VEHICLE electronics

The monthly magazine for automotive electronics engineers

Continental's Aumovio debuts at IAA in Munich

Continental's automotive group sector will participate at September's IAA Mobility fair in Munich for the first time under the brand of the new independent company Aumovio.

Aumovio has emerged out of Continental's automotive group sector, pooling together Continental's consolidated automotive expertise in a new technology and electronics company with a lean and agile organisational structure.

"IAA Mobility is the ideal platform to introduce Aumovio to the automotive world, with exciting products and pioneering innovations," said Philipp von Hirschheydt, CEO of Aumovio. "We have bundled our unique expertise into one company that is focused on key technologies. Together with our customers, we can now shape the future of mobility and create value in a more focused way."

The show will provide Aumovio an opportunity to present various technologies for software-defined vehicles (SDVs), which enhance and enable assisted, automated and autonomous driving.

On its stand, Aumovio will present the Xelve scalable, modular system, comprised of hardware and software that was developed for levels two to four functions.

Thanks to Xelve, vehicle manufacturers should be able to put assisted and automated driving functions into series production more quickly and efficiently.

The precise capture of the vehicle environment, especially including the road ahead, is a fundamental requirement for the further evolution of self-driving vehicles. Aumovio will show visitors at IAA numerous innovations including a night vision camera that improves image quality and therefore vision in the dark, thanks to the use of AI developed in-house.

The show runs from 9 to 12 September.



Aumovio stand design for IAA Mobility

Issue 141
September 2025

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Helm.ai and Honda sign adas research agreement

Autonomous driving AI software provider Helm.ai has signed a multi-year agreement with Honda to accelerate the development of self-driving capabilities.

This will include Honda's NOA navigate on autopilot platform.

The partnership centres on adas for production consumer cars, leveraging Helm.ai's full stack real-time AI software and large-scale auto-labelling and generative simulation foundation models for development and validation.

Helm.ai will contribute its full suite of products geared towards highway and urban autonomy, including its Vision perception stack, Driver vision-based real-time path prediction AI, and VidGen-2, GenSim-1, GenSim-2 and WorldGen-1 generative simulation models.

Powered by Helm.ai's Deep Teaching technology, these real-time AI systems and offline foundation models are pre-trained on large-scale, diverse, multi-modal datasets and can be adapted to meet Honda's specifications for safe, reliable and scalable deployment.

NOA uses an end-to-end (E2E) AI architecture that controls everything from environmental perception to decision-making and vehicle actuation. Designed as a partially automated system requiring constant driver attention, NOA supports both highway and complex urban driving.

Honda aims to scale this E2E technology across a broader vehicle line and is developing a system that assists in operating the accelerator and steering throughout the entire route to the destination, without distinction between regular roads and highways, with mass production targeted after 2027.

"This joint development supports Honda's goal of realising safe and affordable automated driving technologies for our global customers," said Mahito Shikama, vice president at Honda. "Through our collaboration with Helm.ai, we are advancing the development of AI technologies that enhance the real-world applicability of autonomous driving, bringing us closer to a future with zero traffic collision fatalities."

Vladislav Voroninski, CEO of Helm.ai, added: "This joint development highlights our shared vision of enabling AI-powered mobility at scale."

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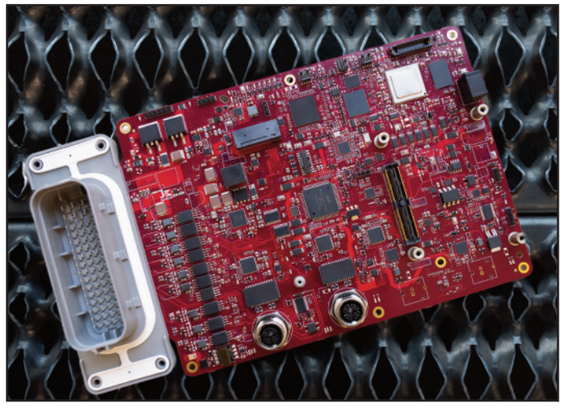


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Kodiak integrates NXP chips into self-driving trucks



NXP components power Kodiak Driver

Autonomous truck company Kodiak Robotics has integrated NXP's automotive processors and in-vehicle networking interfaces to enhance performance, robustness and reliability.

The NXP S32G3 vehicle network processor, S32K3 microcontroller, VR5510 multi-channel high-voltage PMIC and PF53 core supply regulator are integrated in the Kodiak Ace actuation control engine, a custom computer that manages vehicle actuation independently from the main autonomy system.

The Ace is designed to allow the Kodiak Driver AI-powered autonomous system to run a safe fallback manoeuvre and bring a vehicle to a controlled stop if any safety-critical component of either the Kodiak Driver or the underlying vehicle platform fails.

NXP's products also enable critical functions such as vehicle performance monitoring. Ten times each second, the Kodiak Driver evaluates the performance of more than 1000 safety-critical processes and components in the self-driving stack and the underlying truck platform.

Lastly, they power critical safety functions such as on-vehicle power management.

The addition of these products improves reliability and robustness, by supporting the system's self-diagnostic capabilities. Additionally, the interfaces provide a flexible and cost-effective way to adapt the Kodiak Driver to additional vehicle platforms.

"Safety is the foundation of everything we do at Kodiak, and a responsibility we have taken seriously since day one," said Don Burnette, CEO of Kodiak. "Driverless trucks require powerful and reliable safety-critical computing platforms which meet our rigorous safety standards."

NXP's computing and in-vehicle network processors support real-time performance, subsystem integration and functional safety requirements of Kodiak's autonomous system. The processors deliver deterministic, real-time performance for improving the Kodiak Driver's precision control over steering, braking, throttle and power management.

The products comply with ISO 26262 Asil D.

"Autonomous driving systems demand a level of safety and reliability that leaves no room for compromise," said Robert Moran, vice president at NXP.

Nvidia integrates QNX OS into Thor development kit

QNX OS for Safety has been integrated into the Nvidia Drive AGX Thor development kit (see page 34) engineered to power autonomous vehicles.

Developers can tap QNX OS for Safety 8 with Drive AGX Thor to speed innovation from prototype to production.

The Nvidia AGX Thor SoC delivers up to 2000 FP4 performance for generative AI and 1000 INT8 Tflops. Running on this hardware is Nvidia DriveOS, an Nvidia Halos element designed for automotive grade functional safety.

The Nvidia Drive platform, built on the Halos safety system, provides a foundational approach that allows developers to build safe autonomous vehicles with diverse software stacks, sensors and redundant computers.

As part of the DriveOS stack, developers can leverage QNX OS for Safety, a real-time operating system pre-certified to ISO 26262 Asil D and ISO 21434. This integration provides a trusted path for building intelligent, secure and certifiable systems for autonomous mobility.

"The kit, integrated with our newly released QNX OS for Safety 8, offers an industry-proven, ready-to-use platform that simplifies development and helps accelerates certification," said John Wall, COO at QNX.

SiMa.ai and Synopsys extend adas and IVI collaboration

SiMa.ai, a pioneer in machine learning systems-on-chip (MLSoCs), has expanded its collaboration with Synopsys to accelerate AI innovation for the automotive industry.

This collaboration will combine SiMa.ai's energy-efficient ML processing with Synopsys' automotive IP and design tools to develop chiplet architectures and reference SoC designs for adas and in-vehicle infotainment (IVI).

This collaboration focuses on overcoming problems such as low power consumption for EVs and hybrids, real-time processing for safety-critical adas functions, scalable designs for diverse performance needs, cost-effective architectures for broad market adoption, and compliance with automotive functional safety.

The expanded collaboration integrates SiMa's ML simulators into Synopsys' Platform Architect, Virtualizer and ZeBus platforms.

Platform Architect enables exploration of architectural options and model ML requirements for automotive OEM specific adas and IVI workloads. The Virtualizer development kit enables early software development and testing across the automotive ecosystem. And ZeBu emulation provides pre-silicon power, performance and efficiency validation, supported by 95 to 97% accuracy between pre-silicon power emulation estimates and actual silicon.

This collaboration should help automotive users accelerate adas feature development for object detection, lane keeping assistance, automated parking and collision avoidance, and enhance infotainment experiences with AI-powered voice recognition, gesture control, personalised user interfaces and multimedia processing.

Machine-learning accelerator IP and associated software will be available from SiMa.ai for early access by mid-2026 with production release targeted for the end of 2026. A machine-learning IP chiplet will be available by mid-2027.



Toyota adopts Hesai lidar at Chinese joint venture

A new-energy model, to be manufactured by a joint venture of Toyota based in China, will feature Hesai's long-range automotive lidar ATX, and is scheduled to enter mass production next year.

This Toyota joint venture is accelerating its transition to electrification and intelligence: new-energy models now drive its growth, while its adas products are said to set the pace. Powered by a local R&D ecosystem, it integrates global engineering standards with Chinese innovation to deliver smarter, greener mobility at scale.

This partnership reaffirms Hesai's position in lidar and inaugurates a chapter of collaboration with Japan's automotive industry.

Hesai's ATX upgrades its optical-mechanical design and laser transceiver modules. It combines a compact form factor with performance, making it popular among OEMs. ATX has already secured design wins across multiple models with several OEMs planning to adopt it aa standard in their 2025 to 2026 production lines.

Moving forward, Hesai will leverage its lidar R&D and manufacturing capabilities to help Toyota set a benchmark for joint venture brands in the new-energy market.

TÜV certifies Qorix Adaptive Autosar

Qorix, a provider of safety-critical middleware for software-defined vehicles, has achieved TÜV SÜD certification for its Adaptive Autosar stack, confirming compliance with ISO 26262 up to Asil B.

The certification applies to the Qorix Developer tooling, which plays a role in configuring, validating and deploying safety-relevant software components in Adaptive Autosar environments.

This makes Qorix one of the few companies in the automotive industry to hold TÜV certification for an Adaptive stack, a significant achievement given the architectural complexity and service-oriented nature of Adaptive platforms.

"Achieving ISO 26262 Asil-B certification for Qorix Adaptive is a significant technical and strategic milestone," said Nico Hartmann, Qorix's CTO.

Qorix also holds TÜV SÜD certification for its Classic Autosar stack (Asil D).



Test vehicle, powered by AiDrive, in Guangzhou

WeRide develops adas with Bosch

Autonomous driving firm WeRide has launched WePilot AiDrive, a one-stage end-to-end adas, developed in partnership with Bosch.

This comes just six months after both companies took their two-stage end-to-end offering into mass production.

Unlike the traditional two-stage process of sensing and then decision-making, AiDrive integrates both into a one-stage architecture, enabling vehicles to see and act at the same time, similar to a skilled human driver.

This delivers faster responses, shorter driving routes and greater fault tolerance.

AiDrive has completed core function validation and is expected to enter mass production and vehicle deployment later this year, paving the way for smarter, more efficient and widely accessible assisted driving worldwide.

AiDrive is engineered to navigate complex road scenarios with ease, including lane changes in heavy traffic, detours around unplanned construction, unprotected turns at intersections, smooth acceleration when following vehicles, and complex interactions with pedestrians, oncoming vehicles and roadside obstacles on narrow roads in urban villages.

The software runs on high-performance computing platforms and can quickly scale down to mid- and low-power setups via model distillation. Its proprietary middleware decouples algorithms from hardware and foundational software, enabling seamless adaptation across platforms, while its modular level-two functions simplify deployment, speed integration and accelerate mass production.

Partnership ready to advance 4D imaging radar

Radar company Bitsensing has signed a three-way memorandum of understanding (MoU) with the autonomous vehicles laboratory at the Korea Advanced Institute of Science & Technology (Kaist) and Zeta Mobility to advance and commercialise AI-powered 4D imaging radar technology for the automotive sector.

The MoU aims to leverage each party's strengths to co-develop a real-time, embedded AI-based offering that enhances the performance of 4D imaging radar, a critical sensor for autonomous driving and adas.

Bitsensing will provide its 4D imaging radar hardware, Kaist will contribute AI algorithms based on radar signal processing and sensor fusion, and Zeta will offer large automotive datasets and embedded AI expertise.

Together, the three organisations will collaborate on research and development to accelerate commercialisation.

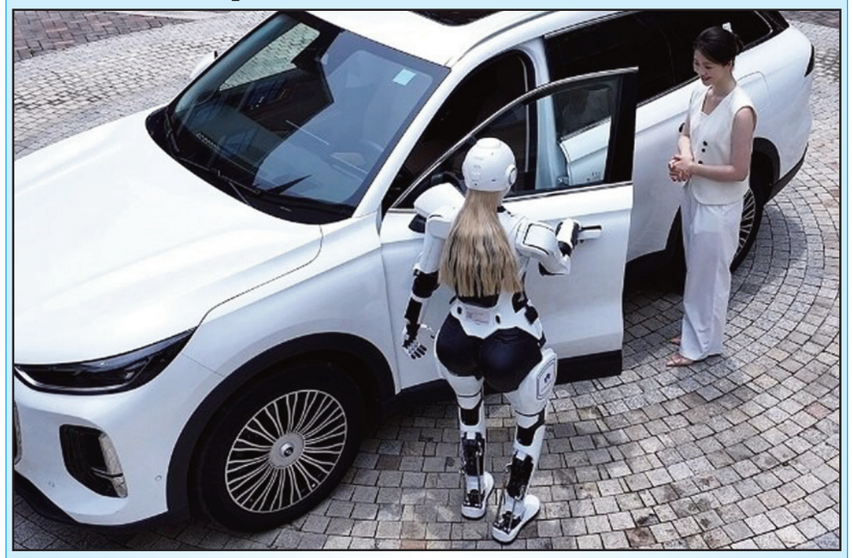
Unlike conventional radar, 4D imaging radar captures not only distance, velocity and direction, but also elevation, enabling accurate detection and classification of objects in complex environments. Thanks to radar's inherent robustness in rain, snow and fog, this ensures consistent performance in adverse weather conditions.

"4D imaging radar is a key sensor for autonomous driving that demands both high precision and all-weather reliability," said Jae-Eun Lee, CEO of Bitsensing.

The partners expect to improve the recognition and classification accuracy of vehicles, pedestrians and infrastructure on the road.

The three parties will pursue phased cooperation, including joint R&D, performance validation and field testing.

Robot opens car doors in dealers



Car maker Chery's Aimoga Robotics division has built a humanoid robot called Mornine that can open car doors inside Chery dealership using its onboard sensors, full-body motion control and end-to-end reinforcement learning.

Unlike traditional scripted robots or teleoperated systems, Mornine completes the task without human intervention. The robot identifies the door handle, adjusts its posture and pulls open the door using coordinated force across its arms, waist and legs.

Mornine's sensor stack includes 3D lidar, depth and wide-angle cameras, and a visual-language model, allowing it to perceive door position and opening status in real time. Rather than being programmed to recognise handles, the robot learned this through reinforcement learning: over millions of simulation cycles, the model independently learned to focus on the correct region and execute the task.

"We never explicitly told the robot what a door handle is," said the engineering team. "It learned to focus on that region by itself."

Mornine is operating in several Chery dealerships in China. Beyond opening car doors, it assists in customer greeting, vehicle introduction and item delivery.

US and Europe MoU unites commercial connectivity

The US Connected Vehicle Systems Alliance (Covesa) and the European Automobile Manufacturers' Association (Acea) have signed a memorandum of understanding (MoU) to achieve industry-wide interoperability for connected commercial vehicles.

The MoU establishes a cooperative framework between Covesa, formerly known as the Genivi Alliance, and Acea to ensure interoperability across truck and bus OEMs through the joint development of a standard onboard API, designed to support fleet management applications.

This collaboration will build on and extend Covesa's VSS vehicle signal specification by jointly defining an expanded data catalogue tailored to the needs of commercial vehicle manufacturers and fleet managers.

The onboard API is based on transport protocols already supported by Covesa's Viss vehicle interface service specification, which provides access to VSS data.

By enabling consistent data exchange across different vehicle platforms, this initiative aims to enhance integration, efficiency and scalability for commercial vehicles across the industry.

"Commercial fleets depend heavily on data," said Steve Crumb, executive director of Covesa. "As data increasingly fuels the daily operations and long-term strategies of commercial transport, this collaboration with Acea aims to address the urgent need for reliable, secure and standardised data exchange. Together, we can eliminate fragmentation and foster interoperability across the industry, increasing the value of data for fleets, OEMs and technology providers alike."

Jocelyn Delatre, head of digital policy at Acea, added: "This collaboration supports Acea's mission to drive Europe's mobility transformation while strengthening the global competitiveness of our automotive industry. Together with Covesa, we are advancing interoperability in commercial transport by standardising onboard APIs and aligning data specifications. This will help accelerate innovation in fleet management, support regulatory demands, and address major technology shifts and the changing mobility needs of Europeans."

MediaTek backs Google project for firmware upgrades

MediaTek has become the first partner to commit to Google's Project Treble specifically for the automotive ecosystem.

This programme, which provides customers with at least four years of firmware upgrades and maintenance patches, is designed to enhance partner support, reduce total costs, protect user data and extend the lifecycle of automotive products.



MediaTek commits to Google Project Treble

At launch, two MediaTek products – the MT8678 and MT8676 – will support Project Treble for automotive partners. As part of this programme, members will not be charged additional fees for major upgrades or maintenance updates, which results in a reduced total cost of ownership.

"We've enjoyed a long history of working together with Google in many product categories, and we're looking forward to extending our collaborative relationships to strengthen our automotive product portfolio," said Mike Chang, corporate vice president at MediaTek. "Through Project Treble, we will be able to affordably provide automakers with the latest technology features over the life of the car, ensuring drivers will have everything they need to stay informed, focused and safe on the road."

The MediaTek MT8678 and MT8676 are available today.



Arm transforms data for Aston Martin F1 team

Arm is helping the Aston Martin Formula One team transform sensor data from its wind tunnel into insights that improve vehicle performance.

When Aston Martin built its wind tunnel, the goal was to turn data into aerodynamics and downforce faster than the competition. That required a compute platform to deliver scalable intelligence at the edge, inside a regulated, high-pressure development loop.

Arm is Aston Martin's official AI compute platform provider.

By regulation, all F1 wind tunnel models must be no larger than 60% of the actual car. Inside that, Aston Martin has packed sensing technology and compute systems to capture more detailed aerodynamic data with greater accuracy.

However, more fidelity introduces complexity, with over a thousand sensors packed into the body, all functioning within strict power and thermal budgets. Each session in the wind tunnel is also time-limited and high-stakes, where a single faulty sensor can invalidate an entire run.

To make sense of the large volume of data generated, the team uses Arm-powered compute at the edge to filter and process signals in real time. This gives engineers faster access to cleaner insights, so they can focus on identifying development paths that lead to real performance on the track sooner.

"In Formula One, everything we do is driven by data," said Charlie Blackwell, head of electronics at Aston Martin. "From an engineering perspective, our decisions rely on having the right information at the right time. The faster we can access and understand those data, the faster we can move, and that's where this system makes a real difference."

At the heart of the infrastructure is the CoreWeave wind tunnel built on the Arm compute platform. It begins at the sensor level, where embedded Arm microcontrollers provide accurate, energy-efficient signal acquisition.

To ensure engineers are working with clean, usable insights, the data are processed in real time at the edge, organising, filtering and flagging any inconsistencies before results are validated in the cloud. This helps protect the integrity of each session and enables faster feedback into the development process.

From there, selected data flow to the cloud, where they are validated against computational fluid dynamic simulations and correlated with telemetry from the track. The result is a continuous, synchronised loop that helps engineers validate concepts and refine upgrades.

"The CoreWeave wind tunnel plays a critical role in how we develop the car," said Blackwell. "Accuracy is everything in Formula One; every single detail matters, so we need to get the right tools and the right sensors."

The backend complements the real-time processing at the edge, ensuring insights gathered in the tunnel can be rapidly confirmed, compared with digital models, and aligned with real-world performance data from the car.

With Arm-powered edge AI inference and real-time processing in place, the team extracts more value from every minute of time spent in the wind tunnel. Each session delivers insights with higher confidence and fewer disruptions, which then translate into earlier upgrade validation, smarter development calls and a faster cycle from concept to competition.



Miovision collaborates with Samsung subsidiary Harman

Miovision and Harman let cars talk with traffic lights

Intelligent mobility firm Miovision is collaborating with Samsung subsidiary Harman to bring predictive traffic light-based insights to connected vehicles.

By the end of this year, they expect to be communicating with traffic lights at 100,000 intersections in major cities and economic centres across North America and Europe, with the intention of doubling that number in 2026.

This partnership, announced at ITS World Congress in Atlanta, Georgia, aims to create safer, more efficient and sustainable urban environments by combining Harman's Ready Aware cloud-native, vehicle-to-network (V2N) SaaS with Miovision's AI-powered traffic signal prediction.

Ready Aware offers intersection-level situational awareness to drivers for safer and more informed driving decisions on the road.

With exclusive access to Miovision's expansive and growing traffic signal data network, Harman will offer an intelligent vehicle-to-cloud digital alerting system, ready for deployment in current and future production vehicles.

"Harman Ready Aware offers a unique in-vehicle experience by leveraging insights from surrounding traffic lights to deliver digital alerts that help drivers make more informed decisions and navigate connected corridors and intersections safely," said Suman Sehra, vice president at Harman. "This exclusive partnership with Miovision will see its real-time traffic signal data integrated into Ready Aware, making it easier than ever for automakers to deliver a scalable, contextually aware in-vehicle driving experience."

Thomas Bauer, vice president at Miovision, added: "This collaboration brings the intelligence of city infrastructure directly into the driver's seat. By knowing how traffic lights will behave ahead, drivers gain greater confidence to make safer, smoother decisions, avoiding unnecessary stops that waste time and fuel. Together with Harman, we're helping automakers deliver a connected experience that improves safety, efficiency and sustainability where it matters most: on the road."

Tata establishes cloud HiL centre for Suzuki

Tata Elxsi has opened a cloud hardware-in-the-loop (HiL) centre in Trivandrum, India, with Suzuki to accelerate software-defined vehicle programmes.

This dedicated facility is Suzuki's first full-vehicle cloud-enabled HIL validation centre and is the second engineering centre established under the Tata Elxsi-Suzuki partnership, following an offshore development centre in Pune

The cloud HIL centre is engineered for early-stage, full-vehicle simulation and validation through a cloud-native infrastructure. Suzuki's development and test teams can remotely access HiL infrastructure integrated with ECUs, reducing reliance on physical prototypes and accelerating validation cycles.

Court backs Infineon in GaN patent row

A German court has ruled in favour of Infineon in its patent infringement case against Innoscience.

The District Court Munich ruled in favour of Infineon in a first instance patent infringement case concerning gallium nitride (GaN) technology between Infineon and Innoscience.

The case centres on the unauthorised use of Infineon's patented GaN technologies by Innoscience. GaN enables high-performance and energy-efficient power in applications such as renewable energy systems, data centres, industrial automation and electric vehicles.

The Munich court's decision was issued in a patent infringement case brought by Infineon against Innoscience. The court found that Infineon's patent was infringed by GaN products that Innoscience is offering in Germany.

The decision prohibits Innoscience from manufacturing, selling or marketing the infringing products in Germany. Additionally, the decision requires Innoscience to pay damages to Infineon.

"The ruling is a testament to the strength of Infineon's intellectual property and confirms Infineon's commitment to vigorously defend its intellectual property against infringements," said Johannes Schoiswohl, senior VP at Infineon.

Innoscience was approached for comment but had not replied at the time of going to press.

• Infineon has completed the acquisition of Marvell's automotive Ethernet business, having received necessary regulatory approvals. This should strengthen Infineon's expertise for software-defined vehicles and expand its position in microcontrollers for automotive applications.

New Eagle announces ECU software support for Codesys

New Eagle, a specialist in embedded control systems for intelligent vehicles and machines, has announced software support for Codesys across its rugged ECUs, beginning with the John Deere M-series controllers.

The release should bring programming flexibility to OEMs and developers in off-highway, utility and industrial vehicle markets.

By enabling support for the Codesys platform, New Eagle gives engineering teams more ways to design, develop and deploy control systems, leveraging the same ECU hardware already proven in the field.

Teams can now select the development workflow that best suits their needs, without the overhead of switching controller platforms or compromising production readiness.

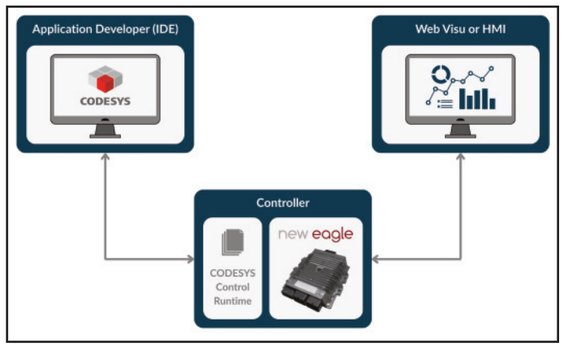
"Our mission is to help customers get to market faster, with more freedom in how they build their systems," said Chris Baker, CEO of New Eagle. "Supporting Codesys on rugged, production-ready ECUs is a major step forward in giving engineers the tools they trust, on hardware they can rely on."

The Codesys-compatible ECUs are identical in hardware to the company's Raptor-supported platforms, offering around 98% commonality in board-level software. This ensures teams retain all the reliability, ruggedness and supply chain confidence of New Eagle's embedded control portfolio, while opening development options for Codesys users.

This is suitable for OEMs and system integrators in construction, agriculture and utility vehicle segments, as well as projects requiring CanOpen network functionality.

Engineering teams already using Codesys in desktop or industrial workflows can now look to scale into mobile, vehicle-grade applications.

The production-grade ECU hardware is already adopted in off-highway and industrial sectors. This added capability addresses growing market demand for rugged control that doesn't require proprietary software stacks, providing long-term flexibility and freedom from vendor lock-in.



New Eagle with Codesys integration

Danlaw picks ISS for V2X roadside units

Integrity Security Services (ISS) has partnered with Danlaw and its subsidiary Cohda Wireless to expand its V2X business, to demonstrate vehicle-to-network-to-everything (V2N2X) capabilities.

As part of this collaboration, the Danlaw RouteLink roadside units (RSUs) are now powered by the ISS TrafficAuth-SCMS client libraries, to deliver secure, standards-compliant and interoperable communications to accelerate the development of safer, smarter transportation networks worldwide.

"We've trusted ISS since our inception and turned to them for this newest partnership as they are a pioneer in SCMS," said Andrea Ash, vice president at Cohda Wireless. "With the new ISS API, we can seamlessly integrate our networked applications into the expanding ecosystem of vehicles, traffic infrastructure, emergency services and other intelligent mobility."

This collaboration enables interoperability between LTE (cellular), Uu and PC5 protocols for RSUs, ensuring secure communications across transportation and mobile infrastructures. By integrating the TrafficAuth-SCMS client libraries, Danlaw can deploy ISS certificates, handle enrolments and signing functions and enable critical data – such as traffic light changes, road hazards and construction alerts – to be securely transmitted to connected vehicles and mobile devices.

RouteLink RSU, enhanced with ISS, provides real-time situational awareness by alerting drivers to hazardous conditions, empowering first responders with information, and optimising signal priority for buses and service vehicles.

"Our goal is to accelerate the growth of the V2X ecosystem by enabling truly interoperable, secure and standards-based communications between mobile devices and transportation infrastructure," says Murray Egan, director of sales at ISS.

ISS has just released TrafficAuth-Mobile, the first V2N2X application that enables secure interoperability of messages across cellular networks and the rapidly growing direct V2X transportation network.

"TrafficAuth-Mobile builds a whole new foundation for safer, smarter and more reliable V2N2X communications that will improve the efficiency of roadway systems and operations, and help keep American drivers and transport workers safe, connected and secure," said Brian Romansky, vice president at ISS.

TrafficAuth-Mobile lets Android and iOS mobile devices send and receive secure messages with other transport applications including connected cars, traffic infrastructure and other mobile users.

Features help keep road workers safe. For service providers and other transportation vendors, the TrafficAuth-SCMS client libraries also let them embed the same functionality in their own apps for V2N2X communications.

Cetecom gives green light to Anritsu NG eCall tester

Cetecom Advanced has validated Anritsu's MX-703330E ecall tester as a Public Safety Answering Point (PSAP) simulator that meets the EN 17240: 2024 NG eCall conformance test standard.



This certification positions the MX703330E as a proven, compliant PSAP simulator for NG eCall vehicle type-approval testing, a critical requirement as Europe prepares for mandatory implementation.

When a traffic accident occurs, the car's in-vehicle system automatically initiates an emergency call and transmits vital accident information directly to emergency response centres. By leveraging communication networks including LTE, NG eCall enables faster, more reliable emergency responses.

European regulations mandate NG eCall for all new vehicle types from the start of next year. This makes EN 17240: 2024 certified PSAP simulators essential for vehicle manufacturers seeking vehicle type-approval testing in Europe.



Sensors measure occupant size and posture

RFPro simulation aids in-cabin sensor research

RFPro is helping a collaborative research project develop and validate automotive sensor systems through simulation.

The Sim4CamSens2 initiative builds on the success of the original Sim4CamSens project and extends the focus from exterior to include interior-facing sensors, addressing the growing importance of in-cabin monitoring for safety and autonomy.

Led by Claytex, the project brings together partners including Oxford RF, Syslek, Queen Mary University of London, National Physical Laboratory (NPL), Compound Semiconductor Applications Catapult, and Aesin.

RFPro's contribution aims to advance simulation verification processes and research how synthetic data can be used for assessing the performance of real-world deployed perception systems. It is enhancing its simulation platform to model and test in-cabin sensor systems with greater fidelity than previously possible.

The first Sim4CamSens project improved the realism of external-facing sensor simulation. RFPro upgraded its platform to replicate more accurately real-world light attenuation, reflections and environmental conditions, such as fog. These simulations were correlated with physical sensor data across a wide range of lighting and weather conditions.

Sim4CamSens2 continues this trajectory by developing more efficient sensor characterisation methods. Rather than extensive field testing over months, the initiative aims to establish minimal laboratory testing protocols that provide sufficient data for accurate simulation correlation.

This should significantly reduce the time and cost of developing new sensor integrations into the simulation.

Secondly, it will examine how perception systems perform in degraded conditions, such as a scratched or dirty lens or various levels of fog, in real and synthetic data. This will help define the conditions that most impact system performance, enabling engineers to focus development efforts where they matter most.

RFPro will adapt its simulation tools to model human movement and skin appearance, develop detailed digital twins of vehicle interiors, and create in-cabin specific edge case scenarios for testing. It will also develop sensor type integrations for infra-red cameras.

"A lot of our existing technologies can be applied to interior-facing sensors with some adaptation," said Matt Daley, technical director at RFPro. "By covering both exterior and interior sensing, we're providing the industry with the most advanced single simulation platform to accelerate the safe deployment of intelligent and autonomous vehicles."

Several tier-one automotive suppliers are already collaborating with RFPro on this technology, establishing a commercialisation pathway and demonstrating existing market demand for enhanced interior sensor simulation capabilities.

Socionext licenses AIWare IP

Socionext has been granted access to AIMotive's AIWare IP and development tools to support the development, including tape-out, of custom SoCs based on chiplet technology for adas applications.

The licence agreement is expected to accelerate the adoption of AIMotive's technologies while enabling Socionext to broaden its portfolio of automotive products.

By integrating AIWare's low-power, high-efficiency neural network accelerator, Socionext aims to deliver optimised SoCs tailored to the evolving demands of adas.

"This is a pivotal moment for AIWare," said Márton Fehér, senior vice president at AIMotive. "Socionext's deep expertise in automotive custom SoC design and strong industry relationships make them ideal to bring our scalable, power-efficient AI acceleration technology to the next level."

In the automotive sector, Socionext focuses on developing high-performance, energy-efficient products, such as neural network accelerators and SDKs.

VEHICLE NETWORKS



KEEPING IT SIMPLE

Andreas Pellkofer and Madhura Deyanda Poonacha look at how 10baseT1S Ethernet simplifies zonal architectures in automotive applications

With modern cars aiming to provide home-like comfort and entertainment, the demand for ECUs has grown exponentially. However, older bus technologies and electrical-electronic (EE) architectures struggle to keep up.

The use of ECUs, which control each component of a vehicle's operation, in automobiles has grown rapidly since their first installation by Volkswagen in 1968. Features are added to modern cars to offer the driver and passengers the same level of experience as at home or work in comfort and entertainment.

As a result, most bus technologies and EE architectures – some of which were established decades ago – cannot keep up with the growing demand for ECUs to interact and process large amounts of data.

Network

Current vehicle ECUs are divided into almost isolated, functional domains such as powertrain, chassis, infotainment or comfort. Sensors and actuators are dispersed around the vehicle and wires flow to link to its functional domain ECUs, as shown in Fig. 1, increasing vehicle complexity, cost and weight. Cables are the third heaviest part of the car.

Legacy bus technologies such as Can, Flexray and Lin were introduced decades ago to facilitate communication between various ECUs and simple sensors or actuators.

In contrast, high speed Ethernet is used for communication between different domains. To facilitate data transfer between different bus technologies,

expensive dedicated gateways are employed within the ECUs.

The complexity of the architecture expands as the number of features increases. Extending existing features or introducing new ones necessitates significant development, implementation and testing.

The goal of OEMs is not only to accelerate innovation while reducing costs, but also to generate post revenue sales. Compared with other consumer products such as mobile communication devices, a vehicle architecture has significantly longer development cycles.

Breaking the link between hardware and software towards a software-defined vehicle is a target set by many OEMs.

Two major challenges prevent realising this vision: the static functional domain architecture; and wiring complexity.

The ideal architecture identified is a zonal-based view of the vehicle, see Fig. 2. Local ECUs serve all functions regardless of the domain. These ECUs are then connected to zonal controller devices, which concentrate processing power in a small number of units across the vehicle. The communication between zonal ECUs and the high-performance compute unit takes place via high-speed point-to-point links.

According to Volkswagen subsidiary Cariad, this will replace over two dozen ECUs and wiring harnesses longer than a kilometre.

With technology transforming vehicle design and performance, the automotive industry is going through a significant vehicle network architectural transition. Implementation of technologies such as vehicle-to-vehicle communications, augmented reality dashboards and self-driving adds complexity, cost and the need for more electronics. By 2030, it is estimated that these technologies will increase automotive electronics by up to 45%.

With the introduction of zonal architecture, numerous electrical components and control systems are consolidated and centralised into predetermined zones within the vehicle. Now nodes are dependent on their location and not on their functional ECUs. The network is made simpler, which results in less weight and an increase in fuel efficiency.

Additionally, this architecture makes scaling simpler because new features and systems may be added without requiring extensive modifications. Over-the-air software upgrades may now be made more efficient by delivering through the vehicle's central computer unit.

OEMs may now remotely enhance features by offering customisation to the customer and adopting post-sales strategies such as adas, autonomous driving or comfort and infotainment.

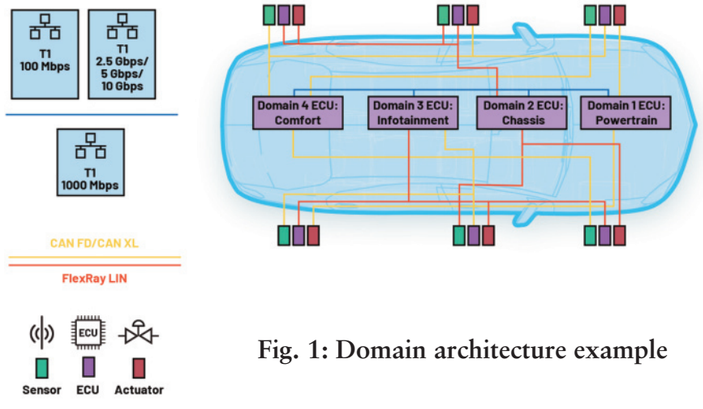


Fig. 1: Domain architecture example

Bridging

Legacy bus technologies lack the performance capabilities, such as throughput and quality of service, required in this new architecture. Now, another well-established technology has made its way into the automotive industry: Ethernet.

For decades, Ethernet technologies have evolved with the demand for higher data rates by developing new physical layers (phys), thereby keeping the higher protocol layers identical or at least compatible.

Some speed grades even work on identical harnesses. Network features are serviced by higher protocol layers, mainly in software.

Initially, Ethernet was not specifically tailored for automotive environments, lacking features such as EMC and power efficiency. Also, using shielded cables with two or four pairs of wires is contrary to the goal of saving weight.

The automotive industry standardised a single twisted pair cable, prompting the need for the development of new phy technologies that meet all the demands of an automotive communication link.

This led to the development of the xbaseT1 automotive Ethernet standards; T1 stands for a single twisted pair cable.

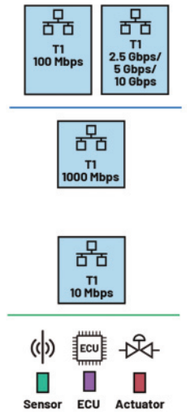
Different data rates are supported for ECU interconnects. In addition, the crossing between different speed grades is handled by much simpler devices: switches. This allows the number of expensive gateways to be reduced.

Although zonal architecture provides a wide platform for all network technologies, issues remain with adaptation to homogenous network architecture, boot time, achieving latency and throughput.

With about 90% of network nodes running at rates of up to 10Mbit/s, many automotive network technologies that were formerly sufficient are now incapable of achieving the required throughput. These constraints impede the smooth integration of advanced in-vehicle systems. As a result, there is an increasing demand for creative options to assure quick response times and improve overall performance.

Implementation

By extending Ethernet to the edge node, the system has a robust network and packet movement is simplified. 10baseT1S is an integrated part of the IEEE 802.3-2022 collection of Ethernet specifications and OEMs have begun to implement this Ethernet phy technology, with plans to have it on the road this year. The Open (One-Pair EtherNet) Alliance, a working group, built its specifications to augment the IEEE standard, aiming to encourage the widespread adoption of Ethernet in automotive industries.



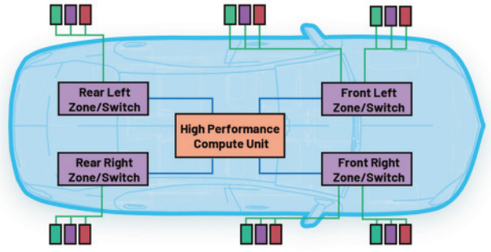


Fig. 2: Zonal architecture example

Like other automotive link technologies, 10baseT1S can operate in multidrop mode configurations. It employs a new bus access technique called physical layer collision avoidance (PLCA) on top of carrier-sense multiple access with collision detection (CSMA-CD) to avoid bus collisions. PLCA ensures that latency remains within predictable bounds while increasing throughput and network efficiency.

The use of 10baseT1S in some common, system-critical applications reduces system complexity, allowing for faster and efficient data transfer within vehicles. These extended system benefits include cost reduction, enhanced security, a unified communication mechanism without the need for complex gateways, and the option of power over data lines, ensuring a smooth integration into the forthcoming generation of software-defined vehicles.

Conclusion

The transition from existing automotive domain design to zonal architecture marks a significant advancement in automobiles. Zonal architecture offers flexibility and scalability. It enables centralisation of software, reduces wiring, enhances fuel efficiency by decreasing weight, and maintains cost-effectiveness.

Ethernet simplifies network complexity compared with using a combination of technologies. The inclusion of 10baseT1S extends Automotive Ethernet to the vehicle's edge, reducing the need for expensive gateways. The EE architecture with 10baseT1S at zones will offer a scalable software approach with more advancement in future vehicle networks.



Andreas Pellkofer is system applications engineer and Madhura Deyanda Poonacha is product marketing specialist, both at Analog Devices



SAFETY & SECURITY



Dani Cherkassky shows why voice AI can be key for safer automotive human-machine interfaces

DASHBOARD DILEMMA

The automotive industry stands at a critical juncture as safety regulators worldwide increasingly scrutinise the touchscreen-dominated dashboard designs that have defined vehicle interfaces for over a decade.

The evidence is stark: research from the Norwegian Council for Road Safety found that entering an address into a car's navigation system via touchscreen caused drivers' eyes to be off the road for an average of 15.7 seconds, with some drivers remaining distracted for nearly a kilometre of highway travel.

Even more alarming, studies show that reaction times while using touchscreens can be worse than those experienced under the influence of alcohol or drugs.

The US National Highway Traffic Safety Administration reports that even a two-second glance away from the road doubles crash risk, yet touchscreen-based infotainment regularly demands up to 40s of visual attention. The same report attributed 3522 fatalities – 8% of all traffic deaths in 2021 in the USA – to distracted driving, with in-vehicle technology playing a growing role.

A voice user interface (VUI) is the key to solving the core safety and usability problems. When properly implemented, a VUI can address the core safety concerns of modern vehicle human machine interfaces (HMIs) while meeting consumer expectations for intuitive, intelligent control systems.

Touchscreens

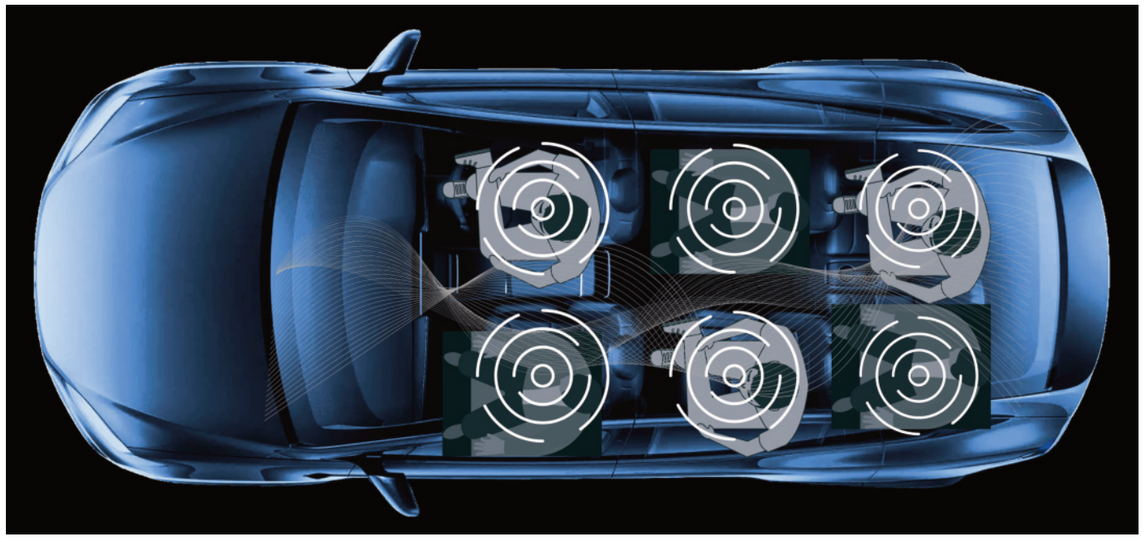
The automotive industry embraced touchscreens for good reasons: they're sleek, flexible and cost-effective. Replacing physical buttons with software-driven interfaces promised design freedom and modern appeal. But this shift has come at a price, and concerns around driver distraction and safety have grown louder and harder to ignore.

Unlike physical buttons that drivers can find by feel, touchscreens demand continuous visual attention from drivers. The problem compounds when critical functions are buried within multiple menu layers, requiring several swipes or taps to access basic vehicle controls.

This significantly extends the time drivers must divert their attention from the road, which is a dangerous proposition, as research consistently shows taking eyes off the road for just two seconds doubles the risk of a crash.

The cognitive load imposed by touchscreen interfaces extends beyond the time required for simple task completion. Drivers must locate virtual buttons on unmarked surfaces, navigate through software menus and confirm selections, all while processing road conditions, traffic and vehicle dynamics.

This multitasking burden can overwhelm human cognitive capacity, leading to delayed reactions and poor decision-making.



Spatial hearing AI and cognitive AI for automotive



Automotive voice user interfaces and control

Voice

VUI offers a compelling solution to the safety problems inherent in complex in-vehicle controls. When functioning optimally, voice interaction helps drivers maintain visual focus on the road while controlling sophisticated vehicle systems through natural language interaction.

VUI can reduce off-road glance behaviour. Speech input decreases both total glance duration and the frequency of visual diversions, improving driving performance across various scenarios.

The safety advantages of VUI extend beyond simply reducing distraction. Natural language is used effortlessly by humans to provide complex, multi-parameter commands that would require numerous touchscreen interactions. A driver can adjust climate control, navigation settings and entertainment preferences through a single spoken command, eliminating the need for sequential menu navigation while driving.

However, realising these safety benefits requires overcoming significant technical challenges that have historically limited the effectiveness of VUI in the automotive sector.

Understanding

The automotive cabin is one of the toughest environments for VUI to get right, and most systems today still fall short. It's a confined space filled with reflective surfaces, such as windows, dashboards and panels, that create complex reverberations, distorting the clarity of spoken commands.

Environmental noise makes things even tougher. Inside a vehicle, voice systems have to compete with a constant mix of sounds — engine rumble, HVAC airflow, road vibrations, wind noise, conversations and outside traffic. These sounds shift unpredictably with speed, terrain and weather, creating a moving target that traditional voice recognition systems simply weren't built to handle.

But acoustic challenges are only half the battle. Even in perfect silence, voice interfaces must wrestle with the chaotic reality of human speech patterns. Drivers want to speak to their cars the way they speak the other humans. Under stress, in motion or while multitasking, people issue fragmented commands, use imprecise language, and expect systems to understand context that wasn't explicitly stated.

Traditional voice systems expect specific syntax and keywords, but real-world usage reveals commands such as "Make it warmer but not too much" and "Skip this song, no wait, the next one", or interrupt mid-sentence when traffic demands attention.

Advanced natural language processing must parse these imperfect inputs, handle corrections and clarifications, and maintain conversational context

across interrupted interactions.

Recent advances in spatial hearing AI technology processing offer promising solutions to these problems. Advanced signal processing algorithms can identify the spatial origin of speech signals and apply directional filtering to improve recognition accuracy even when commands are garbled or incomplete.

Voice AI enables natural language interfaces to process complex commands, thereby eliminating the need for numerous touchscreen interactions. Advanced voice AI systems can also interpret ambiguous requests based on vehicle state, environmental conditions and user preferences.

For example, "I'm getting cold" can trigger climate adjustments without specific parameter settings, and "find the fastest route home" can account for traffic conditions.

Modern small language models (SLMs) built for automotive enable natural voice interaction. These systems understand vehicle context, recent command history and driver patterns to make intelligent predictions about likely commands. They can maintain context when conversations are interrupted by driving demands. The result is improved recognition accuracy and a more intuitive user experience.

Edge computing enhances reliability and responsiveness by processing routine commands locally while leveraging cloud resources for complex queries. This hybrid approach reduces latency for safety-critical functions while maintaining access to comprehensive knowledge bases for complex requests, ensuring that even unconventional phrasings can be understood and acted upon.

Accuracy

Unlike traditional statistical approaches, spatial processing based on neural networks adapts to the changing noise profiles typical in automotive environments and the unpredictable nature of human speech patterns. These AI-driven systems learn to identify and suppress specific noise signatures from tyre noise on different road surfaces to hvac system harmonics, while preserving speech intelligibility. The result is dramatically improved recognition accuracy across varying driving conditions, from quiet suburban streets to high-speed highway environments, even when drivers speak naturally rather than robotically.

Speaker identification and separation technologies add another layer of sophistication to automotive voice systems. Machine-learning algorithms can now distinguish between individual cabin occupants, enabling personalised responses and enhanced security for driver-specific functions. This capability supports both convenience features and safety protocols, ensuring that critical vehicle controls respond only to authorised operators.

Significant advances in edge computing and SLMs are paving



Future of automotive voice UI



Spatial hearing AI platform

the way for a new generation of in-car VUI. Unlike current systems that rely on a constant cloud connection, these purpose-built SLMs can run directly on the car's hardware. This architectural shift allows for an always-on, always-listening VUI that can understand context and respond to human language seamlessly and efficiently, even without an internet connection.

This is a giant leap closer to creating truly human-like VUIs that are more natural and responsive.

Multimodal

The future of automotive HMIs lies not in choosing between physical controls, voice commands or visual displays, but in thoughtfully integrating these modalities to optimise safety and usability. Each interaction method offers distinct advantages that complement, rather than compete with, each other.

Physical controls remain optimal for immediate, safety-critical functions that require instant, reliable access. Turn signals, emergency flashers and windshield wipers benefit from tactile interfaces that function regardless of system state or environmental conditions. Additionally, physical controls are essential for drivers with speech impairments or communication disabilities, ensuring universal accessibility and safety.

VUI excels for complex, multi-parameter adjustments that would otherwise require multiple touchscreen interactions. Climate control, navigation programming and entertainment system management become significantly safer when accomplished through natural language commands.

Visual displays serve important roles for information browsing and system feedback when vehicles are stationary. The key is preventing these interfaces from demanding attention during active driving scenarios.

Implementation

The successful implementation of automotive VUI requires careful attention to several engineering challenges. Integration with vehicle acoustic design must consider cabin geometry, material properties and noise characteristics from the earliest design phases. Advanced software can help manufacturers optimise performance while controlling hardware costs compared with traditional multi-microphone approaches.

Global market requirements demand robust performance across multiple languages, accents and regional speech patterns. VUI systems must maintain high accuracy across diverse user populations while adapting to local linguistic preferences and cultural communication styles.

Safety considerations require voice systems to enhance rather than complicate operation. Systems that accurately identify speakers and process natural language commands can significantly reduce the need for drivers to interact with physical controls or visual displays.

Future

The rise of gen AI, specifically SLMs, represents a fundamental shift towards human-centred design, prioritising safety while delivering the intelligent and intuitive experiences that modern drivers expect. As safety regulators worldwide examine the relationship between vehicle interfaces and accident rates, voice AI technology has now reached a level of maturity that enables it to serve as a genuine safety enhancement rather than merely a convenience feature.

The convergence of advanced acoustic processing, neural network-based recognition and context-aware intelligence creates unprecedented opportunities to reduce driver distraction while improving vehicle functionality.

The coming years will likely witness significant innovation at the intersection of regulatory requirements, safety research and technological capabilities. Manufacturers who embrace this transition early will be best positioned to create vehicles that are both safer and more capable than those relying solely on traditional interface approaches.



Dani Cherkassky is CEO of Kardome



DESIGNING FOR IMPACT

Andrea Incardona explains why engineers in the automotive and electronics sectors rely on tensile impact data to guide material choice

From reinforced structural components to thin battery films, materials in the automotive and electronics sectors face vastly different demands. Yet, both rely on tensile impact testing to characterise material strength, energy absorption and failure behaviour under dynamic loads.

Tensile impact testing helps engineers simulate real-world conditions, spot weaknesses before failure and build safer, more reliable products.

Today's large automotive components, designed to meet growing technical demands such as improved crash energy absorption and reduced vehicle weight, often use hybrid materials such as carbon fibre reinforced polymers (CFRP) or multilayer structures such as aluminium-plastic composites. These materials often behave unpredictably under high strain rates, making mechanical characterisation difficult under real-world conditions such as crash events.

In contrast, electronic materials such as thin polymer films, adhesives or ceramics are smaller and demand more precise testing. Even minor cutting defects during specimen preparation or alignment errors during testing can skew results beyond expected tolerances.

Real-world environmental conditions introduce additional variables during material characterisation testing. Dashboards and phone casings, for example, experience thermal swings from intense summer heat to freezing winter mornings. These fluctuations affect material properties and must be accounted for.

Test setup is critical. Some plastics deform gradually under stress, while others fail suddenly. Gripping methods, specimen geometry and impact velocities must reflect real-world conditions. A test that doesn't simulate field conditions may miss critical weaknesses.

Impact

Tensile impact testing evaluates how materials behave under sudden loads, guiding material choice and product design.

In automotive crashes, crumple zones must absorb energy without cracking. In electronics, battery components, films and battery components must withstand impact, heat and dynamic stress without losing integrity.

Often, a material's failure mode matters as much as its strength. Car interior components might be needed to shatter into small, non-lethal fragments for safety. In consumer electronics, repeated drop testing helps predict performance and lifespan under real-world conditions.

Testing procedures also differ by sector. Automotive materials typically use dog-bone shaped specimens, suited to larger, stiffer samples. In contrast, electronics favour strip-shaped specimens for thin, flexible polymers, as they reduce stress concentrations and better reflect real use.



Drop tower systems are common for tensile impact testing

Drop tower systems are a common tool for tensile impact testing. These provide controlled, repeatable impact velocities across a wide range of impact energies. In a typical setup, the specimen is gripped vertically between fixtures, and a weighted striker is dropped from a specified height to apply a sudden tensile load, simulating real-world dynamic stress events such as crashes or drops.

Digital image correlation (DIC) can be integrated with the drop tower testing to enhance outputs by mapping strain fields in real time. This is especially useful for composites, where force measurements alone may not capture local deformations due to the material's high anisotropy.

Design

Tensile impact testing guides engineers in materials selection at every stage, from raw polymer formulation to choosing the most suitable processing method. For example, nanoporous polymer films in lithium-ion batteries must balance porosity for ion transfer with the strength necessary to maintain functionality.

Testing across strain rates and temperatures helps fine-tune mechanical properties for safe, reliable performance. In plastics, tensile impact testing can reveal the glass transition temperature, informing design decisions that enhance durability and safety.

From thin films in electronics to reinforced structures in vehicles, tensile impact testing bridges the gap between material science and real-world performance.

By simulating dynamic impact loads, it helps engineers identify failure modes early, refine designs and choose the appropriate materials.



Andrea Incardona is a material engineer at Instron

AUTONOMOUS VEHICLES

END in sight

John Li asks if end-to-end is the endgame for level-four autonomy

Waymo operates in multiple cities

Autonomous vehicle technology has evolved significantly over the past year. The two market leaders, Waymo and Apollo Go, both have fleets of over 1000 vehicles and operate in multiple cities, and a mix of large companies such as Nvidia and Aptiv, OEMs such as Tesla and Volkswagen, and unicorns such as Wayve and Pony AI have made large strides in autonomous driving systems.

As software becomes an increasingly important differentiator and component of autonomous driving, the term end-to-end has been used to describe a new approach to autonomous driving software.

End-to-end autonomous driving systems are defined by the input of raw sensor data into a deep learning model, and outputting vehicle control commands such as steering, acceleration and braking.

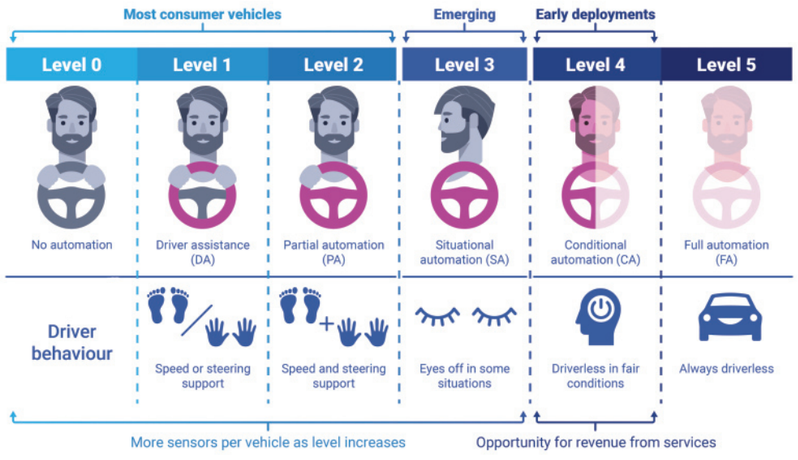
This represents a shift from the traditional modular software approach used in autonomous vehicles.

Modular

Both the market leaders – Waymo in the USA and Apollo Go in China – deploy a form of modular software for autonomous driving. The concept of modular software is that specific purposes such as perception, localisation, route planning and actuation are containerised into different software modules, with hard-coded, defined rules that define the behaviour and actions of the vehicle.

These systems will take data from multiple sensors such as cameras, mm-wave radar and lidar and combine them via sensor fusion. In combination with high-definition (HD) maps, the output of, for example, the perception module, is fed as the input into the localisation module, in a sequential manner until the vehicle's overall action is decided and acted upon.

Although companies have different strategies, such as the inclusion of additional modules or combining two modules into one, the general approach is the same.



SAE autonomous driving levels

This has worked well in practice and is also used in most adas up to SAE L2+ systems on roads today.

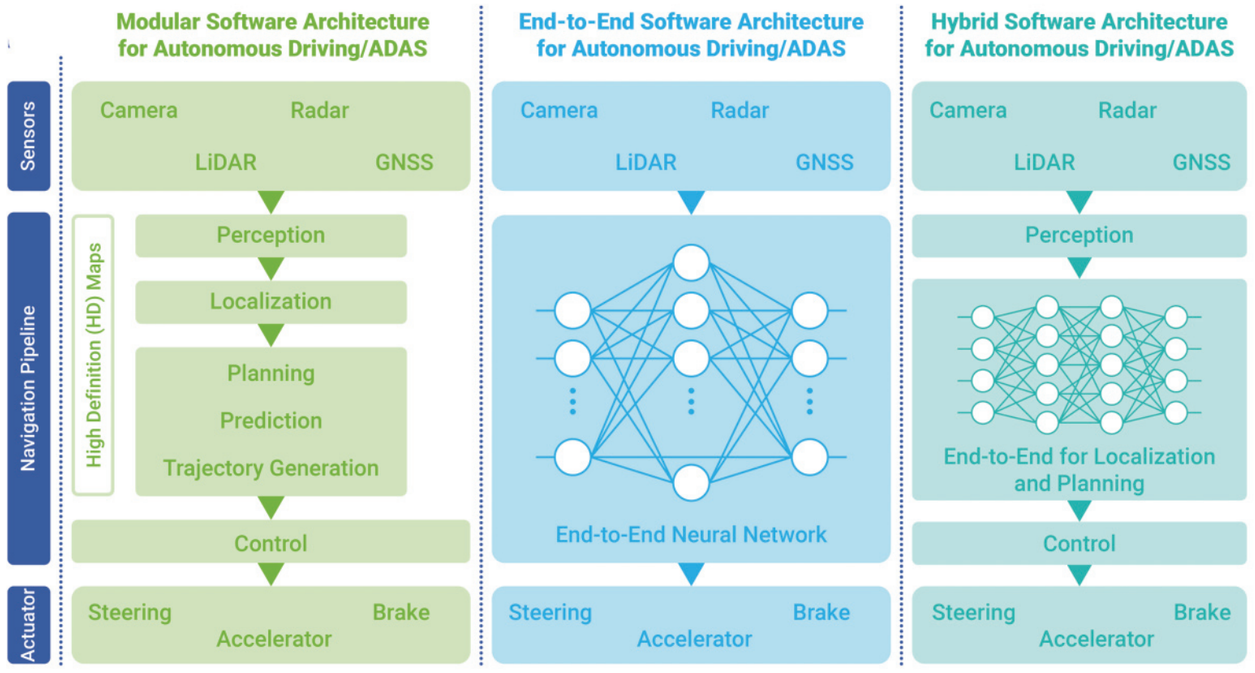
Goal

The argument made by many in the industry is that the modular software structure is not optimal. Each module has a different objective, for example accurate positioning, increasing safety and comfort, and therefore the entire system does not have a unified target. In some ways, an end-to-end approach is simpler due to the singular model being jointly trained for all applications covering perception, prediction and planning.

Furthermore, compared with one end-to-end network, a multi-task, multi-model deployment can involve multiple encoders and transmission systems, increasing the computational power required and potentially leading to sub-optimal use of compute.

There exists what is known as the long-tail problem of autonomous driving, where pre-defined human rules and code struggle to translate to complex driving situations. A situation that has not been accounted for by the system design can throw off the model, potentially leading to accidents.

As a result, many companies are pursuing an end-to-end model for autonomous driving, such as Wayve and Turing. By being trained on vast amounts of real-world and simulated driving data, the end-to-end network learns by imitation and reinforcement, similar to how humans develop driving intuition, instead of following hard-coded rules.



Examples of modular, end-to-end and hybrid software architectures in autonomous vehicles

Companies backed by extensive corporate funding, such as Waymo (Alphabet) and Motional (Hyundai), are also developing end-to-end approaches for autonomous driving. However, these are yet to be deployed commercially.

Black box

The deployment of one end-to-end network for all tasks and actions yields a significant problem in interpretability.

Essentially, it is much more difficult to explain an end-to-end network, since the raw sensor information is the input, and the appropriate action is the output, with no clear direction or path taken in between.

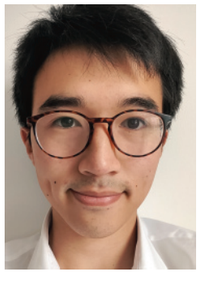
This is often referred to as a black box.

This lack of interpretability yields several concerns. For engineers, end-to-end networks are more challenging to debug, and may also struggle with societal acceptance and trust. Perhaps most importantly, how can a company prove that its autonomous systems are safe and in line with regulations when it is an end-to-end network? For example, the EU Artificial Intelligence Act, published in July 2024, emphasises the need for traceability and explainability in AI systems. It remains unclear whether a fully end-to-end network would meet those requirements.

Hybrid

A fully end-to-end network for autonomous driving, despite its advantages, has proven challenging and impractical to deploy. While it is true that end-to-end can theoretically learn to drive like a human, there are certain parts of autonomous driving, such as localisation and route planning, which may benefit from the high reliability and interpretability of hard-coded algorithms.

While companies differ in their approach, even those that claim to have an end-to-end network for autonomous driving will have some deterministic algorithms integrated for certain tasks. Neural networks of different sizes can be combined with intermediate inputs, defining a hybrid approach that holds significant potential in the short term.



John Li is technology analyst at IDTechEx

MOTORSPORT

FAST LANE

Martin Wilson looks at why motor racing is not simply about speed

Photo: Red Bull Content Pool



Photo: Wikimedia Commons

Finish of the 1971 Italian GP at Monza; the first five cars finished within 0.61 seconds

Faster cars do not necessarily produce great motor racing; indeed Formula One rather suggests the opposite. Excitement in motorsport comes from close racing not simply faster cars.

Even the FIA recognises that aerodynamics gets in the way pf producing close racing as they did when they introduced the drag reduction system (DRS) and the revision of regulations for 2022 that were intended to enable F1 cars to follow more closely.

But cars still lose downforce when they are within three to five seconds of another car, so getting close enough to overtake can be difficult especially as the downforce shortens the braking zone where overtaking traditionally takes place.

As the 2022 regulations had little impact on the closeness of the racing, the FIA has produced 2026 regulations that bring in even more active aerodynamics, albeit without ground effect, in the hope of producing better racing. They are missing the obvious answer.

The best racing comes in classes that do not use much in the way of aerodynamic downforce and therefore rely on mechanical grip as all motor racing, including F1, did until the late 1960s. In the UK some of the best races comes from national championships such as Minis and other one-make classes.

For example, the Caterham 7 Championship consistently produces extremely close racing with places, including the lead, changing every lap. A recent race was won by 0.017 seconds with the first five cars being covered by little more than a second for the whole race. The lead changed almost every lap as did places throughout the field. As Caterhams do not rely on aerodynamic downforce for their cornering grip, the following car can slipstream within centimetres of the car in front; indeed a whole group can form a train where cars are separated by centimetres and frequently swapping places.

There was a time when similar results occurred in F1. The closest finish in a grand prix was the 1971 Italian GP at Monza, where Peter Gethin won by 0.01 seconds from Ronnie Peterson and the first five cars were covered by 0.61 seconds.

There were two factors that contributed to this close finish. First, it was early days of aerodynamic downforce, so the cars were not so reliant on it as they are today. Also, as Monza was the fastest circuit on the calendar, the cars were using skinny wings to reduce drag. It meant the cars were able to follow closely and use the slipstream to overtake.

By eliminating aerodynamic downforce, F1 cars would be able to slipstream more closely, facilitating overtaking. With the reduced drag, the cars would be faster in a straight line so would need to slow more for corners. The extended braking zone would give more opportunity for brave and skilled drivers to overtake, part of the intention with the 2026 regulations.

The greater differential between speed on the straight and when cornering would make for more excitement as fewer corners would be flat out, requiring skill and not just bravery. Judging by the junior classes, without downforce there may be more usable racing lines in each corner allowing cars to go through corners side by side.

From experience of UK national racing, it would suggest the closeness of racing in non-aerodynamic classes also produces fewer collisions. As there are more opportunities to overtake, there is less need for the aggressive lunge that causes collisions or forces other cars off the track. With Caterhams, the racing is closer but as determined, though more respectful than in F1. Crashes and spins still occur but due to a driver's own exuberance rather than being punted off by another car.

Removing the aerodynamic downforce means there would be no easily damaged front wings, which ruins a driver's race due to reduced grip or need for an extended pitstop to replace the wing or punctured tyres. With less debris from broken front wings, there should also be less need for safety cars and there would also be no need for other artificial aids such as DRS, or even pit stops.

Without wings or underfloor venturis, any downforce would have to come only from the upper surface arguably providing time to produce more aesthetic and elegant cars that are more comfortable to drive because they can have more compliant suspension. It would probably mean the tyres would have to change but that would be no bad thing as the current tyre management because of the limited working temperature range is disliked by drivers, commentators, spectators and probably engineers as well.

So, FIA, can we get back to proper racing in F1? For the 2030 F1 regulations, can you eliminate aerodynamic downforce except from a smooth upper body surface without wings or ground effect? It should even provide new lessons that can be applied to everyday road cars as well.

As F1 World Champion Nico Rosberg put it in a 2017 interview in The Guardian: "The thrill of racing is not the speed but the feeling of driving on the edge."



Photo: Caterham 7 Championship

Typical close finish in Caterham 7 Championship at Snetterton in April 2025

Resistor modules simplify high-voltage applications

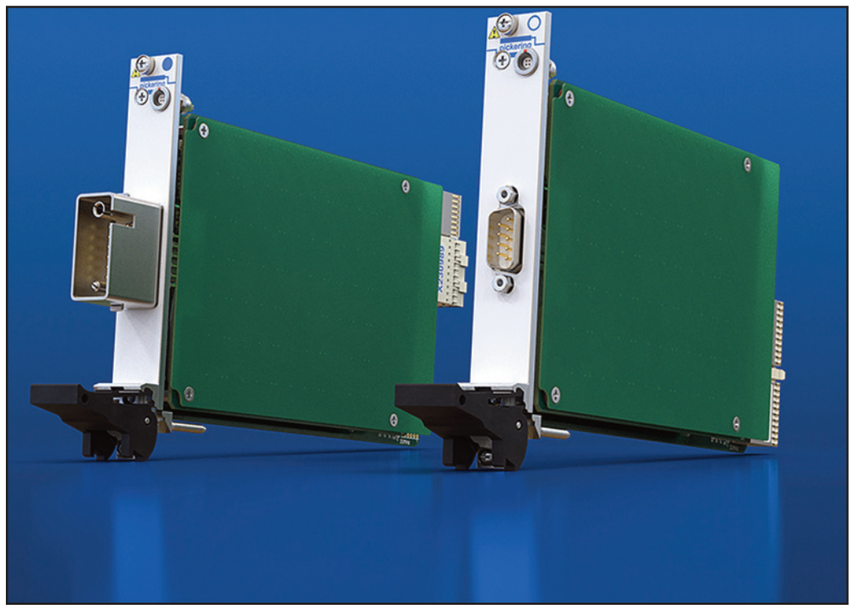
High-voltage programmable resistor modules from Pickering provide a simple option for applications requiring voltage handling up to 1.2kV.

The PXI and PXIe simulation modules combine high-voltage capability, channel flexibility and a broad resistance range.

Available in a compact single-slot PXI and PXIe form factor, the 40-230 (PXI) and 42-230 (PXIe) come in 70 standard builds, including four single-channel builds that offer various resistance ranges and resolution capabilities, playing a role in simulating real-world resistive loads and fault conditions for high-voltage devices-under-test (DUTs) across automotive, aerospace, and energy sectors.

DUTs include EV power inverters, BMSs and some aerospace components. Engineers can use these modules for critical tasks, including voltage isolation check testing, which ensures the safe functionality of high-voltage systems and compliance with ISO 6469 and IEC 60664.

Engineers can emulate resistance sensor values, such as those from thermistors and RTDs, in high-voltage environments, enabling safe testing without needing the actual sensor hardware.



For added test coverage, when used in the HiL (hardware-in-the-loop) simulation testing of ECUs, each channel can be set to short and open circuit conditions to verify the controller's response to a faulty sensor or connection.

With up to four channels available from a single slot, the module offers multi-channel flexibility and a resistance range from 1Ω to 76.8MΩ; resistance resolution is down to 0.125Ω.

Hardware interlock and simulation features ensure safety and facilitate diagnostics.

Uses range from high-voltage test environments, including automotive EV and aerospace systems, to applications requiring rapid reconfiguration of resistance, or test systems with limited PXI slots, as well as HiL simulation platforms needing fault insertion.

Software control is simplified by using resistor value calls. The module calculates the resistance setting closest to the requested value and sets that value. The user can then interrogate the module to find the actual setting used.

To help ensure long-term accuracy, an optional cable assembly may be attached to the module in place of the DUT, enabling simple calibration using a digital multimeter to verify the resistor channels.

A hardware interlock provides greater safety than typical software protection.

When activated, the interlock will return all relays to their default unpowered state (assuming the switches are fully functional) and provide error notification via the software interface.

The interlock can be daisy-chained between additional hardware interlock-enabled modules, allowing one signal to disable multiple cards.

Drivers are supplied for Windows, Linux and real-time operating systems.

Developer kit accelerates AV design and testing

The Nvidia Drive AGX Thor developer kit provides developers and researchers worldwide with a platform to accelerate the design, testing and deployment of autonomous vehicles and intelligent mobility.

The kit is built on the Nvidia Blackwell architecture, Arm Neoverse V3AE CPUs and the Nvidia DriveOS 7 software stack.

It is purpose-built for reasoning vision language action models and suitable for automotive development, with IO to support surround cameras, radars and lidars, as well as common vehicle interfaces including GbE, 10GbE and PCI-Express.

It also meets ISO 26262 functional safety and ISO 21434 cyber-security requirements.

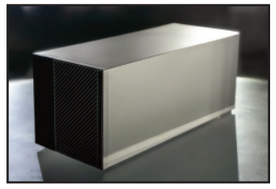
Automotive companies building on Drive AGX Thor include BYD, GAC, IM Motors, Li Auto, Volvo, Xiaomi and Zeekr, as well as autonomous trucking companies Aurora, Gatik, PlusAI and Waabi.

DeepRoute.ai, Nuro, WeRide and ZYT are using AGX Thor for their AV software platforms. Production systems are available from tier-one suppliers Continental, Desay, Lenovo, Magna and Quanta.

It is also supported by a growing number of sensor and embedded technology pioneers, including AdaCore, Lauterbach, Omnivision, QNX and Vector.

Designed for automotive-grade safety and security, AGX Thor and DriveOS are key elements of Nvidia Halos, a safety system that brings together the firm's automotive hardware and software safety technologies with AI research in AV safety.

Halos offers a holistic



approach to safety. At the technology level, it spans platform, algorithmic and ecosystem safety. At the development level, it includes design-, deployment- and validation-time guardrails.

And at the computational level, it spans AI training to deployment, using Nvidia DGX for AI training, Omniverse and Cosmos running on OVX for simulation and Drive AGX for deployment.

Diodes protect 48V networks

ESD diodes from Nexperia are designed to protect 48V automotive data communications networks against the destructive effects of ESD events.

This six AEC-Q101 qualified devices cover the higher reverse working maximum voltage (VRWM) for increasingly common 48V board nets. This saves PCB space and cost while maintaining signal integrity even at higher data rates.

While data communications protocols such as Can, Can-FD, Lin and Flexray have been around



for several decades, their proven reliability in lower speed applications means they continue to feature in even the most recent automobiles, including EVs and HEVs. However, unlike conventional internal combustion engine (ICE) powered vehicles that have a 12V battery, or commercial vehicles with a 24V battery, the higher efficiency requirements of EVs and HEVs mean they are increasingly moving towards using a 48V battery to power various electrical systems, including these legacy communications networks.

For design flexibility, this portfolio features ESD diodes with 54V (PESD2CANFD-54VT-Q and -54LT-Q, 60V (-60 VT-Q and -60LT-Q) and 72V (-72VT-Q and -72 LT-Q) VRWM.

These low capacitance – down to 3.4pF – devices come in the sot23 package.

The optimised capacitance ensures signal integrity is not impacted even in higher-speed protocols such as Can-FD.

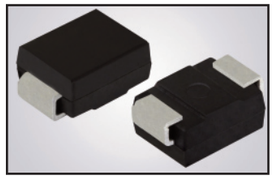
AEC-Q101 TVSs shrink footprint

Uni- and bidirectional 1.5kW surface-mount PAR transient voltage suppressors (TVSs) from Vishay come in the SMB (DO-214AA) package.

To meet the demands of automotive applications, the T15BxxA and T15BxxCA series are AEC-Q101 qualified and operate up to +185°C.

Compared with TVSs in the SMC (DO-214AB) package, the automotive-grade devices provide a 58% smaller footprint.

The unidirectional T15BxxA offers stable breakdown voltages from 12 to 51V, while the bidirectional T15BxxCA provides breakdown voltages from 12 to 100V.



Clamping capability is 17.0 to 70.1V for the T15BxxA and 17.0 to 137V for the T15BxxCA.

The TVSs are designed to protect sensitive electronics against voltage transients induced by inductive load switching and lightning. Typical applications will include lighting, electro-mechanical brake and fuel pump control; 48V DC-DC converters and inverters; integrated starter generators, BMS, vehicle control units and on-board chargers; and telematics control units for audio, electronic stability control and radar sensors.

Theys meet MSL level-one standards per J-STD-020 and are RoHS-compliant.

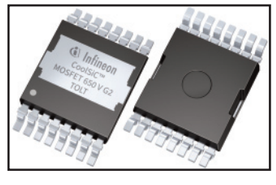
Mosfets for EV chargers

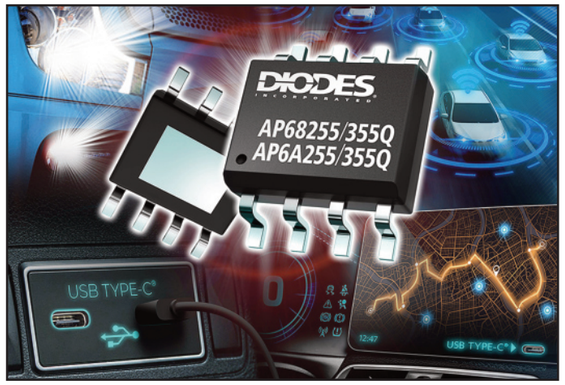
Infineon is expanding its CoolSiC mosfets 650V G2 portfolio with 75mΩ variants to meet the demand for more compact and powerful systems including in electric vehicle and e-mobility chargers.

The devices have multiple package options, including Toll, ThinToll 8x8, Tolt, D2Pak, TO247-3 and TO247-4.

As a result, the family supports top and bottom side cooling.

The mosfets are based on the second-generation of CoolSiC technology and offer improved figures of merit, reliability and ease of use.





Buck converters boost efficiency

Four automotive-compliant asynchronous buck converters from Diodes are for 48V low-voltage rail point-of-load (PoL) applications.

The AP-68255Q, 68355Q, 6A255Q and 6A355Q have 500mΩ power mosfets to deliver high-efficiency step-down DC-DC conversion with up to 3.5A of continuous output current.

These converters cover the full automotive battery range from 5.5 to 80 or 100V, including load dump scenarios. They can be used in 48V motor control, adas, telematics, infotainment, body control, instrument clusters and lighting systems.

Constant on-time control maintains a nearly constant 300kHz switching frequency. This results in fast load-line transient response, easy loop stabilisation and low output voltage ripple.

The proprietary gate-driver arrangement reduces switch node ringing effects without sacrificing the turn-on and turn-off times of the n-channel mosfet switch. This helps reduce the high-frequency radiated EMI noise normally associated with mosfet switching.

Built-in overcurrent protection with frequency foldback ensures high load-current support while reducing junction temperature under fault conditions.

The overtemperature protection circuit immediately shuts down the controller's output voltage at +160°C. When the temperature drops below the +140°C safety threshold, the converter automatically restarts.

They are available in the thermally enhanced SO-8EP package with an operating range of -40 to +125°C.

Photorelay supports EV battery systems

An automotive photorelay from Toshiba is housed in a SO12L-T package and achieves an output withstand voltage of at least 1.5kV with a reaction time up to 1ms.

This capability is crucial for supporting the high-voltage requirements of modern automotive battery and fuel-cell control and battery management systems (BMS), which monitor voltage and detect mechanical relay sticking and ground faults.

These photorelays can also replace traditional mechanical relays.

The TLX9161T consists of an infra-red LED optically coupled to a photo-mosfet, ensuring the primary (control) side and the secondary (switch) side are electrically isolated.

The isolation voltage of 5kV RMS enables safe switch control across varying potentials. The trigger current is 3mA maximum, which reduces energy consumption.

Furthermore, this device's off-state current is up to 100nA at ambient temperature, drawing little power while inactive. The IR LED forward current and the detector element's on-state current are both rated at 30mA ambient.

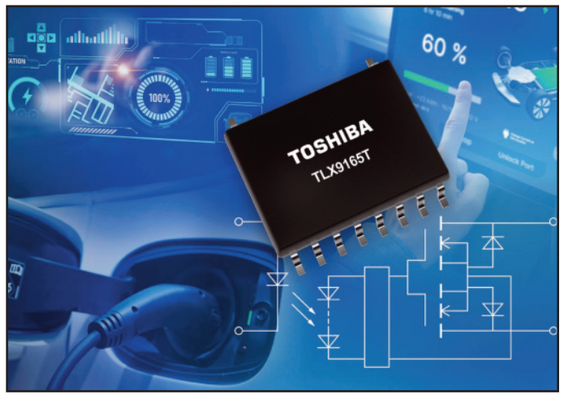
Reducing the size of the built-in mosfet chip has let the photorelay be housed in a package approximately 25% smaller than the SO16L-T used for its predecessor, the TLX9160T. This reduction helps keep down the overall size of the battery unit and allows for cost savings.

Despite the smaller package, it maintains the same pin pitch and pin layout as the SO16L-T, allowing for common use of circuit board pattern designs.

The typical dimensions of the package are 7.76 by 10 by 2.45mm.

It uses a resin with a comparative tracking index exceeding 600, classifying it under Material Group I according to IEC60664-1. This standard specifies principles, requirements and test methods for insulation coordination for systems up to 1kV AC or 1.5kV DC.

The normally-open (1-Form-A) device exhibits creepage and clearance distances of 8mm minimum, confirming effective isolation even in operating temperatures from -40 to +125°C, making it compliant with AEC-Q101 grade one.



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