VEHICLE electronics

The monthly magazine for automotive electronics engineers

# Aumovio pays €350m to settle BMW brake dispute

Continental spinoff Aumovio has paid BMW €350m to settle all pending legal proceedings in connection with an integrated brake system that Aumovio, in its Continental days, produced for BMW.

The two firms have also signed a far-reaching, long-term supply and development agreement to expand their technology partnership leading to a planned order volume of more than €1bn.

The dispute related to a past warranty case in connection with an integrated brake system. The parties have agreed that all claims in this context, which were the subject of the legal dispute, are fully and finally settled.

The partnership will focus on collaborative projects for brake technologies and electronics. These include the MK C2 integrated brake system as well as components and systems such as brake callipers and electronic controls for future vehicle platforms.

"The agreement demonstrates confidence in our innovative brake technology and at the same time motivates us to further advance the partnership between our companies and jointly shape the future of mobility," said Philipp von Hirschheydt, Aumovio CEO.

For the MK C2, the companies have agreed to expand series deliveries until the mid-2030s. The MK C2 is an integrated one-box brake system that combines the master cylinder, brake booster and control functions such as the anti-lock braking system and electronic stability control in a compact and lightweight module.

The system increases functionality and availability while supporting key requirements of modern vehicle platforms, such as faster autonomous brake pressure build-up, efficient regenerative braking and functions for highly automated driving.

Last year, Aumovio emerged as a spin-off from Continental's former automotive group sector and has established itself as an independent technology company.




Aumovio's Frankfurt headquarters

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# Ford and Geely set up joint venture in Spain

Ford and Geely are establishing a Europe-focused joint venture at Ford's manufacturing facility in Valencia, Spain.

Ford will hold a 66% stake and Geely Auto 34%.

Subject to regulatory approvals, the joint venture is expected to begin operations in the first half of next year, with the first new vehicles scheduled to roll off the production line in 2028.

The Valencia plant will continue to produce the Ford Kuga. The planned vehicle line will also include a new member of the Ford Bronco family, an all-new multi-energy crossover designed by Ford and jointly developed with Geely, and two Geely-branded electric SUVs.

The partnership will include joint vehicle development.

By combining their strengths in products, engineering, manufacturing and market insight, Ford and Geely aim to improve plant use and development efficiency while expanding the range of multi-energy vehicles available in Europe.

Geely's External Collaboration Research Institute (ECRI) is an integral part of the Chinese firm's R&D system and serves as a platform through which Geely engages with global automotive partners on engineering and technology collaboration.

Through this approach, complex cross-company collaboration can be translated into clearly defined engineering programmes, appropriate allocation of resources and executable delivery plans.

Geely's cooperation with Renault in markets such as South Korea and Brazil shows how global automotive partnerships can be adapted to different regional and business requirements.

The partnerships in South Korea, Brazil and now Europe differ in ownership structure, product responsibilities and market objectives. Their underlying logic, however, is consistent: combining product, technology, engineering, manufacturing and local-market capabilities in ways that reflect the specific needs of each partner and region.





# Cranfield University drives autonomous vehicle projects



Autonomous test car at Cranfield University

Cranfield University is playing a key role in two UK autonomous vehicle technology projects.

The university is a partner in the Driven By Sound+ and 5D Rapid projects, which have secured funding through the UK government's Connected & Automated Mobility (CAM) Pathfinder programme.

Together, the projects aim to improve how autonomous vehicles detect, interpret and respond to complex driving environments, helping advance the safe deployment of automated transport technologies.

The funding is from the UK government's £150m CAM Pathfinder programme.

"Britain's autonomous vehicle sector is world-class, and with our modern industrial strategy we're bringing business and science together to support the innovators and businesses who are shaping the future of transport," said industry minister Blair McDougall.

Driven By Sound+, led by Calyo in partnership with Benedex and Cranfield University, will develop an all-weather perception subsystem designed to improve the reliability of automated driving across a wide range of environments and operating conditions.

The £1.25m project builds on a programme that demonstrated the use of 3D ultrasound sensors for autonomous navigation, and aims to create an integrated and commercially deployable perception system.

It focuses on improving how autonomous vehicles detect and understand their surroundings in real-world conditions such as rain, fog, spray and low light, which are particularly difficult for many existing camera and lidar systems.

The project will combine 3D ultrasound sensing with AI to integrate data from multiple sensors and produce an accurate model of the surrounding scene.

5D Rapid is a £2.5m project led by Oxford RF which also involves IPG Automotive, Coventry University, Ecosar Tech and Halo Drive.

The project is developing perception systems for self-driving vehicles that are safe, reliable and cost effective in a wide range of conditions. Current autonomous vehicles can struggle with fast-moving objects, poor weather or complex urban environments.

Cranfield University will integrate four Oxford RF radar sensors into its autonomous vehicle platform, alongside existing computing infrastructure, and test perception algorithms to detect and track road users in real time.

"These projects address some of the key technical challenges facing automated mobility," said Marco Cecotti, a lecturer at Cranfield University, "including improving the affordability and coverage of perception systems, ensuring robust performance in all weather conditions, and enhancing reliability in the face of component and system failures."

# SiEngine receives $200m to fund SDV work

ECarX-backed chip manufacturer SiEngine has secured $200m financing to accelerate silicon development for software-defined vehicles (SDVs).

The investment is said to validate ECarX's long-term vertical integration strategy and the eight-year-long collaboration between ECarX and its flagship silicon innovation affiliate.

Co-founded in 2018 by ECarX and Arm China, SiEngine has evolved into an independent automotive semiconductor enterprise, with ECarX remaining the company's largest shareholder.

SiEngine was created to develop tailor-made, vehicle-grade silicon chips for ECarX's full-stack SDV ecosystem, delivering cost-performance advantages for intelligent mobility.

This $200m equity injection will fuel SiEngine's R&D, production capacity expansion, globalisation and international customer growth.





# Tier IV and Astemo MoU to develop AI platform

Open-source software pioneer Tier IV has signed a memorandum of understanding (MoU) with Astemo to produce a software development platform for autonomous driving.

The two companies will leverage Tier IV's CoMLOps collaborative data-sharing technology to build Astemo's development platform, enabling the continuous improvement of production-quality end-to-end (E2E) autonomous driving AI models.

Astemo aims to deploy E2E autonomous driving AI models in passenger vehicles in the early 2030s using this platform.

These AI models integrate perception, planning and control into one learning process. They are emerging as a foundational technology for adas and autonomous driving.

Tier IV is working towards level 4+ to expand fully autonomous driving into more complex environments. E2E AI models are a key technology for achieving this.

Bringing these models to production readiness requires compliance with automotive safety and manufacturing standards. It also demands an AI development infrastructure capable of continuously collecting, processing, training and evaluating large-scale driving data.

Through their involvement in the Autoware Foundation and Soafee, Tier IV and Astemo previously collaborated on the reference implementation of the Open AD Kit cloud-native framework for autonomous driving development based on Autoware. Astemo is also involved in Tier IV's CoMLOps project, launched in 2024.

This latest initiative deepens their partnership and expands Tier IV's data-sharing platform for autonomous driving AI development.

The MoU lets the firms combine Tier IV's expertise in AI development with Astemo's expertise as a tier-one supplier.

This includes functional safety compliance and vehicle integration across braking, suspension, powertrain and adas technologies.



# EU emission rules driving sensor demand, says Mouser

Euro 7 vehicle emissions standards will drive increased demand for sensing, power and monitoring electronics as manufacturers prepare for the first regulatory deadlines in late 2026, according to Mark Patrick, a director at distributor Mouser Electronics.

The rules will apply in the EU to all new types of passenger cars and vans from 29 November 2026, and to all newly sold light-duty vehicles from November 2027, before extending to lorries and buses from 2028.

Manufacturers outside the EU will need to comply if they want to sell new vehicles into the EU market.

Euro 7 is the first European emissions standard to target non-exhaust sources such as brake and tyre wear explicitly alongside traditional exhaust gases, while also extending emissions compliance to up to ten years or 200,000km for many vehicle categories.



Demand up for sensing, power and monitoring

"Euro 7 compliance will be heavily driven by advanced electronics and real-time vehicle monitoring technologies," said Patrick. "As manufacturers move towards the 2026 and 2027 milestones, we expect to see more design activity around precision sensing of exhaust and non-exhaust emissions, robust power management for emissions systems, and on-board monitoring that can maintain accuracy over significantly longer lifetimes."

He said three areas were likely to see particular focus as engineering teams adapt existing platforms and develop new models for Euro 7: exhaust and after-treatment control; brake and tyre particulate emissions; and battery durability and on-board monitoring.

There will be increased use of high-accuracy NOx, particulate, pressure and temperature sensors, coupled with automotive microcontrollers and power management ICs, to maintain emissions performance under broader real-driving test conditions.

He said there would be further development of electronics for measuring and managing brake dust and tyre wear, from in-vehicle sensing and control to test and measurement systems for validating new materials and braking concepts.

More sophisticated monitoring of battery health, energy flows and system diagnostics in hybrid and electric vehicles will be needed as Euro 7 introduces minimum performance requirements for traction batteries over defined mileage and time.

"Engineers now have to design electronics that not only hit tighter particulate and monitoring requirements but also stay in specification for much longer in harsh conditions," Patrick said. "That creates challenges around component selection, thermal management and robustness."

# India phases V2V introduction

The Indian government is planning the phased implementation of vehicle-to-vehicle (V2V) communications.

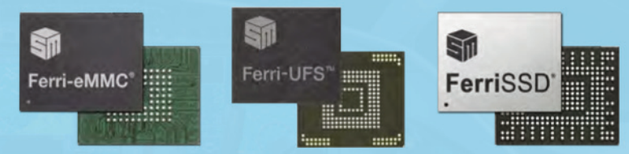
The 5.875 to 5.925GHz band is being considered for V2V and other intelligent transportation applications. The Department of Telecommunications has exempted the use of this frequency band from licensing requirements.

Under the draft notification, some vehicles manufactured from October 2027 onwards will be required to be fitted with V2V communications. More vehicles will be added the following year.

The AIS-230 standard has been developed with features to specify the minimum technical, functional, performance, environmental and security requirements for V2V communication systems.



SiliconMotion




## Silicon Motion's NAND Memory Solutions for Autonomous and Electric Automotive Applications

**Software-defined vehicles, advanced driver assistance systems (ADAS), autonomous driving, and increasingly sophisticated infotainment are transforming vehicles into data-intensive computing platforms. Cameras, sensors, radar, connectivity, digital cockpits, and black-box recording continuously generate and access data, increasing demands for storage capacity, bandwidth, reliability, and security.**



As vehicle architectures evolve from distributed ECUs toward centralized and domain-based computing, storage must support multiple applications while delivering predictable performance and long-term reliability throughout the vehicle lifecycle.
Silicon Motion provides integrated automotive NAND storage solutions designed for these demanding environments. The FerriSSD®, Ferri-UFS™ and Ferri-eMMC® families integrate proven controller technology with NAND flash to simplify system design while addressing the performance, reliability, endurance, and security requirements of next-generation vehicles.

### Built for Next-Generation Automotive Applications

Silicon Motion automotive storage solutions support a wide range of applications, including:

**ADAS & Autonomous Driving**
High-performance storage for sensor data, surround-view monitoring, driver monitoring, 3D maps, and autonomous driving workloads.

**Telematics & Connectivity**
Reliable storage for connected vehicle services, diagnostics, software updates, and data logging.

**Digital Cockpit & Infotainment**
Fast, responsive storage for navigation, digital clusters, multimedia content, and connected in-vehicle experiences.

**Black Box & Drive Recording**
Robust data storage designed to protect critical vehicle information and support sudden high-volume data writes.

### Silicon Motion Automotive Storage Advantages

- **Integrated Storage Solutions:** FerriSSD, Ferri-UFS, and Ferri-eMMC integrate controller technology and NAND flash to simplify automotive system design.
- **High Performance & Capacity:** PCIe NVMe, SATA, UFS, and eMMC solutions address different performance and capacity requirements across vehicle applications.
- **Automotive-Grade Reliability:** Designed to operate across demanding automotive temperature, shock, and vibration environments.
- **Data Protection:** Advanced NAND management technologies help maintain data integrity and extend NAND endurance throughout the vehicle lifecycle.
- **Security:** AES-256 full-disk encryption and secured password protection help safeguard vehicle data and over-the-air updates.
- **Power-Fail Protection:** Dedicated mechanisms help safely preserve user data during unexpected power loss, including vehicle collision scenarios.
- **Health Monitoring:** SSDLifeGuard software and commands enable SSD health monitoring to help maintain data integrity and reliability.

### Storage Ready for the Future of Mobility

As vehicles become increasingly software-defined, connected, and autonomous, storage becomes a critical part of the vehicle computing architecture. Silicon Motion's automotive NAND solutions provide the performance, reliability, security, and scalability required to support the evolution toward the data center on wheels.

# Soracom manages connectivity across vehicle lifecycle

Soracom is helping manage connectivity across the full vehicle lifecycle.

Its automotive suite's multi-carrier integration manages Soracom and third-party carrier lines through a unified interface. A connectivity hypervisor switches operator profiles remotely on a single IoT esim.

In-car wifi handles in-vehicle user experience for drivers and passengers. And it deals with downstream billing for direct end-user charging while split billing separates connectivity costs by usage type.

The company is also providing round-the-clock incident response for enterprise global operations.

"The connected vehicle is one of the most demanding environments in IoT," said Ken Tamagawa, CEO of Soracom. "A car ships once and stays on the road for more than a decade, crossing borders and regulatory regimes its connectivity was never provisioned for. We are entering the automotive market because the problem it presents – long-lived connectivity under constant change – is the problem our platform was built to solve."

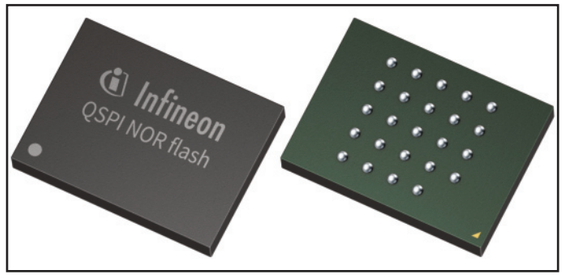
At the core of the suite, the connectivity hypervisor uses GSMA SGP.32 remote provisioning to download, switch and add operator profiles over the air after a vehicle is in the field.

A vehicle activates on a profile and switches to a local or use-case-specific carrier profile by region, regulatory requirement or application need, with a built-in profile fallback.

Through a mobile core, the platform reaches more than 500 carriers across 200 countries and territories, letting automakers apply the best profile for each market without renegotiating carrier contracts vehicle by vehicle.

The suite also supports multiple commercial models on a single sim. Using multiple APNs and traffic analysis, split billing separates connectivity costs across OEM telematics, operator services and end-user infotainment, so each party is billed for what it uses.

Soracom is a cloud-native IoT platform providing cellular and satellite connectivity, cloud integration, and AI services across 200 territories.




MediaTek chooses Infineon NOR flash

## Infineon collaborates with MediaTek on smart cockpits

Infineon is partnering MediaTek to enable an AI-driven in-cabin experience.

MediaTek has qualified the Infineon 512Mbit quad-SPI NOR flash automotive-grade memory for use in its Dimensity C-X1 cockpit.

This turns the Infineon device into an approved and adoptable memory option for automotive OEMs, tier-one suppliers and designers developing smart cockpits.

"Automotive memory is a strategic enabler of innovation as software-defined vehicles depend on high-performance systems-on-chip, increasingly complex firmware and large data stores," said Rainer Hoehler, a senior vice president at Infineon. "Cutting-edge digital cockpits and over-the-air update capabilities are driving the demand for higher density NOR flash."

Mike Chang, MediaTek vice president, added: "Infineon's automotive-grade NOR flash delivers the performance, reliability and functional safety features required for our premium and high-end Dimensity auto cockpit platform C-X1."

He said its high-density design enabled the advanced AI and user-experience capabilities that would be essential in next-generation software-defined vehicles.

The NOR flash stores the firmware and boot code required to facilitate AI-driven features at the SoC level, such as voice assistants, driver monitoring, travel vlog generation, environmental perception and personalised audio-visual recommendations.

By supporting safe and secure boot, it also provides critical redundancy for enhanced safety.

Built on Infineon's MirrorBit technology, it offers a robust interface, broad compatibility with automotive SoCs, AEC-Q100 qualification and operating temperature up to +125°C.





# Xen hypervisor update enhances SDVs

The Xen Project, an open-source virtualisation platform hosted by the Linux Foundation, has released Xen 4.22, the latest version of the open-source Xen hypervisor.

The release includes broadened hardware support, improved core infrastructure and enhanced system performance.

Advancements ensure hypervisors meet the growing demands of software-defined vehicles with targeted virtualisation benefits across enterprise and safety-critical industries.

In the automotive and embedded space, Xen continues to advance functional safety compliance and dom0less virtualisation, enabling secure, reliable isolation for production-ready automotive platforms, infotainment and driver assistance.

"Xen 4.22 reflects the steady momentum of our community and our continued investment in the future of open-source virtualisation," said Cody Zuschlag, community manager for the Xen Project.

Xen 4.22 expands hardware support across x86, Arm and Risc-V platforms while introducing infrastructure improvements that enhance scalability and system robustness. The release also advances the project's long-term maintainability through continued codebase modernisation, ensuring Xen remains a secure and reliable virtualisation platform.

Version 4.22 adds per-domain Xenstore quotas and watch-depth support to prevent resource over-consumption by individual guests, increasing scalability for large deployments. It introduces AMD Zen 5 bus lock threshold support to reduce system-wide performance degradation from improper atomic instructions.

The release enables guest suspension and resumption to ram via standard PSCI for improved power management. It continues Arm v8-R MPU support for safety-critical systems, and updates FF-A support to the v1.2 specification to streamline secure-world communication.






Road Alerts deliver real-time information on hazards

# Here alert service ups Euro NCap ratings

Mapping company Here Technologies' Road Alerts service now formally fulfils the requirements defined by Data for Road Safety (DfRS) to support Euro NCap scoring for real-time road hazard information.

This milestone enables automakers using Here Road Alerts to qualify for up to 1.35 Euro NCap points, depending on implemented use cases and system capabilities.

With the latest Euro NCap protocols placing increased emphasis on speed assist systems, vehicles are rewarded for their ability to receive local hazard information and inform drivers about these hazards through connected services.

Road Alerts directly address these requirements by delivering real-time information on hazards such as accidents, roadworks, slippery roads and reduced visibility as key inputs for speed assist and safety assist scoring.

Beyond regulatory alignment, Road Alerts provide tangible safety value so vehicles can anticipate and help drivers respond to real-world driving risks. The cloud-based service aggregates data from vehicle sensors, traffic feeds and other sources, delivering timely and high-confidence alerts to support safer driving decisions.

This enables earlier awareness of hazards ahead on the road, safer speed adaptation based on conditions, reduced risk of accidents caused by weather, congestion or unexpected events, and enhanced performance of adas and speed assist systems.

"Beyond delivering hazard intelligence to vehicles, Here can also support OEMs in contributing vehicle-generated hazard data to the DfRS ecosystem, providing a streamlined path to connected safety compliance and Euro NCap eligibility," said Remco Timmer, senior vice president at Here Technologies.

Vehicle makers gain a scalable way to improve safety assist scores through real-time hazard awareness, align with evolving Euro NCap protocols for connected safety services, deliver enhanced driver assistance capabilities across vehicle segments, and simplify Euro NCap compliance through optional support services.

Eligibility for scoring also requires automakers to participate actively by contributing relevant data for at least one supported use case via DfRS, ensuring a collaborative ecosystem that improves data quality and coverage over time.

This participation model aligns with Here's privacy by design principles and does not involve sharing personal data, user identities or other attributable signals with DfRS as part of the road hazard data contribution process.

Road Alerts combine real-time vehicle sensor inputs, traffic intelligence and cloud processing to deliver low-latency, continuously updated hazard information at scale.





# BMW uses NXP UWB to detect left-behind children

NXP's Trimension NCJ29D6 UWB family will be deployed in BMW's fleet, starting with selected 2026 vehicle programmes.

Addressing potentially emerging regulatory requirements and supporting future NCap protocols in Europe and China, presence detection technology helps reduce the risk of vulnerable passengers being left behind in a vehicle, where temperature levels can be unsafe.

The NCJ29D6 uses UWB technology to detect a living being left behind in the car by identifying subtle motion patterns consistent with occupant presence. The in-cabin presence detection system indicates the possible presence of people or animals in the cabin when parked and sends a warning message to vehicle users.

The NCJ29D6 is said to be the first monolithic automotive UWB device to combine secure fine-ranging and robust short-range radar capabilities, enabling safety applications such as presence detection.

Beyond a potential safety enhancement, UWB connectivity offers seamless convenience.

For instance, BMW's UWB-based Digital Key Plus replaces the traditional key fob with a smartphone or a smart watch.

This allows drivers to unlock and lock the vehicle automatically and hands-free, even triggering personalised experiences such as individual light conditions and welcome sequence upon approach.

"NXP's proven Trimension UWB platform maximises value for OEMs, using a single system to deliver multiple new and differentiating features for drivers," said Markus Staeblein, NXP senior vice president.

## Integration at IAA Transportation



**At this month's IAA Transportation in Hanover from 14 to 20 September, Aumovio will be looking at technologies that could transform the commercial vehicle sector.**

**"Efficient, software-defined commercial vehicles, safe and autonomous driving, and electrification must all advance simultaneously, not as standalone technologies, but as integrations that work in real-world operations," said Ismail Dagli from Aumovio. "The key is not only to develop innovation, but also to implement it in a way that is economically scalable. This is exactly where we are focusing our efforts."**

**Across four focus areas – efficiency, software-defined commercial vehicles, safe and autonomous driving and electrification – Aumovio will demonstrate in hall 11 and at the outdoor exhibit area how technology can deliver measurable value for commercial vehicle manufacturers and fleet operators.**

**At the show, the company will demonstrate how hardware, software, architecture platforms and services can be combined within a single integrated approach. This can shorten development cycles, accelerate the deployment of features and help manufacturers manage increasingly complex vehicle architectures more effectively.**

# Qualcomm to supply silicon to BMW for ten years

Qualcomm is to provide compute silicon for BMW's digital cockpit, adas and automated driving systems for the next decade.

The agreement reflects years of technical collaboration and Qualcomm's ability to deliver compute performance and AI capabilities that BMW's vehicle programmes require.

Spanning Qualcomm's Snapdragon Digital Chassis, its most powerful SoCs, the Snapdragon Elite automotive platform and dedicated AI accelerators, the agreement establishes the hardware basis for BMW to deliver future AI experiences.

"The versatility and performance depth of the Snapdragon Digital Chassis has enabled our companies to continually expand the scope and ambition of what we build together," said Nakul Duggal, executive vice president at Qualcomm. "Being selected as their lead compute silicon provider for the digital cockpit and automated driving reflects the trust BMW has placed in our technology and roadmap. As agentic and physical AI drive a new generation of intelligent vehicles, this collaboration enables both companies to define the future of mobility."

The companies' existing collaboration was demonstrated with last year's commercial launch of the Snapdragon Ride Pilot in the BMW iX3, the first vehicle in the Neue Klasse programme.

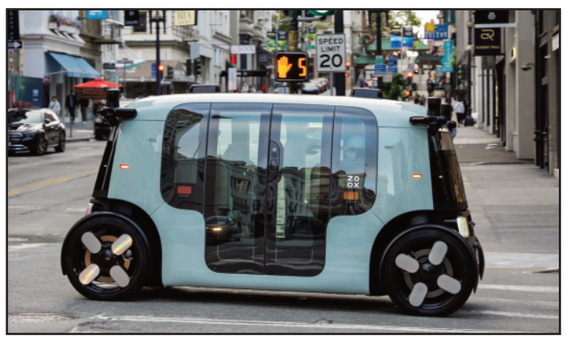
Co-developed by both companies, Snapdragon Ride Pilot powers BMW's symbiotic drive experience, integrating the driver into the automated driving system.

The Snapdragon Digital Chassis is Qualcomm's integrated automotive compute platform. Its products are purpose-built for their domain yet designed to work together on a common architecture, enabling the vehicle to function as a unified intelligent system.

# Zoox gets go-ahead to charge for robotaxi service

Amazon's autonomous driving subsidiary Zoox has been given the green light to charge for its robotaxi service using vehicles without a steering wheel.

It has received the first commercial exemption for a purpose-built autonomous robotaxi from the US National Highway Traffic Safety Administration (NHTSA).



Zoox robotaxi has no manual controls

With this, Zoox now has federal regulatory approval to charge for its robotaxi service.

Zoox was founded in 2014 to develop a purpose-built robotaxi to offer a premium ride-hailing experience.

Last year, the US administration and NHTSA opened an exemption pathway for domestic manufacturers developing autonomous vehicles without traditional manual controls. In August 2025, Zoox became the first AV company to receive a demonstration exemption under this process.

With this latest commercial exemption, Zoox can now move towards charging fares. It has been working closely with regulators in Nevada and California, where it currently operates its service, to complete all necessary requirements for commercial operations.

Last year, it launched a free service in Las Vegas and San Francisco. Since then, it has had more than half a million riders, and another half a million have signed up for its waitlist.

It is now charging fares in Las Vegas as the first step.

"We are excited to build on this momentum and expand what's possible with the unique product our riders are beginning to know and love," said a Zoox statement. "We are continuing to work closely with the administration and NHTSA on lasting, industry-wide change."

This roadmap includes updates to the Federal Motor Vehicle Safety Standards to enable the deployment of safe autonomous vehicles, without the constraints of vestigial elements applicable only to human drivers.







Volkswagen hopes this will be the world's safest e-bike

# VW brings automotive technology to e-bikes

Volkswagen will unveil what it hopes will be the world's safest e-bike at September's IFA consumer technology show in Berlin.

Bringing automotive-grade radar, camera and wearable safety technology to two wheels, it was developed and produced by N+ under licence from Volkswagen.

The e-bike will be on public display and available for test rides at IFA from 4 to 8 September.

At the heart of the e-bike is Smart View, a radar-activated rear-view camera system, the first of its kind on a production e-bike.

Alongside Smart View is a connected safety ecosystem spanning intelligent lighting, wearable heads-up display glasses and a crash-detecting smart helmet, each engineered to close the safety gaps that leave cyclists vulnerable in traffic.

"The Volkswagen smart e-bike demonstrates how technologies already established in the automotive sector can be intelligently transferred to two wheels," said Peter Jost, CEO of Volkswagen Accessories. "The optional radar-activated rear-view camera is an unprecedented innovation for production e-bikes, and reliably detects approaching traffic and helps address the blind spots that can leave riders vulnerable."

He said by combining this technology with intelligent lighting and connected rider equipment, the e-bike showed what modern assistance systems could achieve, enhancing awareness, supporting safer decisions and giving riders greater confidence in traffic.

Smart View pairs a high-resolution, full-colour display integrated into the handlebar with a radar-camera unit built into the rear mudguard.

The radar continuously monitors traffic up to 70m behind the rider, detecting vehicles and other road users approaching at greater speed, unaffected by wind noise or ambient sound, while the camera streams a live rearward video feed to the display.

When approaching traffic is detected, an orange alert bar appears across the camera view, or a blind-spot warning telltale appears on the dashboard view if that is what is displayed at the time.

The e-bike's full-length LED strip lighting is built into both sides of the top tube. The strips glow amber as side marker lights during normal riding and automatically increase in brightness when the radar detects an approaching vehicle, giving drivers an additional visual cue during an overtake manoeuvre.

The same strips double as turn signals and brake indicators, working in sync with an integrated rear brake and tail lamp and illuminated front and rear Volkswagen emblem lighting.

The smart helmet is equipped with more than 500 lumen of high-visibility front, rear and side LED lighting. It automatically mirrors the e-bike's brake and turn signals, so a braking or turning rider is signalled to traffic from both the bike and the helmet simultaneously.

POWER TECHNOLOGIES

# POWER UP

## IDTechEx report dives deep into BMS landscape

GM integrates a wireless BMS developed in collaboration with Analog Devices and Visteon



Vehicle Electronics

POWER TECHNOLOGIES

As the capacity of battery packs in electric vehicles has increased, the danger posed by a battery fire has also increased. However, the rate of battery fires has decreased significantly since the 2010s.

This is due to improvements in several battery pack technologies, including sensor deployments, fire protection materials, thermal management systems and battery management systems (BMS).

The BMS acts as the brain of the battery pack, taking in data from sensors and using them to enable safe operation of the battery.

IDTechEx has provided deeper insights into emerging technologies in the BMS landscape in its recent report "Li-ion batteries and battery management systems for electric vehicles 2026-2036", including potential improvements to vehicle charging, safety and lifetime.

There are many approaches to improving BMS capabilities. These include hardware- and software-based approaches. On the software side this includes adaptive charging algorithms from Iontra, Elysia, GBatteries and Breathe Batteries, and diagnostics from Eatron and Qnovo.

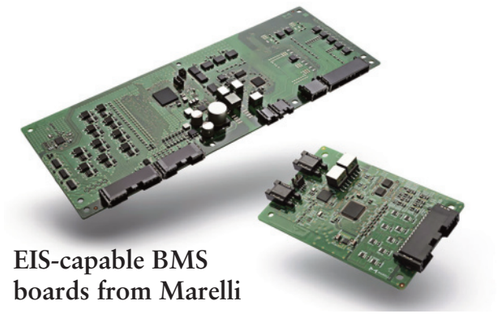
On the hardware side, these include cell-level control from Brill Power, Nerve Smart Systems and Relectrify and electrochemical impedance spectroscopy (EIS)-capable BMS boards from Marelli.

There are many players operating in this space, as well as developments from automotive OEMs and battery developers. The focus is primarily on achieving faster charging and safer, longer battery operation.

There is also a growing trend of battery energy storage systems (bess) and mobility fleet operators using external data analysis services, specifically cloud analytics. The premise of this approach is that the analysis performed by the BMS itself is limited by the processor in the BMS. By exporting data to the cloud and performing diagnostics on more powerful computers, better predictive power can be achieved.

The focus is primarily on achieving improved diagnostics, however better operational management can also be achieved for example by using adaptive charging protocols that reduce degradation.

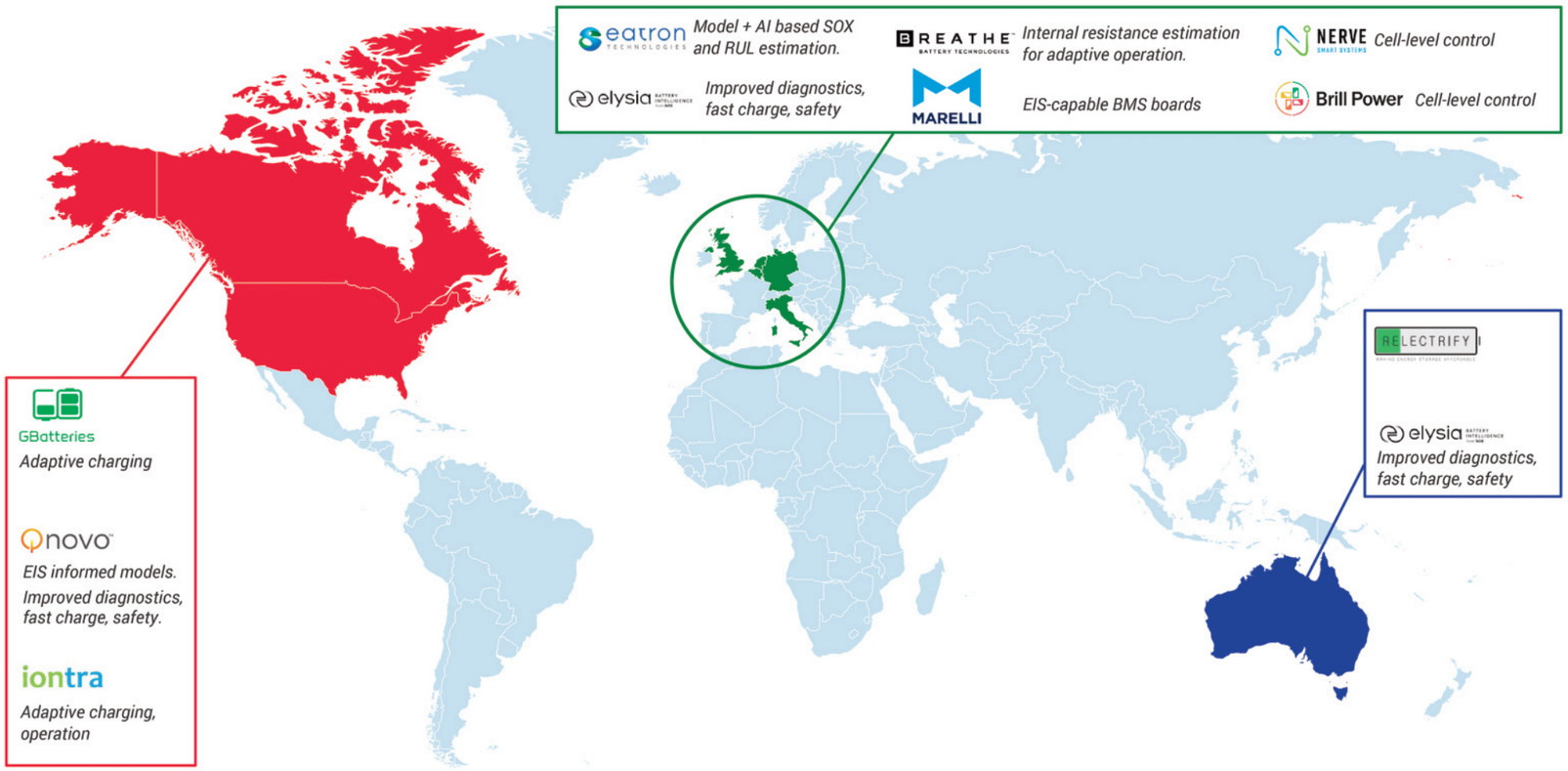
LFP batteries are particularly challenging to model for conventional state of charge (SoC) and state of health (SoH) algorithms used by standard BMS chips, and benefit significantly from cloud analytics. By taking in data from BMS across the entire fleet, fleet-wide problems can also be identified, including non-optimal usage strategies.



EIS-capable BMS boards from Marelli

Players in this space such as Twaice and Accure have experienced significant growth in the past few years, with this technology being used for MWh-scale battery deployments in the bess and mobility markets.

IDTechEx predicts that by the end of this year, more than 25GWh of bess and mobility fleets will be managed through cloud analytics services.




Advanced BMS activity from players in key regions (source: IDTechEx)

## Adoption

Another major design decision for the BMS is the communication protocol used. A standard BMS uses wired connections between sensors, module ICs and BMS boards, and in turn communicates with the vehicle's internal management system through the Can bus. However, some players have developed wireless alternatives, using for example Bluetooth, near field communications (NFC) or proprietary communications protocols.

The advantage of a wireless system is two-fold. First, it enables pack weight reductions and, secondly, it can enable cost reductions in large battery packs, in which wiring would be complex. However, wireless systems also suffer from security challenges, which have prevented wide-scale deployment.

General Motors (GM) was the first major automotive OEM to integrate a wireless BMS (wBMS) into its cars, specifically within the EV3 battery platform for Ultium battery packs. The BMS was developed in collaboration with Analog Devices and Visteon. For GM, it seems wBMS will continue to be the way forward, though it remains to be seen whether other automotive OEMs will also shift towards wireless systems.

## Patents

IDTechEx also conducted an in-depth analysis of BMS-related patents, to look for trends in patent topics, regions and assignees. This included a shift from hardware-focused patents to software-focused patents in the past five years, as well as a general increase in BMS-related patents applications since 2015.

## Outlook

The analysis indicates an increasing focus on integration of advanced BMS software in electric vehicles, for improved SoH and SoC estimation and to enable fast charging. IDTechEx also anticipates potential deployment of alternative battery management system communications protocols, including wireless BMS.

MOSFETS



Muhammad Ahmad explains how to optimise mosfet selection for 48V automotive systems

# TRANSITION


Vehicle Electronics

The transition to 48V electrical architectures is reshaping automotive power design. As electrification expands across mild-hybrid platforms and advanced auxiliary systems, engineers are under increasing pressure to deliver higher efficiency, lower losses and improved power density.

At the heart of this shift is the mosfet. In particular, 100V devices have become a critical enabler, providing the necessary voltage margin for 48V systems while supporting high current operation. However, as device performance improves, the criteria used to evaluate mosfets must evolve as well.

## Efficiency

At its simplest, $R_{DS(ON)}$ is the resistance of a mosfet when it is turned on. This resistance directly determines conduction losses, which follow the well-known relationship: power loss = I2 x $R_{DS(ON)}$.

This means losses increase with the square of the current. In high-current automotive systems, even a small reduction in $R_{DS(ON)}$ can significantly reduce power dissipation, which translates directly into higher efficiency and lower heat generation.

While significant, conduction losses are not the only losses incurred by a mosfet. Additional power losses include switching and gate drive losses.

Switching losses occur during the transition periods when the mosfet is neither fully on nor fully off, resulting in simultaneous voltage and current across the device. Unlike conduction losses, which occur when the mosfet is in a fully enhanced state, switching losses are dynamic and depend on factors such as switching frequency, load current and device characteristics.

On the other hand, gate drive losses are associated with the charging and discharging of the mosfet's gate capacitance and are primarily determined by the device's gate charge ($Q_g$).

The two parameters can impact overall system efficiency in high frequency applications such as DC-DC converters but have little impact in always-on applications such as battery disconnect switches.

## Performance

As current increases, thermal management becomes more of a constraint. Even with low $R_{DS(ON)}$, high currents generate significant heat that must be dissipated.

Thermal performance is defined by parameters such as junction-to-case thermal resistance ($R_{\theta JC}$), which governs how efficiently heat is removed from the device. Low values enable efficient heat transfer from the silicon to the package and into the PCB.

Low thermal resistance can be enabled by copper clip die bonding combined with a direct thermal path through the exposed drain pad, reducing heat transfer resistance and supporting continuous operation at very high current levels.

From a system perspective, this enables higher usable current, reduced cooling requirements and improved long-term reliability, all of which are critical in automotive environments.




**Modern mosfets help engineers design more efficient systems**

## Reliability

Automotive systems demand high reliability, particularly under transient conditions. The safe operating area (SOA) defines the combinations of voltage, current and time over which a mosfet can operate without damage.

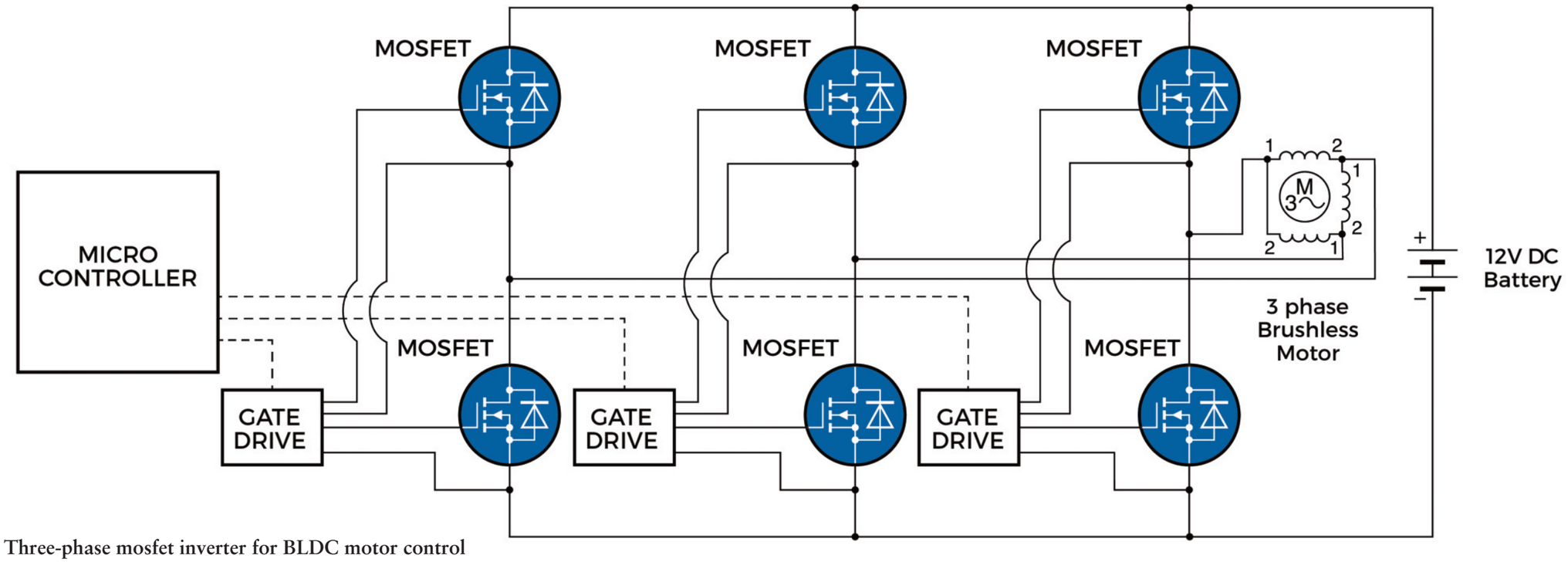
This is especially important in battery disconnect and motor control applications, where devices may encounter high-current surges, inductive loads or fault conditions, such as short circuits.

A robust SOA ensures the mosfet can safely handle these conditions without degradation, supporting long-term reliability in demanding automotive environments.

## Disconnect

Battery disconnect switches are a key function within 48V architectures. These provide a positive break, isolating the high-voltage battery to prevent accidental discharge, to enable safe maintenance and protect against fault conditions.

In this application, the mosfet functions primarily as a switch rather than a fast-switching element. It is either on or off for




**Three-phase mosfet inverter for BLDC motor control**

extended periods, meaning switching losses are low.

The most important design considerations therefore are reducing conduction losses, maintaining thermal stability under high current and ensuring robust operation under transient conditions.

This is where a 100V mosfet optimised for low $R_{DS(ON)}$ deliver the greatest benefit.

Low $R_{DS(ON)}$ directly reduces power dissipation, improving efficiency and reducing thermal stress. At the same time, a robust SOA ensures the device can withstand transient conditions such as inrush currents or fault events.

Because switching activity is limited in this application, parameters such as $Q_g$ are less critical, reinforcing the importance of selecting devices based on conduction and thermal performance.

## Control

Motor control is another major application area, particularly in electric power steering and auxiliary systems such as pumps and hvac. These systems typically use brushless DC (BLDC) motor drives, where mosfets switch at moderate frequencies. While switching performance is relevant, it is not the dominant factor.

Electric power steering is a particularly important example in 48V architectures. These systems benefit from reduced current and improved efficiency, but they require multiple mosfets within each design, often arranged in multi-phase configurations.

As multiple mosfets operate within these systems, even small reductions in $R_{DS(ON)}$ can deliver significant cumulative efficiency gains. At the same time, consistent thermal performance ensures stable operation under varying load conditions. In these applications, conduction efficiency remains the dominant factor in overall system performance.

## Coverage

While 100V mosfets are essential for 48V systems, lower-voltage devices also play an important supporting role.

There are 40V mosfets widely used in motor control applications operating from 12V rails, including pumps, hvac systems and other auxiliary functions. These devices offer similarly low $R_{DS(ON)}$, enabling efficient operation in continuous-use applications.

In addition, logic-level variants enable operation at reduced gate drive voltages, typically around 4.5V, making them suitable for direct control from microcontrollers. This simplifies system design by removing the need for dedicated gate drivers.

Together, these 40V and logic-level devices complement higher-voltage options, allowing engineers to optimise performance across a wide range of automotive subsystems.

## Selection

While mosfet selection is often framed as a trade-off between conduction and switching performance, the reality is that it is application-dependent.

In high-frequency conversion systems, low switching losses and $Q_g$ are critical. However, in many automotive systems, particularly battery disconnects and motor control, conduction losses dominate, and switching requirements are less demanding.

This reinforces the need to align device selection with application, rather than relying solely on generic comparison metrics.

This alignment, in turn, shifts the focus towards reducing $R_{DS(ON)}$, managing thermal performance and ensuring robustness under real-world conditions. In these scenarios, prioritising low $R_{DS(ON)}$ delivers the greatest system-level benefit.

## Conclusion

As automotive power systems evolve, mosfet selection must move beyond simple comparisons of headline specifications.

While metrics such as figure of merit (FoM) remain useful, they do not always reflect real application needs. In many high-current automotive systems, efficiency and reliability are defined primarily by conduction losses, thermal behaviour and robustness.

By focusing on these factors and leveraging advances in device design and packaging, engineers can design more efficient, reliable and optimised automotive power systems.



**Muhammad Ahmad is automotive product marketing engineer at Diodes**




48V architecture leads way for modern vehicles

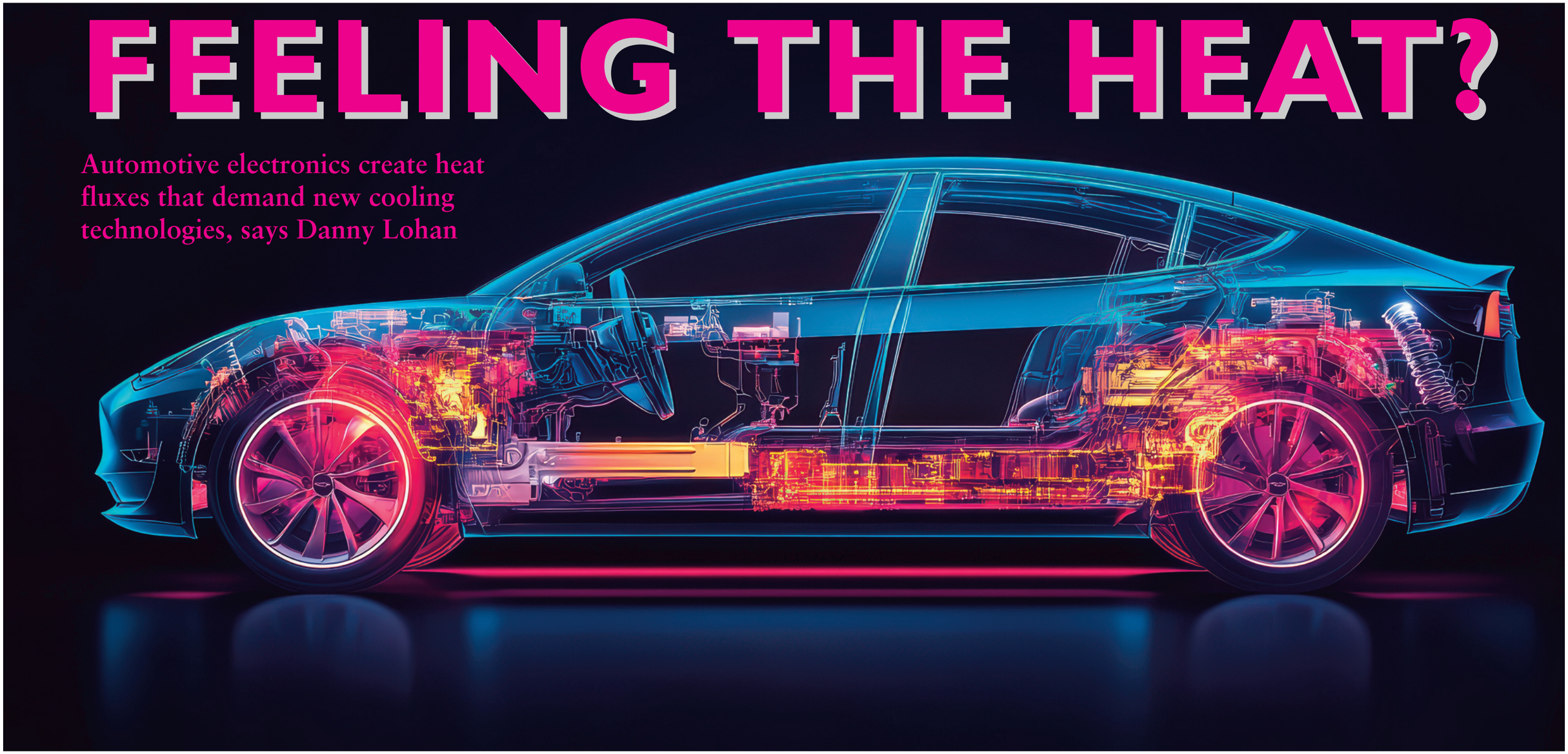



Driver convenience and safety features are supported by 48V systems

COOLING

# FEELING THE HEAT?

Automotive electronics create heat fluxes that demand new cooling technologies, says Danny Lohan



The growing concentration of electronics in modern vehicles, combined with increasingly compact electronic packaging, is making thermal management an increasingly complex problem for the automotive industry.

Traditional cooling methods, such as forced air and cold plates, are becoming less effective at handling the higher heat fluxes now common in internal combustion engine (ICE) vehicles, hybrids and electric vehicles (EVs).

Batteries, traction inverters, charging systems, lidar sensors, cameras and AI processors all generate heat.

Meanwhile, electronics are being built into increasingly compact spaces.

At the same time, automakers are adopting higher-voltage architectures and wide-bandgap (WBG) semiconductors to improve efficiency, reduce charging times and increase vehicle performance.

Together, these trends are increasing power density and creating localised thermal hotspots that conventional cooling architectures were not designed to manage. Fig. 1 illustrates this trend.

The automotive industry is actively exploring new approaches to thermal management for vehicular systems.

Promising cooling technologies that could help the automotive industry meet its thermal management challenges include architected thermal structures that enable new cooling geometries, embedded evaporative cooling approaches that bring heat removal closer to critical components, and adaptive thermal-management concepts that actively respond to changing thermal loads.

## Electronics

The amount of electronics in ICE vehicles has been growing for decades, with the addition of power brakes, power steering (drive-by-wire), cameras and proximity sensors. At the same time, automakers added a wide variety of in-cabin electronics including power windows, audio equipment, navigation systems

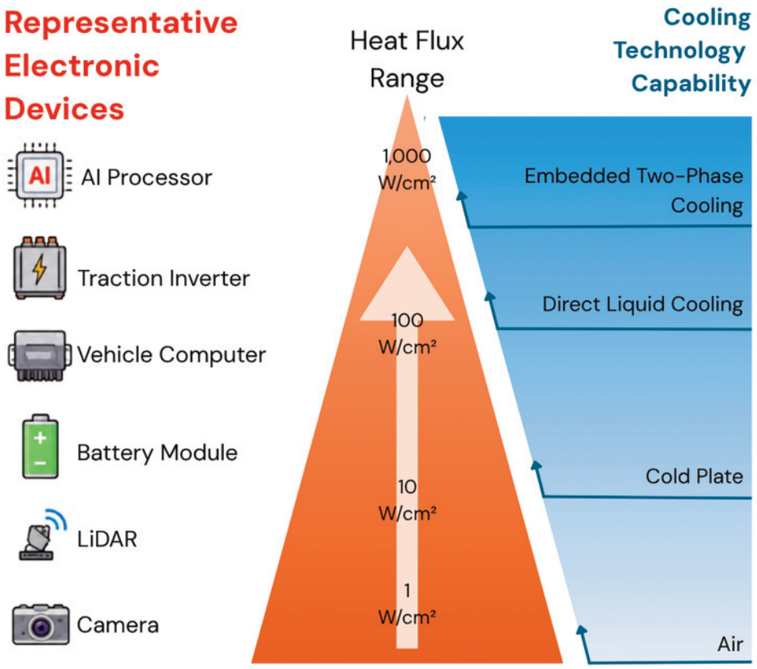



**Fig. 1: Future automotive electronics may require embedded cooling architectures and phase-change heat-transfer mechanisms capable of managing localised thermal hotspots within compact packages**

and comfort systems.

Next, automakers began to incorporate into their vehicles more sensors, along with associated electronics, to enable safety features such as adas and for semi-autonomous and autonomous driving.

Hybrids and EVs added electric motors, powertrains and batteries, along with electronic power control units that must manage powertrain traction inverters, growing sensor suites and charging infrastructure. Every EV has a plug-in charger. Hybrids may or may not have plug-in chargers but, just like EVs, virtually all will have regenerative braking systems to recharge their electric motor batteries.

Modern vehicles are among the most sensor-rich consumer products in everyday use. They all incorporate multiple cameras, often supplemented by lidar and radar for driving, along with heat sensors, flow monitors and positional sensors for internal purposes, such as gauging the position of valves and vents.

Another important trend is the gradual transition from 400 to 800V electrical architectures, with some manufacturers exploring 1kV and above. Higher voltage architectures enable faster charging and improved power delivery for EVs and plug-in hybrids (PHEVs).

The desire for faster charging and the shift to higher voltages is leading to the adoption of components and power ICs based on WBG materials such as gallium nitride (GaN) and silicon carbide (SiC).

Because modern automotive designs prioritise compact packaging, these performance gains do not eliminate the underlying thermal-management challenge. Even though using SiC and GaN instead of silicon for power electronics provides electrical performance advantages, heat becomes localised within modern packages effectively increasing heat flux.

## Mitigation

In the past, if a vehicle subsystem required cooling, it typically received a dedicated cooling system. Now it is more practical to share cooling loops among multiple subsystems, for example the traction inverter, motor, battery and hvac system for the passenger cabin. Some powertrain elements continue to use oil cooling systems, while liquid cooling is increasingly being adopted for high heat flux systems.

As heat fluxes continue to rise, more auto designers will be compelled to increase their reliance on some of the more advanced cooling approaches, including the use of vapour chambers, heat pipes that channel heat to cooling fins, heat pumps, immersion cooling and two-phase cooling. These approaches bring cooling closer to the heat source and improve the ability to manage localised thermal hotspots.

AI is already being used in battery management systems (BMS), which carefully manage charging, discharge rates and thermal management of each individual battery cell in the battery packs that power every hybrid and EV.

Looking ahead, AI is expected to play a broader role in coordinating thermal management across the vehicle, dynamically optimising cooling-system operation to improve efficiency, performance and component reliability.

## Vapour

Improving vapour chamber technology has a great promise for automotive cooling. Vapour chambers are already in use with some of the most advanced smartphones.

Although a vapour chamber occupies a relatively small footprint, it spreads heat well beyond the dimensions of the heat source. Inside the sealed chamber, heat vaporises the working fluid, allowing thermal energy to spread rapidly through the vapour chamber before the fluid condenses and returns to the heat source via a capillary wick.

While smartphone processors can generate extremely high local heat fluxes, automotive thermal management systems must often remove larger total heat loads. One way to extend vapour chamber performance is to cascade vapour chambers and customise geometry for interface heat flux.

Triply periodic minimal surface (TPMS) geometries offer high interfacial surface area for favourable heat exchange across vapour chamber interfaces.

These structures consist of continuous three-dimensional networks that can be engineered to create large surface areas, interconnected transport pathways and precisely controlled thermal architectures within compact volumes. However, their intricate three-dimensional features are difficult to fabricate at the necessary micro-scale using conventional manufacturing methods. New fabrication techniques are making TPMS structures increasingly practical at microscale, see Fig. 2.

Vapour chambers incorporating TPMS structures promise to distribute loads approaching 1kW/cm², levels relevant to emerging WBG traction inverters and other high-power-density applications, for example.

Without advanced heat spreaders such as vapour chambers, air cooling is capable of dealing with heat fluxes below 100W/cm².

## Axial

While many cooling innovations focus on semiconductor packages, similar principles can also be applied at a system level. One

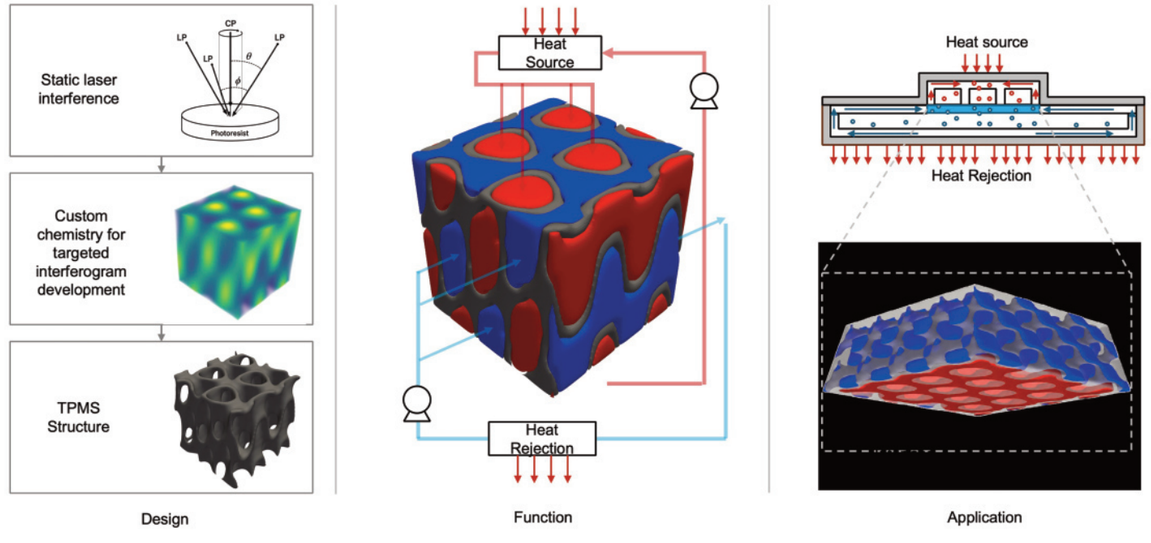



**Fig. 2: Fabrication technologies that enable complex microscale thermal structures based on triply periodic minimal surface (TPMS) geometries**

example is the cooling of axial flux motors.

Axial flux motors are considerably more power-dense than conventional radial flux machines. Their smaller size and higher power density make them attractive for future EV designs. Depending on the application, they may incorporate multiple rotors surrounding a common stator to increase torque output. Their compact design makes conventional cooling approaches more difficult to implement.

The cooling approaches available for axial flux motors thus far focus on cooling their end windings, but the middle remains hot with low coolant flow. One proposed cooling approach involves a combination of pumped and wick flows to distribute coolant uniformly from an outer cooling ring, through the gaps between the coils and into an inner cooling ring of the motor.

### Evaporative

With capillary-driven evaporative cooling, coolant is supplied to an outer cooling ring and distributed through embedded cooling pathways located adjacent to the motor windings, see Fig. 3. As heat is absorbed, the liquid undergoes a phase transition, removing thermal energy through evaporation while capillary forces continuously replenish liquid to the evaporating regions.

This combination of pumped flow and capillary-driven transport helps maintain uniform coolant delivery throughout the winding structure, including regions that are difficult to reach using conventional flow-distribution approaches.

This combination of capillary-driven transport and evaporative cooling has the potential to improve temperature uniformity throughout the motor while supporting higher heat-removal capability within a compact package.

More broadly, this concept illustrates how future thermal-management systems may leverage passive physical mechanisms to improve coolant delivery without significantly increasing system complexity. Such approaches may support higher continuous-power operation and improved power density without significantly increasing motor size, coolant flow requirements or pumping power.

### Stability

As vehicle electronics become increasingly integrated, thermal-management systems must often satisfy the needs of components with very different operating requirements. Power electronics, processors, sensors, memory devices and communication hardware may increasingly share the same package or cooling infrastructure, yet each has different thermal sensitivities and optimal operating temperatures.

For many advanced electronic devices, maintaining stable and uniform temperatures can be just as important as increasing heat-removal capability. Temperature fluctuations can affect performance, reliability and

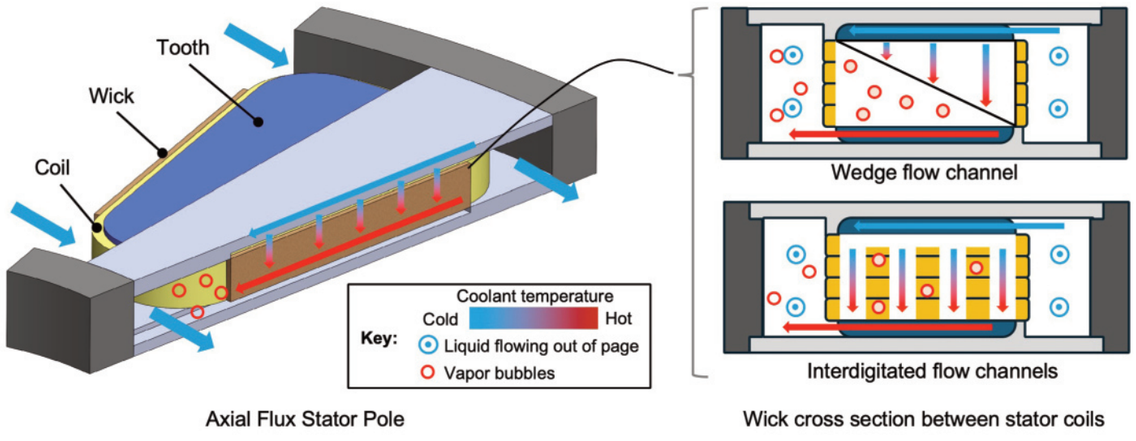



Fig. 3: Capillary-driven, evaporative cooling concept for high-power electric machines





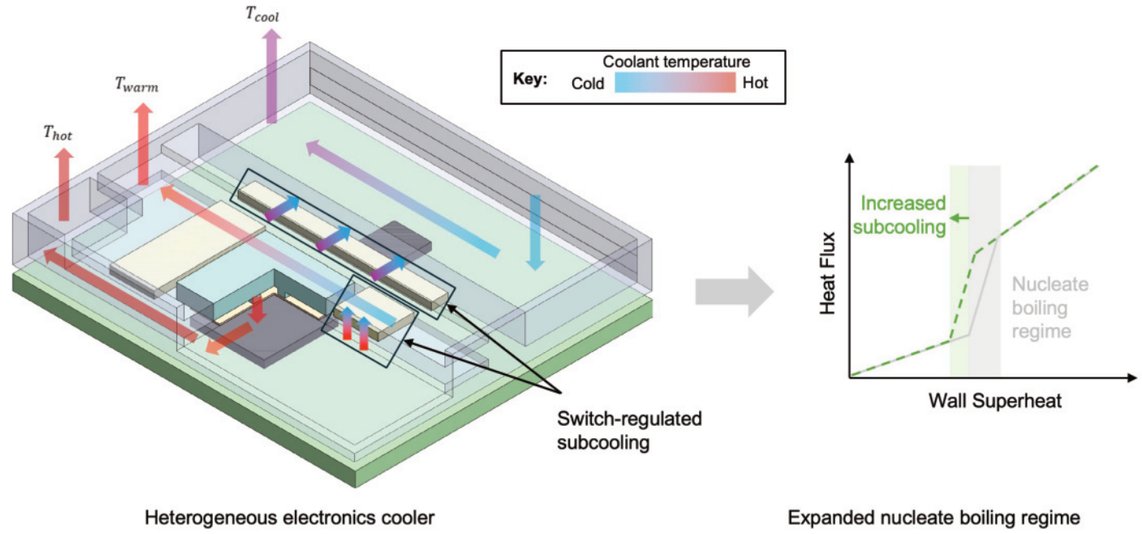



Fig. 4: Using thermal switches to regulate interactions between adjacent cooling regions, enabling local control of subcooling and phase-change behaviour

operational consistency, particularly in systems that rely on precise electronic or sensing functions.

In two-phase cooling systems, operation within the nucleate boiling regime is often desirable because it provides highly effective heat transfer while maintaining relatively uniform surface temperatures.

As electronic packaging continues to evolve, increasingly diverse components are being placed in close proximity. While this integration creates new thermal management challenges, it also creates opportunities to design cooling systems with spatially varying thermal performance.

Different regions of a cooling structure may be optimised to support different heat loads, operating temperatures or thermal-response requirements.

### Thermal switches

Architectures that leverage these spatial thermal variations through the use of integrated thermal switches are being explored, see Fig. 4.

Thermal switches positioned between adjacent cooling regions can dynamically regulate local coolant conditions, including subcooling levels and phase-change behaviour. By controlling the interaction between neighbouring thermal zones, these structures may help maintain more stable operating temperatures across sensitive devices while preserving high heat-transfer performance where it is needed most.

This approach enables cooling performance to be tailored to specific regions within the package. Such capabilities may become increasingly important as future vehicle electronics continue to integrate diverse functions within compact, high-power assemblies.

### Summary

As vehicle systems become increasingly electrified, software-defined and power-dense, cooling technologies must evolve alongside them. Although these technologies address different challenges, they share a common objective: bringing thermal management closer to the point of heat generation while providing greater control over how heat is transported, distributed and regulated within increasingly integrated automotive systems.



**Danny Lohan is a staff engineer at Adeia**

PRODUCTION




# LIGHTS IN

**A long-term partnership is helping a motorsport electronics manufacturer transform production repeatability and eliminate a costly scrap problem**

At the highest level of motorsports, performance demands on all components are immense. To withstand the extreme vibration and environmental exposure of the racetrack, while adding as little weight to the vehicle as possible, is a serious design problem.

With changes such as the FIA's reduction of Formula One cars' minimum weight by 30kg for the 2026 season, these demands are only growing greater. When components get smaller and tolerances tighten, manual assembly processes quickly become the weakest link in the production line.

This was the situation facing one high-performance motorsport electronics manufacturer. It builds custom-made exterior LED lighting and display products for the highest level of motorsport.

Its assemblies integrate dissimilar materials such as metals, plastics, composites and optical components in compact,



**The manufacturer sells LED lighting assemblies for high-end motorsport**

intricately contoured housings.

As the industry has come to focus on smaller, lighter bespoke components, rather than commercial off-the-shelf parts, repeatability and accuracy in production have become key considerations.

"As our products got smaller, the limitations of our processes became clear," said the company's founder and managing director. "The bonding and encapsulation stages were heavily dependent on skilled individuals, meaning our business model was vulnerable to disruption and limited from expanding. This was particularly visible in our silicone potting step, a manual process that relied on operator experience and dexterity. Around ten per cent of the products that entered this phase had to be scrapped due to potting quality falling short of the acceptance parameters."

The impact on profits drove the company to contact adhesives and dispensing specialist Intertronics to find a better way of working.

When the manufacturer approached Intertronics, lead sales specialist Darren Rea arranged a meeting and demonstration at Intertronics' technology centre in Oxfordshire, UK. The demonstration centred on a three-axis dispensing robot capable of positioning adhesive to within five microns and delivering volumetric dispensing accuracy of 99.9 per cent.

"The system we demonstrated represented a step change above the level of control that manual dispensing allows," said Rea. "Automating that process allowed the customer to remove operator error and reach their repeatability targets. It supported quality improvement, achieving consistent adhesive volumes, movement speed and flow rates."

Following a successful rollout of the first system, it became clear this was the beginning of a much wider conversation. Each new lighting design brought fresh adhesive and processing challenges, and Intertronics worked closely with the manufacturer in the early design stages to match the adhesive, dispensing method, and curing approach to the specific assembly task.

"Whenever when we brought them new issues, Intertronics would help us find a way forward," said the managing director

Over the past six years, Intertronics has supplied multiple robotic dispensing systems to the manufacturer, each introduced in response to a new production requirement. All addressed the same challenge: dispensing adhesives accurately and repeatably onto complex assemblies with differing geometries and material combinations.

The variation came from the



**Top level motorsport demands elite performance from every component**





products' performance requirements and the specific adhesive selected to achieve them.

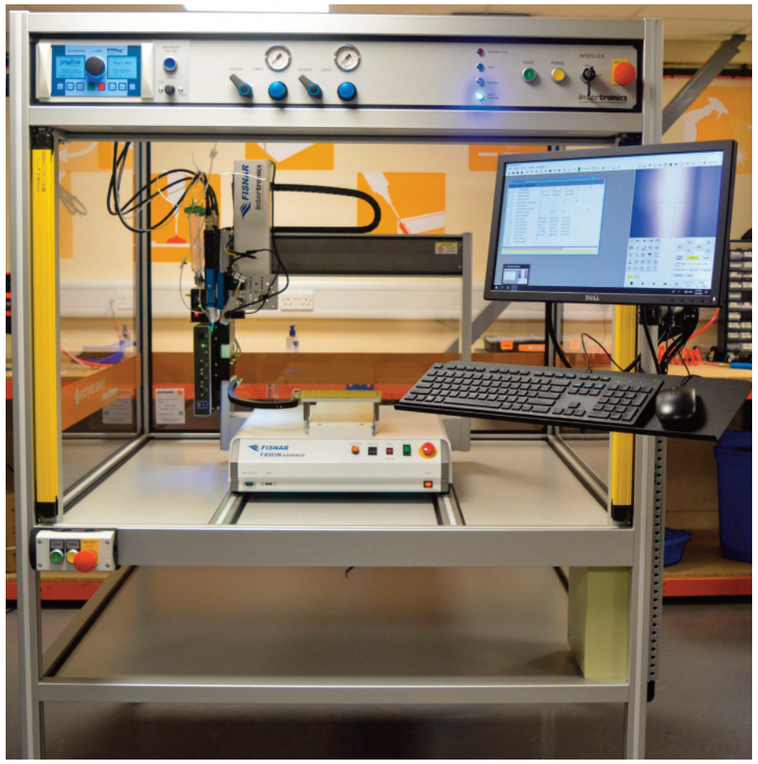
Three bonding and sealing products have been central to this relationship. The first is a silicone encapsulant, used to pot the electronics of a unique digital colour display panel, which is the first of its kind.

The second, a UV-curable adhesive, is used for on-demand bonding of plastic substrates, while the third is a twin-cartridge, thermally conductive, electrically insulating epoxy that helps dissipate heat from sensitive electronics while providing resistance to leakage current, moisture and chemical ingress.

As production volumes and complexity grew, Intertronics introduced volumetric dispensing technology, with products capable of handling single-part materials, and the metering and mixing of two-part materials. Unlike time-pressure dispensing systems, volumetric dispensing ensures a consistent shot size and mix ratio regardless of changes in material viscosity or temperature, eliminating a further source of process variability.

The clearest illustration of what the partnership has delivered came at the silicone potting stage. The encapsulation process that previously generated around ten per cent scrap has since being automated and run for between 400 and 500 cycles without a single product being wasted. The financial and operational impact of eliminating that scrap rate has been significant.

"The consistency that these robotics bring to the manufacturing process allowed us to automate previously specialist bonding and potting work, while upgrading the quality of our products," said the managing director. "Our expansion has been organic and natural as a result. The silicone potting rig shows how Intertronics' continuing support has boosted our production capacity. The difference in throughput is night and day."



**Automated dispensing eradicated manufacturing errors that led to waste**

Automation has also reshaped the business model itself. By removing the dependence on specific skilled individuals for precision dispensing and encapsulation work, the manufacturer has been able to expand production capacity and grow in a way that is both controlled and sustainable.

"Some of our most complex products wouldn't have been commercially viable without these process improvements," said the managing director.

Intertronics' consistent engagement with the manufacturer as a technical partner, rather than a detached product supplier, is the key to a relationship that has blossomed since 2020.

"The personal support that Intertronics provides, both technical and sales, is especially valuable," said the managing director. "Basically, Intertronics has succeeded and delivered everything that we've required, across a broad range of applications, over the last six years of working together."

# TALKING DATA

How Mitsubishi Electric Automotive in Czechia transitioned to data-driven decision making



In modern production environments, competitive advantage is increasingly determined by how effectively a manufacturer can capture, connect and act on data. At Mitsubishi Electric Automotive Czech (MEAC), located in Slaný, data have become a strategic asset.

The facility, which supplies electrical automotive components including integrated starter generators to manufacturers across Europe, first opened in 2001. It now employs more than 500 people and has evolved from a traditional production environment into a highly connected factory where millions of data points are transformed into real-time operational insight, as it looks to support the automotive industry's transition towards electrification and smart manufacturing.

Crucially, rather than pursuing digitalisation through wholesale equipment replacement, MEAC has adopted a pragmatic approach that combines proven production assets with connected automation technologies, facilitated by its long-term automation equipment supplier and sister company Mitsubishi Electric Factory Automation.

The result is a factory that has made significant improvements to its output, quality, uptime, environmental impact and employee wellbeing.



MEAC facility in Slaný, Czechia

## Foundations

One of the most striking aspects of MEAC's digital transformation is its approach to existing infrastructure.

While many manufacturers would have pursued a strategy of replacing existing machinery and control systems, for MEAC the focus has been on extracting greater value from equipment that continues to perform.

"On the production side, we keep what works," said Jan Kabát, manufacturing engineering manager at the factory. "Our Q series control units have been operating reliably for more than ten years, while modernisation is achieved through a data layer using MES interfaces to connect machines and generate operational insights without disrupting output. We do not modernise machines simply for the sake of modernisation. The stable Q series control remains in place, while connectivity and data capabilities are added where they deliver measurable gains: less downtime, better visibility and faster troubleshooting."

This approach has enabled MEAC to connect more than 100 machines through Mitsubishi Electric's e-F@ctory architecture. This has created a digital layer that provides visibility into plant performance without incurring significant capex costs.

The data generated now form the basis of day-to-day decision making throughout the factory. They enable engineers to create custom reports and deploy additional sensors where greater process visibility is required.

## Quality

However, for MEAC, the real value of connectivity lies in the ability to improve manufacturing performance continuously.

Digital tools and analytics provide detailed visibility into processes, allowing teams to identify issues quickly and implement corrective actions before they affect production quality or customer deliveries.

For Dalimil Bartoň, general manager, data have become central to the company's continuous improvement strategy.

"We use data to drive continuous improvement in both process and product quality," he said. "By analysing detailed manufacturing data, we can identify defect patterns, optimise processes and reduce scrap. The result is more consistent quality for customers and lower manufacturing costs for the business."

The point, he said, wasn't about using technology for technology's sake.

"It's knowing how to deploy systems so they genuinely support production within a true PDCA [plan, do, check, act] cycle," he said. "By using Mitsubishi Electric's portfolio in a pragmatic way, the team continues to raise automation levels, protect quality and deliver measurable results on the shop floor."





## Digitalisation

While digital transformation is often associated with plant equipment, MEAC has also applied data-driven techniques to improve working conditions for employees.

The company uses RFID technology and workstation data to understand how work is performed across the facility and identify opportunities to reduce physical strain.

"We use RFID technology to identify operators and understand where they are working, combining this information with muscle-load and workstation-level data," said Petr Soukup, senior manager for manufacturing. "This helps us plan job rotations and organise work more effectively to reduce ergonomic strain. As a result, we've achieved more consistent performance across shifts."



Data enable faster decision making

## Production

With MEAC also understanding the impact of environmental conditions on production performance, the facility represents a comprehensive software-defined building based on Mitsubishi's iQ-R PLCs and Iconics Genesis 64 software.

According to facility manager Milan Koňarik, the system provides a single view of critical facility infrastructure.

"This allows us to actively manage the plant environment and its impact on production," he said. "We monitor hvac, the data centre, pre-cooling systems, UPS and other technical utilities, with over 3000 measurement points feeding a single data view for faster decision-making. The system can trigger SMS and email alarms, support smarter energy purchasing and help our energy-saving team act quickly. We see it as a practical tool for reducing energy costs and operational risk while keeping our carbon neutrality ambitions on track."

## Model

Ultimately, as automotive manufacturers continue to face pressure to improve efficiency, quality and sustainability, MEAC says it is showing how effective digital transformation can be achieved without disrupting established production processes.

With improved visibility of key data points, reduced downtime, enhanced product quality, lower energy use and a more sustainable working environment, it has managed to get its data talking.

# Actuator improves steering control for SDVs

A high mount, direct drive (HMDD) steer-by-wire hand-wheel actuator from Nexteer can help OEMs rethink steering system packaging and cockpit design for software defined vehicles.

By combining a high-mount motor location, direct-drive responsiveness and stationary hub, the HMDD enables more design freedom, premium steering feel and scalable integration across vehicle platforms.

As OEMs move towards software-defined, electrified and increasingly flexible vehicle architectures, steering systems have an opportunity to evolve from fixed mechanical layouts to more adaptable, software-enabled motion control.

It translates driver steering input into digital commands to the road wheels while delivering steering feel feedback to the driver.

Alongside Nexteer's low-mount option positioned under the dash, this gives OEMs flexibility to select the actuator architecture that best supports their vehicle packaging, cockpit design and driver experience strategies.

By combining a compact high-mount architecture, direct-drive responsiveness and a stationary hub, it creates opportunities for vehicle makers to reimagine the cockpit, including centre-hub control and display concepts, stowable or reconfigurable steering interfaces, and expanded steering wheel placement options.

Scalable integration is possible across internal combustion, hybrid and electric vehicle platforms, with support for 12 and 48V electrical architectures and left- and right-hand-drive configurations.

For drivers, HMDD is designed to deliver a premium steering feel through smooth, direct torque response and adjustable modes that provide realistic road feedback and driver connection.

Its direct-drive configuration and flexible software tuning can support feature evolution through software including potential over-the-air updates as OEM software strategies advance.

For OEMs, it creates opportunities to standardise and scale steer-by-wire hardware while allowing brand differentiation through software-defined steering feel, cockpit experience and user features.

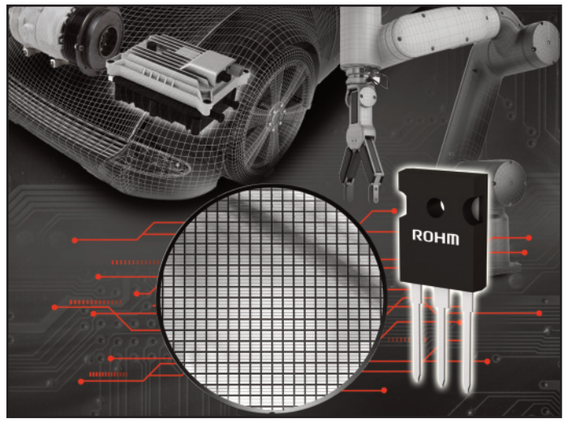
# IGBTs achieve low conduction loss

The fourth generation of Rohm's 650V IGBTs are suitable for automotive electric compressors as well as HV heaters and industrial inverters.

The automotive-grade products achieve low conduction loss with a $V_{CE(sat)}$ of 1.55V, while providing high short-circuit tolerance and complying with AEC-Q101.

Rohm has redesigned the device structure, including the process and edge termination structure, to develop IGBTs that combine low-loss characteristics with high short-circuit tolerance while addressing higher-voltage requirements.

By revising the device structure, the products increase current density while reducing conduction and switching losses. Despite the trade-off between lower loss and short-circuit tolerance, the products ensure a long short-circuit withstand time of 7$\mu$s at a junction temperature of 25°C.



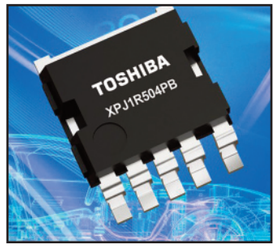

The line includes 12 products in the TO-247N package, the RGAxxTS65HR and RGAxxTS65EHR series, and ten bare wafer products, the SG83xxWN series.

The firm is also developing 12 products in the TO-247-4L package, the RGAxxTR65HR and RGAxxTR65EHR series. Design models and materials needed for circuit design are also available for download.

Going forward, there are plans to expand the line in the same packages and develop compact, surface-mount IGBT products that adopt the TO-263L and top-side cooling packages.








## 40V mosfet

An automotive-compliant 40V, 120A n-channel power mosfet from Toshiba is housed in the S-TOGL package, expanding its line for 12V systems.

Target applications for the XPJ1R504PB include inverters, semiconductor relays, load switches and motor drives.

It enables compact, high-density mounting and better thermal performance, reducing the size of automotive equipment and improving efficiency.

To improve the reliability of the solder joints, the package uses gull-wing leads that help relieve mounting stress.

In addition, the package has a post-less structure that integrates the chip's source-electrode connection and outer leads, reducing parasitic resistance and achieving an on-resistance of up to 1.54mΩ at a gate-source voltage of 10V.

The use of a thick copper frame in the package lowers the transient thermal impedance between the channel and the case to 0.76°C/W.

# Integrating AM radio and audio processing

An automotive audio and radio processor from NXP can simplify infotainment architectures.

The SAF9800 integrates analogue radio (AM and FM) and AI - and ML-enabled audio processing into a flexible single chip.

The aim is to help automakers reduce complexity and scale features across global platforms.

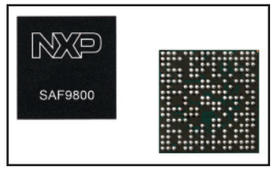
It combines analogue radio reception and audio processing so OEMs can consolidate functions that have traditionally required multiple discrete radio and audio components.

AI-driven acoustic source separation technology transforms in-cabin microphone data by isolating critical sounds such as vocal commands, mechanical failures or emergency sirens from overwhelming background noise. Traditional filtering often fails in complex acoustic environments such as vehicle cabins, making machine learning a better option for dynamic, real-time audio extraction.

It integrates a Hifi 5 audio DSP with integrated neural-network processing capabilities with hardware-based biquad accelerators, delivering more than ten-times audio processing performance than previous generations. This enables audio use cases such as real-time noise reduction, voice and sound classification, and more adaptive in-cabin listening experiences using data-driven algorithms rather than fixed signal processing.

Designed for software-defined architectures, it supports feature scalability through software, allowing automakers to configure, upgrade and differentiate radio and audio capabilities without changing hardware.

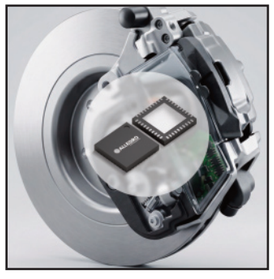
The processor consolidates radio and audio processing into one scalable chip and provides support. AM de-noising technology on the device addresses signal interference from EVs into the AM frequency band.




# PMIC integrates wheel-speed sensor

An Asil-D-certified power management IC (PMIC) from Allegro integrates a wheel-speed sensor interface.

The A81415 provides electromechanical braking designers with a single-chip power and sensing foundation for brake-by-wire systems.



With an on-chip wheel-speed sensor interface, it decodes standard two-level PWM and three-level AK protocols (standard and high-resolution) without complicated analogue circuitry or a separate decoder IC.

By incorporating a fully integrated buck-boost pre-regulator, five low-dropout (LDO) regulators and a single-inductor architecture that requires no external switches or diodes, the device eliminates up to nine external components, reducing costs.

This integration opens up more than 50% of usable board space to provide the brake calliper with design headroom.

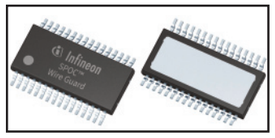
# Efuse supports SDV architectures

An integrated 12V automotive efuse from Infineon has an SPI interface and is the first member of a smart power switch family.

The Spoc Wire Guard BTS80009 SWPx 1ES combines a protected high-side switch with integrated $I^2t$ wire protection, software configurability and diagnostics.

It is designed for EE architectures that support software-defined vehicle (SDV) concepts with over-the-air updates.

The automotive efuse provides failure isolation in microseconds as well as precise current sensing, avoiding over dimensioning of the wire diameter. At the same time, it ensures high availability of the power supply with freedom of interference.




For permanently powered loads, a dedicated idle mode has a power consumption of a few $\mu$A while maintaining protection. To mitigate a limited amount of microcontroller IO ports, its 24bit SPI interface is daisy-chain capable.

To support platform reuse across vehicle variants, configuration and protection parameters can be adjusted in software for each variant. In addition, Spoc Wire Guard devices provide real-time status, pre-warning indicators and other diagnostics to improve vehicle availability and enable optimisation throughout the vehicle's lifecycle.

Features support adas and enable fail-operational capabilities for L2++ to L5. It is offered as a safety element out of context (SEooC) for use in systems up to ISO 26262 Asil D, with an integrated non-volatile memory to configure an application-specific safe state.

It can react autonomously to supply-voltage drops caused by load faults to protect the supply. The single-channel architecture helps prevent fault propagation to other outputs.

There are four variants with a scalable feature set and they support currents up to 34.5A, making it suitable for replacing gate-driver ICs plus mosfet and shunts, and delivering PCB savings.

It is now in production, with three further variants planned to follow by the end of the year.

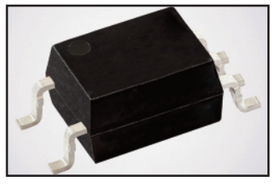
# Optocoupler comes in slimmer package

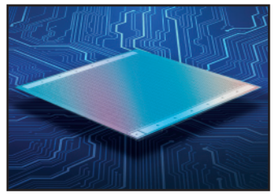
An automotive 1MBd optocoupler from Vishay comes in a sop-5 package with a width of 3.6mm.

Combining a comparative tracking index (CTI) of 400 with minimum guaranteed common mode transient immunity (CMTI) of 40kV/$\mu$s, the VOMHA43A can deliver improved signal transmission quality and save space in applications requiring isolation voltages up to 707V peak, meeting the requirements of 400V battery systems.

The AEC-Q102 qualified device is optimised for isolated data communication, fast signal switching, ground signal isolation and logic voltage level shifting in automotive, industrial, home and building control, and telecoms applications.

In EVs, HEVs and LSEVs, the optocoupler provides communication bus isolation for Can, Lin, $I^2C$ and SPI interfaces, as well as isolated drive circuits such as intelligent power module drivers.





# GaN at 2.2kV

Power Integrations' PowiGaN gallium-nitride technology is now rated at up to 2.2kV.

This positions the technology for high-voltage data centres, EVs, renewable energy and HVDC infrastructure as they leverage higher-voltage bus architectures in search of greater power density.

The technology provides voltage margin for emerging high-voltage power systems while enabling the high switching frequencies required to increase power density.

Applications include EV battery and auxiliary power systems operating at 48V output. This extends the reach of GaN into voltage ranges traditionally served by SiC, enabling a high-frequency alternative.

GaN power switches are steadily supplanting silicon transistors in power conversion applications thanks to their higher efficiency and switching frequencies. However, GaN technology must keep pace with EV roadmaps calling for higher voltages and greater power density.





# Switching signals up to 80A and 300V

Pickering's highest-current switching products to date target EV battery and high-drain automotive electronics testing, fuel-cell and hydrogen-electrolysis research, solar inverter and energy-storage testing, aerospace development, and functional or production testing of high-current power supplies.

The 60-191 LXI high current and sense SPST family can switch signals up to 80A and 300V while simplifying distribution, sequencing and management of multiple high-current power supplies in automated test systems.

The family is available in four standard configurations, combining up to twenty 40A and four 80A hermetically sealed SPST-NO contactors with a complementary number of 1A SPST relays for sense lines.

High-current and sense-line connections are via standard front-panel screw-terminal connections. Custom relay combinations and alternative connector options are available.

Installed between multiple high-current power supply units (PSUs) and a device or system under test, each unit can programmatically connect and disconnect each PSU's positive and negative outputs and their associated high- and low-sense lines.

Engineers can control every relay independently or operate two high-current and two low-current relays as a group with a single command, simplifying the switching of the four connections commonly used by a PSU.

Each unit includes a sequencing service that can store up to 5000 predefined switching sequences and execute them through software or configurable hardware triggers. By storing sequences within the LXI controller, the units can reduce host transactions and system latency.

Front-panel LEDs indicate switch status to simplify programming and debugging, while relay cycle counting supports preventive maintenance and balances usage across available paths.

The units are controlled through an LXI 1.5-compliant 1000baseT Ethernet interface using an API or built-in soft front panel. IVI and direct IO drivers support Windows and Linux and common development environments, including LabView, Python, C/C++, C#, Matlab and Simulink.

All four standard configurations include a three-year warranty and guaranteed long-term product support.



# TVS diodes protect 48V systems

TVS diodes from Littelfuse can protect 48V automotive electronics from transient overvoltage events while delivering low and stable clamping performance.



The TP5.0SMD-FL 5kW and TP1KSMB-FL 1kW devices are for 48V systems in compliance with ISO 21780.

They protect increasingly sensitive ICs such as DC-DC converters and gate drivers without exceeding their absolute maximum ratings.

Using proprietary FlatSuppressX technology, the devices maintain a near-constant, low clamping voltage during fast transients and high-energy surge events.

FlatSuppressX devices leverage a foldback, snapback I-V characteristic to control transient response while avoiding latch-up. This enables the use of lower voltage-rated components.

FlatSuppressX technology exhibits a flatter clamping characteristic with a lower clamping voltage than conventional TVS devices.

# Toolchain simplifies vehicle diagnostics

An end-to-end toolchain from Vector lets vehicle makers and suppliers test, evaluate and integrate service-oriented vehicle diagnostics (SOVD).

SOVD provides a unified API for diagnostics in software-based and traditional mechatronic vehicles. To support the development of diagnostic systems for modern vehicles, the offering combines established and newly developed tools into a comprehensive SOVD toolchain.

It covers all stages of development from specification and validation to the implementation and use of SOVD in the vehicle, and can be flexibly adapted to different project requirements.

Users benefit from seamlessly integrated tools that enable a consistent implementation of the SOVD standard, helping reduce development effort and accelerate development cycles.

At the core of the toolchain is the SOVD Explorer, a diagnostic tool designed for individual vehicle components as well as the entire vehicle. Tailored to the SOVD standard, it assists developers both in using SOVD and in reading and writing vehicle data via SOVD.

By providing intuitive access to all available SOVD API functions, a structured view of the vehicle's status and automation options, the Explorer simplifies the development of diagnostic systems for software-defined vehicles.

There is a three-step implementation model. In the first step, SOVD concepts can be tested on existing UDS-based vehicles without requiring any modifications to the vehicle. In the second step, the technology is tested directly within the vehicle network to evaluate performance and resource consumption.

Finally, the SOVD stack is fully integrated in the vehicle architecture.






## Benchtop tester checks modern ECU architectures

The latest version of the MagicCar Compact Plus desktop test platform from Göpel Electronic expands its portfolio of high-performance test systems for the automotive industry with a benchtop platform addressing the increasing demands of modern ECU architectures.

It covers key areas of ECU development and validation, combining flexibility with a compact design.

The test platform supports network, infotainment, quality, functional and endurance tests for ECUs. It thus targets OEMs and suppliers throughout the entire development process from initial validation through to series production.

The benchtop tester has an integrated, programmable power supply with switchable terminal signals and precise current measurement. At the same time, it provides realistic residual bus simulations, including diagnostics and secure onboard communications across all relevant automotive communication protocols such as Can-FD, Lin, FlexRay and Automotive Ethernet.

Expandable fault modules let targeted interface and robustness tests be carried out. Critical communication states can be simulated and analysed in a reproducible manner to verify the behaviour of ECUs under realistic fault conditions.

For extended tests, additional external devices such as loggers, multimeters, oscilloscopes or signal generators can be integrated.

On-board logging sees communication data from ECU interfaces recorded in real time and stored on an internal SSD.

This ensures continuous, loss-free recording even at high data rates, while simultaneously reducing the need for external logging hardware.





# Power analyser targets EV markets

A high-precision power analyser from Yokogawa addresses a growing need for high-voltage, multi-functional measurement within the renewable energy and electric vehicle markets.

The WT1500 delivers a rated input voltage of 2kV DC, and its four measurement channels fit within a 2U, 19in chassis, making it suitable for rack-mount and PC controlled test environments.

Resolver signal input support enables users to conduct motor evaluation tests without needing additional equipment, while multi-unit synchronisation capabilities, due to be released soon will allow up to five units to connect, for a maximum of 20 power channels.

Total power accuracy is ±0.038% (DC, 50/60Hz) and low-power-factor accuracy is ±0.07% of S at 50/60Hz.

It supports high voltage and wide bandwidth input elements. The HV element supports direct measurement up to 2kV DC and 300kHz, suitable for PCS and ESS applications. The wide bandwidth element supports up to 1kV with a 2MHz bandwidth for measuring complex, high-frequency waveforms generated in modern EV motors.

Both inputs share a common sensor input and can be mixed in one unit.

The 2U height of about 88mm supports four power measurements and four motor evaluations, including encoder and resolver signal inputs, IEEE 1588 time synchronisation, and data output to Can and Can-FD buses and low-latency data transmission via UDP communication.



There are various interfaces for remote control via PC, external monitor or tablet and it has a small front panel for straightforward connection setup or so it can be used as a standalone instrument.

For measurements requiring more than four channels, up to five WT1500 units can be synchronised, enabling 20-channel power measurement. One unit acts as the main controller, directing subunit configuration and consolidating data acquisition. Multi-unit synchronisation support will be out soon.

Four unique current input terminals, alongside its voltage terminals, provide power for current sensors. These, in combination with current adapters that are provided as accessories, enable the unit to accommodate a wide variety of sensors: the CT series solid-core (D-sub terminal, 60 to 2000A, AC/DC), the CT1000S split-core (BNC, 1000A, AC/DC), and AC-only current clamp probes (BNC, 50 and 200A class).

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