STMicroelectronics Electrification Solutions Improve Vehicle Efficiency and Extend Range

arm

The Race to Electrification

Driven by demands for more sustainable mobility and safer, more efficient vehicles, the automotive industry is racing toward electrification. Rapid innovation is vital to calm range anxiety and shrink charging times so that electric vehicles (EVs) become an even more attractive option for drivers who need to travel longer distances.

Vehicle manufacturers and their suppliers are focused on developing new concepts for efficient, safe, and secure e-mobility. A major shift in digital computing solutions is helping to optimize energy management and make EVs the ideal choice for consumers.
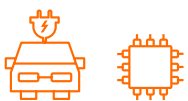

ST is an integrated device manufacturer working with more than 200,000 customers and thousands of partners to design and build products, solutions, and ecosystems that address their challenges and opportunities, and the need to support a more sustainable world.

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Microcontrollers (MCU) play a pivotal role in EV compute platforms, with their management of power conversion efficiency and performance being crucial to ensuring rapid charging and a longer cruising range between charges. There is now a new generation of MCUs that combine superior levels of safety and security, with over-the-air (OTA) software update capabilities to enhance the ownership and driving experience throughout the entire vehicle lifecycle. These features offer manufacturers the ability to keep pace with technology innovation, respond to evolving threats, and add new features and revenue models to their vehicle portfolios.
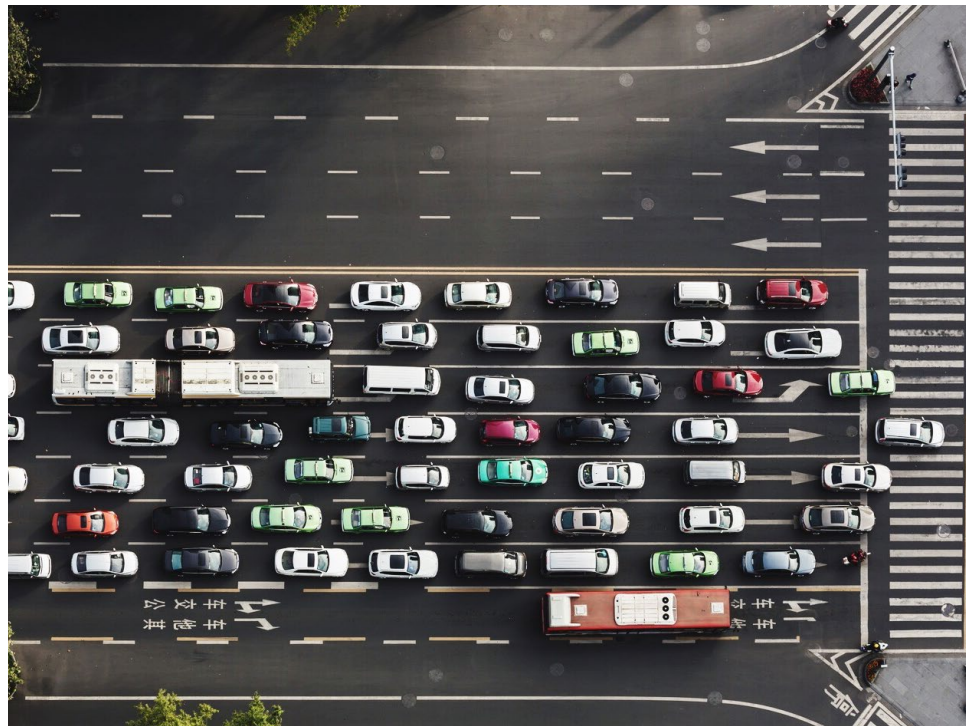
Boosting EVs with Enhanced Efficiency, Safety, and Software Features

ST Stellar E automotive MCUs are built on dual 32-bit Arm® Cortex®-M7 CPU cores to foster vehicle electrification. They feature advanced capabilities and high-resolution control for increased power efficiency and safety features that are essential for extending cruising range and faster charging times.
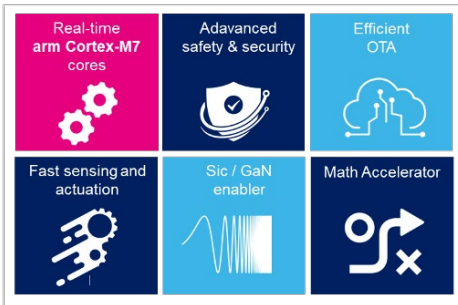
The embedded Cortex-M7 cores, working at 300MHz, ensure real-time control and performance scalability. Stellar E has the flexibility to support various safety integrity levels up to ASIL D, and the compute performance to optimize each design's cost and scalability.

The high-speed control-loop processing of the Stellar E Automotive MCUs drives power conversion applications to maximize the benefits of ST Silicon Carbide (SiC) and Gallium Nitride (GaN) power technologies.
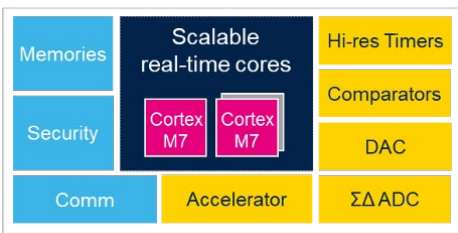
Tailored for onboard charging, DC-DC converters, and traction inverters, Stellar E MCUs deliver both control and actuation in one MCU. This simplifies system design, saves costs, and speeds compliance with automotive safety and security standards. Its safety and security foundations combined with real-time and analog performance, take Stellar E electrification to the next level of vehicle efficiency.

The Sigma-Delta-ADCs and the high-resolution timers embedded in Stellar E deliver fast control loops to support high switching frequency with precise time control. Coupled with fast computing capability and an onboard math accelerator, this control loop chain replaces external DSPs.

Stellar E MCUs also include fast on-chip comparators to implement protection. Additionally, fast SAR ADCs, delivering up to 5 MSPS in dual mode, help boost control-loop performance.

As vehicles rapidly become software-defined, OTA update capabilities are essential for the quick and efficient rollout of new features, optimized performance, and to resolve future safety or security concerns. Stellar E MCUs implement efficient OTA updates, allowing vehicles to continuously improve over time.

Finally, a flexible hardware security module (HSM) sub-system helps protect the vehicle's control systems against cybersecurity threats and ensure that the vehicle operates as intended.

MCUs for the EV Future

By providing reliable and efficient energy management, power conversion control, security, and safety, MCUs are critical components of EVs. In the evolution of vehicle architectures, MCUs must deliver more capabilities than ever before and anticipate future vehicle design needs. Arm's partnership with ST shows that innovative and forward-looking products can help increase consumer confidence and accelerate the shift toward the transformation taking place in the automotive industry.

> "Our Stellar MCUs enable state-of-the-art electrification, while ensuring efficient energy management and software-defined flexibility for vehicle lifecycle management," said Luca Rodeschini, Automotive and Discrete Group Vice President, Strategic Business Development and Automotive Processing and RF General Manager, STMicroelectronics. "With the new Stellar E devices, this platform enables a new value chain for EVs that can sense the environment, control vehicle dynamics, enhance power-conversion efficiency, and safely manage high-current power stages. Stellar E effectively handles all this in a single component. Moreover, Stellar E's ability to update software securely over-the-air lets manufacturers refine their control strategies for extra driving range, performance, and power efficiency."

References

[01]   Stellar Actuation MCUs - STMicroelectronics

[02]   The future of eMobility: Silicon carbide MOSFETs and Stellar E microcontrollers

[03]   Arm Cortex-M7

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