Stellar P3E: the future of automotive edge intelligence

Powering next-gen X-in-1 ECUs and xEV efficiency

The automotive car industry today

What's the solution to automotive's rising complexity?

The automotive industry has been going through an unprecedented transformation

Electrification, **autonomous driving, and connected vehicles**	Unprecedented system complexity
Increasing software content	More powerful, flexible, and secure computing platforms
Stricter **functional safety and cybersecurity** standards	Robust architectures & rigorous validation
New market players, **geopolitical** tensions, **supply chain** disruptions	New layers of complexity

Balancing innovation with **cost efficiency** and **fast development** cycles is critical for competitiveness.

Achieving **efficient electrification**

Electrification challenges traditional architectures

- **Multiple functions consolidated**
- **Functions diversity:** HVAC, BMS, inverter, ...
- **Balancing efficiency and performance**
- **High rpm motors** requiring safe, high-precision analog I/O

Requirements for efficient electrification

- ✓ **System cost**: integration of critical functions toward the reduction of components and wiring harness to streamline vehicle assembly.
- ✓ **SDV innovations**: Deployment of AI-driven algorithms for smarter sensing and control, and reliability with predictive maintenance algos.
- ✓ **High precision controls**: Faster electric motors are pushing for accurate acquisition/actuations and efficient compute

Efficient electrification is the essential key for making electric vehicles **scalable, intelligent, and cost-competitive**

AI is accelerating the shift towards SDV

The shift towards software-defined vehicles and ADAS creates an environment for AI adoption

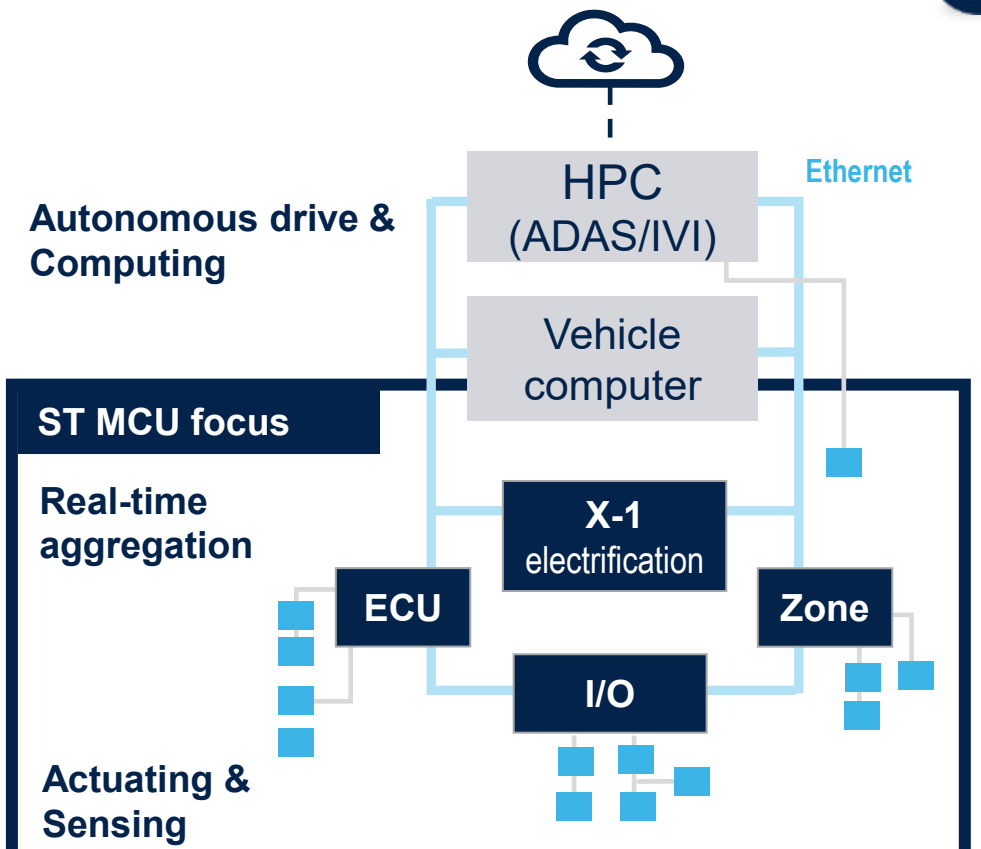
Software innovation enables adaptive vehicle behaviors

Continuous software development is essential in modern vehicles. Enabling systems that can learn, adapt, and improve over time.

AI excels with large, complex, unstructured data

Unlike traditional algorithms, AI can process and find patterns in vast datasets uncovering new insights that traditional algorithms may overlook.

ST's automotive MCU focus areas



Integration & electrification

Stellar P series

- **Integration** with a focus on drivetrain control both for traditional and xEV
- Extensive support of analog interfaces

Aggregation & zonal functions

Stellar G series

- **Zonal** body functions, **power distribution** control & **data routing**
- Feature-rich communication with Audio-over-Ethernet

Body/chassis & convenience

STM32A series

- ASIL safety
- Cost-efficient dedicated solution for **body and control**

~$16B MCU TAM by 2030

Source: S&P Q4 2025

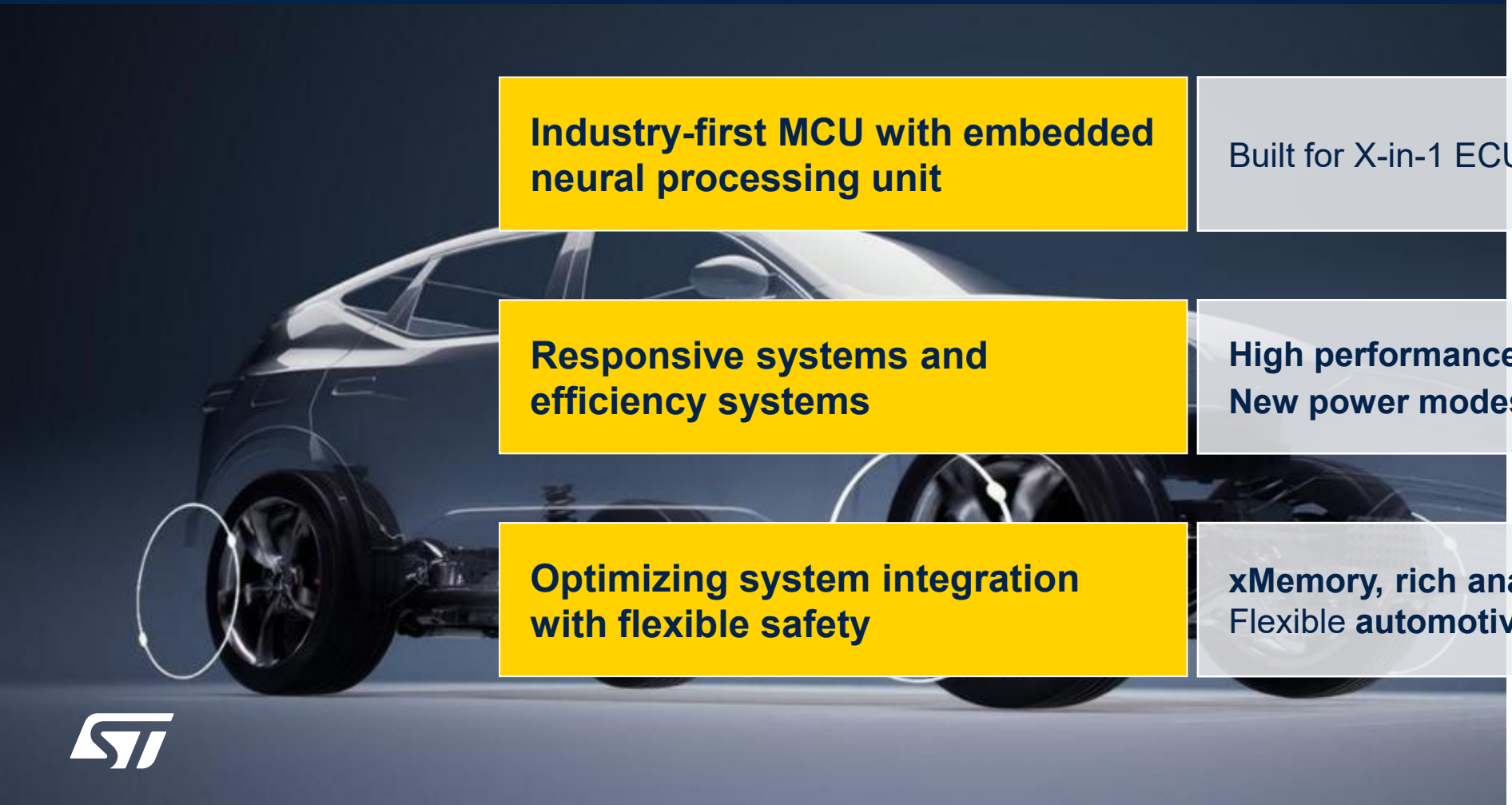
xMemory for code/OTA integration
Real-time control and flexible safety

STM32 ecosystem

ECU: electronic control unit
ADAS: advanced driver assistance systems
IVI: in vehicle infotainment

Introducing Stellar P3E for automotive edge intelligence

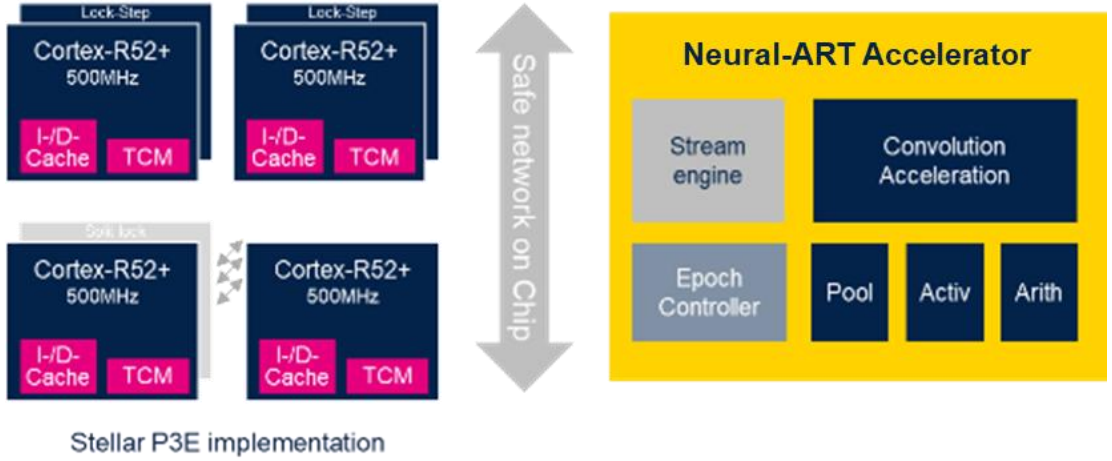
Simplifying multifunction integration for X-in-1



Industry-first MCU with embedded neural processing unit	Built for X-in-1 ECUs with real-time **AI functions**
Responsive systems and efficiency systems	**High performance** for responsive systems **New power modes** for superior efficiency
Optimizing system integration with flexible safety	**xMemory, rich analog I/O, ST reference designs** Flexible **automotive safety** up to ASIL-D

Industry-first MCU with Neural-ART Accelerator
True real-time AI performance

Beyond standard processing



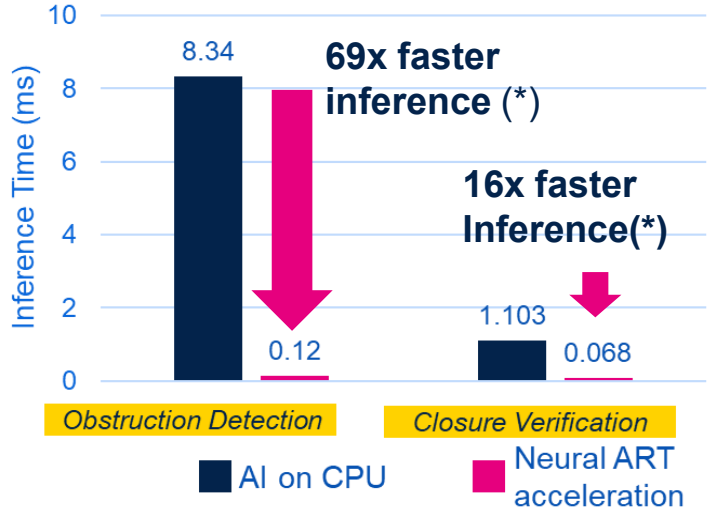
Stellar P3E implementation

Neural-ART Accelerator: ST proprietary neural processing unit (NPU) with **data-flow architecture** optimized to run neural network models **efficiently**.

AI enables better classification vs traditional approaches, enabling new functions like **anomaly detection**

The neural advantage

Window antipinch algorithm



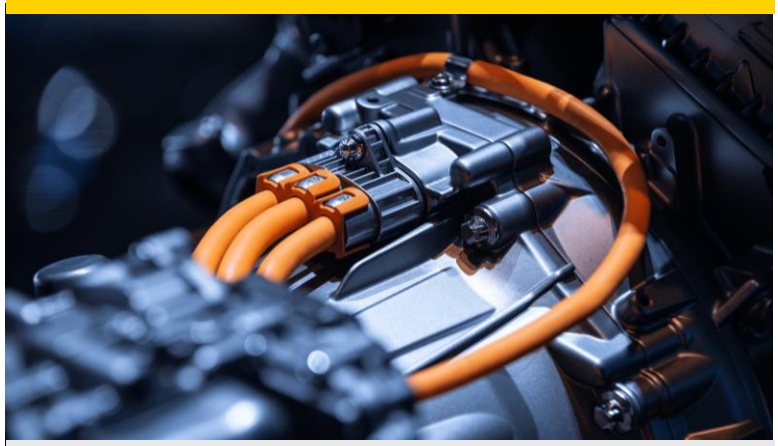
ST hardware & software ecosystem enables edge AI MCU deployment, moving intelligence locally for real-time responses.

New applications like "**smart sensing**" to predict accurately sensor data are now possible with emb. NPU

(*) On the CPU, the model runs in 32-bit floating point (FP32), whereas on Neural-ART it runs in 8-bit quantized integer (INT8) format.

Enabling smart efficiency and responsive systems

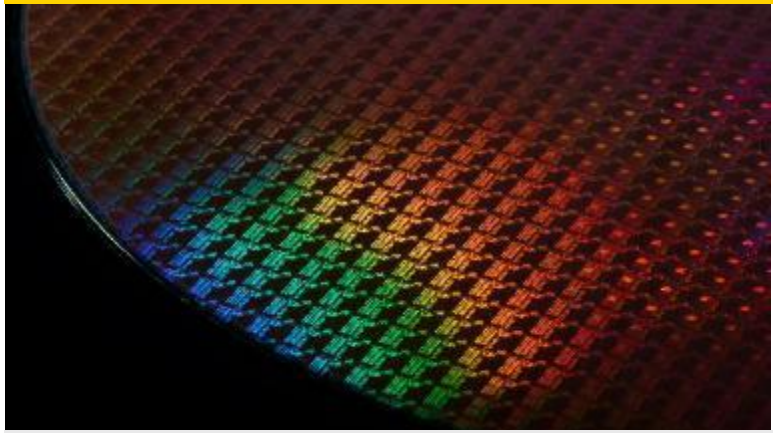
Compute performance



- **Highest CoreMark** with 8,000 score – 500 MHz Arm Cortex®-R52+® cores
- **Split-Lock**: Dynamic balancing between maximum perf and safety redundancy
- **Application isolation** (*more than freedom* from interference)

1.8X(*) faster motor control loop
1.2X (*) compute performance

ST technologies



- **FD-SOI 28 nm with PCM ST Process** (165°C/150°C T_j, 5V)
- **xMemory:** Extensible to **19.5 MB** of non-volatile memory for SDV innovations
- Enables more X-in-1 functions and seamless OTA

Seamless OTA updates

Smart power management

- New **smart low-power modes** offering functionalities beyond standard standby without compromising responsiveness
- New level of efficiency can be achieved when the car is parked

New low-power usages

(*) FOC performance versus Stellar P3/P6

Delivering system integration with flexible safety

More scalability with reliable, safe communication and analog IPs

Feature-rich interfaces for easier x-in-1 integration

- Advanced analog capabilities to support diverse functions, specifically tuned for enhanced vehicle dynamics
- High accuracy timers and safe/precise analog content

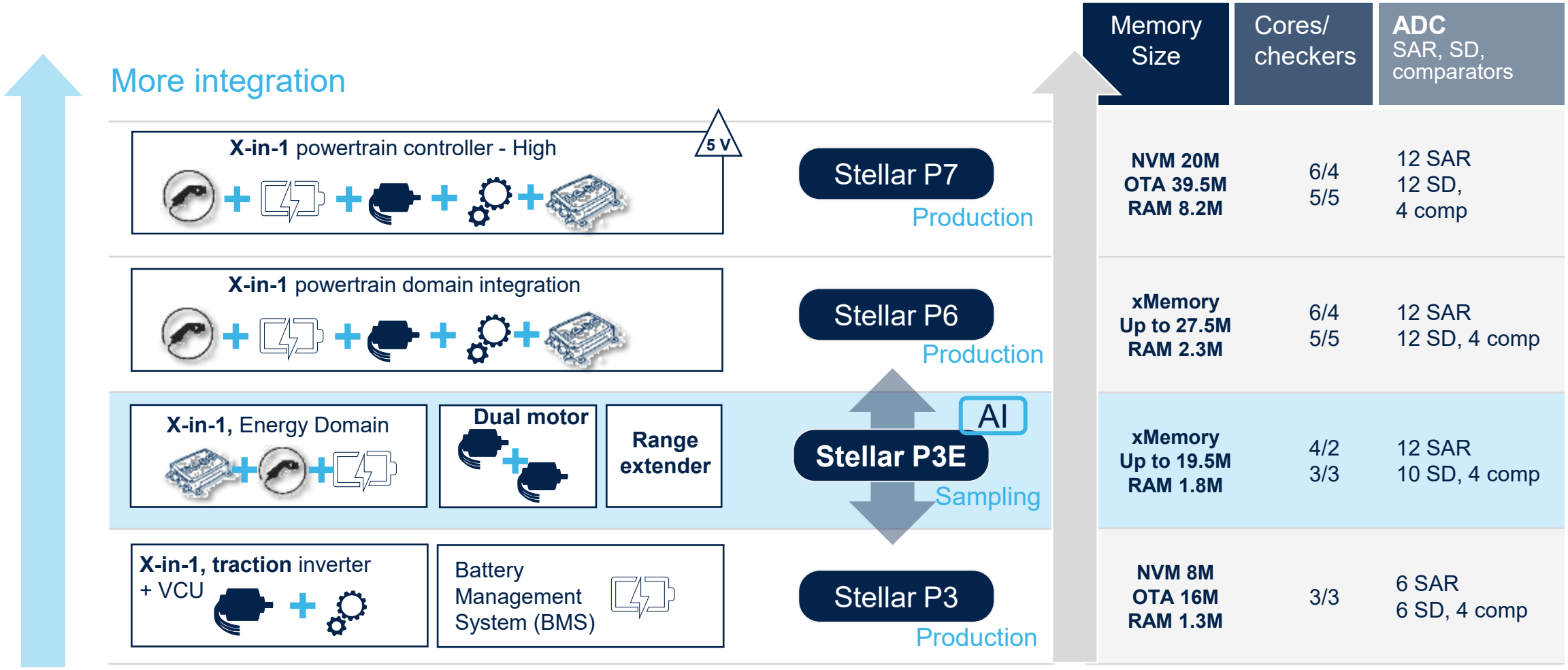
High density I/O packages to support function integration in X-in-1

- **>20% more I/O vs market incumbent** (308 GPIO in 21x21 package)

High speed communications for modular and scalable systems

- 1G/100M/10M Ethernet, CAN XL, …

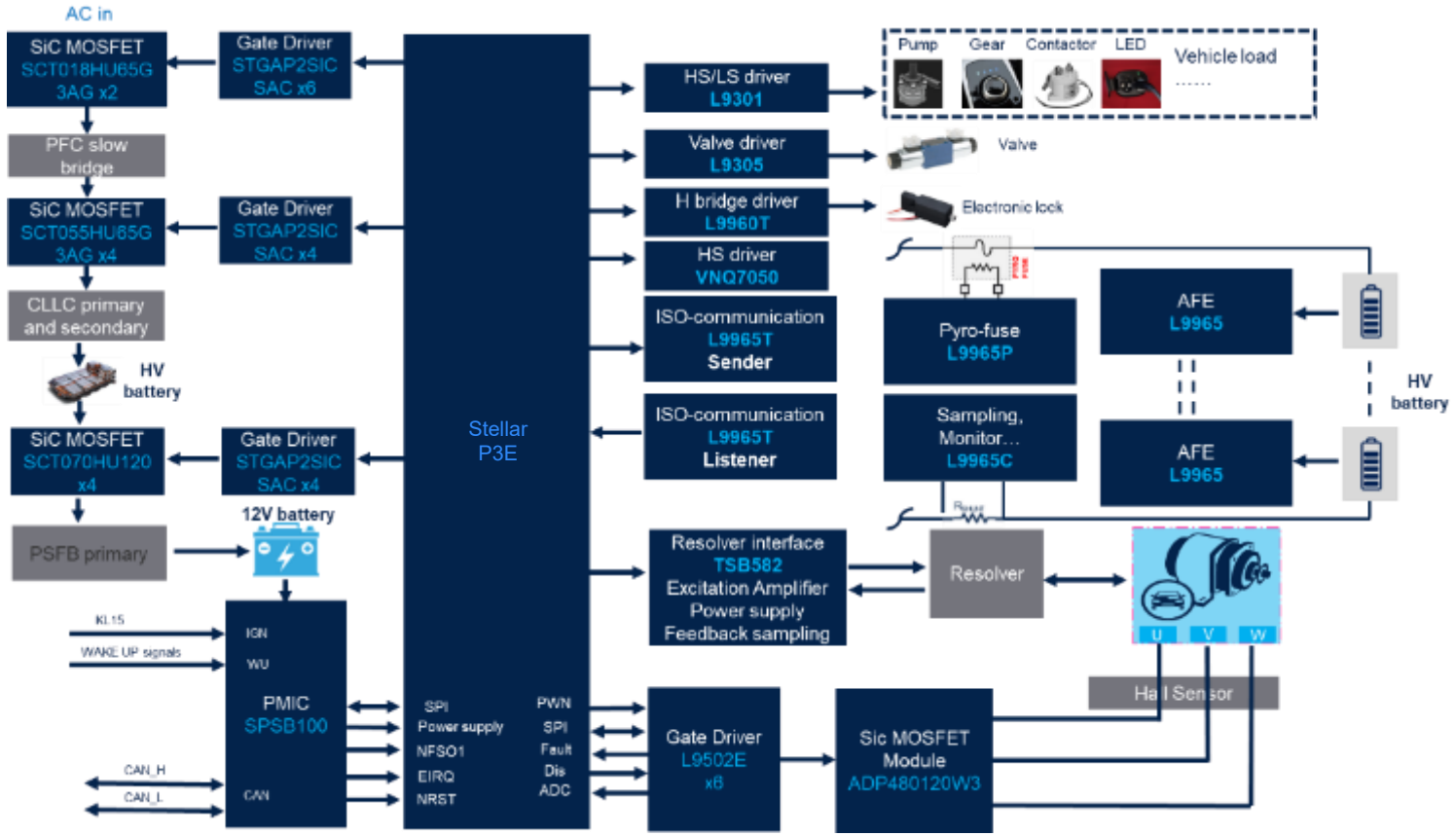
Powering the future of powertrain integration



Stellar P: a scalable series for growing integration needs

Building the **most efficient X-in-1** with ST

X-in-1 powertrain domain controller solution



ZCU solution today built with Stellar P6

NEV Competence Center

Key benefits with Stellar P based system

- **Integrated** VCU, BMS, single or dual traction inverter, DC-DC and OBC into one controller
- **Optimized X-in-1** system with BMS series chip, drivers, SiC MOSFET modules and discrete, and PMIC
- **106ch ADC** with Stellar P3E
  - 12x SAR ADC
  - 10x Sigma Delta ADC

ST X-in-1 solution enables:

- **43% lighter**, 27% less volume
- **+1% High-voltage efficiency**
- **60% cost savings** in high voltage conn.
- **75% less SW**/tools required

Drive the future with Stellar P3E

Stellar P3E extends beyond traditional internal combustion engine applications to cover hybrid and battery electric control, digital power conversion, and battery management, enabling more complex ECU architectures (X-in-1).

- Real-time AI (NPU)
- Industry-leading performance
- xMemory
- Flexible safety & security
- Rich analog interfaces

Stellar P3E enables new applications from AI real-time functions to full redundancy support in dual electrical motor control

Sampling today

Our customers have already started development on Stellar P3E (production Q4’26).

Our technology starts with You

Find out more at www.st.com/stellar-p3e