Welcome to the next generation
AURIX™ TC4x

Thomas Boehm, Senior Vice President Automotive Microcontroller
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TriCore™ is the trusted choice for Automotive, with shipments to exceed 1 Billion Units by end of 2022

The TriCore™ concept was born in 1999

TriCore™ integrates three functions: DSP, RISC & MCU
The success story started in Powertrain and spread to the entire automotive MCU market

845,000,000 TriCore™ shipped to date including >320,000,000 AURIX™
What does the future car need?

**Headroom to grow**
- OEMs and Tier 1's need performance headroom for future upgrades

**High Performance with AI**
- More performance needed for mobility and autonomous driving
- AI is needed to enable this transformation

**New E/E architecture**
- The E/E architecture will change to reduce complexity
- Resulting in adoption of zone based architectures

**Fully connected**
- The future car is fully connected and always online

**Fast Time to Market**
- Technology is changing fast, the market must respond faster than ever before
The AURIX™ TC4x meets these future needs and more, providing the industries most extensive major upgrade path for auto MCUs

- **Headroom to grow**
  - Feature rich to offer applications headroom to grow
  - Scalable family HW and SW concept for platform reuse

- **High Performance with AI**
  - More processing power from TriCore™v1.8 with virtualization support and new AURIX™ Accelerator Suite
  - Parallel Processing Unit (PPU) for affordable AI

- **New E/E architecture**
  - Optimized devices for Zone and Domain control,
    - Optimized devices for complex sensor and actuator control

- **Fully connected**
  - Enhanced connectivity, new high speed interfaces
  - Data Routing Engine for efficient communication
  - Faster cloud connection and crypto agility for SOTA

- **Fast Time to Market**
  - Seamless "Ease of Use" tool chain and software offering
  - Model based design support for rapid prototyping
  - Early development support based on virtual prototyping

Whilst ensuring **dependability**
AURIX™ TC4x extends a proven architecture with a rich set of new features, furnishing the headroom needed for future growth

**Headroom to grow**

- **More** Performance…
- **More** Memory…
- **More** Safety and Security
- **More** Real time control…
- **More** Connectivity…
- **More** Freedom from interference

**Enhanced TriCore™ v1.8, Up to 6 CPUs, up to 500 MHz**

**New!** AURIX™ Accelerator Suite

**Upto 25 MB on chip-flash**

**Security according to ISO21434, ISO26262-2018 compliance for Safety to ASIL-D**

**New!** CSRM and CSS security modules

**New!** eGTM timers, High Resolution PWMs

**New!** Low latency interconnect (LLI) to PPU

**New!** 5 Gbps Ethernet, PCIe, 10 Mbit T1S Base Ethernet and CAN-XL

**New!** Data Routing Engine accelerator

**New!** TriCore™ v1.8 with upto 8 Virtual Machines per Core and Hypervisor
But a car is still a car. It must be robust, reliable, available, safe and secure, this is what Infineon calls dependability

<table>
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<tr>
<th>Robust</th>
<th>Reliable</th>
<th>Available</th>
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<tr>
<td>AURIX™ history</td>
<td>AURIX™ TC3x is ultimate benchmark in robustness</td>
<td>Trusted automotive partner with Long-term commitment</td>
<td>Holistic architecture based on deep application know-how</td>
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<td>AURIX™ safety features</td>
<td>AURIX™ TC4x safety concept built on proven AURIX™ TC3xx</td>
<td>Strong feature reuse from TC3xx</td>
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<td>AURIX™ implements industry standards</td>
<td>New cybersecurity modules meet the new ISO 21434 standard</td>
<td>Safety up to ASIL-D according ISO26262-2018 Standard</td>
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New TriCore™ v1.8
Up to 500 MHz
60% more ASIL-D performance

TriCore™ and AURIX™ Accelerator Suite combine to deliver a major performance upgrade of up to 3 times vs. AURIX™ TC3xx

Whilst maintaining safe and secure real time performance

AURIX™ Accelerator Suite

- Parallel Processing Unit: PPU
  Up to 78 times more performance

- Data Routing Engine: DRE
  Up to 50% more performance

- Signal Processing Unit: SPU
  Up to 4 times more performance

- CSRM / CSS
  Up to 8 times more performance

1 vs. TriCore™ v1.8
2 vs. AURIX™ TC3xx
Why are AI capabilities important? New use cases for low-power AI are emerging.

**Automotive AI Use Cases**

**Domain/Zone Control**
- Modelling
- Model Predictive Control
- IDPS & other security methods

**ADAS**
- Object classification
- Advanced Radar Signal Processing
- Sensor Fusion

**xEV Applications**
- Predictive Control
- Virtual Sensing
- Advance State of Health (SoH) and State of Charge (SoC) algorithms

High Performance with AI

Artificial Intelligence & Neural Networks
Parallel Processing Unit: PPU
SIMD Vector DSP for AI

PPU Compute Cluster
- Scalar Core
- SIMD Core
- L1 Memory
- System Components
- DMA, Shared Memory

Dedicated resource for AI
...offering affordable intelligence

High Performance with AI
Parallel Processing Unit: PPU
SIMD Vector DSP for AI

- SIMD vector DSP (VDSP)
- Optimize performance / cost for various neural network architectures
- Up to 78x more performance vs TriCore™ v1.8 dependent on the algorithm
- AURIX™ TC4x offers scalable PPU portfolio
- Integrate more sophisticated functions per ECU
The E/E architecture will change and zone architectures will become more widely adopted

New E/E architecture

4 key requirements of zone control

**Higher Performance and versatility**
- Up to 6 new TriCore™ v1.8
- Up to 5 application specific accelerators to offload TriCore for optimal efficiency

**Safety and Security**
- Support of latest safety & security standards
- Security cluster minimizes latency, maximize throughput and enables SOTA

**Freedom of interference**
- Hypervisor enables separation and isolation
- TriCore™ v1.8 with Hypervisor Mode
- Up to 8 Virtual Machines per TriCore™

**Richer connectivity**
- New high speed comms interfaces plus legacy automotive busses
- Communications accelerator for fast processing and forwarding

**AURIX™ offers…**

Provide **hard realtime performance** for **safety critical SW** with safe isolation

Provide **cost effective** solution that still functions with **legacy sensors & actuators**
The future car has a hierarchical network and is always connected to cloud services.

**AURIX™ Accelerator Suite TC4xx DRE/CRE Routing accelerators**
- Reduces SW processing load of data transmission
- Increases performance and throughput by up to 50% vs TriCore™ by reducing routing latency and jitter

**TC4xx Ethernet MACs and Ethernet bridge**
- Performance & redundancy for safety critical application in daisy chain & ring topologies

**NEW! Scalable high speed communication interfaces**
- 5 Gbps Ethernet and PCIe
- Support for new communication standards, 10 Mbit
- T1S Base Ethernet and CAN-XL

 reduces communication load on CPUs and enables safety critical real time communication.
The infrastructure is in place to get started with AURIX™ TC4x using either simulation.

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**Fast Time to Market**

**Synopsys** offers an AURIX™ TC4x Virtual Prototype (VP) in the **Synopsys Virtualizer Development Kit**

- Start development independent of HW availability
- Address new automotive use cases in AI and xEV and improve SW quality
- Developed in co-operation with software & tool partners, consists of several independent interoperable packages, including the PPU toolchain
- Enables ease of use and fast TTM
Or using first silicon, with the MetaWare for AURIX™ Development kit

The Synopsys ARC MetaWare Toolkit for AURIX™ TC4x SDK enables those wishing to start development with AURIX™ TC4x silicon

**Fast Time to Market**

**Basic SW Ecosystem**
- Auto code generation via model based design and auto vectorization
- Compiler supporting C/C++ & OpenCL and debugger
- Simulation tools for easy application & kernel development

**xNN SDK for AI flow**
- Tool automates & optimizes mapping of neural network models
- Reduce computation, memory and bandwidth requirements

**HW Optimized libraries**
- PPU optimized vector library including BLAS/LAPACK
- Basic linear algebra subprograms
- Linear algebra package
The AURIX™ TC4x will meet these future needs and more… providing a major upgrade path for Tier 1’s and OEMs.

- Headroom to grow
- High Performance with AI
- New E/E architecture
- Fully connected
- Fast Time to Market

AURIX™ TC4x is sampling now to lead customers.

The Synopsys Virtualizer Development Kit and ARC MetaWare Toolkit for AURIX™ TC4x are available now.

More partner offerings will be shared over 2022.
Part of your life. Part of tomorrow.