We make green mobility smarter
Infineon automotive PSoC overview
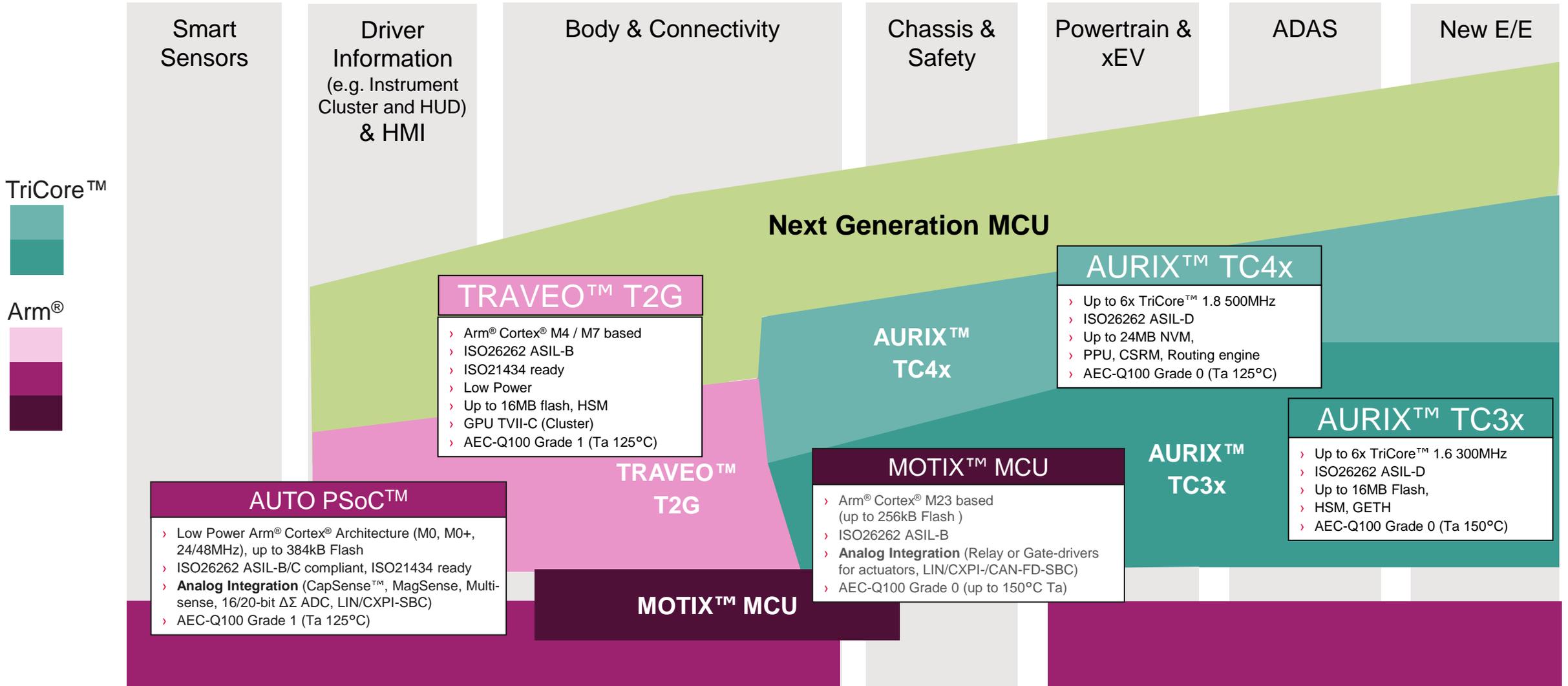
Q2 2024

ATV MC SBS

Infineon Microcontroller – most scalable portfolio
Successfully covering the entire range of automotive applications

Infineon

Smart Sensors

Driver Information (e.g. Instrument Cluster and HUD) **& HMI**

Body & Connectivity

Chassis & Safety

Powertrain & xEV

ADAS

New E/E

TriCore™

Arm®

Next Generation MCU

AURIX™ TC4x
› Up to 6x TriCore™ 1.8 500MHz
› ISO26262 ASIL-D
› Up to 24MB NVM,
  PPU, CSRM, Routing engine
› AEC-Q100 Grade 0 (Ta 125°C)

AURIX™ TC4x

TRAVEO™ T2G
› Arm® Cortex® M4 / M7 based
› ISO26262 ASIL-B
› ISO21434 ready
› Low Power
› Up to 16MB flash, HSM
› GPU TVII-C (Cluster)
› AEC-Q100 Grade 1 (Ta 125°C)

TRAVEO™ T2G

AURIX™ TC3x
› Up to 6x TriCore™ 1.6 300MHz
› ISO26262 ASIL-D
› Up to 16MB Flash,
› HSM, GETH
› AEC-Q100 Grade 0 (Ta 150°C)

AURIX™ TC3x

MOTIX™ MCU
› Arm® Cortex® M23 based
  (up to 256kB Flash)
› ISO26262 ASIL-B
› **Analog Integration** (Relay or Gate-drivers
  for actuators, LIN/CXPI-/CAN-FD-SBC)
› AEC-Q100 Grade 0 (up to 150°C Ta)

AUTO PSoC™
› Low Power Arm® Cortex® Architecture (M0, M0+,
  24/48MHz), up to 384kB Flash
› ISO26262 ASIL-B/C compliant, ISO21434 ready
› **Analog Integration** (CapSense™, MagSense, Multi-
  sense, 16/20-bit ΔΣ ADC, LIN/CXPI-SBC)
› AEC-Q100 Grade 1 (Ta 125°C)

MOTIX™ MCU

PSoC™: One-stop-shop for a range of automotive HMI & smart sensor applications

Door handle and foot-kick detection

Buttons/sliders Force detection/haptics

Interior Lighting

Touchpads

Touchscreens

Segment LCD cluster

Capacitive navigation

Occupant detection

Hands-on detection

Biometrics & Navigation

PTC Heater

Level Sensing

Intelligent Battery Sensors

Li Ion Battery Management Systems

Legend

HMI

Beyond HMI

HMI = Human Machine Interface

Automotive PSoC microcontroller roadmap

			Sampling or available today	In development
Precision Analog	**High Voltage**	**BMS +**		**PSoC next gen BMS family** ASIL D
		BMS	**PSoC 4 HVPA-144k** 12V supply (42V max), 24-48 MHz Cortex M0+, ASIL C 144kB Flash, embedded LIN-SBC (12V-LDO & PHY) 16/20-bit ΔΣ ADC (Lead acid focus)	**PSoC 4 HVPA-SPM** Smart Battery Pack & Shunt Monitor (Li ion battery focus)
HMI & Smart Sensing		**Capsense**	**PSoC 4 HVMS family** 12V supply (42V max), 24-48 MHz Cortex M0+, 32-128kB Flash, embedded LIN-SBC (12V-LDO & PHY)	
	3-5V supply		**PSoC 4xxx family** 3-5V supply, 24-48 MHz Cortex M0 / M0+, 16-384kB Flash, Optional Op-Amps, comparators, CAN/CAN-FD, USB, Crypto	
HMI		**Multitouch**	**PSoC Multitouch TSG6, 6L, 6XL** 8.5'' – 15'' touchscreens **PSoC Multitouch TSG7, 7L, 7XL** 12'' – 15'' touchscreens Multichip-support for >15''	**PSoC Multitouch TSG8** OLED, Up to 24'' touchscreens (55'' with multichip-support)
		Fingerprint	**PSoC Fingerprint FGP 1**	

PSoC™ - One stop shop for Automotive HMI & Smart Sensors

PSoC™ Key Features

- › **Low Power** ARM® Cortex® Based
- › Robust & Reliable CAPSENSE™, Inductive Sense & Multi-Sense Converter
- › "Edge-Connectivity" through **LIN, CXPI, CAN FD, iso-UART,** options with integrated **LIN-SBC-functionality**
- › Safety: ISO 26262 up to **ASIL B (SEooC) / ASIL C (App-specific)**
- › Security: **ISO 21434-ready -** process compliance and partial ("off the shelf") product support
- › **Upcoming:**
  - › Extension of the BMS portfolio to higher voltages & with increased safety
  - › Support for Ultra-Large touchscreens and **OLED**
  - › Full **ISO21434** security support ("out off context", for devices starting development after ISO-release date)

Smart Sensing

HMI

PSoC™ next gen	– **Next gen (ASIL D)**	• Please contact Infineon representative
PSoC™ 4 HVPA	– **H**igh **V**oltage **P**recision **A**nalog MCUs, ARM® M0+, – 64KB – 144KB Flash – **16/20-bit ΔΣ ADC** for precise Current and Voltage measurement, **12V LDO, LIN PHY**, ASIL-C compliant	• LV Battery management (12V Lead acid, ASIL C) • HV Battery and Pack & Shunt Monitoring (Li-ion batteries)
PSoC™ 4 HVMS	– **H**igh **V**oltage **M**ixed **S**ignal MCUs, ARM® M0+, – 32KB – 128KB Flash – Programmable Analog, Robust HMI, **12V LDO, LIN PHY**, ASIL-B compliant	• Smart Sensing Applications such as Steering Wheel (HOD, buttons) or Liquid Level Sensing • actuators (eg. PTC Heater, int/ext. lighing)
PSoC™ 4 S	– Scalable General Purpose MCU platform, ARM M0+ – 16KB – 384KB Flash – Programmable Analog & Robust HMI – CAPSENSE™, MSC, OpAmps (PGA, TIA), Comparators	• HMI applications such as Capacitive/Inductive buttons, sliders, touchpads • Smart sensor applications such as hands off-, or passenger occupancy detection (HOD/POD)
PSoC™ Multitouch	– Scalable MCU-based Touch sensing platform – Supporting display-sizes up to 15'' (24'') – Preprogrammed by Infineon-firmware – Detecting up to 3 fingers simultaneously	• Multitouch - touchpads, touchscreens (LCD/OLED) • touch integrated cockpit • touch-enabled rear view mirror etc.
PSoC™ Fingerprint	– Cost optimized substrate based architecture – MCU-based, preprogrammed & factory tuned firmware – Partnering with Precise™ Biometrics for embedded matching algorithm support	• Fingerprint sensors used for authentication e.g. for in-car payments, biometric indicators, unlocking glove-box, etc.

Scalable Human Machine Interface Roadmap

Configurable Sense

Ultra-large Touchscreen up to 35" Multi-chip	**PSoC™ Multitouch Gen7XL Multi-Chip** 298 I/O, 120 Hz RR	**PSoC™ Multitouch Gen8** 126 I/O, 120 Hz RR	OLED, Micro-LED, ISO 26262 Large Touchscreens
Large Touchscreen up to 15" Hover, Force, Haptic, CRYPTO, CAN	61-103 I/O, 120 Hz RR **PSoC™ Multitouch Gen7XL**		
Large Touchscreen up to 15"	**PSoC™ Multitouch Gen6XL** 61-88 I/O, 120 Hz RR	**PSoC™ Multitouch Gen6XL** 31-54 RX, 100 Hz RR	Hybrid In cell
Small Touchscreen up to 8.5"	**PSoC™ Multitouch Gen6L** 48 I/O, 120-Hz RR	**PSoC™ Multitouch Gen7L** 72 I/O, 100-Hz RR	Medium Touchscreen up to 12.3"

PSoC™ Multitouch Gen6L-Slider
41/48 I/O, 200-Hz RR

PSoC™ Multitouch Gen6L-Trackpad
41/48 I/O, 120-Hz RR

PSoC™ ONS CYONSFN3xxx
600 DPI

PSoC™ FPG1 CYFP1002xxx
340 DPI

Optical and capacitive Finger Navigation Capacitive Fingerprint Identification

Programmable Sense & MCU

PSoC™ 4 HVMS-64K
48 MHz, 64KB/8KB
Up to 40 buttons, LIN/CXPI PHY

PSoC™ 4 HVMS-128K
48 MHz, 128KB/16KB
Up to 53 Sense I/Os, LIN/CXPI PHY

PSoC™ Multitouch Gen7L + MCU
72 I/O, 100-Hz RR

Touchscreen with Integrated MCU up to 12.3"

PSoC™ 4200L
48 MHz, 256KB/32KB
UDB,2XCAN,USB2.0

PSoC™ 4100S Max
48 MHz, 384KB/32KB
Up to 84 buttons, CAN-FD

PSoC ™ 4100M/4200M
48 MHz, 128KB/16KB
Up to 51 buttons

PSoC™ 4100S Plus
48 MHz, 128KB/16KB
CAN

PSoC™ 4700S Plus
48 MHz, 128KB/16KB
Inductive Sense

PSoC ™ 4100/4200
48 MHz, 32KB/4KB
UDB

PSoC™ 4100S
48 MHz, 64KB/8KB
CAN

PSoC 4
PSoC 4 HVMS
PSoC Multitouch
ONS/Fingerprint

Buttons	Sliders	Touchpad	Touchscreen	Biometrics/Navigation

PSoC 4 scalable family

One stop shop for Driver Information, POS systems and HMI

Driver Information / HMI requirements

HMI (Capacitive/Inductive buttons, sliders & touchpads)

- High accuracy CapSense or Multi Sense converter IPs enable high performance capacitive and inductive sensing on Human-Machine interfaces such as buttons, sliders, touchpads.
- Targeted for HVAC controls, infotainment buttons, sliders and touchpads, door handles, POD, HOD, steering wheel buttons, sunroof control, foot kick/trunk opener
- ASIL-B ready, integrated CRYPTO hardware accelerator

Multitouch-Touch & Fingerprint Controllers

- Wide portfolio to support touch screens from 8" to 35", trackpads, slider and buttons
- Gen7XL controller supports advanced features: Hover, Force Sensing, Haptic, Acoustic, and wet-finger tracking
- Gen8 device to support OLED display

Sunroof control · Footkick · Door handle · Fingerprint Sensor · Wireless charging · Interior lighting · HMI · Multitouch Controllers · Smart Ignition control
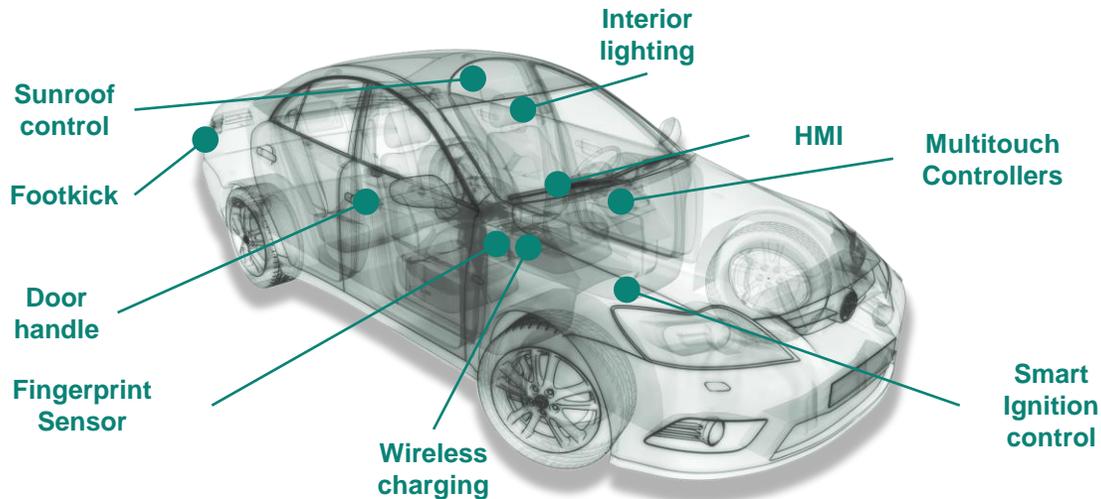
…and our Automotive microcontroller offering

PSoC 4100S Max 48MHz, 384KB/32KB, MSC,CRYPTO, CAN-FD	
PSoC 4100L/4200L 48MHz, 256KB/32KB, 2x CAN,UDB,2xCSD,USB2.0	
PSoC 4700S Plus 48MHz, 128KB/16KB, Inductive Sense	
PSoC 4xxxS Plus 48MHz, 128KB/16KB, CAN, CapSense (CSDv2)	
PSoC 4xxxM/ 48MHz, 128KB/16KB, UDB, 2xCAN, 2xCSD	
CYAT8168X 61-88 I/O, 120-Hz RR	
CYAT817 61-103 I/O, 120-Hz RR	
CYAT817LS 72 I/O, 100-Hz RR, MCU	
CYAT818xx OLED	
CYFP1002xxxx Fingerprint Sensor	

Automotive Interior HMI

- ✓ Touch-sensing buttons/sliders/touchpads with very thick overlays (>5mm) can be supported by CAPSENSE
- ✓ High refresh rates to provide intuitive / responsive HMI
- ✓ Support force-sensing with CAPSENSE (capacitive) or Inductive Sensing
- ✓ Metal touch surfaces can be enabled by Inductive Sense
- ✓ Drive LEDs brightness / effects with PWMs
- ✓ Scalable solution from 16KB/2KB (Flash/SRAM) up to 384KB/32KB

Multitouch Touch Controllers & Fingerprint

- ✓ High performance Multitouch technology supporting self and mutual capacitance sensing with high refresh rate (RR)
- ✓ Small footprint packages in TQFP / QFN
- ✓ Thick glove (5mm) and water rejection support
- ✓ Extensive EMI/EMC testing completed to CISPR-25 standard
- ✓ Automotive quality software with Auto SPICE level-2 and safety features to enable configuration and tuning
- ✓ Fingerprint: Excellent biometric performance: < 1% FRR at FAR 1:50K,360° finger placement,8.0× 8.0 mm sensing area,340 DPI

Scalable PSoC™ 4 Product lineup for General Purpose & BMS Sensing

Smart Sensors, HMI and general-purpose application focus	BMS application focus

ASIL D compliant SEooC

PSOC™ Safe Next gen*

PSOC™ Safe BMS Next gen*

ISO 26262 compliant ASIL-C

PSoC™ 4 HVPA-SPM
Smart Pack Monitor, 16/20-bit ΔΣ VIO, CRYPTO, CAN FD, iso UART, ASIL C

HV Li ion Battery Pack & Shunt Monitors

HVAC
HMI/Infotainment
Buttons & Slider
Interior Lighting
Door Handle
Sunroof Control
Steering Wheel Buttons
Touchpads

Footkick
Hands-on-Detection (HOD)
Passenger Occupant Detection (POD)
Liquid Level & Quality Sensing
Wireless Charging
PTC Heater

PSoC™ 4 HVPA-144K
128KB/8KB,16/20-bit ΔΣ, LIN/CXPI, ASIL C

12V lead-acid Battery Pack & Shunt monitor

ISO 26262 compliant ASIL-B

PSoC™ 4 HVMS-128K
128KB/16KB, Multi-sense/CAPSENSE, LIN-SBC, CXPI

PSoC™ 4 HVMS-64K
64KB/8KB, Multi-Sense/CAPSENSE, LIN-SBC, CXPI

ISO 26262 Ready Entry level MCU with CAPSENSE™

PSoC™ 4100L/4200L
48 MHz, 256KB/32KB UDB, 2x CAN, USB 2.0

PSoC™ 4100S Max
48 MHz, 384KB/32KB Multi-Sense, CRYPTO LCD, CAN FD

PSoC™ 4100M/4200M
48 MHz, 256KB/32KB UDB, 2x CAN, USB 2.0

PSoC™ 4100S Plus
48 MHz, 128KB/16KB CAN

PSoC™ 4700S Plus
48 MHz, 128KB/16KB Inductive Sense

PSoC™ 4100S
48 MHz, 64KB/8KB

PSoC™ 4100/4200
48 MHz, 32KB/4KB, UDB

PSoC™ 4000S
48 MHz, 32KB/4KB

PSoC™ 4000
16 MHz, 16KB/2KB

Legend

* *Subject to feasibility & market study*
Arm Cortex M0/M0+ Frequency, Flash/SRAM
BLE = Bluetooth Low Energy
BMS = Battery Management Systems
HMI = Human Machine Interface
OCD = Overcurrent Detection
SBC = System Basis Chip
UDB = Universal Digital Block
CMC = Cell Monitor Controller (inc. balancer)
VIO = Voltage / Current / Over-Current

PSoC™ 4 (5.5V, Cortex M0/M0+ , 24/48 MHz)

PSoC™ 4 HV (42V, Cortex M0+, 24/48MHz)
Mixed signal MCUs with 12V LDO and transceiver (LIN, CXPI or iso-UART)

PSOC™ Safe (100V, dual core lockstep)

PSoC™ 4 High Voltage - enabling Smart Sensing for future mobility
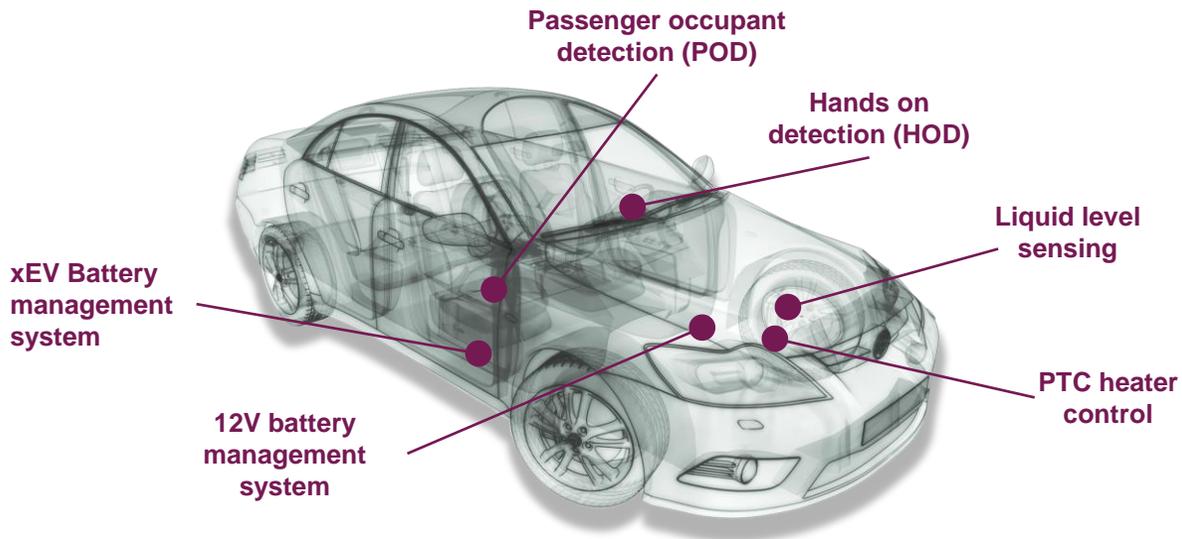# Enabling safe smart sensing systems

Battery management & Smart sensing requirements

Battery management system (Cell-balancing, Current-Sensing)

- High precision analog performance for longer range driving and better battery life
- Functional safety support up to ASIL-D ISO 26262
- Scalable and comprehensive solution supporting the latest xEV trend

Smart sensing (POD, HOD, Liquid level sensing, PTC heater ctrl)

- Multiple sensing interface support with robust operation
- Small footprint and cost-effective integrated solution with newest communication stacks
- Software solution for easy to design and quick market launch

Passenger occupant detection (POD)

Hands on detection (HOD)

Liquid level sensing

xEV Battery management system

12V battery management system

PTC heater control

…and our Automotive microcontroller offering

PSoC 4 HVPA-SPM
48MHz 128kB

PSoC 4 HVPA-144k
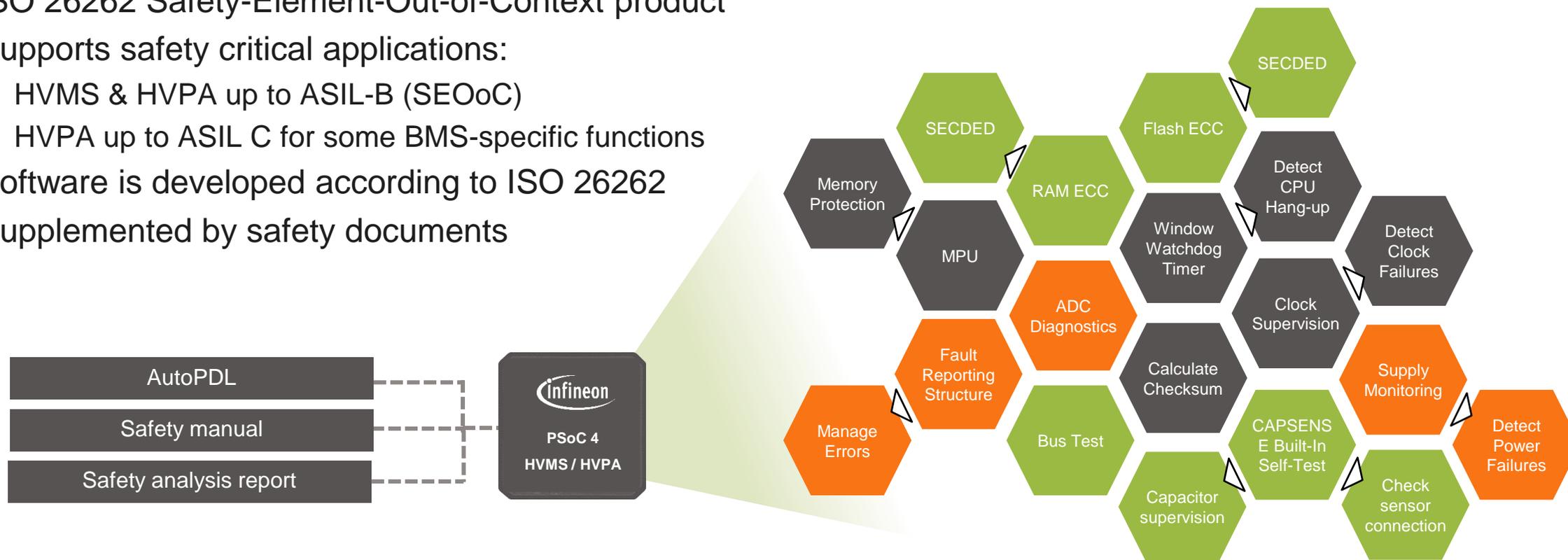48MHz 128kB

Battery management system

- ✓ Integrated PSoC-solution with programmable MCU & high precision analog for current and voltage monitoring
- ✓ Scalable high voltage technology from 12V battery to HV battery
- ✓ NVM for increased flexibility, data-preconditioning, compression and storage (eg. for calibration, SOH for 2nd life)
- ✓ Synchronous cell voltage and current measurement with integrated transceivers (isoUART, BLE)
- ✓ Integrated overcurrent detection and drivers/triggers for battery disconnect switch
- ✓ Safety components supporting up to ISO 26262 ASIL-D
- ✓ Automotive quality and safety supported software

PSoC 4 HVMS-64K
48MHz 64kB

PSoC 4 HVMS-128K
48MHz 128kB

Smart sensing

- ✓ High performance analog (12b SAR ADC @1Msps), integrated OpAmps, comparators, CAPSENSE, Multi-Sense Converter
- ✓ Serial communication block supporting I2C, SPI, UART, LIN, CAN, CXPI
- ✓ Small footprint packages in wettable flank QFN
- ✓ 12V battery directly operation with integrated high voltage subsystem (LDO, LIN PHY)
- ✓ Automotive quality and safety supported software

PSoC 4 HV: Functional Safety: A holistic system-level approach

- ISO 26262 Safety-Element-Out-of-Context product
- Supports safety critical applications:
  - HVMS & HVPA up to ASIL-B (SEOoC)
  - HVPA up to ASIL C for some BMS-specific functions
- Software is developed according to ISO 26262
- Supplemented by safety documents

AutoPDL

Safety manual

Safety analysis report

PSoC 4
HVMS / HVPA

SECDED · SECDED · Flash ECC · Memory Protection · RAM ECC · Detect CPU Hang-up · Detect Clock Failures · MPU · Window Watchdog Timer · ADC Diagnostics · Clock Supervision · Fault Reporting Structure · Calculate Checksum · Supply Monitoring · Manage Errors · Bus Test · CAPSENSE Built-In Self-Test · Detect Power Failures · Capacitor supervision · Check sensor connection

PSoC 4 HV is ISO26262 compliant (supported by safety hardware, software, and collaterals)
PSoC 4xxx is ISO26262 ready (supported by safety-collateral like HW-safety manual, FMEDA allowing customers safety-assessment)

ISO 21434 Security Approach for automotive PSoC

Process Compliance:

– ISO/SAE 21434 was published end 2021

– Infineon received certificate for **Process Compliance** for Cyber Security Management System (CSMS) in 2022

Product Compliance:

– Most automotive PSoC devices were starting their development before ISO/SAE 21434 was published:
   – Impossible to claim full ISO21434 ("out of context") compliance
   – But Infineon will support partial ("off-the-shelf") compliance for automotive PSoC – called "ISO21434 ready"

– New PSoC devices that started development after ISO/SAE 21434 was published:
   – Infineon targeting full ISO21434 ("Out-of-context") compliance

Cyber Security Management System (CSMS)

ISO 21434 based Work Packages for CSMS	TC3x, T2G PSoC 4xxx, PSoC 4 HV	TC4x PSoC BMS next Gen
ISO 21434 Security claim	**ISO21434 ready**	**SO21434 compliant**
Cybersecurity Management 5. Organizational Cybersecurity Management 6. Project Dependent Cybersecurity Management	✅	✅
Continuous Cybersecurity Activities 8.3. Cybersecurity Monitoring 8.4. Cybersecurity Event Evaluation 8.5. Vulnerability Analysis	✅	✅
Risk Assessment Methods 15.3 - 15.9 Asset, Threat Scenario identification, impact rating, attack path analysis, attack feasibility rating, risk determination, and risk treatment decision	N/A	✅
Concept phase 9.4. Cybersecurity Goals 9.5. Cybersecurity Concept	N/A	✅
Product development Phase 10.4.1. Design 10.4.2. Integration and Verification	N/A	✅
Post-development Phase 12. Production 13.3. Cybersecurity Incident Response 13.4. Updates	Cyber incident response only ✅	✅

This is due to the fact that ISO21434 was not yet standardized during product development cycle

Automotive PSoC microcontroller roadmap

				Professional / payed	Demo / free
Precision Analog	**High Voltage**	**BMS +**	**PSoC next Gen BMS family**	• AutoPDL & SafeTlib 2.0 (ASIL D)	• tbd
		BMS	**PSoC 4 HVPA**	• AutoPDL & SafeTlib 1.0 (ASIL B)	• Q3'25: MTB-PDL (ModusToolbox)
HMI & Smart Sensing		**Capsense**	**PSoC 4 HVMS family**	• AutoPDL & SafeTlib 1.0 (ASIL B) • CapSense Middleware for AutoPDL	• Jan'25: MTB-PDL (ModusToolbox) • Q4'24: CapSense Middleware for MTB-PDL
	3-5V supply		**PSoC 4xxx family**	• N/A	• MTB-PDL (ModusToolbox) • CapSense Middleware for MTB-PDL
HMI		**Multitouch**	**PSoC Multitouch TSG 6, 7, 8**	• PSoC Multitouch products come preprogrammed with Infineon Application Firmware • On host side they are supported by TTDA driver (Linux & Android environment, Free) • TSG7L as well comes preprogrammed, also supported in uVision Keil IDE (need IDE license)	
		Fingerprint	**PSoC Fingerprint FPG1**	• PSoC Fingerprint products come preprogrammed with Infineon Application Firmware • Host side software supported by Infineon Preferred Partner Precise Biometrics(need License)	

Automotive quality software support for PSoC HV

– Software packages offered by Infineon for PSoC 4 HV devices are developed as per standard Automotive software development process

– The software is ASPICE qualified (MISRA 2012 AMD1, CERT C) and ISO 26262 compliant.

Peripheral driver library (PDL)	CAPSENSE middleware library	SafeTlib
› **Complete package of low-level drivers** comprising of analog, digital and communication components	› **Middleware to implement CAPSENSE functionality** such as basic control, filter, data processing and sensing for interface widgets etc…	› **Integrates critical safety tests** which are mandatory as per the hardware safety manual to achieve ASIL-B compliance
› **Enables shorter time to market** by reducing the customer development time	› **Configurable** various parameters such as number of widgets, capacitance settings, noise threshold settings etc. using a simple GUI based CAPSENSE configuration tool	› **Enables shorter time to market** by reducing the customer development time
› **Functional Safety (ASIL-B) compliant software** built as per ASPICE standards, using FuSa compliant IAR compiler with safety features based on SEooC	› **Enables shorter time to market** by reducing the customer development time	› **Enables safe operation of the chip** during start-up and runtime