And all this with a high degree of compatibility across generations.

The new AURIX™ family members are manufactured in a 65nm embedded Flash technology designed for ultimate reliability in harsh automotive environments. Furthermore, the dual frontend concept ensures continuous supply.

As was the case with previous generations, safety software is also available to help manufacturers meet SIL/ ASIL safety standards, as well as AUTOSAR libraries which Infineon has been developing since 2005.

PRO-SIL™

Infineon's PRO-SIL™ program, designed to protect

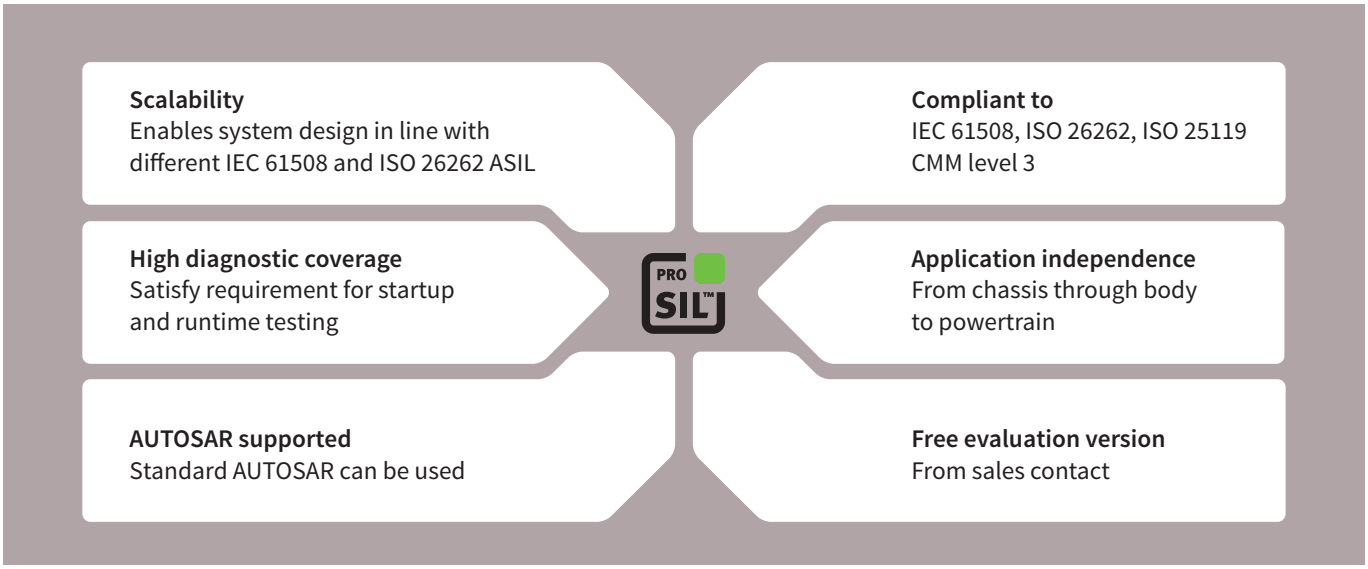
The functional complexity and levels of integration of real-time safety-critical applications continue to increase exponentially. In addition, the product life cycle of these applications has to meet stringent safety standards. Norms such as IEC 61508 and ISO 26262 mandate more robust and comprehensive product development processes and functional safety concepts in automotive and industrial applications.

Infineon's PRO-SIL™ safety program is designed to ease and speed up your automotive and industrial design to comply with such standards. Across the full certification spectrum from Safety Integrity Levels (SIL) 1 to 4 and Automotive Safety Integrity Levels (ASIL) A to D, our end-to-end PRO-SIL™ approach will help you select the right hardware, software and functional safety concepts to meet your design and compliance needs.

PRO-SIL™ highlights

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

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



www.infineon.com/prosil

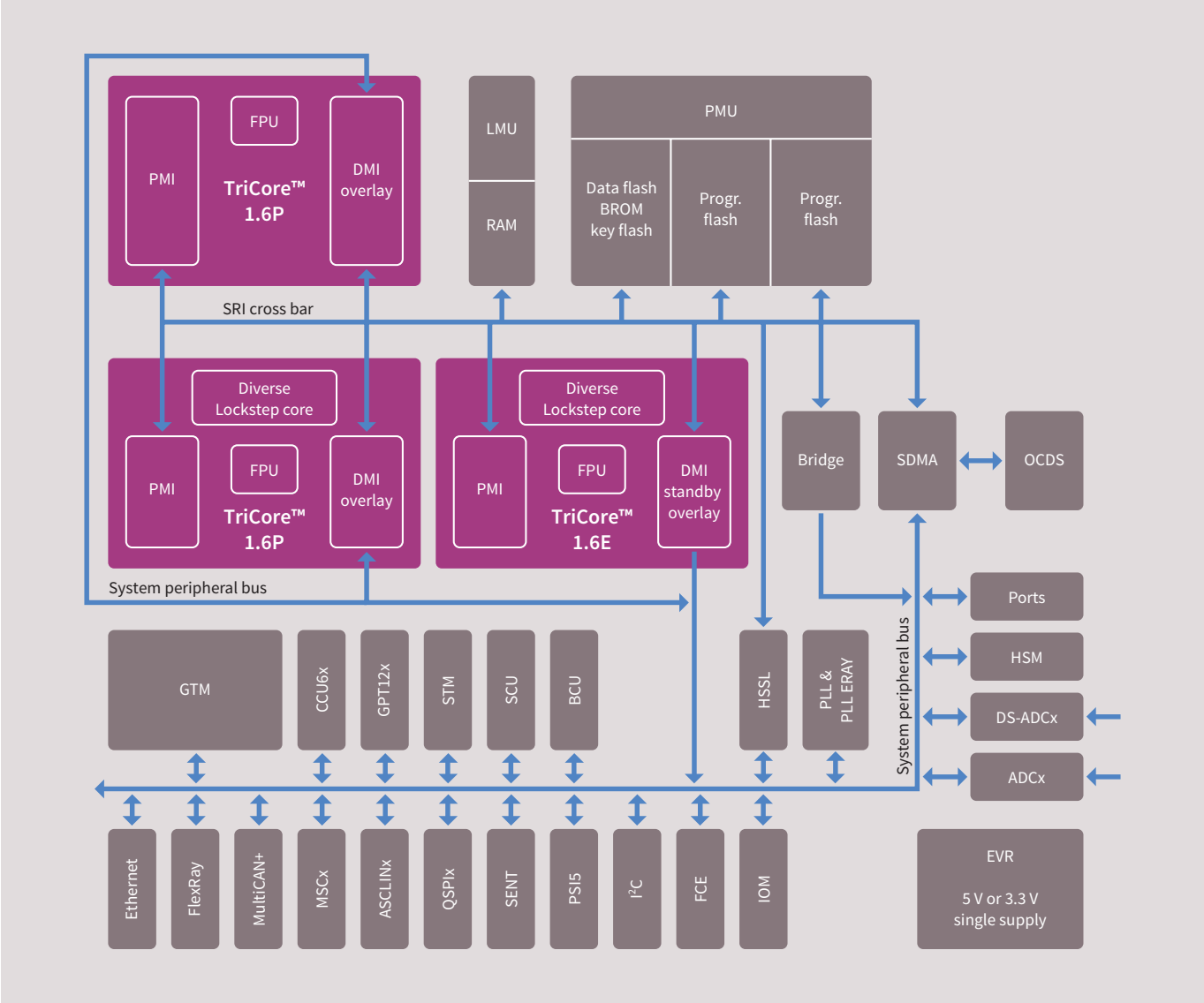
AURIX™ family system architecture

AURIX™ is Infineon's brand new family of microcontrollers serving exactly the needs of the automotive industry in terms of performance and safety. Its innovative multicore architecture, based on up to three independent 32-bit TriCore™ CPUs, has been designed to meet the highest safety standards while significantly increasing performance at the same time.

Using the AURIX™ platform, automotive developers will be able to control powertrain and safety applications with one single MCU platform. Developments using AURIX™ will require less effort to achieve the ASIL-D standard than with a classical lockstep architecture.

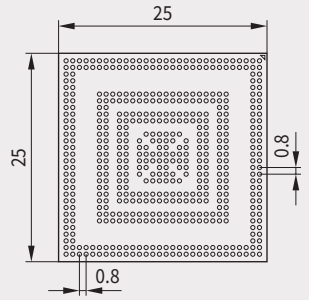
Customers wanting to reduce their time-to-market can now cut down their MCU safety development by 30%. By the same token, a performance surplus of 50% up to 100% allows for more functionality and offers a sufficient resource buffer for future requirements, keeping the power consumption on the single-core microcontroller level. While protecting IP, and preventing theft and fraud, AURIX™ provides an already built-in hardware security module.

With its special feature set, AURIX™ is the perfect match for powertrain applications (including hybrid and electrical vehicles) as well as safety applications (such as steering, braking, airbag and advanced driver assistance systems).

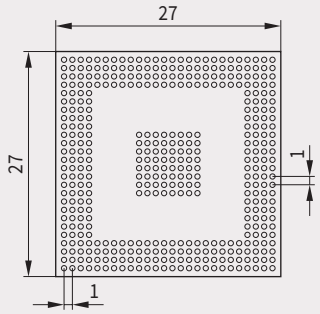


Package information[1)]

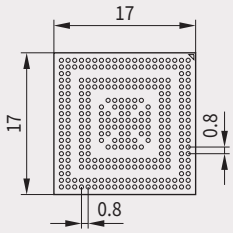
LFBGA-516



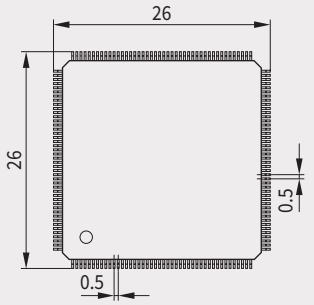
BGA-416



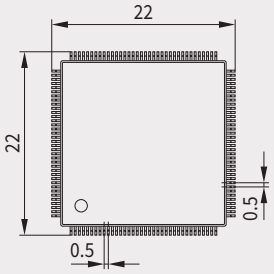
LFBGA-292



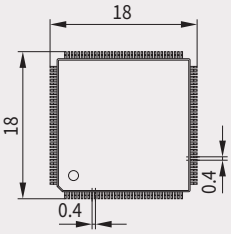
LQFP-176



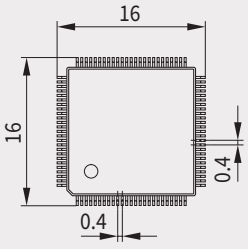
LQFP-144



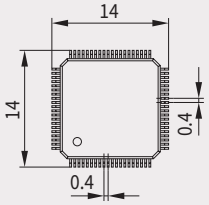
TQFP-144



TQFP-100



TQFP-80



1) For further information on Infineon packages, please visit our internet site at www.infineon.com/packages

AURIX™ family offers a complete roadmap for automotive security

	TQFP-100	TQFP-144	LQFP-176	LFBGA-292	LFBGA-516	Bare Die
9x series up to 8 MB				TC297T 270 MHz HSM	TC299T 270 MHz HSM	TC290T 270 MHz HSM
7x series up to 4 MB			TC275T 200 MHz HSM	TC277T 200 MHz HSM		TC270T 200 MHz HSM
3x series up to 2 MB	TC233L 200 MHz HSM	TC234L 200 MHz HSM		TC237L 200 MHz HSM		

High-end engine & transmission management
ADAS & sensor fusion domain control (H)EV System

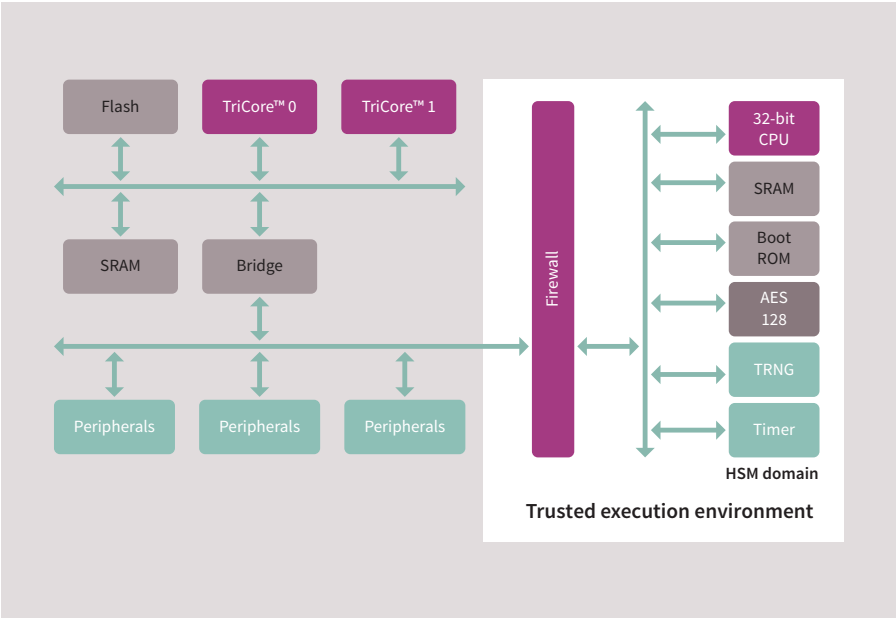
Mid-range engine & transmission management
High-end brake and EPS domain control (H)EV system

EPS airbag brake systems ADAS

Typical use cases

- Secure on-board communication
- Tuning protection
- Immobilizer
- Secure SW update

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



AURIX™ Hardware Security Module (HSM)

- A highly flexible and programmable solution
  - AES128 and TRNG implemented in HW
  - Customer-specific requirements, such as HASH or asymmetric encryption, can be implemented in software
- Offers the performance required to encrypt/decrypt e.g. Ethernet traffic
- Secure key storage provided by separated HSM-DFLASH portion
  - Alternative secure key storage feasible in dedicated HSM-PFLASH sections
- SHE+ software

The SHE+ driver controls the hardware security peripheral in the HSM domain and interacts with the TriCore™ host core. SHE+ offers the AUTOSAR CRY interface for integrating the HSM security features into an automotive application, including interface to AUTOSAR, communication from TriCore™ to HSM and vice versa, key storage functionality and security peripheral drivers.

AURIX™ for powertrain applications

Energy efficiency for combustion engine vehicles

Electronic automotive components are key to raising fuel efficiency levels and cutting emissions. The latest environment protection agency standards – Euro 5 and Euro 6 for passenger cars and Euro 3 and Euro 4 for motorcycles – are driving developments in advanced engine management. TriCore™ based products can be found in improved combustion technologies such as Homogeneous Charge Compression Ignition (HCCI) as well as in direct injection, smart turbocharger and valve actuation applications. They are also ideal for a range of innovative transmission technologies such as Double Clutch Transmission (DCT) and modern Continuous Variable Transmission (CVT).

Driving hybrid and electrification

While excelling in fuel economy, being fun-to-drive and reducing CO_2 emissions, Hybrid Electric Vehicles (HEV) and Electric Vehicles (EV) have the drawbacks of higher cost, limited drive-range and safety concerns (e.g. risk of battery over-charging). TriCore™ products, with their high performance, functional integration and application-based SW support, are the ideal solution for (H)EV motor drives. TriCore™ offers less than 3% CPU load at 300 MHz frequency, for the complete Field-Oriented Control (FOC) algorithm. TriCore™ AURIX™ family offers multicore architecture, allowing inverter control, hybrid torque management and DC/DC conversion to be done within one single microcontroller. Nevertheless, the TriCore™ AURIX™ family has built-in resolver functionality, saving customers the cost of implementing an external resolver IC.

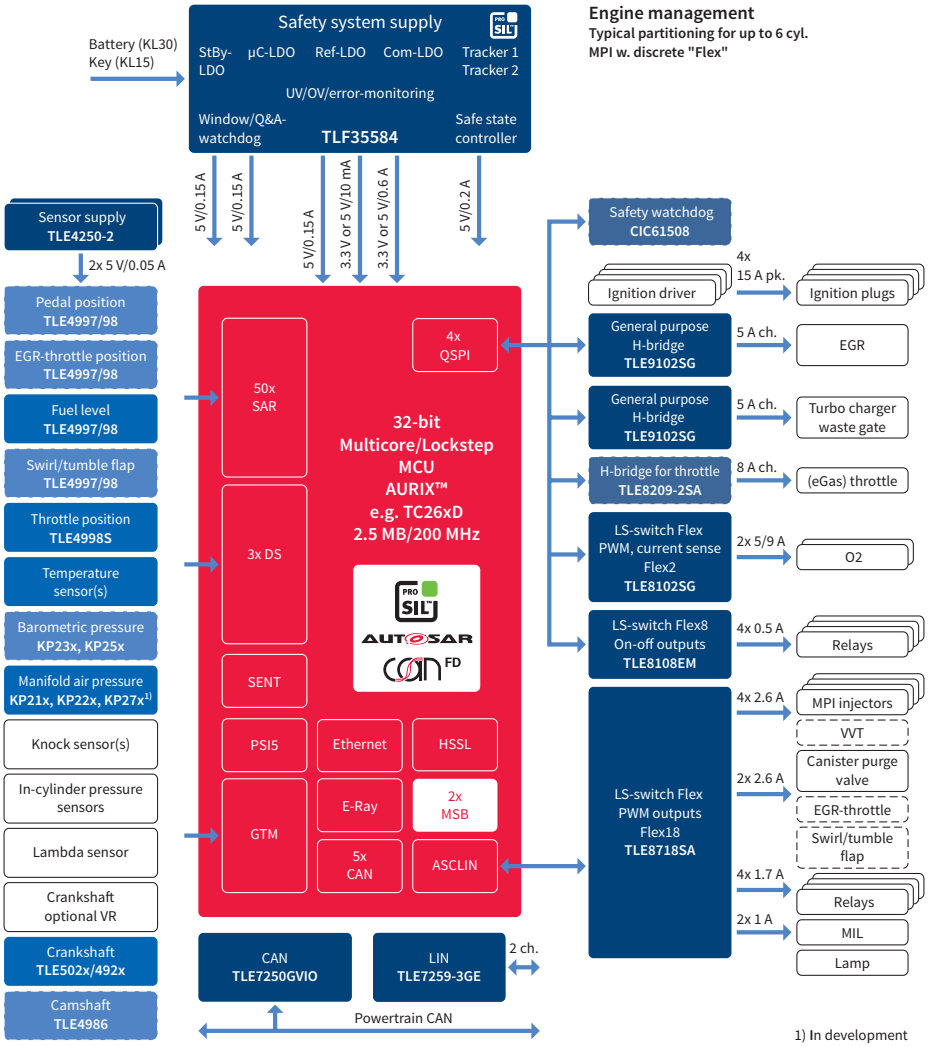
Often seen as master micro in battery balancing topology, the TriCore™ AURIX™ family proposes a 32-bit standby domain combined with an integrated 8-bit standby controller, essential for battery balancing under low power mode (e.g. holiday parking). Infineon is market leader in offering Hardware Security Module (HSM), a feature that prevents the main CPU from illegal manipulation, making the billing for battery charging more trustworthy.

AURIX™ security hardware

Infineon's AURIX™ 32-bit microcontroller family offers a wide portfolio of compatible devices, with embedded Hardware Security Module (HSM), which offer cost-efficient solutions for all typical automotive security applications.

Gasoline multi-port injection – discrete solution

Application example



The new TriCore™ family AURIX™ with state-of-the-art safety features enables systems to achieve the highest safety level up to ASIL-D. The scalable AURIX™ family includes the GTM, the de-facto industry standard timing module that supports highly complex engine management, while meeting the market's most stringent emissions regulations.

Application features

- Gasoline port injection
- Scalable software-based knock detection
- Throttle and EGR control
- Catalyst after treatment
- Start/stop systems
- Cost-optimized for entry segment

System benefits

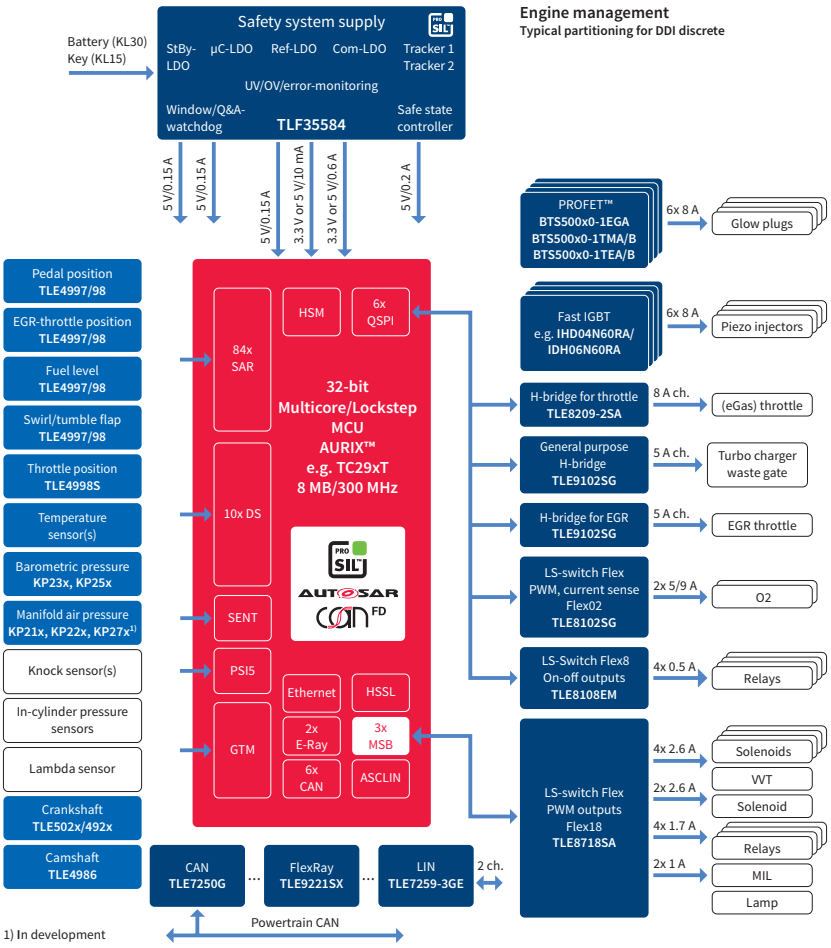
- Scalable platform – performance, memory size and I/Os
- Single voltage supply (EVR)
- Focus on reducing CO_2
- Easy migration from ultra low-end to mid-range applications
- Best tool/partner support for all development phases within V-cycle

Suggested products

- TC265 – TriCore™ 32-bit microcontroller
- TC264 – TriCore™ 32-bit microcontroller

Diesel direct injection

Application example



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Application features

- Direct injection (piezo/magnetic)
- In-cylinder pressure measurement
- Hardware-supported security enhancements
- Throttle and EGR control
- Turbo charging
- Diesel particulate filter
- 'Blue' after-treatment support (e.g. urea-based SCR)

Suggested products

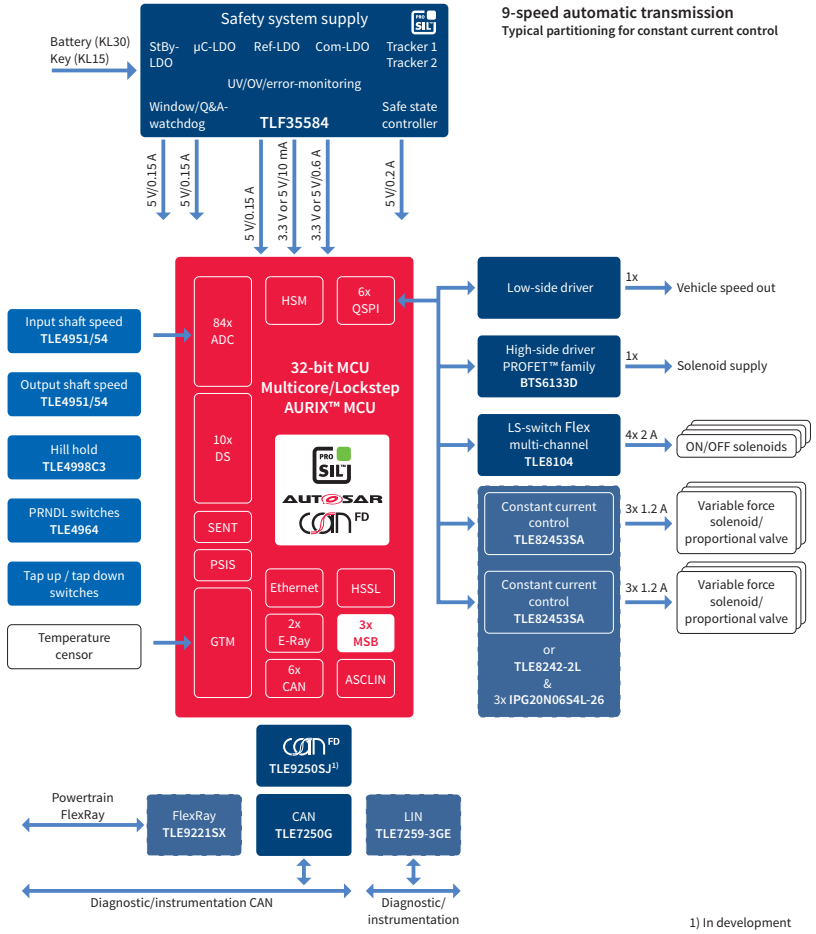
- TC29x – TriCore™ 32-bit microcontroller
- TC27x – TriCore™ 32-bit microcontroller

System benefits

- Microcontroller with best-in-class real-time performance
- Scalable platform – performance, memory size and I/Os
- Committed to reduce NOx and particulate matter in line with Euro 6 standard
- Hardware-supported IP/anti-theft protection and tuning protection
- Increased accuracy with in-cylinder pressure sensing via DS-ADC
- Enhanced communication (Ethernet)
- Dedicated peripherals for powertrain

Automatic transmission – hydraulic control

Application example



The new TriCore™ family AURIX™ with state-of-the-art safety features enables systems to achieve the highest safety level up to ASIL-D. The rich scalability of the AURIX™ family permits a platform approach that meets the needs of a range of transmission system demands. Furthermore, the hot temperature package and bare die solutions enable AURIX™ to be used in both attached and integrated control units.

Application features

- Smooth gear shifting
- Closely coupled with engine control via high-speed CAN/CAN-FD/FlexRay link
- Support of four 3-phase DC-brushless E-drives
- TC270: high microcontroller junction bare die temperature
- TC275/TC277: extended ambient temperature range to meet harsh environment requirements

System benefits

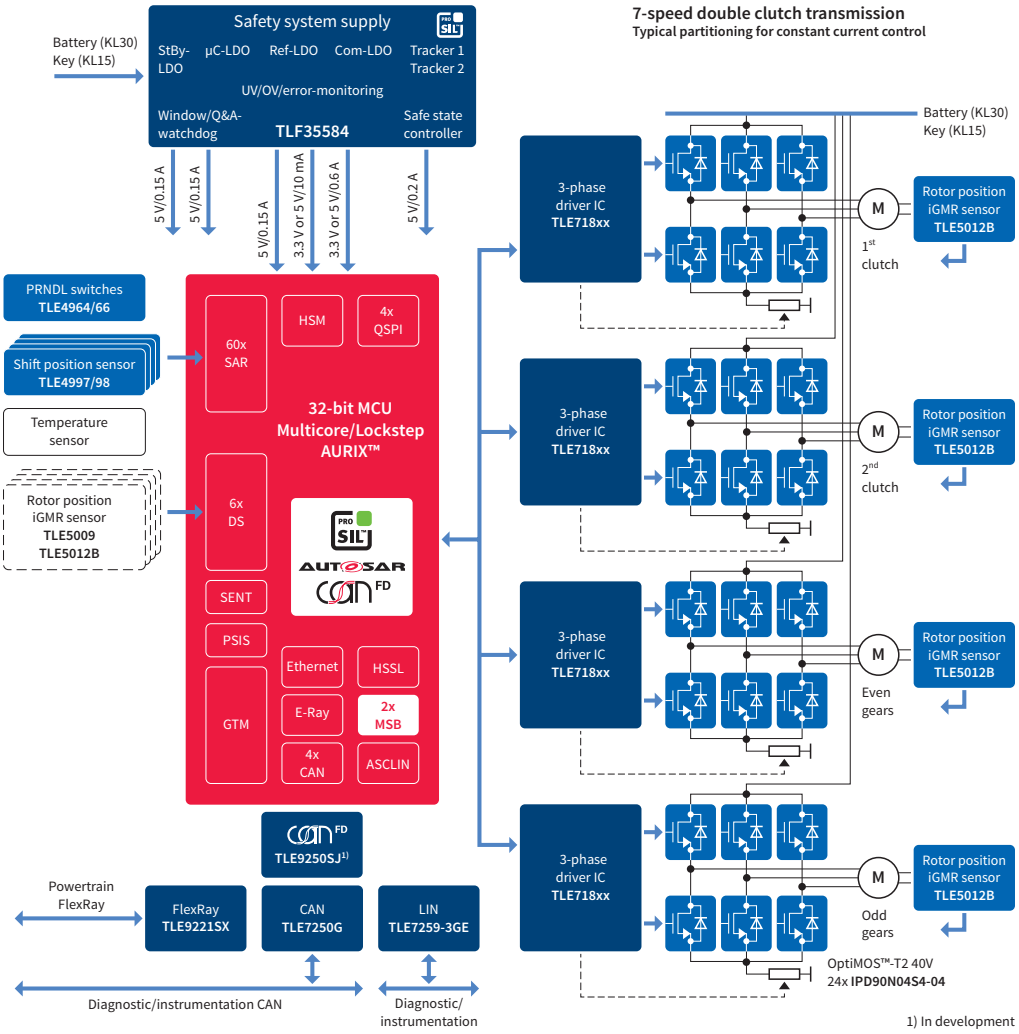
- Improved and fast clutch control
- Supports Safety Level up to ASIL-D
- Security module HSM to prevent tampering
- Hot bare die supports modular temperature-optimized TCU design
- Hot bare die capabilities enable microcontrollers to be placed wherever they are needed in the system
- Scalable product offering ensures perfect fit for individual application needs

Suggested products

- TC29x – TriCore™ 32-bit microcontroller
- TC27x – TriCore™ 32-bit microcontroller
- TC270 – Bare die TriCore™ 32-bit microcontroller

Dry double clutch transmission – electrical control

Application example



The new TriCore™ family AURIX™ with state-of-the-art safety features enables systems to achieve the highest safety level up to ASIL-D. The rich scalability of the AURIX™ family permits a platform approach that meets the needs of a range of transmission system demands. Furthermore, the hot temperature package and bare die solutions enable AURIX™ to be used in both attached and integrated control units.

Application features

- Ultra-fast gear switching
- Closely coupled with engine control via high-speed CAN/CAN-FD/FlexRay link
- Support of four 3-phase DC-brushless E-drives (dry-DCT)
- High microcontroller junction bare die temperature

Suggested products

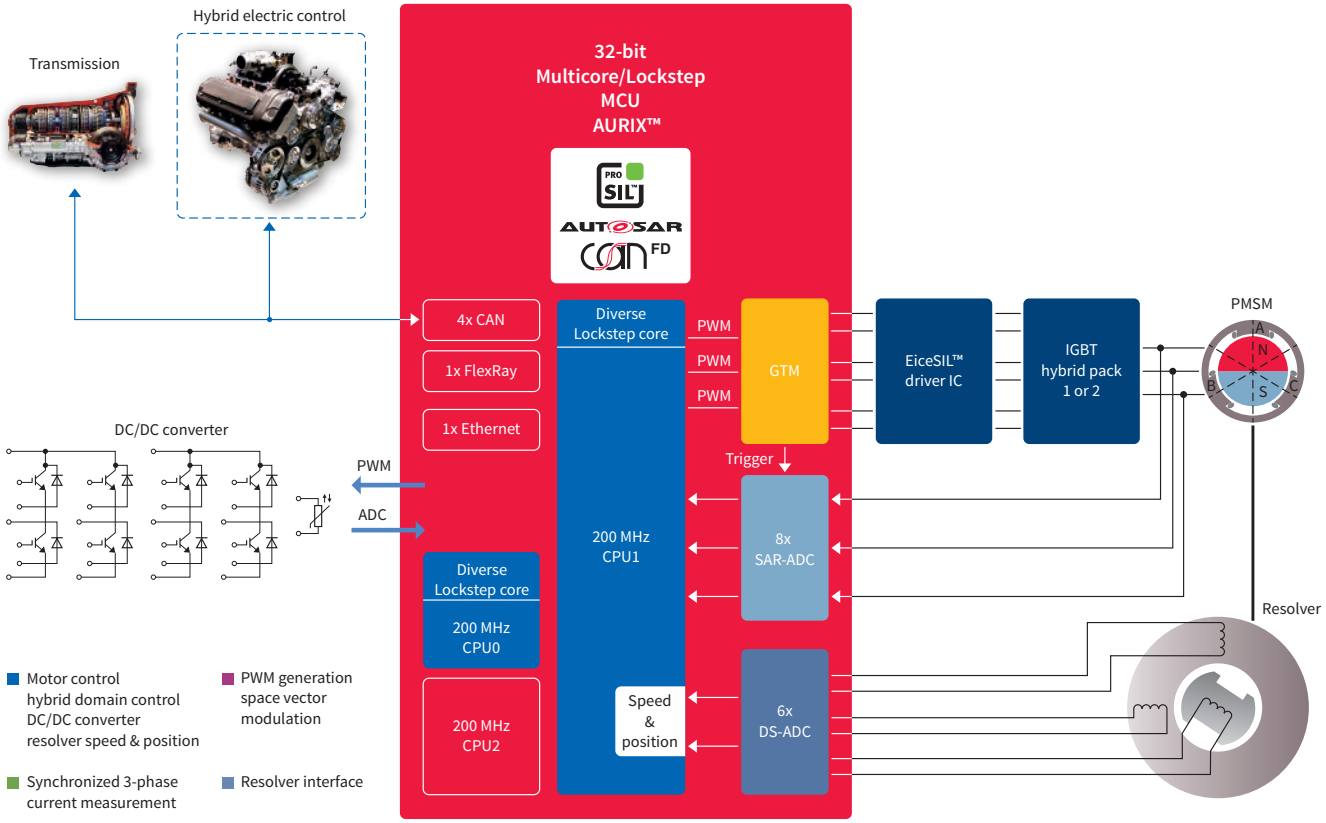
- TC275 – TriCore™ 32-bit microcontroller
- TC270 – Bare die TriCore™ 32-bit microcontroller

System benefits

- Improved fast clutch control
- Supports safety level up to ASIL-D
- Feature set optimized for wet and dry DCT designs
- Continuous torque on wheels ensures a sportive driving experience
- Hot bare die capabilities enable microcontrollers to be placed directly where they are needed in the system
- Hot bare die supports a modular temperature-optimized TCU design
- Infineon e-motor driver

Integrated (H)EV control

Application example



The inverter controls the electric motor via an electric drivetrain. It resembles the Engine Management System (EMS) in vehicles with an internal combustion engine. It is seen as a key component in determining (H)EV drive behavior. The inverter captures energy released through regenerative braking and feeds this back to the battery. As a result, the range of the vehicle is directly related to the efficiency of the inverter. A safe, highly efficient inverter control system is crucial to the quality of driving.

Application features

- Multicore & lockstep architecture
- DS-ADC-enabled direct resolver-to-microcontroller
- Superior performance
- Customized PWM pattern generation

System benefits

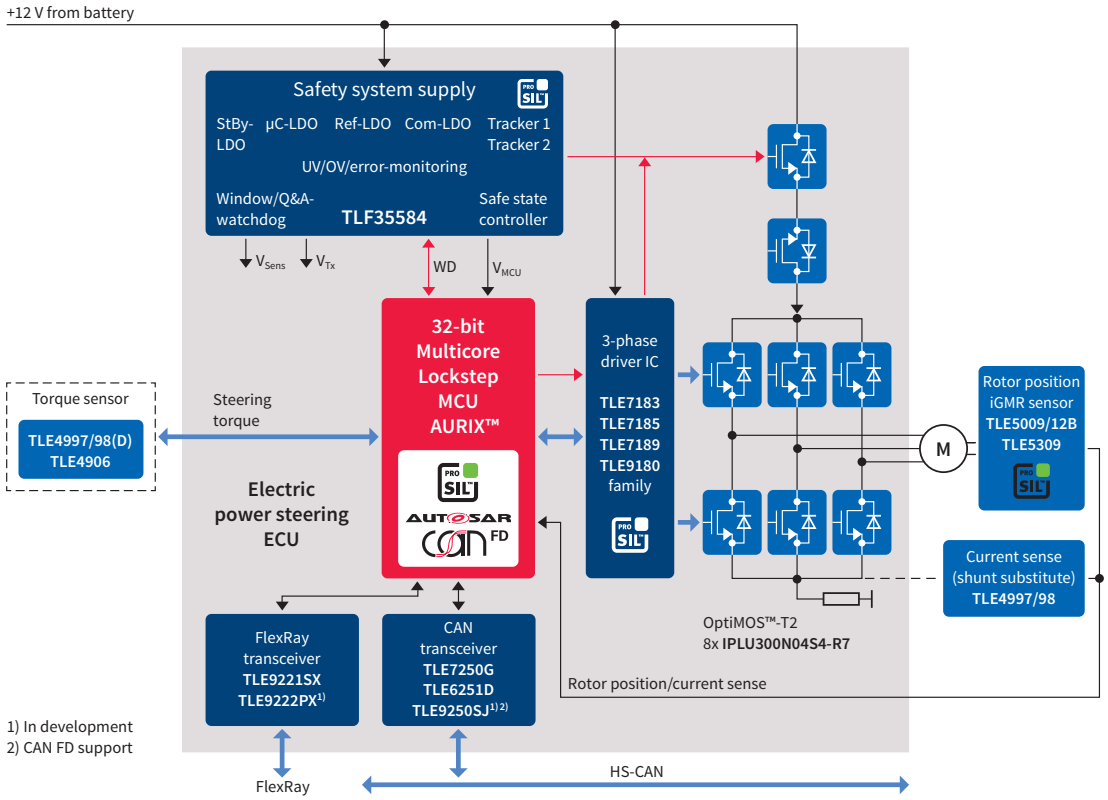
- ISO 26262 ASIL-C/D compliant
- No resolver IC needed, lower system cost
- Enables sub-system integration (driving HCU + inverter + DC/DC)
- Fine motor tuning

Suggested products

- TC29x – TriCore™ 32-bit microcontroller
- TC27x – TriCore™ 32-bit microcontroller

Electric Power Steering (EPS)

Application example



The new TriCore™ family AURIX™ with state-of-the-art safety features enables systems to achieve the highest safety level ASIL-D, which is already required in contemporary steering systems.
The latest diverse lockstep technology with clock delay (diverse lockstep core) reduces the software overhead significantly and enables fast time-to-market.
Its rich scalability meets a variety of different electric power steering system demands.

Application features

- Flash 512 KB–8 MB
- Performance from 133 MHz–3x 300 MHz
- T_a = -40 °C … 145 °C
- Dedicated peripheral set: LIN, CAN, SPI, FlexRay , Ethernet
- Advanced timer unit for totally flexible PWM generation and hardware input capture
- Redundant flexible 12-bit ADC
- Hardware SENT interface for low CPU load
- Hardware-focused safety concept for reduced SW overhead
- Safety software: Infineon SafeTcore library
- ISO 26262 conformance to support safety requirements up to ASIL-D
- Availability of AUTOSAR 4.x

System benefits

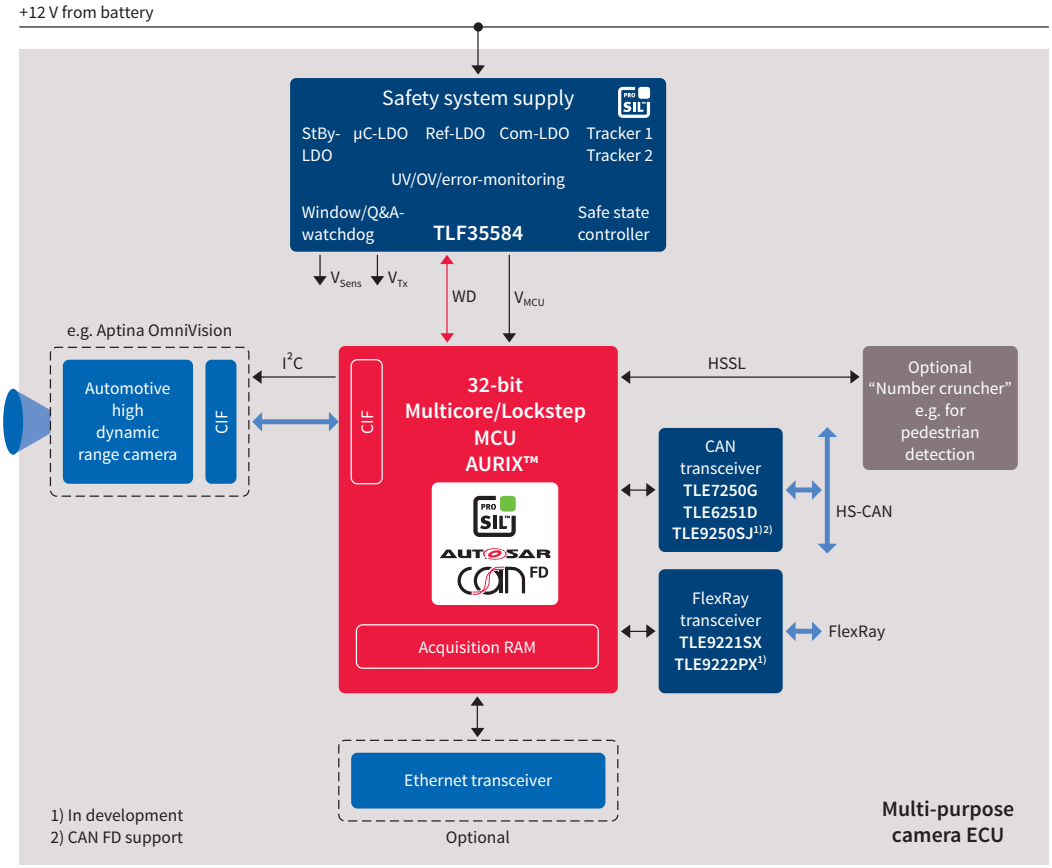
- Scalability over Flash, RAM and peripherals offering the best cost-performance ratio
- Serves all kinds of EPS systems, such as column or belt drive
- Proven safety concept to support ISO 26262
- Innovative supply concept leads to best-in-class power consumption

Suggested products

- TC26x
- TC23x
- TC22x

Multi-purpose camera configuration

Application example



The new TriCore™ family AURIX™ will enhance classic safety features with dedicated features to cater for multi-purpose camera systems.
The combination of new features, such as a picture pre-processing unit, camera interface, DSP functionality and increased SRAM, in conjunction with outstanding safety features enables a high level of scalability in order to achieve the best cost-performance ratio.

Application features

- TriCore™ DSP functionality
- Best-in-class performance: triple TriCore™ with up to 300 MHz per core
- Supporting floating point and fix point with all cores
- Up to 2.7 MB of internal RAM for picture information storage
- Picture pre-processing unit
- Camera interface up to 100 MHz
- Innovative single supply 5 V or 3.3 V
- External memory interface
- ISO 26262 conformance to support safety requirements up to ASIL-D
- Availability of AUTOSAR 4.x

System benefits

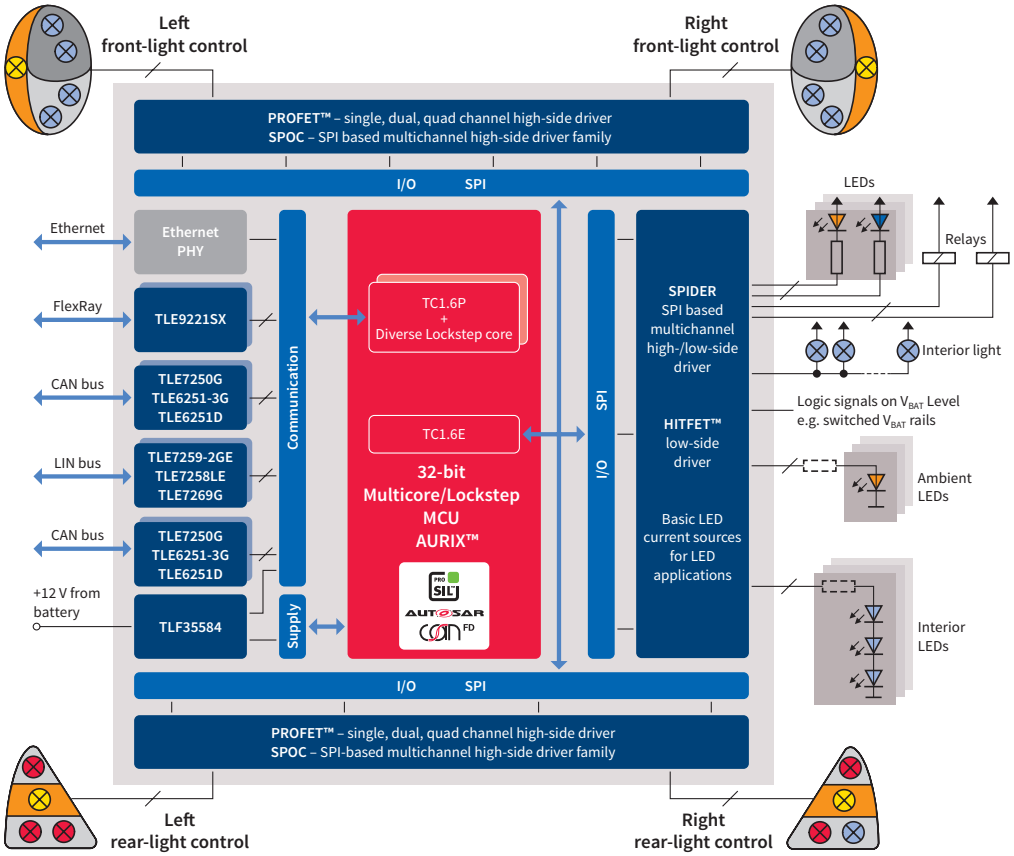
- High scalability option allows a dedicated performance feature fit for multiple camera applications from single automatic high beam systems up to multi-function systems (lane departure warning, forward collision warning, traffic sign recognition, pedestrian recognition etc.)
- High integration leads to reduced complexity
- Support for ISO 26262 decisions such as emergency braking
- Innovative supply concept leads to best-in-class power consumption

Suggested products

- TC29xTA

High-feature body control module with integrated gateway functionality

Application example



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. The AURIX™ multicore concept enables the integration of two applications in one device, e.g. BCM and gateway.

Application features

- Scalable MCU family from single to multicore
- Encapsulation feature allows software development without interference for multiple applications
- Embedded EEPROM
- Advanced communication peripherals: CAN, LIN, SPI, FlexRay, Ethernet
- ISO 26262 conformance to support safety requirements up to ASIL-D
- Availability of AUTOSAR 4.x

System benefits

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

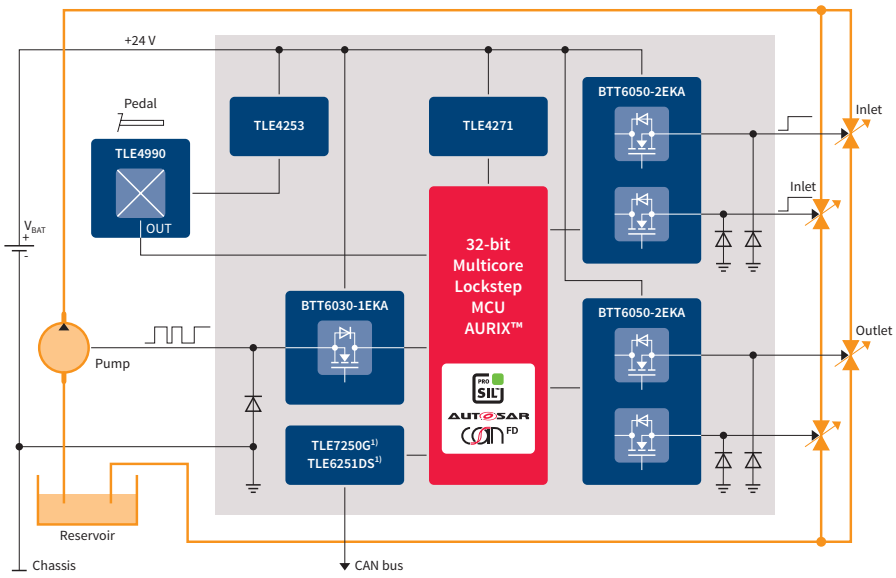
Suggested products

- TC29x
- TC23x
- TC22x
- TC21x

Commercial and Agricultural Vehicles (CAV)

A 24 V complete system solution for hydraulic/pneumatic management systems: power supply, sensors, microcontroller and high-side switches can be used without external protection in a 24 V system. Valves and pumps can be driven via linear activation or demand-controlled via PWM signals.

Hydraulic management system



1) If ECU permanently supplied, you may need to add external protection against load dump 400 ms above 40 V.

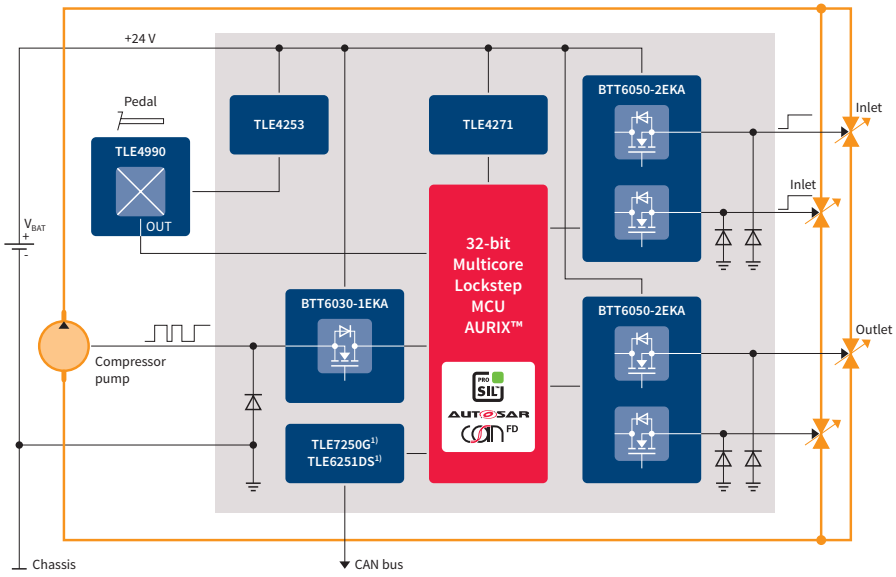
System benefits

- Valves and pumps can be driven via linear activation or demand-controlled via PWM signals
- Quad and dual channels are optimized to reduce costs and space for these applications
- Pin-to-pin and software compatibility
- ISO 26262, ASIL D/SIL 3 compliant
- AECQ-100

Suggested products

- TC23x
- TC22x
- TC21x

Pneumatic management system



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System benefits

- Valves and pumps can be driven via linear activation or demand-controlled via PWM signals
- Quad and dual channels are optimized to reduce costs and space for these applications
- Pin-to-pin and software compatibility
- ISO 26262, ASIL D/SIL 3 compliant
- AECQ-100

Suggested products

- TC23x
- TC22x
- TC21x

AURIX™ for industrial applications

High-performance, multicore and safety-demanding applications

The AURIX™ 32-bit microcontroller family is based on the Infineon TriCore™ high-performance core concept and provides a very high scalability family from single core to multi core.

The AURIX™ family enabling highest integrated safe memory sizes (SRAM up to 2.7 MB and flash memory up to 8 MB) and all memory is protected by hardware Error Correction Code (ECC). The devices reach more than 600 DMIPS at clock rates of up to 300 MHz and combine MCU & DSP instructions with an integrated FPU.

The integrated peripheral set is primarily targeted toward motor control and power conversion providing up to 11 ADCs, DS ADCs and a full set of diverse high-performance timers – namely the General Timer Module (GTM), CapCom 6, GPT12. This is one of the very few in the industry that is able to drive the upcoming three-level inverter topologies.

Furthermore the AURIX™ family supports the latest connectivity like Ethernet, CAN FD, Flexray and multiple other high speed interfaces.

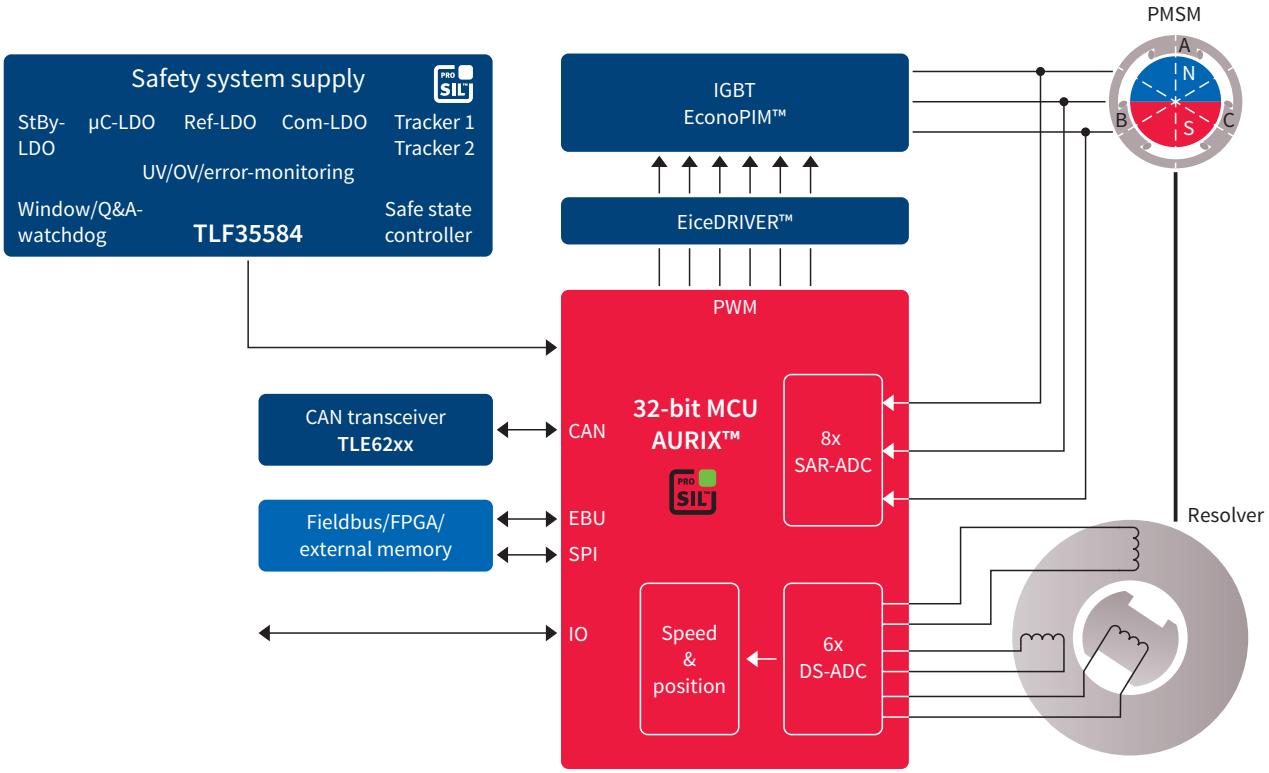
Providing security and functional safety

In a global economy, IP protection and secure communication plays an increasingly important role. This demand is accounted for by the integration of special security modules providing the required means of safe key storage, along with secure boot and encryption on the hardware level. As one of the leaders in functional safety, Infineon has designed the TriCore™ MCUs to meet the growing demand for functional safety in the industrial market as specified in IEC 61508. Via our cooperation partner Hitex, Infineon offers a complete package comprising a microcontroller, safety supply with integrated watchdog TLF35584, software and documentation, achieving safety integrity levels up to SIL3.

The next generation of TriCore™-based microcontrollers – AURIX™ – will provide another significant performance milestone by integrating up to three cores in one device. The multicore concept is targeted at running concurrent applications in parallel. Some of the integrated cores integrate lockstep functionality and the peripherals can be allocated to individual cores. This allows running a combination of safety-critical tasks, such as controlling an inverter, with non-critical tasks, such as network communication, on a single MCU.

Inverter

Application example



Application features

- Multi-axis controller for two 3-phase complementary PWMs
- Multiple modulation strategies (SVPWM, DPWM, soft-PWM, direct torque control) to support requirements for reduced noise emissions and increased efficiency
- Ready for four Q-inverters, matrix-inverters
- Field-oriented control with less than 10% CPU load
- Multiprocessor support for reliability and safety
- Support for 3-level inverter topologies
- High computing performance up to 3 x 300 MHz
- Up to 2.7 MB internal RAM

System benefits

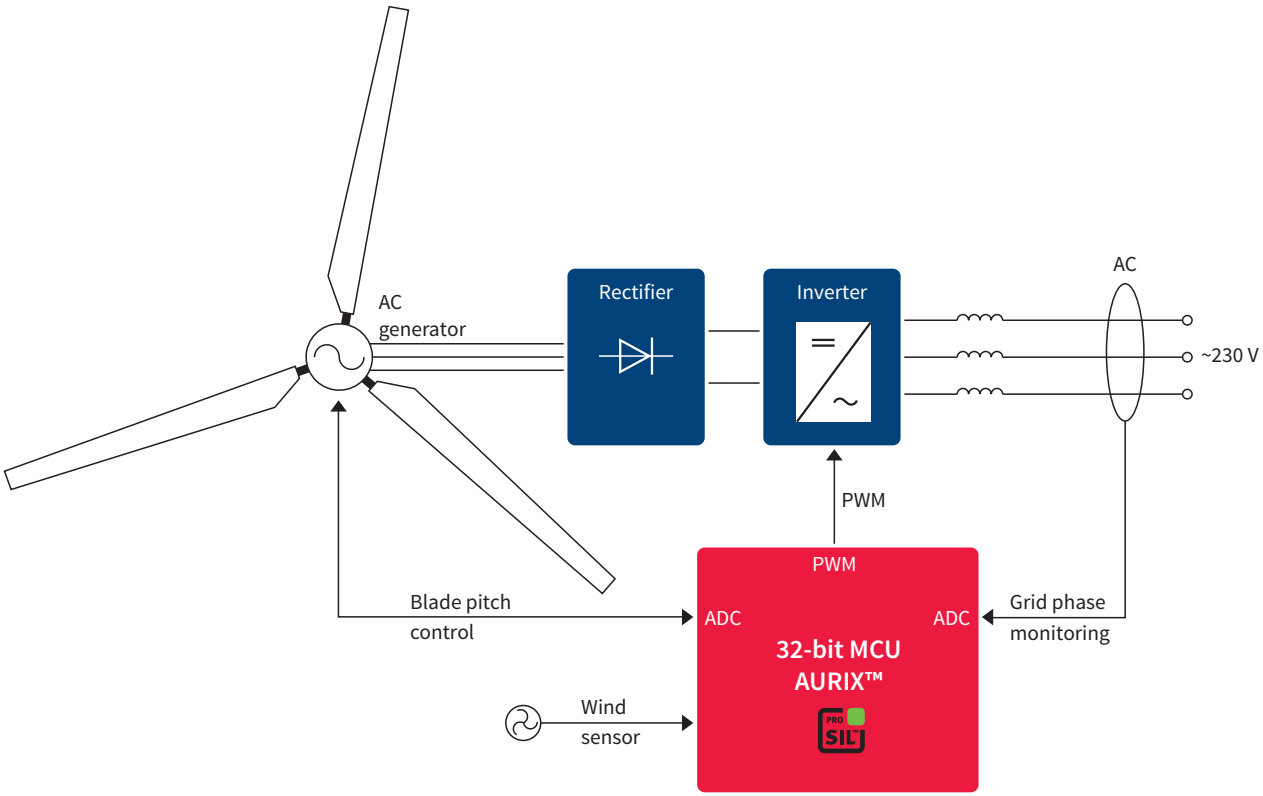
- Diverse timer architecture: generic timer module (GTM), CCU6, GPT12
- 8 SAR-ADCs 12-bit resolution, 1 MSPS
- DS-ADC
- Resolver I/F
- Encoder I/F with digital noise filter
- Very fast control loop
- IEC 61508 support – Integrity Level (SIL) 1 to 3
- Innovative single power supply concept

Suggested products

- TC27xT – TriCore™ 32-bit microcontroller
- TC29xT – TriCore™ 32-bit microcontroller

Wind turbine inverter

Application example



Application features

- Reliable blade pitch control
- Increased wind turbine efficiency
- Multiple modulation strategies (SVPWM, DPWM, soft-PWM, direct torque control) to support requirements for reduced noise emissions and increased efficiency
- Multiprocessor support for reliability and safety
- Support for 3-level inverter topologies

Suggested products

- TC26xD – TriCore™ 32-bit microcontroller
- TC27xT – TriCore™ 32-bit microcontroller

System benefits

- Diverse timer architecture: generic timer module (GTM), CCU6, GPT12
- 8 SAR-ADCs 12-bit resolution, 1 MSPS
- DS-ADC
- Resolver I/F
- Encoder I/F with digital noise filter
- IEC 61508 support - Integrity Level (SIL) 1 to 3
- Innovative single power supply concept

TriCore™ tool partners

Embedded software solutions AUTOSAR suites

Simulation/virtual prototyping

Integrated compiler environments

Auto code generation tools

Timing/scheduling analysis

Operating systems

Debugger and test tools

Data measurement/calibration/rapid prototyping

Programmer/flash tools

Software verification

Training/services

Free tooling

Free TriCore™ Entry Toolchain, MemTool, ACT

Feature overview TriCore™ family

TriCore™ microcontroller

Product type	Max clock frequency [MHz]	Program memory [kByte]	SRAM (incl. cache) [KByte]	Co-processor	Digital I/O lines	Number of ADC channels	Timed I/O channels (PWM, capture)	External bus interface	CAN nodes	Communication interfaces	Temperature ranges	Package	ASC	SSC	Additional features / remarks
AUDO – next generation family															
TC1762-1128F	66–80	1000	52	FPU	81	32	48	No	2	2x ASC, 1x SSC, 1x MSC, 1x MLI	K	LQFP-176	2x	1x	–
TC1766-192F80HL	80	1500	108	FPU, PCP	81	32	48	No	2	2x ASC, 2x SSC, 1x MSC, 2x MLI	K	LQFP-176	2x	2x	–
TC1796-256F150E	150	2000	256	FPU, PCP	123	44	126	Yes	4	2x ASC, 2x SSC, 2x MSC, 2x MLI	K	BGA-416	2x	2x	–
AUDO – future family															
TC1736-128F80HL	80	1000	48	FPU	70	24	53	No	2	2x ASC, 2x SSC, 1x MSC, 1x MLI	K	LQFP-144	2x	2x	–
TC1767-256F	80–133	2000	128	FPU, PCP	88	36	80	No	2	2x ASC, 2x SSC, 1x MSC, 1x MLI	K	LQFP-176	2x	2x	–
TC1797-512F180E	180	4000	224	FPU, PCP	221	48	118	Yes	4	2x ASC, 2x SSC, 2x MSC, 2x MLI	K	BGA-416	2x	2x	–
AUDO MAX – family															
TC1724N-192F80HR	80	1500	152	FPU, PCP	95	28	77	No	3	2x ASC, 4x SSC, 1x MSC, 1x MLI	K	LQFP-144	2x	4x	EVR
TC1728N-192F133HR	133	1500	152	FPU, PCP	127	36	94	No	3	2x ASC, 4x SSC, 1x MSC, 1x MLI	K	LQFP-176	2x	4x	EVR
TC1782F-320F180HR	180	2500	176	FPU/PCP	86	36	80	No	3	2x ASC, 3x SSC, 1x MSC, 1x MLI, 2x FlexRay	K	LQFP-176	2x	3x	–
TC1784F-320F180EL	180	2500	176	FPU/PCP	126	36	122	Yes	3	2x ASC, 3x SSC, 1x MSC, 1x MLI, 2x FlexRay	K	LFBGA-292	2x	3x	–
TC1791F-512F240EP	240	4000	288	FPU/PCP	144	48	100	No	4	2x ASC, 4x SSC, 2x MSC, 2x MLI, 8x SENT, 2x FlexRay	K	LFBGA-292	2x	4x	–
TC1793F-512F270EF	270	4000	288	FPU/PCP	221	44	112	Yes	4	2x ASC, 4x SSC, 2x MSC, 2x MLI, 8x SENT, 2x FlexRay	K	LBGA-416	2x	4x	–
TC1798F-512F300EP	300	4000	288	FPU/PCP	252	72	138	Yes	4	2x ASC, 4x SSC, 2x MSC, 2x MLI, 8x SENT, 2x FlexRay	K	BGA-516	2x	4x	–

ASC = Asynchronous Serial Channel
EVR = Embedded Voltage Regulator
FPU = Floating Point Unit
MSC = Micro Second Channel
MLI = Micro Link Interface

PCP = Peripheral Control Processor
SDIO = SD Card Interface with Input/Output
SENT = Single Edge Nibble Transmission
SSC = Synchronous Serial Channel
USIC = ASC, SPI, I²C, I²S

K = -40/+125 °C

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