VEHICLE electronics

The monthly magazine for automotive electronics engineers

Denso buys Rohm shares in bid for EV partnership

Denso has acquired shares in Rohm as the companies hope to form a semiconductor partnership to tackle the growing electric vehicle market.

The demand for electronic components and semiconductors required for electrification of vehicles is rapidly increasing. And semiconductors are becoming more important to support automated driving and connectivity.

The two companies have been working together through trade and development of semiconductors for automotive applications. Going forward, both will consider a partnership to achieve a stable supply of reliable products, as well as for various initiatives to develop semiconductors.

To solidify the partnership, Denso will acquire a portion of Rohm's shares.

"We believe that by integrating the automotive technologies and expertise we have cultivated over the years, we will be able to ensure a stable supply and accelerate technological development," said Denso CEO Shinnosuke Hayashi.

He said Denso positioned semiconductors as key devices.

"We have deepened our cooperative relationships with semiconductor manufacturers who have abundant experience and knowledge," he said. "Rohm has a line of semiconductors in a wide range of areas important for automotive electronics, including analogue semiconductors, power devices and discrete semiconductors, and has extensive mass production experience."

Rohm president Isao Matsumoto added: "Tier-one manufacturer Denso and Rohm have been deepening collaboration for many years, and in recent years we have been working on joint development of analogue semiconductors. We believe the partnership with Denso and the acquisition of shares by Denso will further strengthen our cooperative relationship."

• Rohm and UAES sign SiC supply deal, page 7.



Denso CEO Shinnosuke Hayashi

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Blackberry fills Gap for HaleyTek cockpit software

Blackberry is providing the QNX hypervisor for safety and a sound platform for HaleyTek's Gap cockpit software, which provides access to a seamless, agile Android Automotive development environment.

This can accelerate the time-to-market for feature-rich infotainment systems.

Gap will offer OEMs access to software defined audio (SDA) and VirtIO.

SDA delivers software-based acoustic and audio experiences for consumers, while enabling cost savings and the ability to generate subscription revenue through personalised audio software features after the sale of the vehicle.

It will also extend the lifecycle of these systems, offering over-the-air (OTA) Android and security updates.

"Embracing open systems like VirtIO enables true hardware software separation, opens up all the benefits of cloud-first development and reduces the custom integration efforts for our entire ecosystem across OEMs," said Jan-Erik Larsson, CEO of HaleyTek.

John Wall, senior vice president at Blackberry, added: "Our customers want to manage software lifecycles across multiple SoC vendors and the cloud. VirtIO simplifies these efforts and is endorsed by large software providers in the auto motive industry. Through our SDA platform, we have already helped automakers achieve hundreds of millions of dollars in savings while creating new revenue opportunities, and we look forward to passing these benefits on to HaleyTek's customers too."

Motorola helps police with enquiries

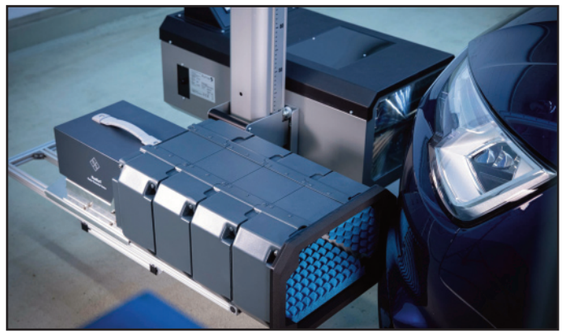


Lancashire police force in the UK is deploying Motorola's M500 in-car video across its entire fleet to observe the vehicles' environment from multiple viewpoints. This should provide officers with real-time awareness of their surroundings, while capturing video evidence that can provide accurate incident documentation to aid investigations.

"Police officers face unpredictable challenges and fast-moving events every day," said Chris Hardy, chief superintendent for Lancashire Police. "The ability to respond quickly is paramount. The Motorola M500 can live-stream video back to the control room, enabling our team to build a clear picture of unfolding events by giving us eyes on the scene. It is a highly configurable, easy-to-use system that can automate processes such as triggering video recording when the blue lights are activated, helping officers to focus on the job at hand."

The interface is designed to be intuitive for officers to operate in demanding situations. Video captured is automatically uploaded to the Motorola VideoManager for secure, auditable storage that is intelligently organised. Recorded footage is tracked and audited to protect the chain of custody so the police, public and judicial systems can be confident in the integrity of video evidence.

R&S and Ryme integrate radar test at Automechanika



RadEst can be integrated with Ryme headlight testers

Visitors to September's Automechanika in Frankfurt saw Ryme and Rohde & Schwarz demonstrate an innovative way to test radar sensors during periodic technical inspections (PTIs).

It seamlessly integrates radar target simulation into existing workshop environments, enabling adas and autonomous driving (AD) testing during PTI.

Radar target simulators are usually used in the development and production phases of a radar sensor, under controlled laboratory conditions. These simulators are often highly complex, expensive and designed to operate in an RF-controlled laboratory environment.

However, Rohde & Schwarz's RadEst radar target simulator is said to allow for cost-effective, high-quality testing of radar sensors in a workshop setting.

RadEst can be integrated with the R-HLT20 and R-HLT30 analogue and digital headlight testers from Ryme. The column of the headlight tester carries both test systems and can be easily moved with the chassis on rollers.

The system can be provided as an analogue or digital headlight tester and the user can save the test results and transfer them using the integrated ASA interface.

The headlight tester is adjustable to cover various headlight technologies, such as H7, Xenon, LED and matrix.

The digital headlight tester has a user interface and supports daily testing routines.

The RadEst can directly measure essential radar sensor quality indicators such as EIRP (equivalent isotropic radiated power) and occupied bandwidth.

Approval for self-driving trucks increases

oval for self-driving trucks is increasing, according to a mobility study from Continental in five countries.

Most expect autonomous trucks to compensate for the shortage of drivers at transport companies and ease traffic flow.

These are the findings of a mobility study conducted by market research institute Infas on behalf of Continental in Germany, China, France, Japan and the USA.

In Germany, of the 1000 people surveyed, 47% believe driverless trucks are likely in the near future. This expectation is more pronounced in the USA at 62% and China at 92%.

Almost 60% of respondents in Germany see autonomous trucks as a means of combating the shortage of drivers at transport companies. And almost half (47%) believe autonomous trucks will improve the flow of traffic on highways and thus reduce the number of traffic jams.

In many countries, the transport industry is suffering from a huge shortage of drivers, while demand for goods transportation by road continues to grow.

Furthermore, the study also reveals scepticism about the safety of heavy commercial vehicles without a person behind the wheel.

In Germany, France and the USA, 60 to 65% have safety concerns, while in Japan the figure is more than 70%. There is less scepticism in China, where almost half of those surveyed have no concerns. Overall, Continental's previous mobility studies over a ten-year period show an increasingly positive attitude towards automated passenger car driving in most of the countries surveyed.

Mipi releases v2.0 of A-Phy serdes interface

The Mipi Alliance has released A-Phy v2.0, the latest version of the automotive high-speed asymmetric serdes physical-layer interface.

Version 2.0 doubles the maximum available downlink data rate from 16Gbit/s to 32Gbit/s on one channel, as well as adds an uplink gear with an eight-fold speed boost to support up to 1.6Gbit/s.

These enhancements support the higher bandwidth requirements for zonal and other emerging architectures.

Mipi A-Phy was purpose-built to provide high-performance links between image sensors and displays and their associated ECUs. It was developed to simplify the integration of greater numbers of onboard sensors and displays for adas, modern digital cockpits, in-vehicle infotainment and autonomous driving systems.

A-Phy offers a reach up to 15m, a low packet error rate of 10^{-19} over a vehicle's lifetime, high noise immunity, low latency, and low bandwidth channel requirements.

Version 2.0 features forward-looking enhancements in recognition of the increasing bandwidth and performance requirements for software-defined vehicles (SDVs), and zonal and other emerging architectures.

Pam4 support now extends up to gear five, up to 16Gbit/s. The addition of G6 and G7 gears, with Pam8 and Pam16 encoding is for speeds 24 and 32Gbit/s, respectively.

A 1.6Gbit/s uplink gear is more than eight times the data rate of the previous uplink gear, providing support for symmetrical 1Gbit/s Ethernet channels over A-Phy links for command and control of automotive peripherals.

No changes were made in the upper layers of A-Phy v2.0.

Version 2.0 is fully interoperable with v1.1 and v1.0, and devices using all three can coexist on the same network.

The alliance is creating a compliance programme to provide manufacturers with assurance their devices meet specification. The next test event will be in December.



Hyundai, Kia and Samsung increase smartphone and SDV integration

Hyundai and Kia are working with Samsung to enhance the integration between software-defined vehicles (SDVs) and smartphones.

Hyundai and Kia are gearing up for the SDV era, anticipating various in-vehicle services. To that end, they are working on an infotainment system and open mobility ecosystem, in collaboration with Hyundai's 42dot global software centre.

This development aims to provide a user-centred vehicle environment, enhancing the connectivity of the infotainment system set to be unveiled in 2026.

"Our goal is to enrich Hyundai Motor and Kia customers' mobility experience by offering personalised services that extend beyond transportation, seamlessly integrating vehicles with smartphones," said Chang Song, head of Hyundai's vehicle platform division.

Hyundai and Kia will develop technology to link SDVs and the smartphone ecosystem organically using Samsung's SmartThings.

By integrating with the IoT platform, they aim to enrich customers' mobility experiences, seamlessly connecting the entire process of vehicle use to smartphones and accelerating the transition to true SDVs.



Chang Song (left) and Paul (Kyungwhoon) Cheun

"Through our collaboration with Hyundai and Kia, customers will experience the convenience of SmartThings not only at home but also in their vehicles, transcending space," said Paul (Kyungwhoon) Cheun, head of Samsung Research. "We will continue to expand the SmartThings ecosystem, offering new lifestyles and value to even more customers."

Through this connectivity, Hyundai, Kia and Samsung will introduce a service for vehicle location verification. It will be expanded and advanced through integration with SmartThings Find, offering a global vehicle location tracking service.

The service is accessible via a crowdsourced network of hundreds of millions of Samsung Galaxy devices that use the Bluetooth Low Energy (BLE) technology to report their location, without restrictions related to cellular coverage.

Users can check their vehicle's location through the Connected Car Service app in unexpected situations, such as forgetting where they parked or in case of theft.

Even Hyundai or Kia customers whose vehicles aren't registered with the Connected Car Service can check the location through the SmartThings app.

Hyundai and Kia will also simplify the member registration process by linking user accounts with Samsung.

In the future, they plan to provide services for customers' lifestyles and tastes, such as healthcare, pet care and vehicle interiors, and continue to cooperate with Samsung to provide new mobility experiences.

Hyundai and Kia, with 42dot, plan to connect vehicles and smartphones seamlessly and continuously introduce services, aiming to make all daily experiences user-centred.

They also plan to develop services for convenient and enjoyable mobility experiences by sharing vehicle data APIs and software development kits (SDKs) with various business partners through the infotainment system based on an open ecosystem.

Hyundai and Kia intend to hold a developer conference in the first half of next year and plan to build an SDK, where external developers can directly participate and develop apps as well as a vehicle app market for SDVs.

Designing a Test System?
Who can you count on?
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Rohm and UAES sign long-term SiC supply deal

Rohm and United Automotive Electronic Systems (UAES), a tier-one automotive supplier in China, have entered a long-term supply agreement for SiC devices.

Since 2015, Rohm and UAES have been collaborating on automotive applications using SiC power devices. This partnership deepened in 2020 with the establishment of the SiC Joint Research Institute at the UAES headquarters in Shanghai.

And in 2021, UAES selected Rohm as a preferred supplier of SiC power devices.

The close long-standing technical partnership has led to the production and adoption of numerous automotive products with Rohm SiCs, such as on-board chargers and inverters for EVs.

This agreement gives UAES sufficient access to SiC power devices to meet the growing demand for SiC-based inverter modules, which have been supplied since November 2023.

Going forward, both companies will deepen their collaboration, contributing to technological innovation in the automotive sector by accelerating the development of SiC power products for EVs.

"The growing popularity of electric vehicles in the Chinese market has made the adoption and integration of power semiconductors like SiC increasingly important," said Guo Xiaolu, UAES deputy general manager. "Choosing Rohm as our long-term supplier of SiC chips guarantees a stable supply for future mass production."

Tsuguki Noma, corporate officer at Rohm, added: "To meet the need for SiC power devices that improve efficiency in the rapidly expanding electric vehicle market,



Tsuguki Noma (left) and Guo Xiaolu

Rohm has established a leading development and manufacturing system within the SiC industry. We believe that by working together, both companies can provide cutting-edge, high performance, high quality automotive applications."

- Three models of the Zeekr EV brand from Geely will use power modules equipped with Rohm's fourth-generation SiC mosfet bare chips for traction inverters. Since 2023, these power modules have been mass-produced and shipped from Haimosic, a joint venture between Rohm and Zhenghai, to Viridi E-Mobility Technology, a tier-one manufacturer under Geely.

Bosch and Pirelli cooperate on intelligent tyres

Bosch and Pirelli have agreed to cooperate on smart tyre technology.

The cooperation will combine Bosch's expertise in system-level hardware, software and mems sensors with Pirelli's Cyber Tyre technologies, algorithms, modelling and in-tyre sensors.

The companies plan to create software and driving functions from sensors integrated into tyres. For drivers, this could mean greater control, comfort and sustainability, as well as improved driving dynamics.

Bosch and Pirelli plan to explore enhanced tyre signal computing logic as a potential input for enhanced vehicle dynamic controllers.

Pirelli Cyber Tyre uses tyres with integrated sensors that collect data and transmit them to the vehicle to be processed in real time. Bosch has already developed an ESP application adapted to Pirelli tyres in an initial joint project with hypercar manufacturer Pagani Automobili.

The Pirelli Cyber Tyre technology on the Pagani Utopia Roadster transmits tyre information to the ESP control unit. This optimises use of the individual properties of the tyres, providing enhanced control and tailored driving conditions.

Eclipse report views open-source software in automotive

The Eclipse Foundation has released the industry's first research report on the use of open-source software (OSS) in the automotive industry.

Titled "Driving innovation and building safer cars with open-source software", the report offers insights into how automotive decision-makers and software professionals are leveraging OSS to transform vehicle design and production.

"Open-source software is playing an increasingly vital role in the development of software-defined vehicles," said Mike Milinkovich, executive director of the Eclipse Foundation. "This is a significant milestone for open source considering the industry's rigorous standards for safety, security and reliability. The automotive industry's embrace of this model is a testament to the growing maturity of open source."

Commissioned by the foundation's software defined vehicle (SDV) working group, the study surveyed 300 automotive developers from OEMS and tier-one suppliers.

Most companies expect to see more than a 10% increase in innovation by leveraging open-source technologies and collaboration. Over 20% anticipate a 20 to 30% boost.

Almost all (98%) decision-makers and software professionals surveyed recognise the value of software-defined vehicle technologies.

A majority of respondents reported that open-source software in SDVs has helped or will help reduce costs and drive down operational expenditures.

About 95% of professionals expect OSS to enhance flexibility and scalability in SDVs.

OSS is valued for improved performance at 31%, enhanced security at 27% and customisation at 27%. Ease of use (29%), security (25%), customisation (22%) and the use of a common platform (21%) are the top reasons developers prioritise OSS.

It is the first of three reports. The second will cover the business value of OSS in the automotive industry, and the third will look at problems facing OSS in the automotive ecosystem.

Solid Sands
SuperGuard Library Safety Qualification Suite

How to qualify a C or C++ standard library implementation?

The C and C++ standard libraries are treated the same as any automotive software component, so the libraries should be tested and qualified for use in safety-critical applications with the same care and quality assurance. Especially for the C++ standard library, this is a challenge.

SuperGuard has the answers to this question.

SuperGuard Features:
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STM reveals fourth-gen SiC mosfet technology

ST Microelectronics has revealed its fourth-generation STPower silicon carbide (SiC) mosfet technology, said to improve power efficiency, power density and robustness.

While serving the needs of the automotive and industrial markets, the technology is optimised for traction inverters, a key component of electric vehicle (EV) powertrains.

"ST Microelectronics is committed to driving the future of electric mobility and industrial efficiency through our cutting-edge silicon carbide technology," said Marco Cassis from STM. "We continue to advance SiC mosfet technology with innovations in the device, advanced packages and power modules."

While the EV market continues to grow, problems remain to achieve widespread adoption and car makers are looking to deliver more affordable electric cars.

The 800V EV bus drive systems based on SiC have enabled faster charging and reduced EV weight, letting car makers produce vehicles with longer driving ranges for premium models.

The SiC mosfet devices, which will be available in 750 and 1200V classes, should improve energy efficiency and performance of 400 and 800V EV bus traction inverters, bringing the advantages of SiC to mid-size and compact EVs.

STM has completed qualification of the 750V class of the platform and expects to complete qualification of the 1200V class in the first quarter of 2025.

Commercial availability of devices with nominal voltage ratings of 750 and 1200V will follow.

To accelerate the development of SiC power devices through its vertically integrated manufacturing strategy, STM is developing multiple SiC technologies in parallel to advance power devices over the next three years.

The fifth generation will feature a high-power density technology based on planar structure. STM is at the same time developing an innovation that promises better on-resistance value at high temperatures.

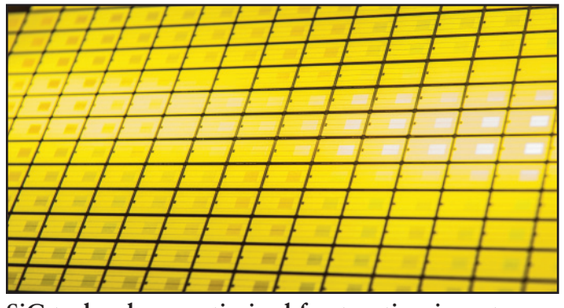
The fourth-generation technology provides extra robustness in dynamic reverse bias conditions, exceeding the AQG324 automotive standard, ensuring reliable operation under harsh conditions.

The average die size of fourth-generation devices is 12 to 15% smaller than that of the third generation, allowing for more compact power converter designs.

The improved power density supports the development of more compact and efficient power converters and inverters for both automotive and industrial applications.

STM has already supplied STPower SiC devices for more than five million passenger cars worldwide in a range of EV applications including traction inverters, on-board chargers, DC-DC converters, EV charging stations and e-compressors.

With the recently announced vertically integrated SiC substrate manufacturing facility in Catania, expected to start production in 2026, STM says it is moving quickly to support the rapid market transition towards e-mobility and higher efficiency in industrial applications.



SiC technology optimised for traction inverters

Hesai and Saic VW sign lidar deal

Lidar firm Hesai Technology is cooperating with Saic Volkswagen to build an automotive ecosystem for lidar products and technology.

Saic Volkswagen is a Chinese-German joint venture formed in 1984 in China, where it sold 1.2 million cars in 2023.

Hesai integrates the manufacturing process of lidar into the R&D design process, ensuring performance, reliability and cost-effectiveness while promoting rapid product iteration. Hesai has accumulated more than 1700 patents and patent applications worldwide.

Hesai is ranked top of the robotic car lidar market globally, with a 74% market share.



Siemens lets SiliconAuto reduce development time

SiliconAuto has adopted Siemens Pave360 software to help reduce development time for semiconductors for the automotive industry and offer a software development environment prior to silicon hardware availability.

This should accelerate its silicon development and let potential customers shift left their development processes.

Established last year, SiliconAuto is a joint venture between Stellantis and Foxconn dedicated to designing and selling semiconductors to the automotive industry.

SiliconAuto's goal is to provide a virtual reference development environment for its forthcoming adas SoC prior to silicon hardware availability.

To do this, it adopted Pave360, enabling the company to build an automotive standards-based multi-client, multi-fidelity, virtual development environment that mixes existing tooling and models with new virtual SoCs and real-world inputs.

This lets it gain early insight, enable early software development and provide key metrics for decision criteria.

"SiliconAuto's commitment to driving innovation in the automotive industry is exemplified by our collaboration with Siemens," said Shawn Tien, vice president at SiliconAuto. "By leveraging Pave360, we are not just accelerating development but also paving the way for future-ready vehicles that meet the highest standards of safety and performance."

David Fritz, vice president at Siemens Digital Industries Software, added: "The pace of development for the advanced technologies required for next-generation electric vehicles is accelerating. OEMs and suppliers need to be able to prove out, simulate and iterate software capabilities long before hardware becomes available. SiliconAuto's selection of Pave360 for its environment of choice for pre-silicon software development shows that our standards-based approach is enabling leaders in the automotive industries to accelerate their development processes and deliver the functionality that the next generation of vehicles is demanding."

SiFive licenses Risc-V cores to Arkmicro

SiFive has licensed its automotive Risc-V IP cores to Chinese chip company Arkmicro Technologies.

With ISO 26262 and AEC-Q100 certifications, Arkmicro's products are used by companies such as BYD Auto, Chery and Saic Motor.

The SiFive automotive series has achieved ISO 26262 and ISO 21434 certification.

The series includes the 32bit E6-A and 64bit S7-AD processor families. The E6-A series consists of the E6-AB processor, designed for real-time applications requiring Asil-B hardware integrity; the E6-AD processor, developed for adas and other safety applications; and the E6-AS processor, which supports configurable lockstep and non-lockstep modes and achieves Asil-D integrity when configured in lockstep mode.

The S7-AD supports functional safety in applications such as zone controllers and functional safety islands.

Pete Lewin, senior director at SiFive, said: "We assembled a world-class team of automotive functional safety experts to help our customers deliver safe, reliable and certified products."



Unreal Engine boost for Qualcomm cockpit platform

The Epic Games Unreal Engine real-time 3D creation tool is being deployed pre-integrated into Qualcomm's Snapdragon cockpit platform to help car makers deliver immersive user experiences.

For Snapdragon Digital Chassis and the cohesive human machine interface (HMI), car makers will be equipped to develop digital cockpit systems that are customisable and scalable across all vehicle types, and tiers.

The collaboration is the first time Unreal Engine has been directly integrated into the Snapdragon automotive platforms.

Car makers who use Snapdragon Digital Chassis will have access to Unreal Engine tools for providing in-cabin visualisation capabilities, including fully customisable 2D and 3D visuals.

Serving as a creative foundation for design, UX, UI and simulation, Unreal Engine supports unified assets across all applications, offering fast and flexible workflows that result in cost savings, while enabling real-time collaboration and iteration at every stage.

Leveraging computing, immersive graphics and AI, the Snapdragon cockpit platform can improve user experiences and drive the shift towards connected and intelligent mobility.

"We are excited to deepen our collaboration with Epic Games to set new standards of in-vehicle experiences," said Laxmi Rayapudi, vice president at Qualcomm. "By seamlessly integrating Unreal Engine with the Snapdragon cockpit platforms, we're empowering automakers and the ecosystem to innovate and elevate in-cabin experiences to new heights."

The HMI offering featuring Epic's Unreal Engine and Snapdragon cockpit is available for developers.

"Unreal Engine is the most open and advanced real-time 3D creation tool, providing unmatched fidelity and possibilities, whether you're building for games or for user interfaces," said Bill Clifford, vice president at Epic Games. "Partnering with HMI pioneer Qualcomm, and leveraging the capabilities of Unreal Engine and the Snapdragon Digital Chassis, we're excited to see how automakers usher in the next frontier in in-vehicle experiences."

SK Keyfoundry improves BCD process

SK Keyfoundry, an eight-inch pure-play foundry in South Korea, has launched its fourth-generation 0.18μm BCD process, which delivers approximately 20% performance improvement over the third generation.

With this, SK says it can provide improved mobile and automotive power semiconductor performance.

The 0.18μm BCD process provides power devices up to 40V with gate inputs of 3.3, 5 and 18V, which can be used in automotive gate drivers.

It also offers multi- and one-time programmable (MTP and OTP) memory and sram as options to facilitate product design.

The process meets AEC-Q100 grade one, which ensures IC operation up to +125°C for use in automotive power semiconductors, and the thick IMD (inter metal dielectric) option enables automotive product designs that withstand voltages higher than 15kV.

Infineon and ZF apply AI to optimise software

ZF and Infineon are using AI algorithms to optimise software and control units for driving dynamics.

The companies have jointly developed and implemented AI algorithms for the development and control of vehicle software as part of the German government funded EEmotion project.

The project's objective was to develop an AI algorithm-based control system for automated driving that ensures more precise trajectory control in various situations.

The AI algorithm, proven in a test vehicle, controls and optimises all actuators during automated driving according to the specified driving trajectory.

ZF has added AI algorithms to its Cubix and Eco Control 4 ACC software, which have been implemented on Infineon's Aurix TC4x microcontroller with integrated parallel processing unit.

This resulted in more efficient AI algorithms and better use of computing power, which in turn leads to better driving performance and increased driving safety.

The two companies have proven this can, for example, carry out automated lane changes more accurately. The energy efficiency of driver assistance systems such as adaptive cruise control has also been increased.

The Cubix software makes it possible to control all chassis components in passenger cars and commercial vehicles. This includes longitudinal and lateral dynamics as well as the vehicle's vertical dynamics.

The Eco Control 4 ACC predictive cruise control system is being further developed using a computationally intensive optimisation algorithm and model-predictive control to achieve as much as eight per cent more range.

Idiada helps VI-Grade deliver digital twins

VI-Grade and Applus+ Idiada have strengthened their partnership to deliver high-fidelity digital twins, enhancing virtual testing for automotive OEMs.

VI-Grade provides human-centric simulation-driven vehicle development. It has expanded collaboration with Applus+ Idiada, a specialist in design, engineering, testing and homologation services for the automotive industry.

This partnership introduces Idiada's high-fidelity vehicle models – accurate digital twins based on real-world test data – into the VI-CarRealTime software for simulation and testing.

The collaboration enables automotive OEMs and suppliers to use Idiada's validated vehicle models in both offline and online simulations on driving simulators through the VI-CarRealTime platform.

These models, derived from physical vehicle testing, let manufacturers perform in-depth virtual evaluations of vehicle dynamics and performance with customisable parameters such as tyre models and payloads, ensuring flexible and accurate development workflows.

"The integration of our vehicle models into VI-CarRealTime ensures seamless interaction between virtual and physical test environments, enabling our customers to accelerate development cycles while maintaining uncompromising standards of safety and performance," said Guido Tosolin, senior manager at Applus+ Idiada.

Guido Bairati, managing director of VI-Grade, added: "This expanded collaboration with Applus+ Idiada further strengthens our commitment to our zero prototypes strategy, bridging the gap between virtual and physical vehicle testing. By offering vehicle models based on real-world data from Idiada's testing facilities, our customers can achieve more accurate simulations and faster development times. This strengthened partnership will greatly enhance their ability to prepare, validate and refine their vehicle designs in a virtual environment before moving to physical tests."



Applus+ Idiada vehicle models added to VI-CarRealTime

ARCHITECTURE

Time to reFUSE

Sreenath Unnikrishnan explains how efuses are helping drive the zonal architecture revolution for software-defined vehicles

The biggest disruption in the automotive industry in the past decade is the move towards software-defined vehicles. Traditional vehicle designs had hardware-based subsystems dedicated to specific functions such as the powertrain or infotainment. With the need to upgrade car models quickly, integrating multiple functions by building modular, flexible subsystems, also known as zones, becomes more efficient.

Instead of dedicated domain control units, cars can support two to three zonal control units with integrated functionality.

The transition to zone architectures includes the replacement of classic melting-wire fuses with semiconductor switches called efuses. Efuses have several benefits over discrete melting fuses.

They have resettable outputs that allow vehicle architects to optimise their location, as they no longer require replacement after a fault. They do not need to be easily accessible, which helps reduce cable lengths from the power source to the loads. Efuses also have improved fuse time-current characteristics with far less variability and thus the potential to reduce cable diameters, weight and cost of the wire harness.

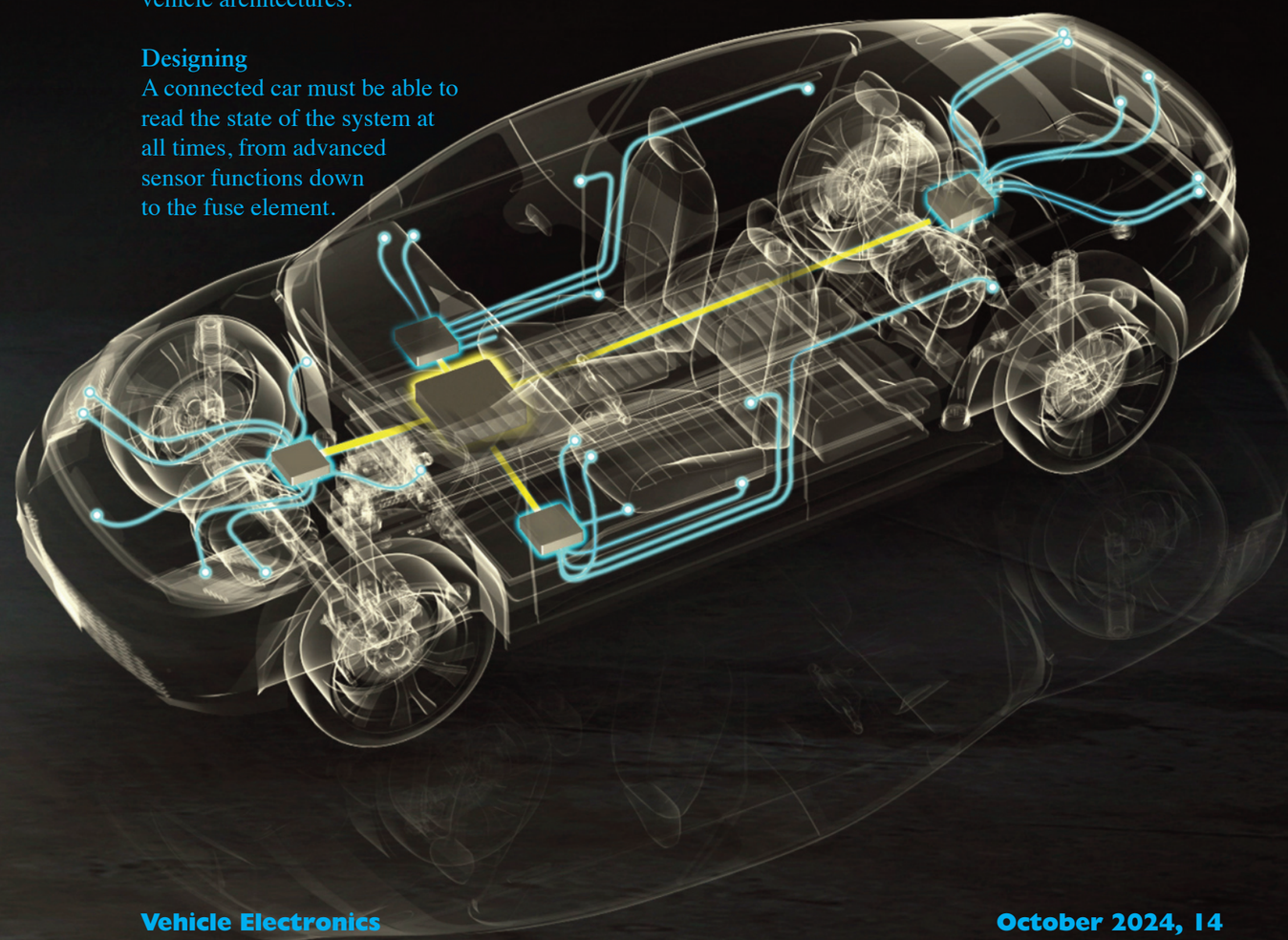
Providing additional capabilities to the power-management system improves preventive and failure diagnostics, helping manage electronic system power consumption to increase driving ranges in electric vehicles.

Fig. 1 shows the transition of melting fuses to efuses.

This article explains how a configurable efuse enables a faster transition to software-defined vehicle architectures.

Designing

A connected car must be able to read the state of the system at all times, from advanced sensor functions down to the fuse element.



In addition, zonal platforms mandate flexibility when fuse requirements change based on the load powered.

An efuse can help solve both of these problems by using an interface such as a serial peripheral interface (SPI) to configure switches dynamically based on the load requirements and to inform decisions by reading load diagnostics.

The overall system cost and component count are lower, despite the additional functionality, because efuses do not need external passive components to configure protection and diagnostics features.

Several switch and load failure diagnostics are available continuously over SPI, reducing microcontroller (MCU) overhead. An integrated analogue-to-digital converter (ADC) in the device allows full digital diagnostics readout over SPI, avoiding the need for an MCU-based ADC to read the current and voltage outputs.

Fig. 2 shows how an efuse senses the output voltage and detects short-to-battery or open-load faults without external components.

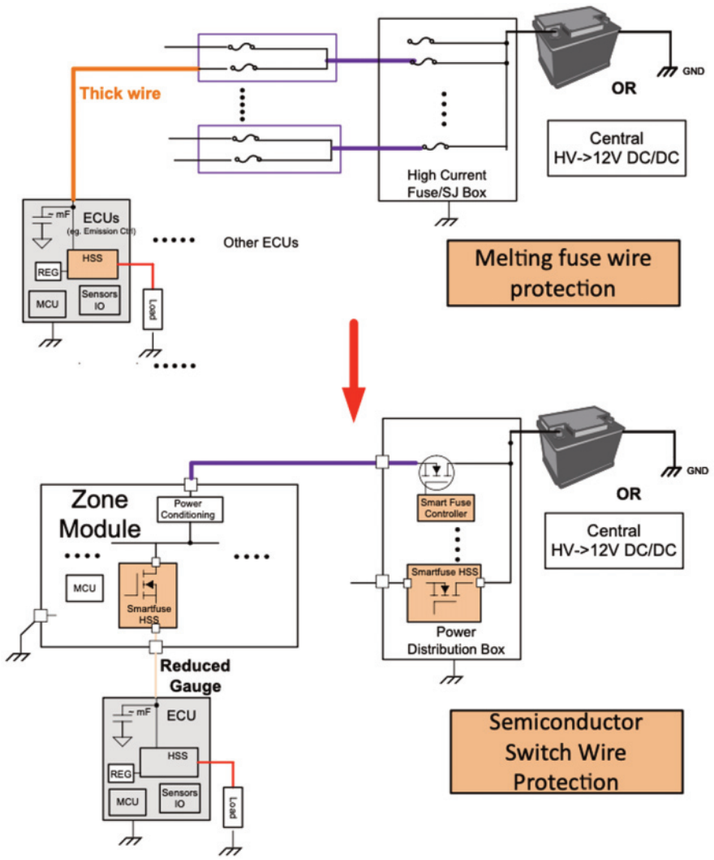


Fig. 1: Melting fuse replacement in zonal controllers and power distribution boxes

One of the most challenging aspects of development when transitioning to a software-defined vehicle is streamlining software and firmware development to enable a cohesive system. Validating multiple systems for various car models adds both cycle time and cost.

An efuse scales between low and high current loads while maintaining a common interface to programme and read information for multiple model variants with different output load characteristics. Having a digital interface for software configuration, control and diagnostics also lowers MCU IO pin requirements, reducing additional IO expander cost and PCB area.

Curves

Rather than a standard flat current limit, an embedded fuse characteristic time-current curve determines when or if the switch turns off, depending on the time and duration of the load current.

This enables the efuse to pass high load currents – motor inrush and stall currents, for example – for brief periods, but turn off under overload conditions to protect the wire harness, PCB traces and connectors.

Furthermore, SPI configuration enables a large programming range for fuse curves with just two parameters: the nominal current and shutoff energy trigger threshold. Fig. 3 illustrates an example protection scheme across the full current range.

Current

Many electronic control units (ECUs) remain on even while the vehicle is parked. The efuses providing power to these ECUs need to consume very low operating current so the battery does not drain too quickly, and the necessary loads can remain active.

Despite the lower current requirements, protection features remain active to keep the system protected against short-circuit events.

Even more importantly, efuses know when to switch between active and low-power settings by detecting load conditions so they can operate autonomously without adding overhead to the MCU.

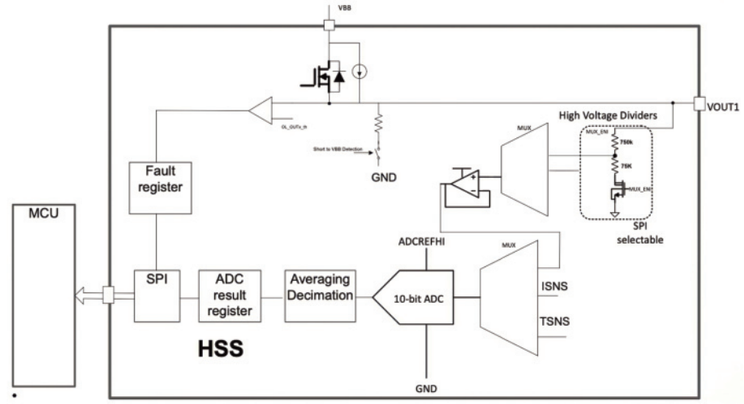


Fig. 2: Output voltage sensing and short-to-battery open-load fault detection with no external components and minimal MCU overhead

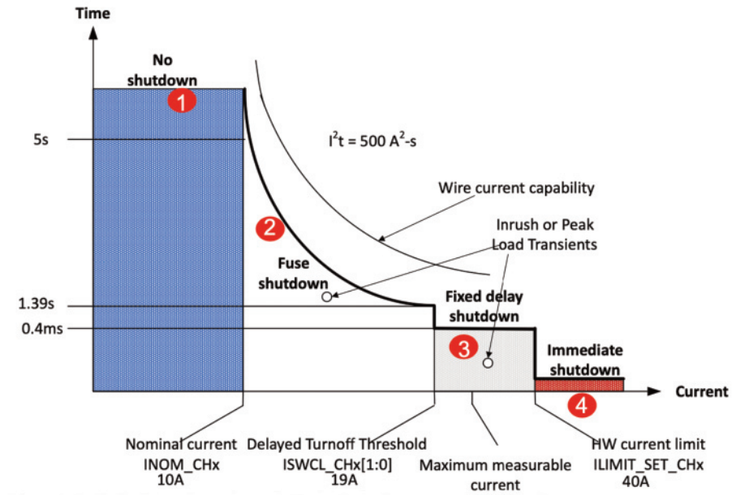


Fig. 3: Programmable fuse characteristics

Loads

Many zonal loads are capacitive in nature, thus the switches used to power them need to be capable of efficient capacitive charging.

While traditional fuses and switches don't have a way to charge capacitors, efuses offer a constant-current charging mode designed for cases where there is a significant load current during charging, or a fixed transient voltage mode for very large capacitive loads that charge with very low charging current.

In either case, the inrush current is limited to a low value during a programmable charging duration.

One benefit of an efuse is the device can drive both large and small capacitive loads by adjusting the current or voltage thresholds for charging. Configuring the device in capacitive charging mode is the best choice for the capacitance and a parallel load current draw.

Conclusion

Efuses address both development and technical challenges with features such as SPI communication, low power mode, I2T current limiting and intelligent capacitor charging. These switches enable a more evolved form of power distribution while providing protective and diagnostic functions for actuator drive applications.

They meet the system needs for smart power distribution and software-defined zonal ECUs while providing cost, space and time efficiencies in development. In the future, a traditional fuse in a car may never need replacing. as it becomes smarter and safer every day.



Sreenath Unnikrishnan is a senior member of the technical staff at Texas Instruments

DON'T STOP



How an ultracapacitor can improve performance during start and stop events

The constant starting and stopping of vehicle motors consumes an excessive amount of fuel and rapidly degrades components. However, an ultracapacitor coupled with a battery can provide high power during start and stop events, reducing fuel consumption and component degradation, and improving overall system performance.

Start, stop, start, stop – lorries, cars and all high-power motion machines, such as cranes, constantly start, stop, and need to be restarted. A typical vehicle uses ten times the amount of power to start compared with idling.

In addition, these machines require peak power at various times, such as when using hydraulic pumps, further contributing to the unevenness of power consumption.

The accumulation of harsh operation means consumption of fuel, wear and tear on systems, and exhaustion of the components. While harsh operation almost always results in greater fuel consumption, more frequent breakdowns and higher maintenance costs, one innovative company is reversing this paradigm with its smart ultracapacitor for automotive and large machine applications, feeding and storing bursts of energy. Further, the result offers improved system performance.

Enter Ioxus, a specialist in ultracapacitor cell and module manufacturing, and its innovative uStart ultracapacitor.

The smart power ultracapacitor module for automotive and transportation applications uses the benefits of an ultracapacitor combined with a traditional battery, creating a hybrid electrical system.

The ultracapacitor connects in parallel with an automotive battery, shown in Fig. 1, and provides high current during starting (cranking) and all other large current consumption scenarios, leveraging the fast discharge capability of the ultracapacitor.

The battery provides power when current requirements are low and works in combination with the alternator to charge the ultracapacitor. Overall, the ultracapacitor actively manages the vehicle battery's energy profile, providing a stable voltage across all operating conditions.

The benefits of an ultracapacitor extend to a wide variety of areas. Most importantly, by accommodating high currents, it prevents transients in the primary voltage. This stability reduces the wear and tear on the overall system, meaning longer operation of the vehicle without replacing components.

The starter motor and battery both run much longer because avoiding both over- and under-voltage and current conditions protects the magnets and windings in the starter motor and protects the chemistry of the battery.

Regenerative braking systems benefit by accommodating a wider range of power levels for charge acceptance, also provided by ultracapacitors. And the entire electrical system can be downsized.

Overall, these benefits result in less raw material mining, consumption and distribution of rare earth and other critical elements. As a final benefit, the carbon for the ultracapacitor comes from renewable natural resources.

However straightforward, these benefits do not translate into a simple development. Among the many challenges, the ultracapacitor manages power across the entire system, both detecting and responding to demand conditions, such as a starting event, and managing the charging of the battery itself. These events require sourcing and sinking energy quickly, within milliseconds.

The development requires consistent control of a complex array of gates through a multitude of load scenarios. EMI adds to the challenge, as automotive environments add tremendous noise to system voltages, where positive and negative voltage transients can be multiple times the battery voltage.

Another design challenge is meeting stringent EMC emissions requirements for vehicle OEMs

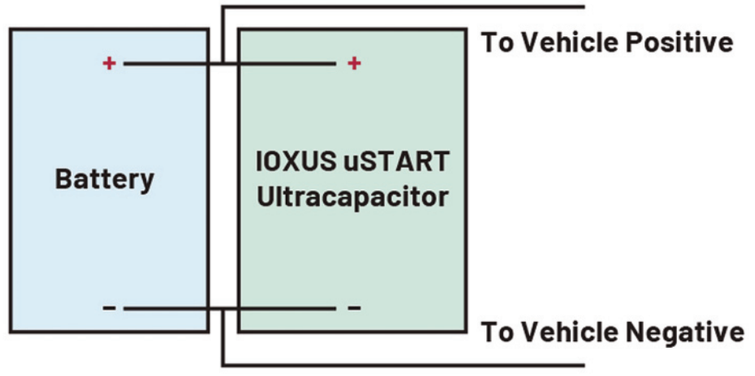


Fig. 1: Configuration of the Ioxus uStart ultracapacitor within a vehicle battery system



Fig. 2: Ioxus uStart v5 smart power ultracapacitor

across wide bands of radio spectra. Further, the chemistry and material connections require keen attention to source and sink power smoothly without unwanted resistance.

Ioxus' portfolio features multiple patents on the chemistry of both electrodes and ultracapacitor.

Ioxus partnered with Analog Devices to develop the power management system. The primary functions include charge management of the ultracapacitor, protection, isolation and system management.

The LT8390 buck-boost controller manages the amount and timing of current to charge the ultracapacitor efficiently from 0V up to its charge set point. It also features spread spectrum frequency modulation to reduce associated system radio frequency emissions for EMC.

The LT8609S synchronous step-down regulator works within the system to provide an efficient and stable voltage source for the control electronics. The LTC4368 provides over- and under-voltage as well as reverse current protection for the LT8390 while the Max17613 does the same for the LT8609S and the low power control electronics.

The vehicle power management system, using multiple Max253 and ADuM4221 devices to switch banks of power transistors, responds dynamically to loads and avoids going to a float voltage.

"When designing new, cutting-edge systems, it's nice to have a partner like ADI," said Joe Agrelo, senior electrical engineer at Ioxus. "Their high-performance products and power expertise make them an excellent partner."

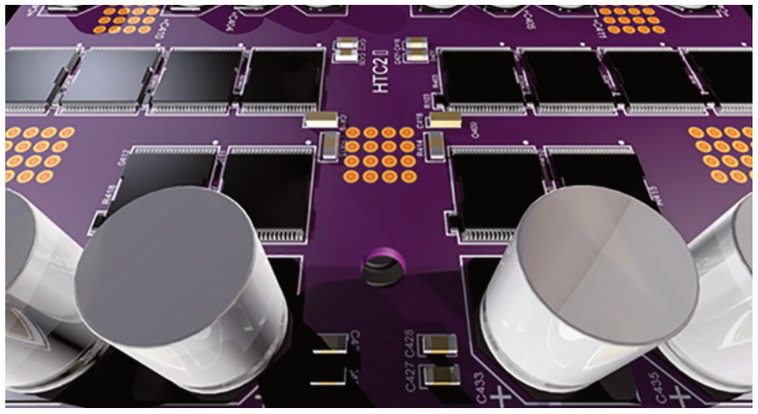


Fig. 3: Rendering of the electronics inside the uStart ultracapacitor

Conclusion

Products such as the Ioxus uStart ultracapacitor improve system performance and reduce energy consumption. The ultracapacitor takes on the difficult problem of constant motor starts and stops, including the associated fuel consumption and component wear, and solves it with an elegant product that also improves performance.



Hyundai Ioniq 5

PACKING THEM IN

John Li looks at how integrated power electronics are driving down the costs of electric vehicles

Efficiency is the key goal of electric vehicle development. This is especially true of power electronics, where one increasingly adopted approach is to integrate multiple functions into the same package.

For automotive OEMs, this can result in reductions in overall weight to increase the efficiency of the vehicle while also reducing the cost of production.

The power electronics of an electric vehicle have well-defined functions. The traction inverter transforms current from the high-voltage battery to the three-phase AC required to drive the electric motor. The onboard charger takes AC electricity from the grid to DC to charge the high-voltage battery.

The DC-DC converter takes high-voltage DC-DC and steps it down to the standard level, currently 12V and sometimes 48V, which can be used to power auxiliary functions in an electric vehicle. These include infotainment, sensors, lighting, steer-by-wire and most things outside the main drivetrain of the vehicle.

With the EV supply and

manufacturing chains starting to mature, one of the key ways automotive OEMs and tier-one suppliers seek to reduce costs and weight without sacrificing performance is by integrating power electronics. That is, combining multiple power electronics functions under one mechanical housing.

Inverters

The first way to integrate power electronics is by combining two inverters in one housing. The market is seeing a trend towards dual, tri and quad motor configurations in electric vehicles, especially in the USA.

In these vehicles, two motors can exist on one axle and an inverter will be required to drive each motor. A straightforward approach is to have two inverters share the same housing by integrating the circuitry for each inverter: power switching modules (Si IGBT or SiC mosfet), passive elements and control boards.

One example is the Rivian R1T, whereby two inverters share a housing, control board and capacitor bank. Conversely, Tesla uses single inverter housings for its models, taking advantage of the modularity of its well-known inverter.

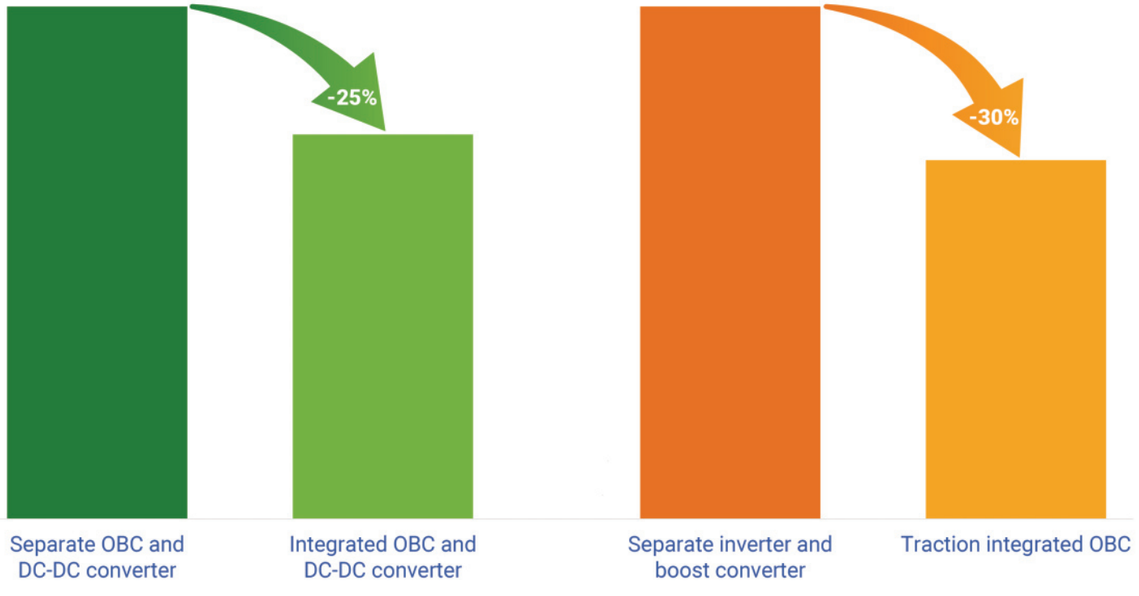
Integration

Many OEMs and tier-one suppliers turn to the integrated onboard charger and DC-DC converter. Bosch, Vitesco and Eaton are tier-one suppliers offering such options, and BYD's eight-in-one powertrain also combines the OBC and DC-DC converter in one housing.

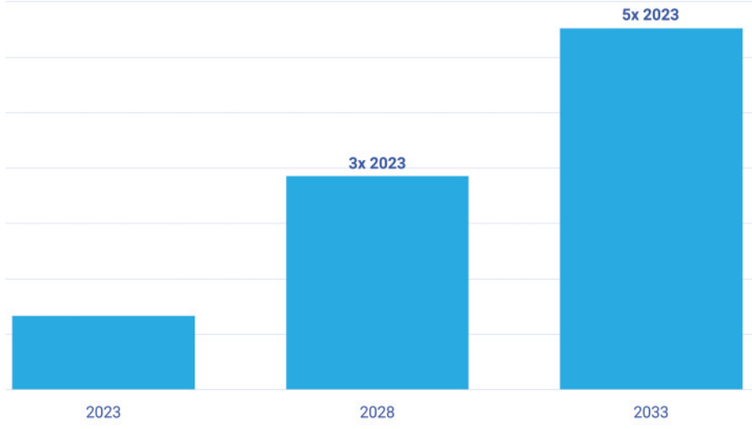
This could result in a cost saving of up to 25% when compared with two separate units. The amount of savings depends on the level of integration, including the mechanical housing, passive elements such as the capacitor, wiring (reducing the total copper content in the vehicle), control circuits, and cooling systems.

The sharing of these elements will also result in a weight reduction, which can yield a marginal increase in vehicle range, although this is unlikely to be significant with current integration methods.

Higher levels of integration bring engineering challenges, including thermal management, EMI and galvanic isolation. Further mechatronic integration



Potential cost advantages to integrating power electronics; bars are drawn to show the decrease in cost from the integration of two units together, but not relative cost between units with different functions, such as the separate OBC and DC-DC converter with the traction integrated OBC



Power electronics market size

will drive costs down over the coming ten years. Integrated systems may currently only significantly affect the mechanical housing and overall wiring, revealing further potential for weight and cost savings through higher levels of integration.

Traction

A key driver to adopting 800V architectures is faster and more efficient charging. The greatest charging power for 400V vehicles is 250kW, whereas for 800V vehicles this can increase to 350kW and beyond. However, if the vehicle is 800V, but the charging station natively charges at 400V, these greater powers cannot be accessed. Therefore, some vehicles are equipped with an extra DC-DC converter that steps up the voltage from the charging station to 800V, unlocking faster charging.

However, this extra unit then requires its own housing, connectors, transistors, circuits and cooling, adding cost and weight to the vehicle. This technology is already in the mass market, primarily in the form of the Hyundai Ioniq 5 and 6 and the Kia EV9.

An innovation comes in the form of the traction-integrated onboard charger. This adds boost converter functionality to the inverter unit; the motor windings act as filter inductance, and the power switches are used to step up from 400V from the charging station to 800V in the vehicle.

The ingenuity of such a system lies in that the inverter and boost converter will never be operating at the same time, as the boost converter operates when the vehicle is stationary and the inverter when the vehicle is moving.

The result of traction-integrated onboard chargers is faster charging, but it is still not as fast as a native 800V charging station. For example, the Hyundai Ioniq 5 charges at an average power of 149kW when on a 400V (rated 150kW) DC fast charger, but when on a native 800V (rated 300kW) DC charger, it can charge at an average power of 200kW, representing a 33% increase in charging power.

The integrated unit is bulkier than a typical inverter, but costs can be reduced by up to 30% compared with having a separate inverter and boost converter.

Conclusions

As previously highlighted, the integration of power electronics can yield technical challenges, such as thermal management and electromagnetic interference. OEMs will also need to consider where to install the larger integrated units. Some internal restructuring may be required to find the space in the vehicle to install the integrated unit. These installations may also need to be different for front-wheel drive configurations. Therefore, an integrated unit will likely have a knock-on effect on the internal structure of the vehicle.

However, the weight, volume and, most importantly, cost reductions make integrated power electronics attractive for automotive OEMs.

There is an increased adoption of integrated power electronics and a wider product offering from many tier-one suppliers. This is a key trend in the electric vehicle power electronics industry, with an integration of the inverter, onboard charger and DC-DC converter all in one unit potentially arriving by 2025.



John Li is technology analyst at IDTechEx

ELECTRIC VEHICLES

CHARGING UP A MOUNTAIN



Technagon believes charging stations should not only work well but look good, a goal towards which Advantech is helping

For Technagon, it is of paramount importance to build aesthetically pleasing charging stations from high-quality materials. This focus on design and quality appeals to all those who want to use their charging stations in high-quality environments.

German company Technagon has specialised in the development and manufacture of high-end charging stations for electric vehicles (EVs) since 2009. Its charging stations combine technology with an elegant, user-friendly design, offering innovations that are both functional and aesthetically pleasing.

The in-house development and production guarantee security for those using charging infrastructure at companies, in cities and municipalities, and in the hospitality or real estate sector.

Its products must therefore not only impress with their functionality, but also convey an impression of quality and value. This dual requirement places high demands on the design and the materials used, which emphasises the need for close cooperation with reliable technology partners.

This is where Advantech comes in.

Advantech, a provider of embedded hardware and software, offers a wide range of products used in markets from industrial automation to intelligent transport. With a global network of offices and development centres, including major locations in Germany, Advantech promises technical support and short delivery times. This makes it a suitable partner for companies such as Technagon that depend on high-quality and reliable technologies.

A central element of Technagon's charging stations is the Rom-5721 Smarc module from Advantech. This module is the basis of the charging controller developed in-house by Technagon.

The choice of the Rom-5721 was the result of a careful evaluation taking specific requirements into account.

Collaboration

There are many reasons for the cooperation between Technagon and Advantech. Taiwan-based Advantech is characterised by its size and global presence, which ensures reliability and short delivery times for its Smarc modules.

These factors are crucial for Technagon as it needs to ensure continuous production without interruptions, especially against the background of supply chain difficulties.

"Our partnership with Technagon is based on trust and the shared vision to provide innovative and reliable options for the EV charging market," said Horst Mattusch, director of sales in central Europe for Advantech. "We not only offer first-class products, but also actively support the design-in process to ensure seamless integration of our modules into Technagon's charging stations."

Another advantage of the collaboration is the presence of Advantech's development centres in Germany. This enables technical support directly on site, which simplifies the design-in

process of the modules into Technagon's infrastructure.

The close cooperation allows technical problems to be identified and solved quickly, shortening development cycles and reducing time to market for new products.

"Our charging stations are designed to fulfil the highest demands," said Manuel Pledl, CEO of Technagon. "The decisive factor here is also the use of high-quality, state-of-the-art components that allow us to move forward with innovative technologies. Advantech provides well thought-out options and reliable support, making an important contribution to meeting our demand for highest quality."

Another highlight of the collaboration is Advantech's warehousing. In times of global supply chain problems, Technagon can count on delivery of the required modules, thus avoiding production downtimes. This is a competitive advantage in a booming market such as e-mobility. Advantech says it always has enough products in stock to be able to deliver even in times of high demand or unexpected bottlenecks.

Performance

The module is at the centre of Technagon's charging generation and said to provide numerous advantages. In addition to precise control of the charging station, it also ensures all safety and performance requirements are met. By using Advantech's technologies, Technagon's charging stations can be operated efficiently and reliably.

The module is characterised by its performance and flexibility. It supports various interfaces and communication protocols, which facilitates integration into different systems. This versatility is particularly important for Technagon, as its charging stations are used in different environments and scenarios.

Safety

Safety is a crucial factor in the field of e-mobility. The module, together with Technagon's proprietary charging controller software and hardware, meets all relevant safety standards and provides protection mechanisms to ensure safe operation of the charging stations. This includes user safety, protection against electrical overload, and data integrity and security.



From the left, Horst Mattusch, Manuel Pledl and Reinier Middel, senior sales director at Advantech

Design

The design-in process is a critical step in the integration of new technologies. Advantech provides support to ensure the module is seamlessly integrated into Technagon's charging stations. This includes the provision of technical documentation as well as direct support from on-site experts.

"Our development centres in Germany enable us to offer our customers fast and efficient support," said Mattusch. "We work closely with Technagon to ensure that all technical requirements are met, and that integration runs smoothly."



Chargers from Technagon

Innovation

By working with Advantech, Technagon can offer its customers technological innovations that go beyond mere functionality. This includes, for example, the integration of IoT functions that make it possible to integrate the charging stations into more comprehensive systems and offer new services.

Expansion

Technagon plans to expand its product portfolio. This includes not only the integration of additional hardware components such as screens, but also the development of software that can improve the operation and management of the charging stations.

Advantech is an important technology partner in this regard and enables the realisation of new functions such as comprehensive fleet management for charging stations or predictive maintenance.

IoT connection offers possibilities to optimise the operation of charging stations. By using the existing Advantech infrastructure, the charging stations could be integrated into a comprehensive fleet management system. This would make it possible to monitor and manage the status and performance of each charging station in real time.

In addition, by analysing the collected data, optimisation potential could be identified, and the efficiency of the entire charging system increased.

Another promising area of application is predictive maintenance. By continuously monitoring the charging stations and analysing the operating data, potential problems can be identified and rectified at an early stage before they lead to failures.

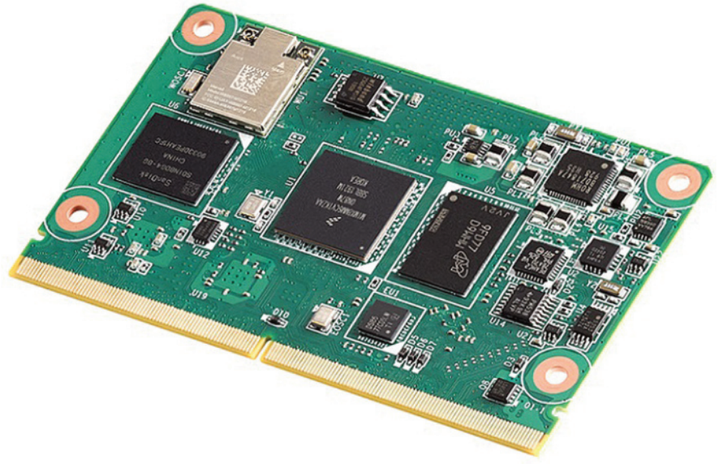
This increases the availability and reliability of the charging stations while reducing maintenance costs.

"The collaboration with Advantech opens up numerous new opportunities for us," said Pledl. "By integrating additional hardware and utilising advanced IoT technologies, we can increase both the efficiency and reliability of our charging stations."

Future

The collaboration between Technagon and Advantech is an example of how cooperation between specialists from different fields can result in high-quality innovations. This collaboration will not only improve Technagon's products, but also make a significant contribution to the further development of the EV infrastructure.

By combining aesthetic design and the latest technology, Technagon and Advantech are setting standards in the EV charging market, offering options that are both functional and visually appealing.



Rom-5721, based on the NXP i.MX8M Mini Cortex-A53 processor, is Smarc 2.0 and 2.1 compatible

ELECTRIC VEHICLES

MOTORSPORT

FULL THROTTLE

Revving up bike performance by improving throttle control reliability with brushed DC motors

Tyler Scott came second at Daytona 200 on a Suzuki GSX-R750

The Daytona 200 is arguably the USA's biggest motorcycle race, with 2024's event attracting 127 riders and eight million digital viewers, according to MotoAmerica. Placing highly in the race is no mean feat and requires precise, advanced bike design, where the importance of reliable throttle control cannot be overlooked.

Employing a high-power, compact brushed DC motor in the throttle actuator, such as those supplied by Electro Mechanical Systems (EMS) for Bike Sport Developments, is essential.

Motorcycle racing success doesn't happen overnight. Teams extensively plan and test their bikes, ensuring that the tyres, frame, telemetry and rider are prepared for each competition's unique conditions.

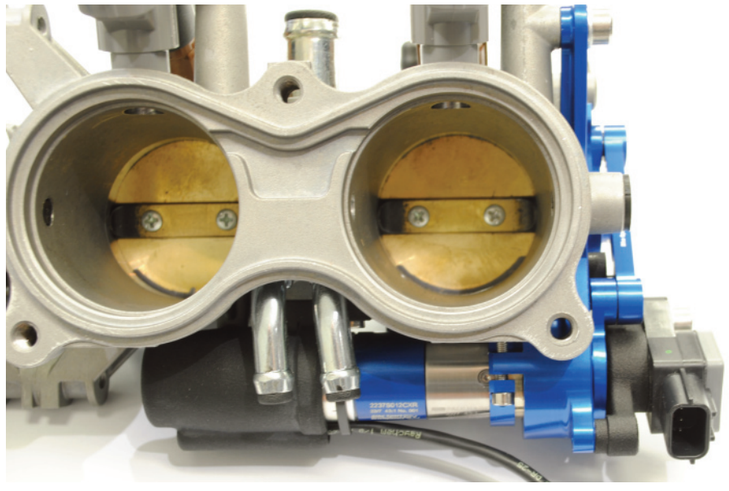
But there is one bike component that can make or break a rider's chances of winning like no other — the throttle actuator. Responsible for controlling air flow to the bike's engine, these actuators employ a DC motor to rotate the parts needed to open and close the throttle plate.

Reliable throttle control is essential for bike acceleration, deceleration, traction and stability. If the motor used in the actuator cuts out, the bike goes into failsafe mode, shutting down the engine and disqualifying the rider.

When motorcycle electronics specialist Bike Sport Developments was tasked with producing electronic throttle actuators for racing motorbikes by an American user working closely with Suzuki, reliability was a key consideration.

"We have traditionally supplied mechanical actuators for client projects, which are operated by cables," said Mick Boasman, founder of Bike Sport Developments. "However, the regulations of the American Motorcyclist Association races dictate that the actuator must be a computer-controlled ride-by-wire system. Essentially, these systems use the sensors from the electronic control unit, or the ECU, and the actuators to regulate the engine's air flow supply.

"Therefore, when I first approached EMS three years ago, I was looking for reliable electronics that could withstand the high temperatures and vibrations produced by the bike's engine. At that time, I had little indication of the product volumes the client would need, so I had to make sure that the motor was readily available with short delivery times."



Bike Sport Developments' electronic throttle actuator

EMS supplied Bike Sport Developments with a Faulhaber brushed DC motor with a 23mm diameter and a 26mm gearbox. EMS later reduced the motor size to 22mm, making it more compact and easier to integrate into the actuator assembly using the standard fixing points on the front of the gearhead and the flap on its outer shaft.

"As the sole UK distributor of Faulhaber motors, we have access to its innovative iron-free skew wound drive systems," said Paul Boughey, area sales manager at EMS. "This technology minimises the moment of inertia in the rotor, resulting in low cogging torque, increased precision and faster reaction times for the throttle."

After a prototyping process lasting approximately five months, the electronic throttle actuators were delivered to Italy for verification from another partner, before being shipped to America for track testing. This proved to be highly competitive in races, resulting in several other American teams also requesting the same product.

However, the supplied motors started burning out after more mileage and time was applied on the product, which had the potential to negatively impact teams' racing performance.



Side profile of electronic throttle actuator

Furthermore, the addition of the extra teams that had adopted the actuation systems made testing and altering the setup more difficult and time consuming for Bike Sport Developments.

Fault testing

"When the motors began to burn out, the situation was very stressful, especially given the importance of engine reliability," said Boasman. "However, faced with these challenges, EMS really came into their own. The team worked alongside Faulhaber to identify a list of potential causes for the motor failures, which we were then able to systematically test and rule out one by one."

Initially, EMS suggested altering the bike's ECU system, which could have been overloading the motor. However, since the electronic software was supplied by another partner of Bike Sport Developments' client and not directly through it, this proved unfeasible.

Bike Sport eventually opted for a modular plug-in inductor to sit between the bike's ECU and the throttle actuator, smoothing the current supply.

"Throughout the fault testing process, EMS was always on hand to support us," said Boasman. "The team's suggestions showed not only their willingness to help, but also their extensive product and application knowledge. After disconnecting our motor from the wiring of the bike and fitting the module between the two components, the issues we'd previously experienced with overheating and burning out stopped pretty much instantly."

Racing success

The project is now in its third year, with the past 18 months being free of motor faults. In this year's Daytona 200, six of the top ten placing bikes were Suzuki GSX-R750s, which use the throttle actuators supplied by EMS and Bike Sport Developments.

During the race, the bikes achieved 100 per cent throttle control reliability.

The actuator has not only brought success on the track, but also resulted in higher sales for Bike Sport Developments. Despite initially predicting to receive less than ten orders, the business has now sold over 70 of the actuation systems, with customers including teams in England, Germany, the Netherlands and France.

MANUFACTURING

Mike Thoeny shows how automotive manufacturing can be transformed with Industry 4.0 technologies

TRANSFORMATION

The automotive industry is experiencing a massive shift to the next generation of mobility. From the fast growth of electric vehicles (EVs) to the proliferation of software-defined vehicles, the industry's transformation requires rapid technological advancements, increased scalable computing platforms, and new business models in how manufacturers and suppliers work together.

Against this backdrop, Industry 4.0 enables greater productivity and quality in automotive manufacturing.

A 2022 McKinsey & Company article stated that: "Manufacturers in industries such as automotive and electronics, nearing the tipping point of digital adoption, are achieving even faster and more sustainable change through Industry 4.0."

The 2023 Deloitte Automotive Supplier Study also identified opportunities within the industry to streamline operating costs and introduce efficiencies, calling out that: "Suppliers can also look to make critical investments in technology and automation that will unlock even leaner manufacturing processes and set the foundation for long-term competitiveness."

In the automotive industry, leveraging advanced manufacturing technologies – such as artificial intelligence (AI), automation, robotics, simulation and digital twins – enable manufacturers to deliver differentiated products at scale with efficiency, agility and speed.

Excellence

Industry 4.0 technologies such as modelling and simulation early in the product lifecycle mean that automotive companies can be assured of greater efficiency and lower risk further down the line when they are producing at scale.

For example, within design for manufacturing (DfM), modelling and simulation are used to determine how to achieve the highest yield with the fastest cycle times well before a product reaches the manufacturing stage.

DfM guidance helps companies ensure product designs are manufacturable, eliminating scrap and bottlenecks while increasing product performance.



Design for manufacturing (DfM) can improve yield

Another big benefit of simulation in the automotive industry is during the production part approval process (PPAP), which is a strict documented process that ensures products delivered to users meet their requirements for performance, quality and delivery.

Simulation can speed up this process, building out production flows in software iteratively until the required capacity and capabilities are achieved, ahead of building products in real life.

This approach saves months of time and resources, enabling automotive manufacturers to accelerate next-generation mobility while maintaining quality, safety and resiliency. Automotive manufacturers are also able to streamline serial production by gathering early input into the process failure mode and effects analysis (PFMEA).

By simulating production lines and processes, they can quickly identify areas of highest risk and key bottlenecks and then develop and implement risk mitigation strategies in advance.

AI

From factory line optimisation to predictive maintenance and anomaly detection, AI offers many benefits to manufacturing processes. AI can help collect, analyse and detect machine issues on the factory floor before they happen.

With significant upstream data from connected machines, AI models can predict when an adverse event might happen, allowing manufacturers to prevent failures and mitigate downtime.

Applying AI on a line that has, say, two almost identical capacitors is particularly beneficial as there is little difference between the two components, which makes it challenging for the human eye to detect anomalies. This is a critical area of concern because if the wrong capacitor is used, the product won't operate.

By using visual data and AI, systems can identify if an employee has placed the components in the correct spot and provide resolutions to fix issues in real time. This translates to greater performance and yield, and enables scrap reduction by identifying issues before a part is sent to another step in the line.

Digital twins

Digital twins – which represent cyber-physical systems where information flows between the simulation and the physical world – enable the next level of optimisation in product design and manufacturing processes.

This closed-loop approach allows for precise modelling, quality assurance and optimisation of complex manufacturing processes in the automotive industry, where safety and reliability are paramount. In an increasingly chaotic world, digital twins also allow manufacturers to understand quickly the true risk and impacts of disruptions.

For example, automotive manufacturers can simulate line flow to understand the potential effect of shortages and other difficulties, then identify alternatives and optimisations to limit the impact. This helps accelerate the change process and validates changes before implementation, resulting in cost and time savings.



Manufacturing technologies can deliver differentiated products at scale

Underway

Simulation tools can be leveraged to help automotive companies design, build and deliver high-quality products at scale, faster. Simulation can also help factories identify the best line configuration for specific product and process requirements, as well as create different space optimisation scenarios for new and current projects.

Simulation also helps identify critical characteristics and processes to define quality assurance controls and achieve zero defects, as well as determine which industrialisation process fits best with product requirements to increase quality and productivity.

Finally, simulation can be used as a complementary stage in DfM to validate the manufacturability of products and suggest design improvements before products go to full scale production.

With one highly complex automotive computing project, automotive manufacturers can double their output while optimising cost.

To succeed in today's new era of mobility and technological acceleration, automotive manufacturers must navigate a dynamic business landscape to get innovations to market faster, more reliably and more sustainably.

Industry 4.0 technologies such as automation, simulation and digital twins deliver significant competitive advantages for manufacturers, empowering them not just to survive today's challenges, but to thrive and play an active role in defining the next generation of mobility.



Mike Thoeny is president of Flex's automotive business group

Oscilloscope aids inverter and motor development

A compact and lightweight multi-channel oscilloscope from Yokogawa is for high-precision, high-speed measurement of complex digital waveforms during inverter and motor development and testing.

The DLM3000HD high-definition oscilloscope is supported by IS8002CDV classic data viewer (CDV) software.

With a line spanning 500 and 350MHz bandwidth models, the combination of low-noise detection and high resolution helps technicians perform studies in detail faster.

The software enables swift analysis of measurement data and algorithms

Using the instrument to capture accurate voltage and current waveforms with high sample rates addresses the capabilities of electric motors and drives to ensure efficiency in transportation applications.

Another driver is power devices deploying SiC technology, which can switch on and off in a few nanoseconds. Oscilloscopes offering bandwidths of 350MHz or greater are needed to capture the fast rising and falling edges of the transient high-intensity voltage spike during switching.

Thanks to its multi-channel measurement, wide bandwidth capabilities and improved vertical axis resolution, it can perform precision parameter measurements, statistical analysis and real-time mathematical functions.



Compared with the DLM3000, resolution 16 times greater (12bit) in the vertical axis captures waveform overshoot and ringing for more accurate observation of tiny changes in high-speed signals.

A 1Gpoint memory supports the development and evaluation of inverter devices by recording multiple channels simultaneously. Engineers can make accurate observations of subtle changes in measurement target signals over a long period, even at sample rates up to 2.5GS/s, confirm signal waveforms, and detect signals causing unexpected anomalies.

There is an auto set-up function for in-vehicle serial bus development and evaluation, a capability that is also possible during post data acquisition analysis. It automatically configures the optimal bit rate and threshold level, accelerating the delivery of secure, reliable measurements in the automotive industry.

Users can take advantage of four-channel synchronous measurement, while the optional dual-unit synchronous measurement function facilitates a unified system of eight channels at the touch of a button by connecting two units.

It supports time synchronisation with power analysers and other waveform measuring devices, providing time-correlated measurements.

High noise immunity allows operation in harsh environments often prevalent in development and testing areas, meaning the touch panel is less likely to malfunction. It is possible to disable the touch panel and use only the buttons if necessary.

The software offers remote control without the need for programming.

The offline analysis of files also lets engineers and researchers use the instrument for other measurement tasks.

Target markets include electronics in transportation sectors such as automotive and rail, including electric and autonomous vehicles.

It can be used to design and assess in-vehicle serial bus and network protocols, including Can and Can-FD. It is suitable for the development and analysis of SiC and GaN inverters, EV chargers, DC-DC converters, ECUs and embedded mechatronic devices.

It can also be used for the analysis and testing of industrial devices such as high-efficiency motors, robots and sensors.



Can interface

A network interface from Vector provides flexible support for all Can standards – Can-XL, Can-FD and classic Can.

The VN1641 is for tasks such as remaining bus simulation, analysis, diagnostics, calibration and flash programming.

It supports Can-XL with data rates up to 20Mbit/s with Can SiC XL transceivers.

Error signalling enabled and disabled modes are supported.

Implementing hardware-based flash protocol support ensures fast flashing for Can and Can-FD.

With interchangeable piggies, it adapts to almost any Can application, ensuring future compatibility and flexibility.

Integrated IO functionality allows synchronous acquisition of signals along with Can and Lin messages and switch loads up to 500mA via a digital output.

It can be connected to the host computer via USB 3.2 gen one or Ethernet 1000baseT.

Sensors support steering and accelerator safety

Melexis has expanded its Triaxis magnetic sensing IC range with stacked dual-die variants of the MLX-90425 and 90426.

Featuring a 5mT stray field immunity and 360° rotary detection of the magnet, these ICs support safety requirements for steering wheel and accelerator pedal position sensing.

The push for higher autonomy creates a demand for increased electrification and by-wire systems that can replace traditional mechanically linked systems. By-wire designs for steering, throttle and braking require reliable sensing with built-in redundancy.

This redundancy is essential to ensure functional safety. Furthermore, for the expanding EV market, it is vital to have immunity to stray field effects to guarantee accurate measurements.

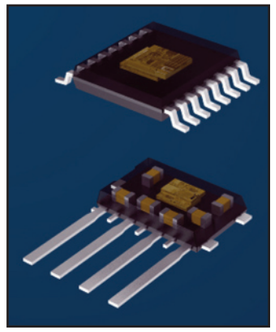
The ICs include a dual-die design, which combines two ICs in a single tssop-16 (SMD) or SMP-4 (PCB-less) package.

They are Asil C and enable up to Asil-D system-level integration. Compared with a discrete dual option, both provide enhanced integrations.

At the core of both is magnetic technology capable of robust measurement of the magnetic flux in a single IC.

Both have a programmable linear transfer characteristic with up to 17 points and an operating temperature of -40 to +160°C, which is suitable for automotive applications.

The MLX90425 has an analogue ratiometric or PWM output, while the MLX90426 is equipped with a digital Sent output.

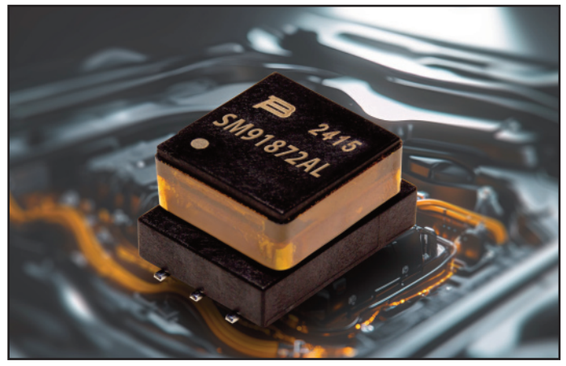


Transformer suits BMS applications

A single-channel reinforced isolation transformer from Bourns is constructed with a fully automated over-moulding process.

This makes the SM91872AL suitable for battery management system (BMS) signal applications in energy storage systems and electric vehicles (EVs).

The AEC-Q200 compliant automotive-grade transformer has a working voltage up to 1kV and a Hi-PoT isolation voltage up to 4kV AC with an extended operating range of -40 to +125°C.



Creepage and clearance distance is greater than 10mm, and its reinforced isolation complies with IEC 60664-1 and IEC 62368-1.

Leakage inductance at 100kHz, 0.1V, is 1.0μH maximum.

It comes in a six-pin package on tape and reel, and is RoHS compliant.

Inductors operate up to 165˚C

Two power inductors from Vishay come in the 2.5 by 2.0 by 1.2mm 1008 case size.

The commercial IHLL-1008AB-1Z and automotive-grade IHLP-1008ABEZ-5A achieve the same performance as the next-smallest IHLP inductor in a 55% smaller footprint while offering operating temperatures from -55 to +165˚C, a wider range of inductance values and lower DCR.

Offering inductance values from 0.33 to 4.7μH, the IHLL-1008AB-1Z's terminals are on the bottom only, enabling a smaller land pattern for more compact board spacing. The IHLP-1008ABEZ-5A's terminals are plated on the bottom and sides, allowing for the formation of a solder fillet that adds mounting strength against high mechanical shock while simplifying solder joint inspection.

The AEC-Q200-qualified device has a typical DCR down to 12.0mΩ.

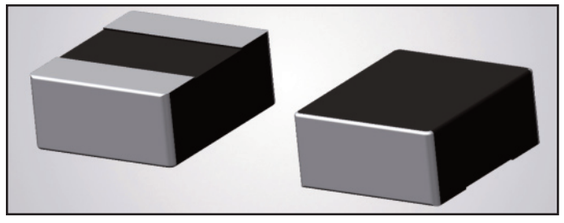
With better performance than ferrite-based technologies, both devices have a robust powdered iron body that completely encapsulates their windings, eliminating air gaps and magnetically shielding against crosstalk to nearby components. Their soft saturation curve provides stability across the entire operating temperature and rated current ranges.

The low DCR and high current handling are results of their flat wire coil, which directly terminates and forms the leads of the inductor, eliminating the need for a lead frame. Precision laser stripping, followed by an electrode plating process at the leads, ensures ease of solderability and the ability to withstand repeated thermal cycling for increased reliability.

The devices are for DC-DC converters, noise suppression and filtering.

The IHLP-1008ABEZ-5A is suitable for automotive infotainment, navigation and braking systems; adas, lidar and sensors; and engine control units.

Packaged in a 100% lead (Pb)-free shielded, composite construction that reduces buzz, they resist thermal shock, moisture and mechanical shock, and handle high transient current spikes without saturation. The devices are RoHS-compliant, halogen-free and Vishay Green.



Mosfets with low on-resistance

N-channel mosfets from Rohm have low on-resistance making them suitable for applications such as motors for doors and seat positioning, and LED headlights.

They come in voltage ratings of 40, 60 and 100V.

A split-gate structure helps achieve low on-resistance, contributing to higher efficiency. All are AEC-Q101 qualified.

For space-constrained uses such as adas, the 2.0 by 2.0mm and 3.3 by 3.3mm packages are suitable. For power applications, the widely used TO-252 DPak 6.6 by 10.0mm package is available.

Mounting reliability is enhanced by using wettable flank technology for the 2 by 2mm package and gull-wing leads for the TO-252 package.



Image sensor

A 12Mpixel cmos image sensor was introduced by Omnivision at this month's AutoSens in Barcelona.

The OX12A10 with TheiaCel technology can improve safety by providing enhanced resolution and image quality, regardless of lighting conditions.

It is for high-performance front machine vision cameras for adas and autonomous driving.

This is the highest-resolution sensor in the firm's 2.1μm TheiaCel family, which also includes the 8MP OX08D10 and 5MP OX05D10 devices.

TheiaCel harnesses the capabilities of lateral overflow integration capacitors (LOFIC) and DCG high dynamic range (HDR) technology to eliminate LED flicker regardless of lighting conditions. It also achieves a wider dynamic range than earlier automotive HDR architectures.

The sensor has a 1/1.43-inch optical format and is the first to feature the firm's a-CSP+ package technology. It measures 12,450 by 8100μm.

Sensor improves SoC accuracy for EVs

A single monitoring unit (SMU) sensor family from LEM helps designers of automotive battery management systems (BMS) extend the driving range of full hybrid, plug-in hybrid and battery electric vehicles.

The SMU continuously monitors such vehicle parameters as battery performance and safety systems. It also identifies anomalies and support diagnostics, which improves vehicle efficiency and ensures compliance with regulations.

The unit measures 29.1 (H) by 35.5 (W) by 49.9mm (L) while the busbar thickness is 2 to 3mm compatible. The integrated busbar has been designed to accommodate different busbar dimensions.

The key to increasing EV driving range is accurate state of charge (SoC) estimation, which means precisely determining remaining battery capacity.

The SMU is a Hall effect technology sensor, open loop configuration using the LEM9 asic. Designed to add intelligence at the battery disconnect unit level, the asic makes it possible to measure environmental factors while ensuring accurate sensor performance.

Accuracy is improved by software algorithms that can correct or adjust measurement data to account for distortions or errors caused by mechanical stresses. This enhances the precision of the sensor's readings and makes it possible to reach 1% of accuracy up to 1.3kA and less than 1.7% up to 1.5kA. The current range of up to ±1.5kA suits BMS applications.



Digital calibration provides end-to-end protection.

Features include improved offset and sensitivity calibration, and diagnostic warnings for under- or over-voltage.

Malfunction is avoided by a dedicated safe state mode should such issues as sensitivity and offset drift, temperature measurement errors, or memory errors be detected. Also, the sensor's internal microcontroller includes a built-in algorithm to correct for any magnetic offset, ensuring more accurate and reliable sensor readings by eliminating errors caused by residual magnetism.

Isolation levels enable it to withstand voltage differences greater than 800V between components or between the device and its surroundings. This improves safety and prevents electrical interference or damage.

The first version to enter the market is Asil-B ready with the possibility to extend it to Asil C.

MLCCs meet EV high-voltage demands

MLCCs from Samsung meet the growing demand for high rated voltages within the EV industry.

These 1812 X7R capacitors offer 2.2 to 470nF capacitance and rated voltage up to 2kV DC.

EVs are seeing the application of higher voltages to a growing list of power electronic components. In motion, the vehicle's charging and distribution system supplies energy to the electric drive system, motors and other sub-systems.

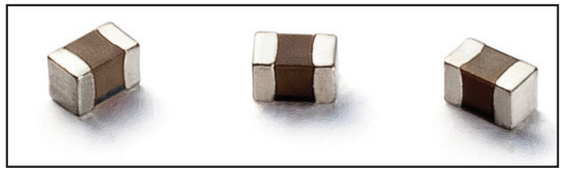
Initial generations of EVs connected these subsystems using 400V power rails. However, the trend today is towards 800V platforms, not just to take advantage of fast-charging technologies but also the greater efficiency of drivetrains at high torque or speed from higher applied voltage.

There are implications of this shift for key components such as on-board chargers, motor drive inverters, DC-DC converters, wireless power transfer systems, battery management systems, compressors and pumps. All require the support of MLCCs offering high rated voltage.

These MLCCs have higher bending strength in the 4.5 by 3.2mm size by employing proprietary ceramics, micronising materials and the application of soft termination technology.

These factors combine to meet the high-voltage demands of electronic components for EVs.

For use in operating temperatures up to 125˚C, all offer RoHS and Reach compliance. They meet AEC-Q200 and are in mass production.



SoCs add AI processing and speedier CPU performance

Renesas has added to its R-Car family of SoCs for entry-level adas with the V4M series and an expansion of the V4H series to deliver robust AI processing capability and fast CPU performance.

Their Tops/W performance and power-optimised features make them suitable for entry-level, cost-sensitive adas applications such as front smart cameras, surround-view, automatic parking and driver monitoring.

Based on the same 7nm manufacturing process as the V4H, the V4M delivers deep learning performance up to 17Tops and boasts high-speed image processing and precise object recognition using on-board cameras, radar and lidar.

The devices maintain pin compatibility within the same series and software compatibility with existing R-Car products, letting OEMs and tier-one suppliers reuse existing software and reduce engineering costs.

The V4M and V4H have up to four Arm Cortex-A76 cores delivering up to 81k DMips for application processing. They also come with three Cortex-R52 lockstep cores with up to 25k DMips performance for real-time operation.

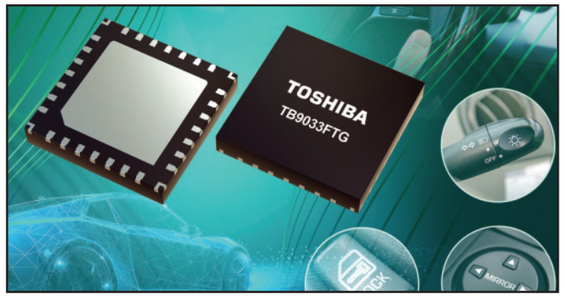
The devices are power efficient, providing 9Tops/W, thanks to their integrated design and manufacturing process technology.

In a typical full-feature smart camera with an 8Mpixel sensor, the V4M consumes around 5W.

Automotive engineers developing with the V4M and V4H can use the recently launched R-Car Open Access (RoX) SDV platform, which integrates essential hardware, operating systems, software and tools for automotive developers to develop vehicles with secure and continuous software updates.

The platform comes with an SDK and AI Workbench.





CXPI responder IC with built-in hardware logic

Toshiba is sampling the TB9033FTG, a clock extension peripheral interface (CXPI) responder IC with built-in hardware logic.

The hardware logic can control the data communication by the CXPI protocol and GPIO, so no need for dedicated software development, shortening development times.

The product enables multiplexing of automotive communications and reduces the number of wire harnesses used in body control systems, contributing to the reduction of vehicle weight.

Compared with the Lin protocol, the high-speed response of the CXPI responder interface device makes it suitable for applications such as steering wheel switches, meter cluster switches, light switches, door locks and mirrors.

The device has 16 GPIO pins; six of them can be switched to one circuit of 10bit A-D converter input, and four can be switched to four circuits of 8bit PWM output.

The device also has an input monitoring function during sleep mode, a switch matrix (4x4 maximum) input function, and an output function in the event of communication disruption.

Standby current consumption is 10μA, drawing low power while in sleep mode.

Low EMI and high electromagnetic susceptibility (EMS), mean less noise is generated, which eases system design. In addition, the device's high ESD characteristic makes it resistant to static electricity.

There are fault detection circuits for over temperature, overvoltage and low voltage. The device can predict fault conditions and automatically alert the commander node, contributing to improved fault detection performance.

Operating temperature is -40 to +125°C, and it conforms to AEC-Q100.

Audio amp includes automotive specific diagnostics

An automotive-grade analogue-input class-D audio amp from ST Microelectronics combines efficiency, small size and a low bill of materials, with load diagnostics optimised for automotive and native EMC.

With its feedback-before-filter topology and 2MHz nominal PWM frequency, the HFA80A lets designers optimise the output filter for targeted performance and achieve a compact outline with small component values.

Spread-spectrum operation simplifies meeting the mandatory Cispr 25 specification, with no additional EMC-specific filtering required.

The amplifier delivers clear listening experiences, driving up to four 49W into 2Ω speakers at 14.4V and with typical harmonic distortion (THD) specified at 0.015% (1W/4Ω).

Pure sound is assured, with low output noise and crosstalk as well as 80dB power supply rejection specified at 1W/1kHz with 4Ω loads.

Flat frequency response up to 40kHz ensures bandwidth for high-resolution audio, which designers can extend to 80kHz by optimising the filter. In addition, it can handle performance-centric applications such as noise cancelling thanks to low latency by design.

The automotive-specific diagnostics is based on a noise-immune algorithm capable of detecting anomalous load conditions and variations.

Features include independent DC and AC load detection for each channel, detection of short-circuit on start-up, and overcurrent protection with configurable thresholds.

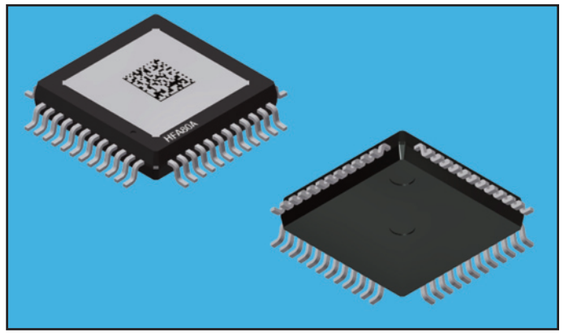
Further diagnostic checks include input-voltage DC-offset detection, output-current offset detection, and thermal protection with a choice of four thermal warnings.

A dedicated, configurable pin signals the host microcontroller when new diagnostic data are available, which simplifies host communications and relieves CPU load.

An I²C-bus interface provides access to the device features and diagnostic data, and a backup mode lets the amplifier continue operating even if I²C control is lost.

A digital admittance meter eases development by helping engineers check the connected speaker characteristics without external measurement tools or sensors.

It is available in a 7 by 7mm LQFP48L thermally enhanced package with exposed pads.



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