



AURIX Knowledge Lab 2021

Battery management in control!

AURIX™ safety & security introduction and AUTO PSoC™ ecosystem

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AURIX™: TC2xx Scalable Family

From low cost to high performance applications



TC29x 8 MB					TC297T 300MHz	TC298T 300MHz	TC299T 300MHz
TC27x 4 MB				TC275T 200 MHz	TC277T 200MHz		
TC26x 2.5 MB			TC264D 200 MHz	TC265D 200 MHz	TC267D 200 MHz		
TC23x 2 MB		TC233L 200 MHz	TC234L 200 MHz		TC237L 200 MHz		
TC22x 1 MB	TC222L/S 133 MHz	TC223L/S 133 MHz	TC224L/S 133 MHz				
TC21x 512 kB	TC212L/S 133 MHz	TC213L 133 MHz	TC214L/S 133 MHz				
Flash							
Package	TQFP 80	TQFP 100	T/LQFP 144	LQFP 176	LFBGA 292	BGA 416	LFBGA 516



Devices with HSM



Single Core (S) Single Lockstep Core (L),
Dual Core (D) Triple Core (T)



Upgrade/Downgrade path with
pin compatible packages



PRO-SIL™: Safety supporting features

MCU Scalability

- › Performance & Flash
- › Software and Pin compatibility
- › Diverse timer architecture

Power Consumption

- › On-chip DC/DC high-efficiency power supply

Safety Concept

- › PRO-SIL™ ISO26262 / IEC61508 compliance
- › HW redundancy options

Security Concept

- › Selected devices with Hardware Security Module (HSM)

Availability

- › All devices are in mass production

Tools & Boards

- › Multiple options available

AURIX™ TC3xx Architecture Evolution (enhancements vs. AURIX™)

Performance

- › New TriCore™ 162 generation
- › New instructions
- › up to 6 CPUs @300MHz
- › New direct Flash access path

Memories

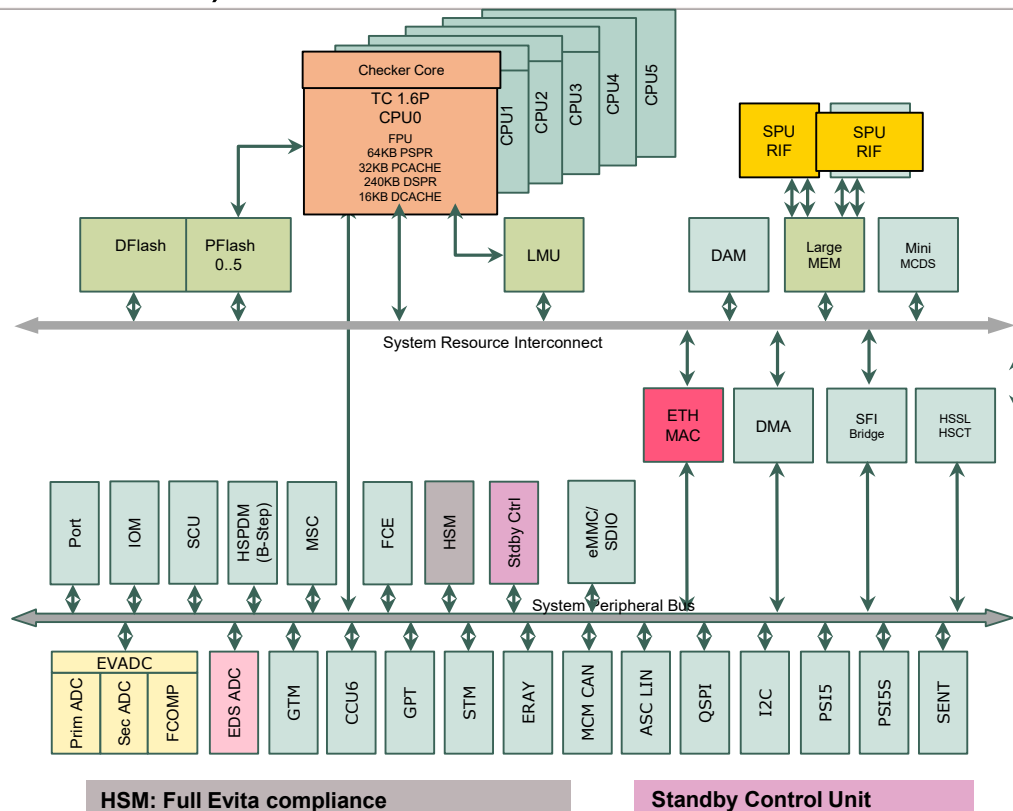
- › Larger SRAM
- › SRAM/Flash ratio increased
- › enhanced MPU

ADC

- › Improvement of existing ADC
- › Reduction of capacitive load

Delta-Sigma:

- › enhanced concept



ADAS

- › New SPU concept

Safety

- › LBIST
- › MBIST upgrade

Ethernet

- › 1Gbit/s ETH
- › QoS services

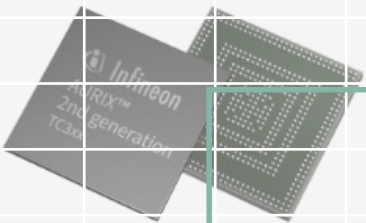
IO Pads

- › all 5V/3.3V

AURIX™ TC3x – Portfolio

From low-cost to high-performance applications



9xA Series 6 x 300MHz - 16 MB	Control and Actuate Sense and Compute 					Data Fusion Front LRR High-end EMS Domain Control Gateway			TC397XA 300MHz	
9x Series 6 x 300MHz - 16 MB									TC397X 300MHz	TC399X 300MHz
Ex Series 4 x 300MHz - 12 MB									TC3E7Q 300MHz	
8x Series 4 x 300MHz - 10MB						Advanced Braking EMS, Transmission, Inverter, BMS High-end body control Domain control, Telematics			TC387Q 300MHz	TC389Q 300MHz
7xX Series 3 x 300MHz - 6MB									TC377TX 300MHz	
7x Series 3 x 300MHz - 6MB									TC377TP 300MHz	
6x Series 2 x 300MHz - 4MB		TC364D 300MHz	TC366D 300MHz	TC365D 300MHz					TC367D 300MHz	
5xA Series 3 x 300MHz - 4MB		Hi-res front radar Corner high Front radar Corner radar		TC356TA 300MHz					TC357TA 300MHz	
3xA Series 2 x 300MHz - 2 MB				TC336DA 300MHz					TC337DA 300MHz	
3x Series 1 x 300MHz - 2 MB	TC332L 200MHz*	TC333L 200MHz*	TC334L 200MHz*	TC336L 200MHz*	Braking, EPS, Airbag, BMS, OBC, DCDC 4WD, eClutch Host control, Telematics				TC337L 200MHz*	
2x Series 1 x 300MHz - 1 MB	TC322L 160MHz	TC323L 160MHz	TC324L 160MHz						TC327L 160MHz*	
Flash/ CPUs Package	TQFP 80	TQFP 100	T/LQFP 144	BGA 180	LQFP 176	BGA 233	LFBGA 292	LFBGA 516		

MCU Scalability

- › Performance & Flash
- › Software compatibility
- › Pin-compatibility

Safety/Security Concept

- › ISO26262 ASIL-D compliance of all devices
- › EVITA Full hardware security support on all devices

Connectivity

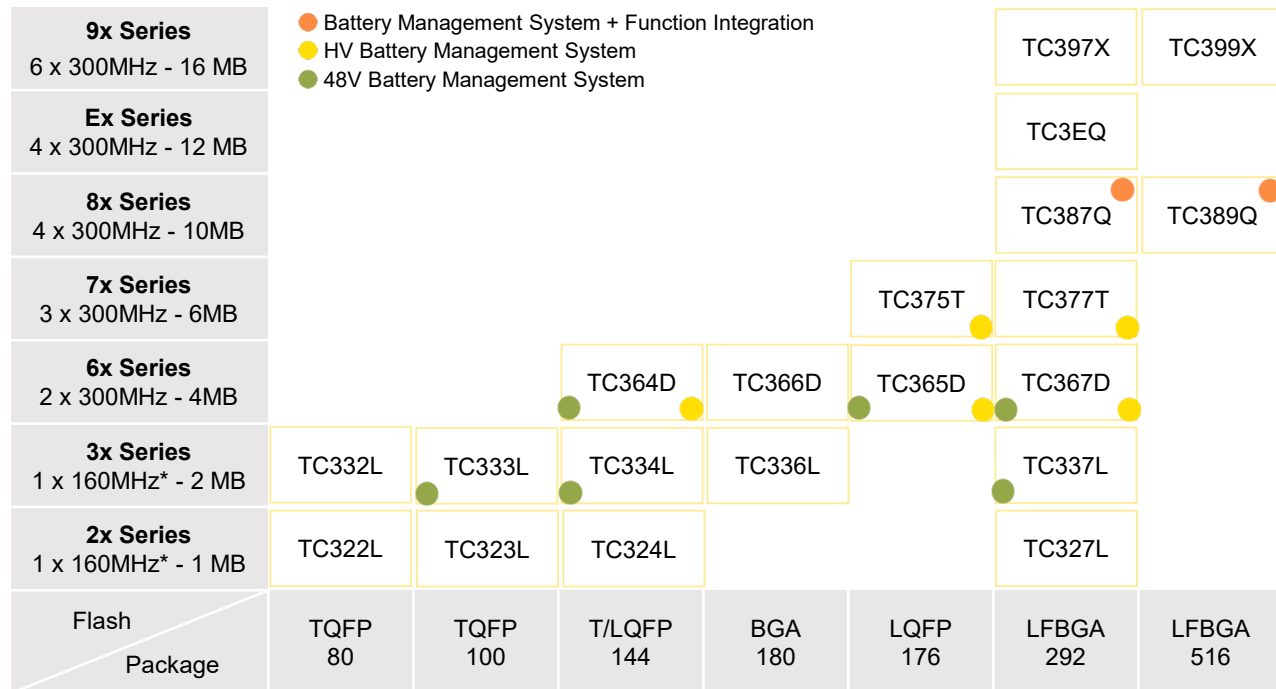
- › Ethernet: up to 2x 1Gbit/s
- › CAN FD: up to 16 ch
- › LIN: up to 24 ch
- › eMMC IF: for external Flash
- › IPC: up to 2x 320Mbit/s

L - Single Lockstep Core
D - Dual Core
T - Triple Core
Q - Quadruple Core
X - Sextuple Core

* 300MHz Option

AURIX™ TC3xx – Portfolio for Powertrain Applications

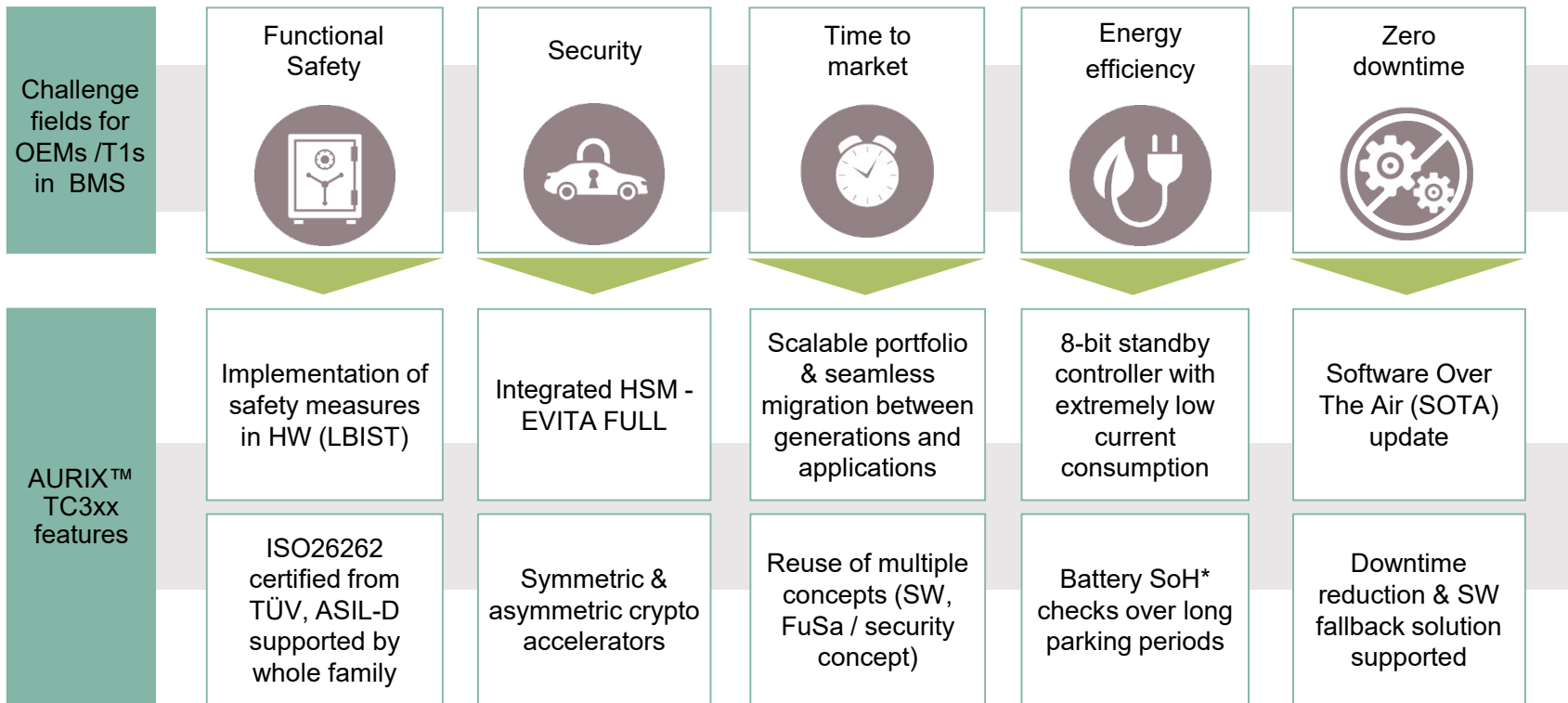
Devices from low-cost to high-performance suit different BMS requirements



*300MHz option available

Key AURIX™ TC3xx feature by application	BMS
High Multicore Performance	☒
Rich peripheral set	
CAN-FD (up to x2)	☒
High RAM content	☒
Timer across family	
Low power modes	☒
Safety (ASIL-D)	☒
Security	☒
Resolver-less solution	
SOTA support	☒
High temp. support	
High RAM/flash ratio	☒

AURIX™ TC3xx solves challenges at tier1s and OEMs for Battery Management Systems (BMS)

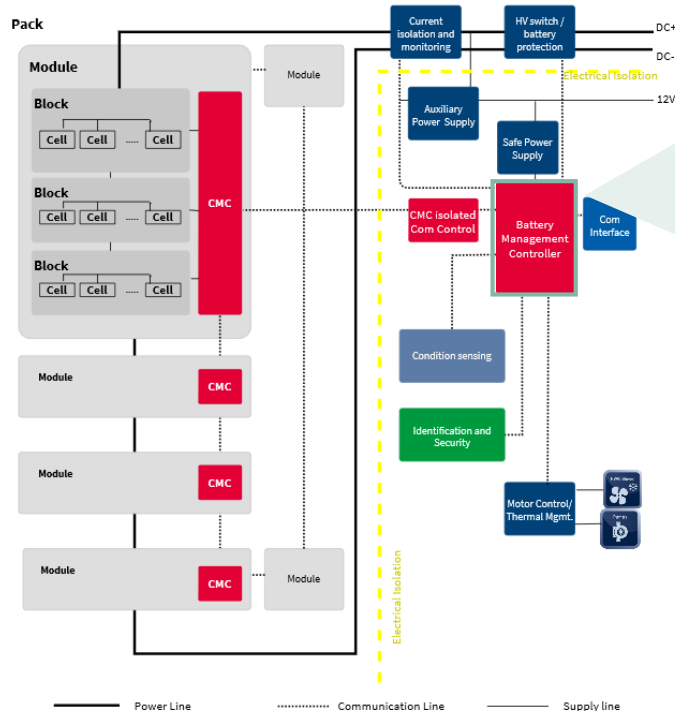


*SoH: State-of-Health

AURIX™ with strong footprint in Battery Management Systems with additional growth expected



MCUs functions for Battery Management Systems (BMS)



- **Battery monitoring**
Continuous controlling of critical cell characteristics (such as voltage, current, temperature) and calculation of state of charge (SoC) and state of health (SoH)
- **Battery protection**
Safety management including crash / mechanical strain detection and Main Switch Control
- **Battery lifetime extension**
Optimizing battery life and capacity by e.g. limiting deep battery discharge and actively managing battery temperature

Why AURIX™?

Strong engagement with all relevant market players along the BMS supply chain

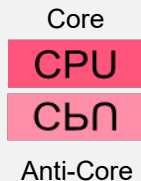
- › **Strong position at EU & Chinese OEMs** for 48V and high voltage systems
- › **Scalable family concept** enables re-use across different battery management systems
- › **Strong product roadmap** provides access to innovation
- › **Proven quality & powertrain knowhow** from conventional applications
- › **Harmonized SW and tool chains** between different applications enables SW re-use
- › **ISO26262 certified** from TÜV

AURIX™ Functional Safety concept

Holistic approach with a multitude of hardware measures

HW designed for functional safety

Superior Lockstep CPU with
Anti-core in inverse logic



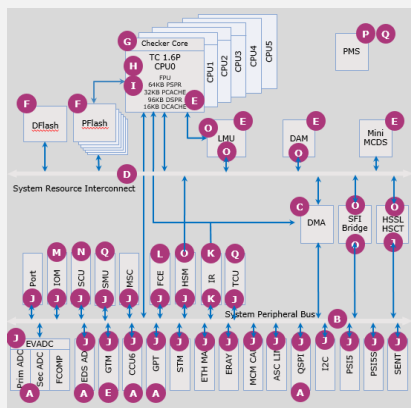
Holistic safety concept in core,
memories, peripherals, buses

SMU for alarm and fault
management in one control point

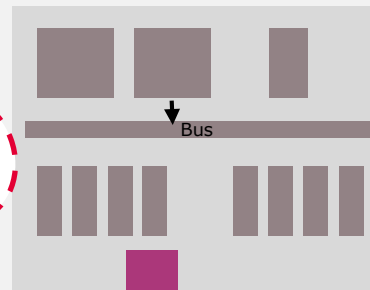
3-layer access protection:

- Memories
- Peripherals
- Global registers

Much more than just a safety island!!



● Safety measures

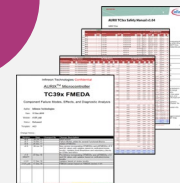


VS.

- | | | |
|---|---|------------------------------------|
| A Redundant, spatial separated peripherals | F Flash ECC | L Flexible CRC Engine (FCE) |
| B Safe SPB | G Lockstep core | M IO Monitor |
| C Safe DMA | H CPU self tests (90% Latent Fault Metric) | N Clock Monitoring |
| D Safe SRI | I Memory protection core | O E2E protection |
| E SRAM ECC | J Register access protection | P Power Supply Monitoring |
| | K Safe Interrupt Processing | Q Self Test |

Everything documented

50k
lines
FMEDA



Comprehensive safety manual & Fully Configurable FMEDA

- › Provides all relevant information necessary for safety analysis
- › Can be tailored to match the user configurations

AURIX™ kits – Evaluation and starter Kits

Lets get started!

new €30  Supported by ADS AURIX™ TC275 Lite Kit › AURIX™ TC275 Device in LQFP-176 package › FTDI based Debugger with micro USB › Use of Arduino Uno/ compatible platform › KIT_AURIX_TC275_LITE - Infineon Technologies	€99  Supported by ADS Arduino Shield Buddy › The Hitex TC275 ShieldBuddy follows the Arduino standard › Compatible with 100's of Arduino application shields › Evaluation licenses available › KIT_AURIX_TC275_ARD_SB	€149  Partially Supported by ADS AURIX™ TFT › Low cost board for early evaluation with limited access to signals › Additional touchscreen display for convenient handling › TFT board available for every silicon › KIT_AURIX_TC2xx_TFT	€350+  AURIX™ TriBoard › Full evaluation board for development to write and debug your 1st programs › Includes Getting Started advice, free TriCore™ Entry Tool Chain , technical documentation, compiler and debugger. › TriBoard available for every silicon › KIT_AURIX_TC2xx_TRB › KIT_AURIX_TC3xx_TRB
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AURIX™ kits – Evaluation and starter Kits

Let's get started!

new
€ 45


Supported by ADS

AURIX™ TC375 Lite Kit

- › AURIX™ TC375 Device
- › **Ethernet PHY**
- › FTDI based Debugger with micro USB
- › Use of Arduino Uno/ compatible platform
- › [KIT_A2G_TC375_LITE - Infineon Technologies](#)

new
€99


Supported by ADS

Arduino Shield Buddy

- › The Hitex TC375
- › ShieldBuddy follows the Arduino standard
- › Compatible with 100's of Arduino application shields
- › Evaluation licenses available
- › [KIT_A2G_TC375_ARD_SB - Infineon Technologies](#)

€149


Partially Supported by ADS

AURIX™ TFT

- › Low cost board for early evaluation with limited access to signals
- › Additional touchscreen display for convenient handling
- › TFT board available for every silicon
- › [32-bit TriCore™ AURIX™–TC3xx - Infineon Technologies](#)

Coming soon


Supported by ADS

AURIX™ TC334 Lite kit

- › AURIX™ TC334 Device
- › FTDI based Debugger with micro USB
- › Use of Arduino Uno/ compatible platform

PSoC™: One-stop-shop for automotive HMI & smart sensors

Door handle
and foot-kick detection



Buttons/sliders



Touchpads



Touchscreens



Optical navigation



Capacitive navigation



Biometrics
and navigation



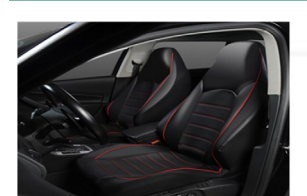
Hands-on detection



Liquid-level sensing



Occupant detection



Intelligent battery sensors



Smart ignition systems

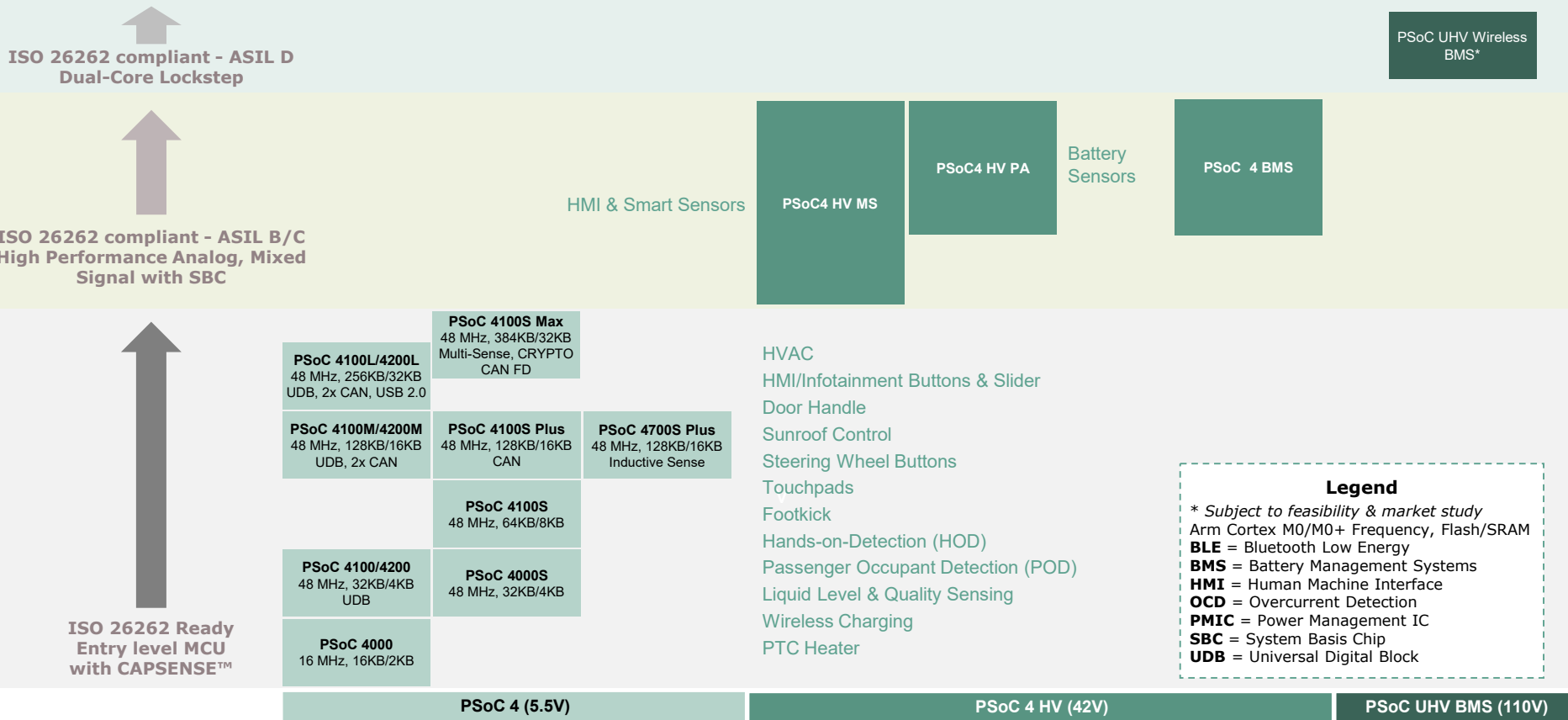


Auto PSoC™ Portfolio



Scalable PSoC™ 4 Roadmap

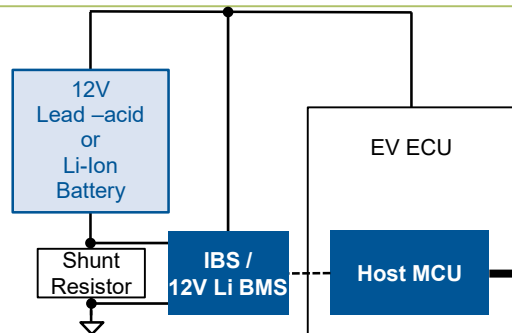
From MCU with CAPSENSE™ to Multi-Sense, High Performance Analog, SBC and BLE integration (Public)



PSoC for BMS

Why PSoC

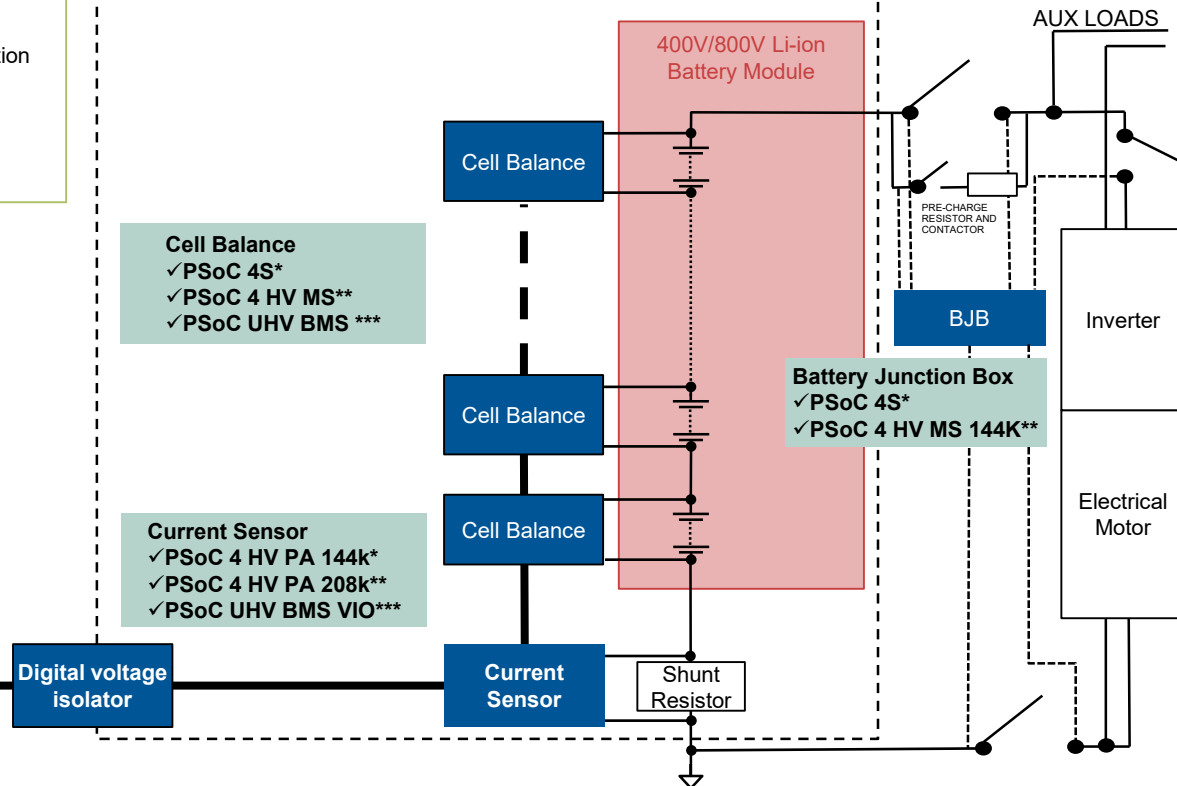
- **High precision analog performance** with complete analog front-end (ADCs, PGA, digital filter blocks) integration
- Functional safety support up to **ASIL-D** (UHV BMS)
- **Wireless BMS** with BLE: monolithic integration
- MCU integration enabling **distributed BMS**



Intelligent Battery Sensor / BMS
 ✓ PSoC 4 HV PA 144k*
 ✓ PSoC 4 HV MS 144k**
 ✓ PSoC 4 12V Li-ion BMS

- * Now = In Production / samples
- ** Intermediate = Design in 1 year
- *** Future = Design in 2 years

Li-ion Battery Pack



Cell Balance
 ✓ PSoC 4S*
 ✓ PSoC 4 HV MS**
 ✓ PSoC UHV BMS ***

Current Sensor
 ✓ PSoC 4 HV PA 144k*
 ✓ PSoC 4 HV PA 208k**
 ✓ PSoC UHV BMS VIO***

Battery Junction Box
 ✓ PSoC 4S*
 ✓ PSoC 4 HV MS 144k**



Part of your life. Part of tomorrow.