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AURIX KNOWLEDGE LAB 2024

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Development Tools

TRUST **IN** SOFT

AURIX TC4xx Software Solutions

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hitex

Proven Software Portfolio for AURIX™ TC4x

Largest AUTOSAR & Safety SW Portfolio in the industry

- 35 drivers in **MC-ISAR MCAL**:
- Safety tests + external watchdog handling covered in **SafeTLib**:
- ASIL D qualified **DSP** filter chains



Automotive grade safety, security and quality

- ISO26262 up to ASIL D, CERT-C
- Latest AUTOSAR R20-11/R21-11
- ISO21434 security standard
- ASPICE v3.1 L3 MCAL & SafeTlib
- Lifecycle management



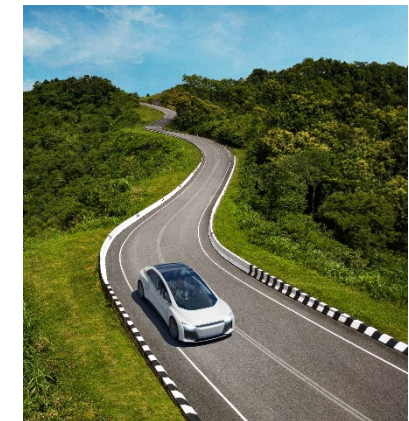
Modular and cost-efficient offering

- Free MC-ISAR Mini package (5 drivers)
- Available licenses: free evaluation, project, company, unit-based
- All qualification and safety documents available



Faster Time-to-market

- Pre-integration in major ASR stacks
- Plug & play safety manual
- Matlab / Simulink model-based development enabled
- Extensive regional PDH support
- PPU SW-ecosystem



Safety

- Avoiding the need for additional driver for ASIL D argumentation
- Eases software partitioning and gives more flexibility; driver can be executed in an ASIL D domain
- Eases system level safety argumentation

ISO 21434 Cybersecurity

- Supporting mandatory Cybersecurity standard
- Infineon provides Cybersecurity incident response for reported incidents



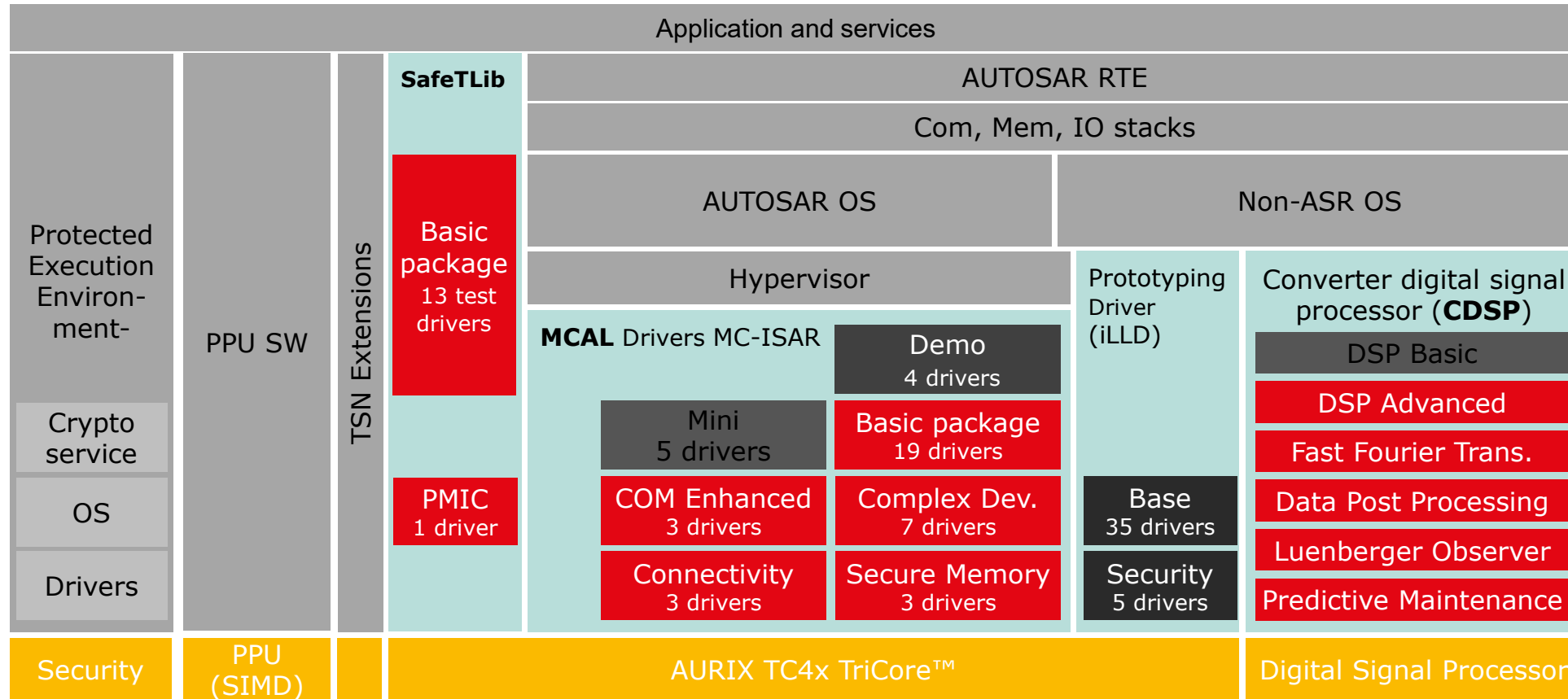
Multicore, virtualization

- Enabling support for virtual ECUs
- Eases software partitioning and gives more flexibility; driver can operate from multiple cores

ASPICE

- Supporting latest standards: ASPICE ver3.1 level 3 targeted
- Avoids need of intensive customer audits

AURIX™ TC4 Software Offering



AURIX™ TC 4 Software Offering

Basic Software (free of charge)

- Productive code
- Reference Code
- Example Code

Premium Software (licensed)

- Productive code
- Partner offering

Tooling

- Tools for reference use
- Partner offering

- AURIX™ TC4x Hardware

Development Tooling (commercial products)

Simulation & Modelling	Calibration & Analysis
Compilers	Debugger & Verification
Integration & Configuration	Neural Network SDK

Prototyping Tooling (for reference)

AURIX™ Development Studio
(Eclipse IDE, C-Compiler, Multi-core)

MCAL: AURIX™ MC-ISAR Drivers for TC4x

Basic Safety claim: ASIL B, ASIL D	Safety claim: ASIL D – MCU (Micro Controller Unit)* – Port* – DIO (Digital Input Output)* – SPI (Serial Peripheral Interface)* – ICU (Input Capture Unit) – TM ADC (Analog Digital Converter) – WDG (WatchDog Driver) – BFX Bit handling library – CRC library – GTM (Generic Timer Module) – BMC (BSW Multicore library) – OCU (Output Compare Unit)	Safety claim: ASIL B – Memory Access (MEMACC): eFLASH & RRAM – FEE FLASH EEPROM Emulation: eFLASH & RRAM – MEM (Data, Program, UCB): eFLASH and RRAM* – CAN incl. CAN-CAN routing features – LIN – GPT (General Purpose Timer) – PWM (Pulse Width Modulation) *part of Mini package
Comm enhanced ASIL B	– FlexRay – GETH Gigabit Ethernet – LETH Lite Ethernet	
Complex MCD ASIL D	– DMA Direct Memory Access – SMU Safety Management Unit* – DS-ADC Delta Sigma Analog Digital Converter	– ADC-CDSP – ENCODER (supporting the GPT12 module) – I2C – UART (ASIL B)
Secured Memory ASIL B	– CSRM memory Access (MEMACC): eFLASH & RRAM – CSRM FEE FLASH EEPROM emulation: eFLASH & RRAM – CSRM MEM (Data, Program, UCB): eFLASH & RRAM	
Connectivity ASIL B	– DRE Data Routing – PCIe End point, PCIe Root complex (for TC45x only)	
Demo Drivers	– HSSL, SENT, STM System Timer, IRQ Interrupt Request (as Example code)	

Feature Highlights

- 35 drivers, 17 with ASIL-D safety claim
- AUTOSAR version R20-11, MEM drivers in R21-11
- Virtualization & Multicore support
- Allocation of drivers to different safety partitions

Software safety, security and quality

- ISO 26262:2018
- ISO 21434
- ASPICE v3.1 L3
- MISRA C:2012 3rd Edition, 1st Revision + MISRA C:2012 Amendment 2, CERT C:2016
- Addl. ASIL D methods ensure freedom from interference in memory for all productive drivers

Compatibility

- Configuration tool: 2.0.0-A1: EB tresos v29.2.1
- Compilers from
 - HighTec
 - TASKING
 - Windriver
 - Greenhills

Delivery format

- Source code, product documentation

AURIX™ TC4x MCAL Starterkit Bundle

Bundle of MCAL and **HighTec Compiler** – free use for 6 month

Downloadable upon registration from

- Dedicated HighTec web page
- Infineon Developer Center (IDC)

Documentation

- Introduction
- Installation guide
- Creating projects

Example Projects

- Ready to import example for ADC and SPI
- In future more examples on GitHub (w/o MCAL sources)

MCAL GUI

- Helper tool with to simplify creation of an MCAL project

EB tresos
Installer

EB tresos
Includes
activation key
for max 6 month

TC4D MCAL
Installer

License key
for Basic
package

C/C++ Compiler
Installer

HighTec TC LLVM
Compiler with 6 month
activation key
Extension options

- PPU package
- SCR compiler
- CDSP compiler
- Rust compiler

IDE Installer
incl .simple AURIX
debugger

HighTec Eclipse-based
IDE plus debugger

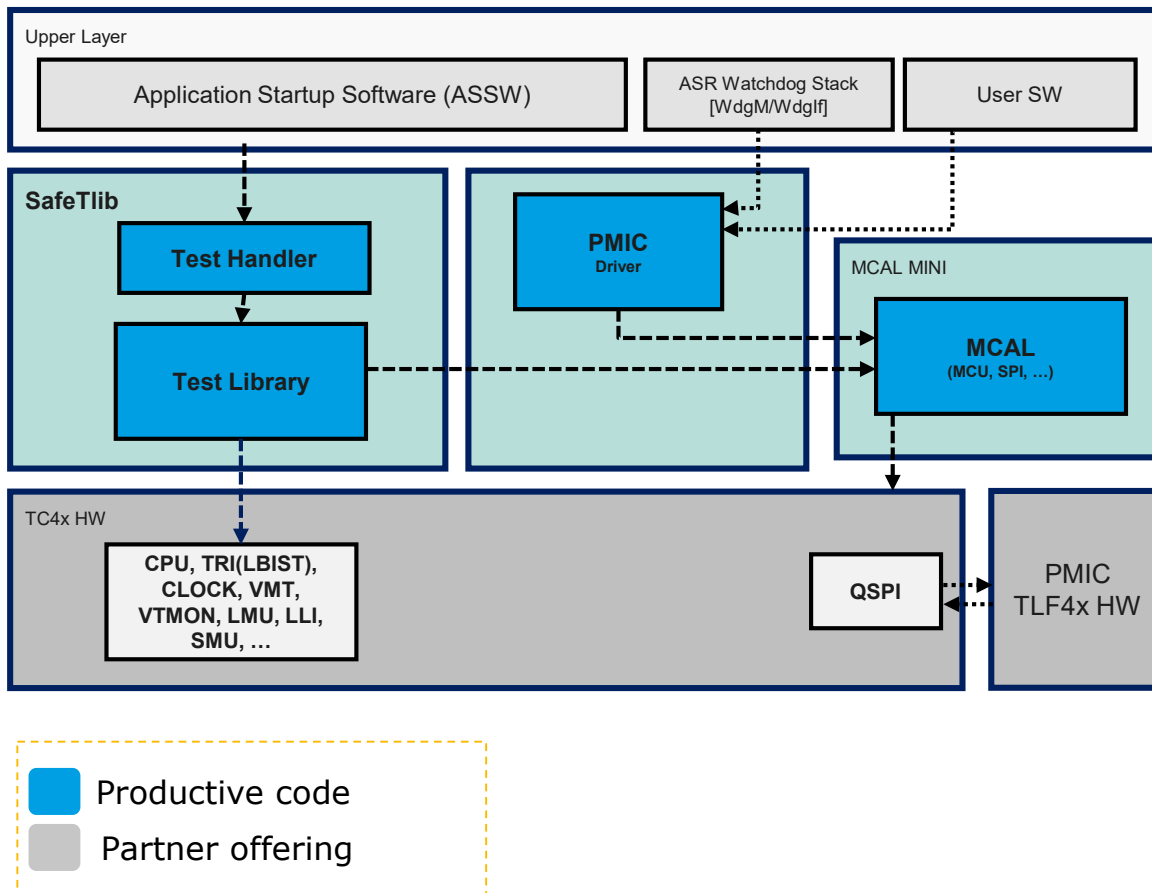
Installer AURIX
Flasher

DAS Installer
included

(A TC4D board is not
included and can be
ordered separately)

AURIX™ TC4x **SafeTlib** Product Overview

SW Architecture Overview



Safety test library: safety tests + watchdog handling

- Test handler: mapping tests to different cores, gather test results
- Test library:
 - SMU core alive alarm test, ESM(s) supported
 - Volatile memory test verifies SRAM, ECC, EDC in addition to alarm path test
 - Logic build-in-self-test: configuration, trigger and result handling, alarm path test
 - Voltage Monitoring: test config, result handling, ESM(s) supported
 - Temperature Monitoring: Die temperature test
 - Bus, Clock, NVM, WTU, XSPI monitor: Alarm path test

WatchDog handling

- Ready-to-use handling of external watch dog:
- Enablement and driver of TLF4x PMIC: Scalable & flexible power supply solution for TC4x

Software safety, security and quality

- ISO26262:2018 compliance, ASIL-D
- ISO21434, ASPICE v3.1 L3 compliant development process

Delivery

- Provision of binaries, user documentation and safety-case

CDSP - Converter Digital Signal Processor - Software

Fast signal processing filter functions on dedicated DSP Core

CDSP Overview

- Fast signal processing filter functions on dedicated DSP Core
- >10 filter functions, 12 ready-to-use configurable CDSP filter chains
- Configurations allow support for various applications without SW rebuild

Target applications and use case

- e-motor phase current/rotation speed measurement e.g. for OBC, DCDC converter, traction motor inverter (DCAC Converter)

Digital signal processing features

- Filtering trends in noise from voltage and temperature sensor
- Filtering trends in noise from supply domains used by high compute SoC
- Filtering noise from power distribution lines e.g. MOSFETs
- Calculating min, max, average value over accumulated number of TMADC sample
- Enhancing resolution / Oversampling of TMADC

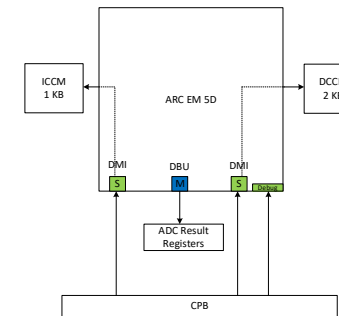
Software safety and quality

- ISO26262 ASIL D, freedom from interference
- Quality process: ASPICE v3.1

Delivery

- Provision of binaries and user documentation including safety-case

CDSP (Converter Digital Signal Processor)

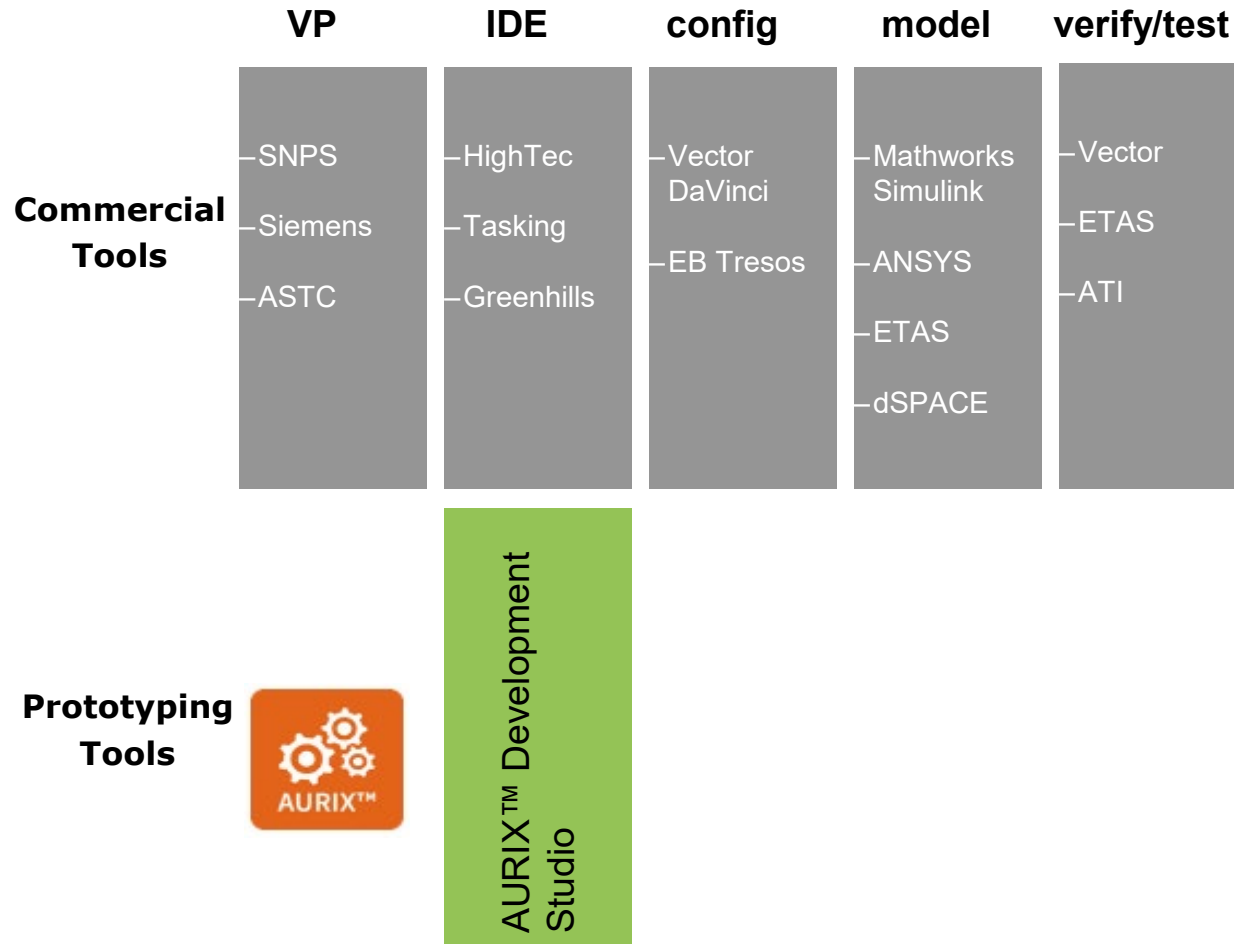


- Synopsys ARCV2 DSP Core EM5D
- Digital signal processing for converted analog signals from DSADC/TMADC
- fADC = 160 MHz
- 2 clock cycles per MAC operation

Available filter chain configurations

DSP FIR	FIR
DSP Basic AURIX	FIR → IIR 1 → DA
DSP Advanced Average1	FIR → IIR 6 → MAT → AVG
DSP Basic Data Accum.	FIR → IIR 6 → MAT → DA
DSP Advanced Median	FIR → IIR 6 → MDN
DSP Advanced Average2	IIR6 → FIR → MAT → AVG
DSP Luenberger Observer	Luenberger observer
DSP FFT	Fast Fourier Transformation
DSP Basic Data Accum.	MAT → SDA
DSP Basic Average	MAT → AVG
DSP Basic Median	MDN
Predictive Maintenance	STAT0

Get started with Dev Kits and code examples



Ressources:

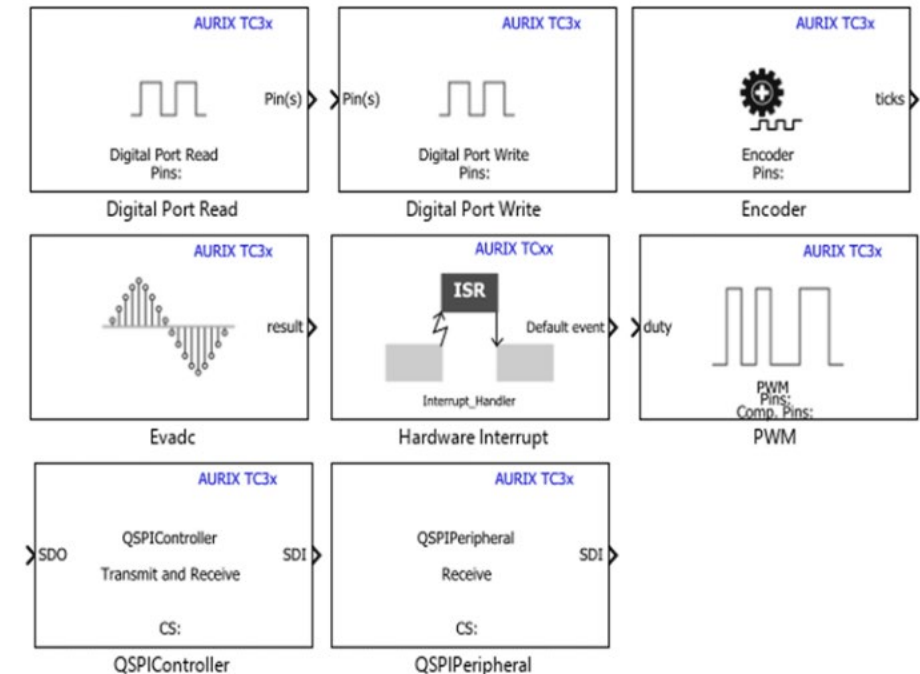


- [AURIX™ Development Studio](#)
- [AURIX™ Microcontroller Kits](#)
- [Github: AURIX™ code examples](#)
- [AURIX™ Forum](#)
- <https://www.ehitex.de/>

- AURIX™ Development Studio is a free of charge IDE for prototyping & evaluation purposes of the TriCore™-based AURIX™ microcontroller family
- Comprehensive development environment, including Eclipse IDE, C-Compiler, Multi-core Debugger, Infineon low-level driver (iLLD), with no time and code-size limitations that enables editing, compiling, and debugging of application code
- Combined with numerous code example projects, the IDE can be used to evaluate the powerful architecture of the AURIX™ microcontroller family.
- Microsoft Windows as a host operating system (OS)

Sneek Preview: Qualified Industrial Driver Package

- Compact high performance drivers for
 - Industrial Applications
 - Robotics
 - Construction and Agricultural Vehicles (CAV)
 - Handling Machines
 - 2-Wheelers
 - ... much more
- Modular
- Easy configuration
- **MATLAB / Simulink support with AURIX HSP**
(Hardware Support Package)
- Certified for IEC 61508 SIL3
- For HighTec and Tasking Compilers
- With User Documentation, Safety Documentation and Democode



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Any Questions?

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Development Tools

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