VEHICLE electronics

The monthly magazine for automotive electronics engineers

GM adopts AI to halve vehicle development time

General Motors is using AI to halve the traditional four-to-five-year vehicle development timeline.

With what it is calling intelligence-defined vehicles, GM is combining shared compute platforms, proprietary data pipelines and specialised models to bring products to market faster.

At GM's scale, this work compounds across millions of vehicles and a global network of manufacturing facilities.

Through advancements in enterprise AI and virtualisation, the company is developing a new operating approach for vehicle development.

By bringing together design, engineering and manufacturing on a unified digital thread, it hopes to move from sketch to production with speed and efficiency.

This concurrent engineering model lets the car maker innovate faster, improve continuously and scale technologies across it line with agility.

That product development operating system is already shaping its fourth-generation EV platform, built to bring electric mobility to mainstream buyers at scale.

A compute and electrical architecture serves as the foundation, enabling smarter energy management, seamless software updates and richer in-cabin experiences.

By decoupling software from physical hardware, the architecture consolidates components such as perception, propulsion, active safety and chassis controls onto one, high-speed central compute unit. This provides the heavy computing power to run sophisticated in-cabin AI and autonomous driving simultaneously.

This propulsion-agnostic architecture delivers 40-times more computing power with 30% less wiring length and mass, plus up to 50% faster cellular connectivity than its previous systems.

Following its 2028 debut on the Cadillac Escalade IQ, GM will roll out this platform across its other vehicles.



GM automated research vehicle

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Göpel and Microchip collaborate on ASA-ML

Göpel and Microchip are growing the ASA Motion Link (ASA-ML) ecosystem for automotive video testing.

Open standards-based ASA-ML technology enables interoperable, high-speed connectivity to support automotive's shift towards software defined vehicles (SDVs).

Göpel is expanding its modular frame grabber and generator to include ASA-ML technology using serdes chips from Microchip. The goal is to expand the ecosystem surrounding ASA-ML and provide users with a seamless, fully functional environment from the chip through test equipment to frame grabbers and generators.

The open standard ASA-ML serdes technology provides an independent, high-performance technology for data connections. Thanks to its interoperability, the standard reduces dependence on individual vendors and facilitates the integration of different components.

"Expanding the ASA-ML ecosystem gives automakers and suppliers greater flexibility, interoperability and confidence so they can move faster from development to deployment," said Kevin So, vice president of Microchip's communications business unit.

ASA-ML was developed by the Automotive Serdes Alliance of automakers, suppliers and chip manufacturers.

The goal is to achieve cross-vendor interoperability of cameras, sensors and other vehicle components while maintaining high data rates.

ASA-ML supports asymmetric transmission of video, control and payload data at rates of up to 16Gbit/s, thereby offering scalable communications for modern vehicle architectures. Particularly for adas and future automated driving functions, the standard enables secure and interoperable networking of sensors and control units.

With Göpel's Video Dragon frame grabber and generator, ASA-ML components can be reliably tested and simulated. Göpel uses the ASA-ML chipsets from Microchip to develop these data transmission capabilities.

• Elektrobit is combining its Autosar software and tooling with Microchip's automotive microprocessors to help automotive OEMs and tier-one suppliers reduce integration effort, lower development risk and accelerate time to market.



Volvo pushes Horizon with Google and Accenture



Accenture and Google transform software development with Volvo

Volvo has become the lead car maker for Horizon, an open-source software development platform that helps car makers and suppliers build, test and deploy software for the Android Automotive operating system more efficiently.

Horizon brings together cloud-native development tools, virtual testing environments and AI-assisted workflows into a unified platform. This helps car makers and automotive suppliers develop and deliver high-quality software at speed and make engineering more productive.

Volvo is working with Accenture and Google Cloud to bring the Horizon platform to the industry. Insights from this collaboration should help refine the platform and expand its generative AI capabilities for automotive companies and other industrial manufacturers.

Volvo is migrating its global Android software development environment to the Horizon platform. The platform will give its engineers access to faster development workflows, virtual testing environments and AI-assisted software development tools, freeing engineering teams to spend more time building in-car experiences.

"We're building some of the most complex products in the world, which requires a development environment built to match," said Gregor Zetsche from Volvo.

Horizon offers up to nine times faster software testing using virtual Cuttlefish-based Android Automotive environments, which enable large-scale testing with agentic AI. It can reduce infotainment feature development costs by up to 40%.

Intelligent caching and optimised build pipelines reduce software build times. Instead of waiting up to two hours, engineers can get feedback within minutes.

Remote access to virtual and physical device farms allows developers worldwide to build and validate software from anywhere, while reducing infrastructure requirements. This improves hardware use and reduces the amount of physical test equipment required.

Virtual workbenches are speeding up the onboarding of new developers. Instead of waiting weeks for physical specialised hardware and investing additional hours for the setup, engineers can instantiate their environments in seconds.

"Horizon enables a faster, more flexible and efficient way to deliver software-defined vehicle features," said Juergen Reers from Accenture.

Accenture, Google and Volvo Cars are working with other automotive and industrial organisations to extend the reach of Horizon into further companies and markets.

Foxconn buys 50% of Mitsubishi vehicle equipment arm

Foxconn (Hon Hai) has bought a 50% stake in Mitsubishi's automotive equipment business for around ¥115bn.

Subject to closing conditions, the deal is expected to be completed in October next year.

The joint-operating arrangement will combine Mitsubishi's technological and developmental capabilities, particularly in electric powertrains, software and vehicle control, with Foxconn's speed, scale and strengths in market deployment.

By providing high-quality electric-vehicle platforms developed in Japan, the companies expect to contribute to the widespread adoption and advancement of future mobility.

The alliance aims to translate technologies and quality achieved through high-level Japanese manufacturing into value for mobility.

TÜV extends MathWorks ISO 26262 certification to AI

TÜV SÜD's certification of MathWorks Matlab, Simulink, Stateflow and System Composer included with the IEC Certification Kit has been expanded to cover generic AI tool classification guidance in accordance with ISO 26262.

MathWorks is the first tool vendor to provide guidance for select AI-assisted engineering workflows in functional safety applications, informed by specific use cases evaluated by TÜV SÜD.

The guidance includes practical applications of AI-assisted model-based design, focusing on workflows that use the Simulink agentic toolkit for agentic model development, model review and test case generation.

By illustrating how these use cases can be integrated into safety-critical development processes in a controlled and auditable manner, the guidance helps organisations accelerate development while preserving engineering rigour, traceability and standards compliance.

The MathWorks technology behind this approach integrates agentic AI with model-based design workflows. These capabilities let engineers move beyond prompting AI systems to AI agents that operate directly on Simulink models and engineering workflows.

MathWorks continues to expand its agentic AI capabilities with skills that guide agents in applying Matlab and Simulink functionality to engineering tasks.

The Simulink agentic toolkit helps AI agents understand model structure, create and modify designs, run simulations, generate tests, and connect requirements to models.

The Polyspace agentic toolkit extends these workflows into software analysis and verification activities, supporting code robustness analysis, coding-standard compliance and defect detection.

Together, the toolkits help organisations incorporate AI agents across the development lifecycle while maintaining established validation and review practices.



Nissan turns to Applied for AI software

Applied Intuition is deploying its AI-powered software-development tools to support Nissan's development of AI-defined vehicles (AIDVs).

Applied Intuition will leverage its Vehicle OS software to support development of Nissan's scalable and open in-vehicle software.

Applied's software teams in Japan and Silicon Valley will work alongside Nissan's engineering team in Japan to help shorten software-development timelines and accelerate AI-native vehicle development.

The Vehicle OS software and Applied's AI-native development tools support Nissan's internal engineering teams by modernising software workflows, reducing development complexity and enabling a common software platform that spans multiple powertrains. By abstracting hardware complexity and unifying legacy and modern software development practices, Applied should help accelerate the development of Nissan's future vehicle programmes.

This collaboration builds on a relationship that began in 2020, when Nissan adopted Applied's simulation technology.



Coretura picks Alloy Kore for commercial SDVs

Coretura calls on QNX and Vector for SDV foundation

Coretura has selected Alloy Kore to advance a software-defined vehicle (SDV) platform for its commercial vehicle customers.

Coretura is a joint venture between Daimler Truck and Volvo. Alloy Kore is a foundational software layer developed by Vector and QNX.

This marks the first design win for Alloy Kore, reinforcing its role as a foundation for SDV.

Coretura is building an SDV platform for commercial vehicles, based on one platform and one standard. To advance this mission, Coretura has selected Alloy Kore as the safety-certified software platform foundation within its SDV platform architecture, targeted at high-performance compute (HPC) in commercial vehicles.

"We are building one foundation the industry can rely on, so our customers can concentrate their engineering on the applications that bring value to theirs," said Johan Lundén, CEO of Coretura.

Alloy Kore combines a safety-certified real-time operating system with a pre-integrated set of common automotive system services into a scalable vehicle software foundation for deployment across HPC.

The result is reduced integration overhead, faster development cycles, streamlined certification efforts and the ability for OEMs to focus engineering investment on brand differentiation at the application layer.

Coretura selected Alloy Kore through the Vector Distribution, a ready-to-use implementation of the platform. Built on the Alloy Kore architecture, the distribution combines the automotive OS foundation with Vector's middleware, communication and integration capabilities for deployment in HPC environments.

For Coretura, this will provide a validated and production-ready software environment that can be adapted to the requirements of its commercial vehicle platform while maintaining a consistent software foundation across development programmes.

Delta and Nvidia collaborate on autonomous driving

Delta is working with Nvidia to accelerate the development of smarter, safer and more efficient autonomous driving.

This collaboration combines Delta's expertise in automotive energy management, xEV powertrain systems, in-vehicle high-performance computing (HPC) capabilities, and system integration with Nvidia Hyperion and the Halos safety system.

Hyperion is a reference sensor and compute platform for level-four autonomous vehicles and robotaxis, combining dual Nvidia Drive AGX Thor with Halos to accelerate safe, production-ready autonomy.

"Autonomous driving requires years of technology development, continuous innovation and strong system integration," said James Tang, executive vice president at Delta. "Through this joint endeavour, we will further integrate AI and HPC capabilities into the enhancement of advanced autonomous driving functions, turning smart vehicles into real-world applications while pursuing new opportunities in the fast-growing smart mobility market."

Delta will combine its automotive prowess and integration capabilities with Hyperion supported by Nvidia's dedicated engineering team, to elevate autonomous driving development.

Delta will also leverage its experience working with automakers, together with Nvidia's global ecosystem, to expand engagement with customers and partners and create business opportunities.

Together, the two companies aim to develop AI-driven autonomous driving and accelerate growth in the smart mobility market.

Garmin helps racers see more



Garmin is helping racing drivers quickly view digital flag signals and changing track conditions from the cockpit.

By connecting a Garmin Catalyst 2 driving performance optimiser and Mylaps X2 RaceLink Club on-board digital flagging device via an in-car flagging Y-cable, motorsports enthusiasts can receive real-time digital flagging in the vehicle, helping them react quicker and race smarter.

"For drivers, we know every moment counts and this innovative tool can help them react faster to changing track conditions including weather, safety checks, recovery operations and more," said Susan Lyman, Garmin vice president.

The Catalyst 2 provides real-time audio coaching during track sessions and performance data to review after each session via the Catalyst app to see where time can be saved.

At select tracks enabled with Mylaps race control technology, the X2 brings on-board flagging to the race vehicle and lets drivers see live personal and track flag signals directly from race control in the cockpit.

Drivers can connect the X2 and Catalyst 2 devices via the Y-cable to gain an enhanced racing experience and react faster to track conditions. Digital flags are displayed on the 7.6cm high-resolution LCD screen of the Catalyst 2.

VW picks NXP chip as SDV building block

NXP's S32K5 family of microcontrollers will serve as a common building block for VW's future zonal software-defined vehicles (SDVs).

The first vehicle featuring the new architecture is planned for next year.

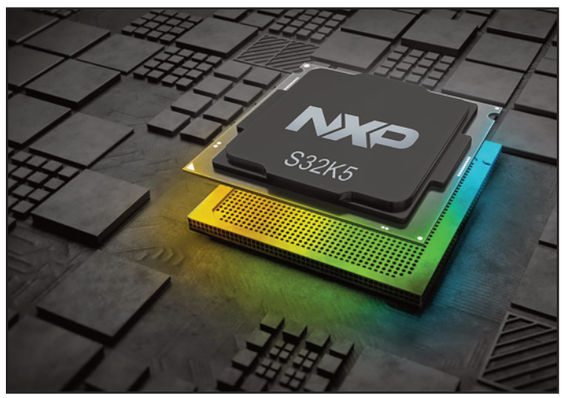
Next to high-performance processors that provide the central computing power and make complex decisions for AI-enabled functions such as automated driving and infotainment, the S32K5 MCUs serve as the core processors of the vehicle's zonal controllers.

They connect sensors and actuators, collect and process data from specific areas of the vehicle, and manage functions such as lighting, body, comfort, chassis and safety systems. These capabilities provide the foundation for the central computing platform to run AI algorithms and perform advanced functions.

The MCUs enable functions that previously required separate chips and ECUs to be consolidated within zonal controllers, reducing hardware complexity.

They are intended to serve as a common building block for the future zonal SDV architecture developed by Rivian and Volkswagen's RV Tech joint venture. The architecture is intended to be used across both companies' vehicles, enabling brand-specific features and experiences.

"Software-defined differentiation is the new auto benchmark, and NXP is excited that the S32K5 family of MCUs has been adopted into RV Tech's innovative new zonal architecture, one of the most sophisticated approaches to streamlined development and differentiating features in the automotive industry today," said Lars Reger, CTO at NXP. "As a core processor for the vehicle's zonal controllers, S32K5 is built for safe real-time compute, fast and secure OTA updates, and the consolidation of functions that together create a basis for a flexible, continuously updateable vehicle."



VW is adopting NXP's S32K5 microcontrollers

The partnership is part of VW's broader semiconductor strategy of direct, long-term partnerships with semiconductor companies, combining its automotive expertise with chip technology to strengthen supply resilience and jointly shape key technologies for future vehicle generations.

"Over the past years, we have systematically expanded our technology ecosystem and built partnerships with leading companies across the value chain," said VW board member Karsten Schnake. "Our partnership with NXP is another step in this journey, showing how Volkswagen is taking a more active role in the semiconductor value chain: defining our technology needs early, leveraging our scale across brands and creating greater long-term planning certainty for both sides."

Reducing weight in motorsport

Reducing the heaviness of electronics is the next light-weighting game-changer in motorsport, according to a sustainable tech expert.

Most racing teams' talk about light-weighting revolves around carbon fibre, titanium, aerodynamics and structure, but often overlooked is the weight in the architecture itself, according to Emma Armstrong, group commercial director at In2tec, which designs and manufactures flexible and sustainable electronics.

"Electronics rarely lead the conversation in motorsport, especially F1, but there is increasing evidence of the value of reducing weight in the electronics beneath the surface," she said.

In2tec partners with race teams to develop systems tailored to fit seamlessly into a vehicle's contours. Its Flexi-Hibrid tech comprises flexible PCBAs, which can be tailored to flow into the superstructure, body and chassis of vehicles, unlike conventional rigid PCB assemblies.

The tech lets printed circuitry and wiring harnesses be combined in a more adaptable structure, reducing dependence on connector-heavy architectures.



LG integrates cockpit technology for Renault

LG Electronics will supply its integrated cockpit technology for Renault's Trafic E-Tech Electric, the car maker's first mass-produced commercial vehicle built on a software-defined vehicle (SDV) architecture; it won the 2027 International Van of the Year award announced in September.

Combining the instrument cluster and infotainment system, LG's technology plays an integral role in the vehicle, enabling a more seamless and intuitive user experience while supporting a software-centric approach to vehicle development.

This combination is optimised for SDVs. While conventional vehicles distribute control functions across dozens of ECUs dedicated to areas or systems, such as the cockpit, adas and powertrain, SDVs use high-performance computing and a centralised software architecture to integrate the control of multiple vehicle functions.

Another advantage of SDVs is the ability to add features and upgrade existing ones via over-the-air (OTA) software updates.

Designed for SDV environments, LG's technology integrates the control of the instrument cluster and infotainment system, serving as a control platform for the cockpit domain.

The cluster element provides driving information such as vehicle speed, RPM and warning indicators, while the infotainment system supports navigation and media playback. This allows driving and infotainment information to be presented in a more consistent and intuitive way across the vehicle's displays.

It also helps automakers reduce costs through component simplification and system optimisation.

LG and Renault have built a long-standing relationship of trust through years of close collaboration. LG was recognised by Renault as an outstanding supplier in 2014, 2017 and 2020, and the two companies worked together to develop an Android-based automotive infotainment system in 2021.

Building on this collaboration, LG developed and delivered the integrated cockpit technology tailored for Renault's first production SDV.

Looking ahead, LG plans to expand its partnerships with major global automakers across North America, Asia and other markets.

OnSemi and Valens collaborate on A-Phy sensors

Valens is collaborating with OnSemi to develop a low-price integrated sensor for high-volume 3MP automotive cameras. The aim is to give OEMs and tier-one suppliers a faster path to A-Phy.

The A-Phy offering will be integrated into OnSemi's image sensors.

"By collaborating with, OnSemi, another major supplier of A-Phy silicon, we are strengthening the ecosystem and giving automakers the supplier choice they expect from an industry standard," said Yoram Salinger, CEO of Valens.

Most automotive image sensors target the 1 to 3MP range. As OEMs continue to migrate towards higher resolutions, a 3MP offering addresses a large established market and a growing upgrade opportunity, making it a relevant entry point for A-Phy into mainstream, high-volume vehicles.

Infineon agrees 200mm SiC supply with Wolfspeed

Infineon and Wolfspeed have signed a multi-year supply agreement for 200mm silicon carbide (SiC) wafers, transitioning Infineon's existing Wolfspeed supply relationship from 150 to 200mm substrate technology.

SiC semiconductors have become a key enabling technology for the electrification and energy efficiency applications that drive global decarbonisation, from electric vehicles and renewable energy systems to AI data-centre power infrastructure.

The agreement directly supports Infineon's conversion to 200mm SiC manufacturing.

"SiC is at the heart of the energy transition, and securing a high-quality, resilient supply of 200mm substrates is essential to delivering on our customers' long-term commitments," said Alexander Gorski, chief operations officer at Infineon. "This agreement further broadens our strong supply base for our 200mm high-volume manufacturing, building on a 20-year supply relationship between our two companies. It strengthens supply chain security for our customers and provides additional flexibility and scalability to support Infineon's future growth."

The switching efficiency and thermal performance of SiC make it technically suitable for specific power conversion stages where silicon reaches its practical limits. Together with growing SiC adoption across electric vehicle drivetrains, solar inverters and industrial motor drives, these trends support a strong long-term outlook for high-quality 200mm SiC substrates.

Flying police car in Florida



The Florida Polytechnic University Police Department has become the first law enforcement agency in the USA to integrate an electric vertical take-off and landing (eVTOL) vehicle into its operations.

The manned aircraft, dubbed Astro in a double nod to science and the dog from the classic Jetsons cartoon, marks Florida Poly's entry into the rapidly developing field of advanced air mobility (AAM).

Florida Poly is in the final stages of seeking approval from the Federal Aviation Administration to use the aerial patrol vehicle in its operations. Astro could enhance the department's ability to monitor campus and surrounding acres, reach areas difficult to access by traditional vehicles, assist with post-storm recovery efforts, and deliver emergency supplies quickly when needed.

The university police plans to collaborate with law enforcement agencies throughout the region to deploy Astro in support of emergency response and other public safety operations.

Beyond its public safety applications, Astro will become a hands-on learning and research tool for Florida Poly students and faculty. The university launched an aerospace engineering degree this autumn, providing students an immediate opportunity to study emerging flight technology in a real-world setting.



Desay helps Li Auto cockpits meet local needs

Desay customises Li Auto cockpits for local markets

Automotive technology provider Desay SV is supporting Li Auto's expansion into global markets with smart cockpit technology that combines hardware and software tailored to regional needs.

Desay is supplying cockpit systems across Li Auto's global vehicle line, supporting vehicles introduced in Europe, central Asia and the Middle East.

Designed for family comfort and long-distance travel, Li 6 has a spacious, technology-driven cockpit. In Europe, Li Auto has developed an independent global software platform supporting eight European languages and integrated local mapping and navigation, Amap, Spotify, and Apple CarPlay, creating a more seamless and personalised in-vehicle experience.

For global models, Desay provides support across hardware, application integration, certification and testing.

This includes cockpit domain controllers, as well as local application integration and feature adaptation to meet market-specific requirements.

Desay also supported Li Auto in obtaining the certifications required for different international markets, having backed the completion of 32 qualification certifications across 35 countries and regions as part of the global model programme.

To address diverse regional user preferences and regulatory requirements, the cockpits incorporate market-specific features and functions.

In Europe, the in-cabin sensing integrates driver distraction, drowsiness and attention warnings, helping meet relevant European regulatory requirements and Euro NCap safety assessment criteria.

For vehicles marketed in Europe and the Middle East, the cockpit also supports DAB, meeting local digital radio requirements.

For in-vehicle entertainment, Desay supports the deep customisation and HMI design of Spotify, tailored to Li Auto's standards for in-vehicle interaction and specific vehicle models, creating a distinctive and visually engaging in-vehicle Spotify interface.

Desay has also supported CarPlay connectivity and Widevine digital rights management certification, expanding the localised in-vehicle entertainment ecosystem and enhancing user convenience.

Desay worked closely with Li Auto to develop tailored testing based on local road conditions. The teams conducted real-world vehicle testing of applications, navigation, DAB and cockpit hardware, helping Li Auto deliver a cockpit experience tailored to local market needs.

In addition, Desay supported Li Auto in obtaining certification for NG eCall with 4G and 5G dual-mode connectivity to meet the requirements of the European and Middle Eastern markets.

Anritsu and Valeo demonstrate SDV digital twin

Anritsu and Valeo jointly showed digital twin validation for software-defined vehicles (SDVs) at October's 5GAA meeting in New Delhi, India.

Building on their joint demonstration at Mobile World Congress in March, the two companies are expanding their exhibit to include use cases such as ecall. This provides a way to validate in-vehicle connectivity in a virtual environment, reducing the need for physical track testing.

As the automotive industry shifts towards SDVs, in-vehicle connectivity is advancing rapidly enabling features such as over-the-air (OTA) updates, cloud integration and 5G C-V2X communications.

However, validating these systems in real-world conditions requires testing thousands of potential combinations across different mobile networks, environments and vehicle states. Relying solely on physical vehicle testing presents hurdles in cost, development time, reproducibility and scalability.

To address this, Valeo's virtualised ECU simulation platform has been integrated with Anritsu's cellular testing technology.



VI-Grade, HBK and MoveDot integrate AI into simulation and testing

MoveDot integrates AI into VI-Grade and HBK simulation

VI-Grade and HBK are working with MoveDot to integrate AI and agentic workflows into automotive simulation and testing.

The partnership combines VI-Grade's simulation technologies, HBK's physical testing and measurement products. and MoveDot's AI-powered engineering platform, connecting simulator, offline simulation, physical test and engineering data within a unified AI-enabled workflow.

This lets engineers analyse information across different stages of vehicle development and move more efficiently from raw data to engineering insights and decisions.

MoveDot uses AI agents that reason across test data, simulation results and engineering documents, interact with engineering tools, and surface relevant information in minutes. The platform connects data across files, databases, lake houses and APIs and operates established engineering environments, including simulation software and Matlab and Simulink.

Through the partnership, HBK and VI-Grade can offer MoveDot technology alongside their existing products, providing coordinated commercial, integration and technical support.

The collaboration creates a differentiated, exclusive AI ecosystem around VI-Grade driving simulators, while extending the benefits of MoveDot's AI capabilities across offline simulation and physical testing workflows.

By making simulation, test and telemetry data searchable, comparable and actionable, the integrated approach helps engineers identify patterns, summarise findings and accelerate analysis and interpretation. Enterprise-focused governance, security and deployment options support adoption within established engineering organisations.

"Our customers are generating increasing amounts of data across simulation and physical testing, and the real value comes from being able to connect and interpret that information efficiently," said Guido Bairati, vice president at HBK.

• VI-Grade and Aidoptation, a Belgian deep-tech company developing EdgeDrive, an adas for level-four autonomous driving on highways, are collaborating to advance the development and validation of autonomous driving technologies at highway speeds.

MHP joins AWS and Here SDV accelerator

Management and IT consultancy MHP has become a collaborator in the software-defined vehicle (SDV) accelerator from Amazon Web Services and Here Technologies.

The initiative combines an open, cloud-based development environment with pre-integrated and validated AWS partner network products available in AWS Marketplace. MHP will develop OEM-specific products from these building blocks and bring them into series production.

MHP will focus on the key SDV domains of infotainment, digital experience, connectivity, over-the-air updates, assisted and autonomous mobility, cyber security, vehicle data, and AI.

The accelerator was developed to simplify automakers' access to AWS services and products from its partners.

Its open architecture combines AWS Cloud and AI with Here's location technology to address the problem of fragmented development environments.

TrustInSoft AI helps developers reach ISO 26262 Asil D

TrustInSoft is targeting developers of safety-critical software under standards such as ISO 26262 Asil D for its latest software release.

TrustInSoft Analyzer (TISA) 26.10, its October 2026 release, introduces expanded AI-assisted automation to reduce the engineering effort required to set up formal analysis, together with enhanced MC/DC (modified condition and decision coverage) capabilities to help safety-critical software teams reach full coverage in fewer steps.

"With TISA 26.10, we combine the power of AI with the rigour of formal verification to make exhaustive software verification faster and easier to deploy at scale," said Caroline Guillaume, TrustInSoft CEO.

TISA 26.10 expands AI-assisted automation directly within the Analyzer interface. Engineering teams can use an AI coding agent to automate key steps required to prepare and configure an analysis campaign, while following its progress and reviewing results directly in TISA.

The AI assists with the engineering work surrounding the analysis.

Murata and Smart Eye create picture of vehicle interior

Murata and Smart Eye are collaborating to show how camera-radar sensor fusion can create a more complete picture of a vehicle interior.

The demonstration combines Murata's expertise in miniaturisation, flexible RF device integration and automotive-grade 60GHz radar technology with Smart Eye's AI-powered interior sensing software for adas, occupant monitoring systems and child presence detection.

Vehicles already incorporate cameras in the overhead console or interior rear-view mirror and are increasingly adopting 60GHz radar for child presence detection.

Cameras provide detailed visual information about occupant position, posture and behaviour. Radar can detect occupants in darkness, through clothing and blankets, and when parts of the body are obscured, while also providing depth information.

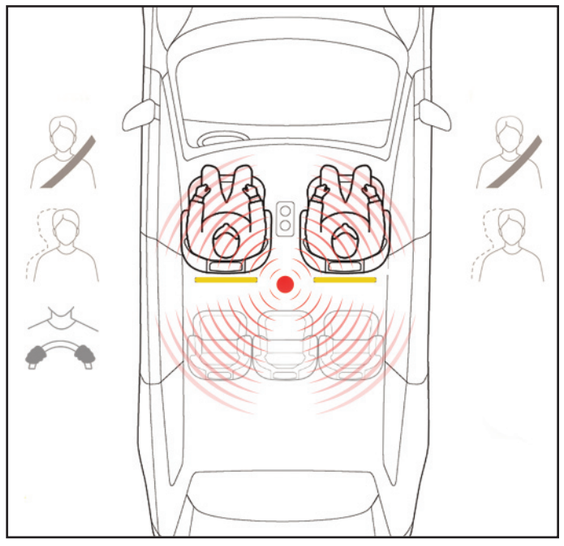
Together, these complementary sensing modalities can reduce dependence on dedicated occupancy sensors such as weight mats or capacitive systems, simplifying vehicle integration while lowering complexity and reducing costs.

More accurate information about occupant position and posture also supports adaptive restraint systems, including optimising airbag deployment and seatbelt control, while reliable occupancy classification reduces unnecessary warnings and improves child presence detection. As sensing capability develops, the same hardware platform also provides a foundation for additional software-enabled functions such as gesture recognition and vital sign monitoring.

"Vehicle interiors are evolving from isolated sensing functions towards a holistic understanding of the cabin environment," said Nozomu Kijiya, product manager at Murata. "By making better use of radar and camera technologies already being integrated into vehicles, manufacturers can improve in-cabin sensing while minimising the impact on interior design and simplifying system integration."

Henrik Lind, Smart Eye research officer, added: "Multi modal sensor fusion is not simply having more sensors but using existing sensors, turning them into a coherent understanding of what is going on inside."

Murata and Smart Eye are inviting automotive OEMs and tier-one suppliers to collaborate on developing scalable interior sensing systems.

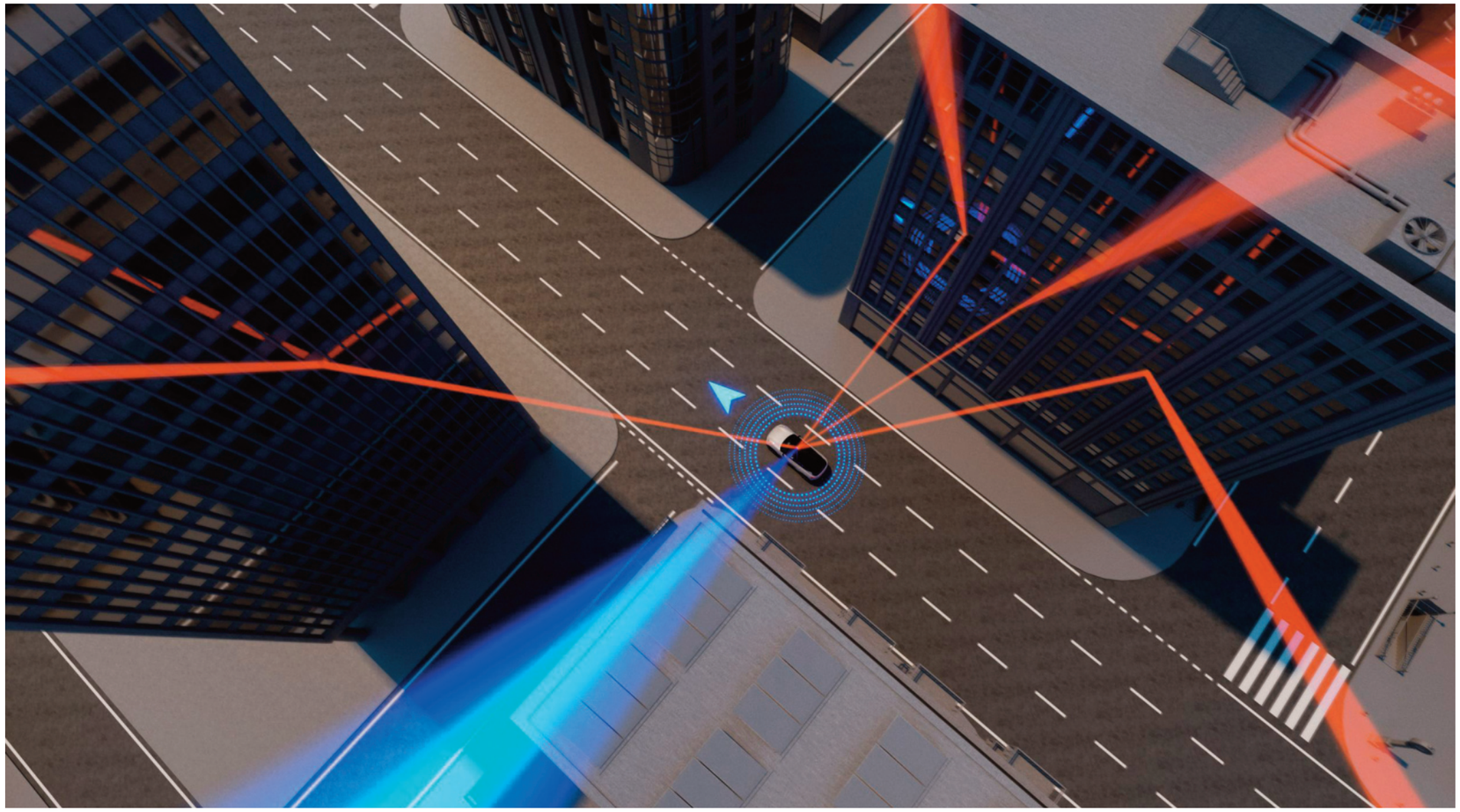


Murata and Smart Eye improve interior sensing

ROBOTAXIS

Manuel Del Castillo looks at whether the recent robotaxi trials in London could be a turning point for self-driving vehicles

Is London the biggest test yet?



Urban canyons can create multipath interference

Wayve recently launched a robotaxi service in London in partnership with Uber. The Cambridge-founded autonomy company, backed by Mercedes-Benz, Nissan and Stellantis, has started putting its AI-driven self-driving system on the city's streets.

A safety driver still sits behind the wheel, and full driverless operation awaits further permitting. Even so, it is one of the clearest signs yet that the robotaxi has moved from demonstration to deployment in the UK.

Wayve currently faces competition from Google-owned Waymo and Chinese company Baidu, both of whom are testing in London. In the USA, Waymo has scaled from 50,000 paid rides a week in mid-2024 to around 500,000 a week across ten cities and has set a public target of one million weekly rides by the end of 2026.

Urban demand is real and growing.

As robotaxis move from mapped test routes into the dense, unpredictable reality of major cities, one question sits beneath every self-driving stack: how does the car know, reliably, where it is?

Deployment

A self-driving vehicle is only as capable as the environment it can read, and cities are the hardest environments there are. As Bloomberg noted, London's irregular street layout presents challenges that Los Angeles and San Francisco do not. Wayve and Uber have themselves acknowledged that UK cities are complex driving environments with road layouts and traffic dynamics markedly different from US testing grounds.

In the words of Muhammad Nauman Nasir, adas lead at Mercedes-Benz: "The technology ceiling for autonomous vehicles is set by the infrastructure floor of the cities they operate in."

As the environment gets tougher, the vehicle has to get smarter. The systems it depends on have to hold up precisely where they're most likely to fail.

The UK's Automated Vehicles Act requires self-driving vehicles to prove they are at least as safe as a competent, careful human driver before approval.

Japan takes a different route: its rules currently require a person in the driver's seat regardless of autonomy level, and a licensed local taxi operator must run any commercial fleet. Tokyo's answer was to bring in transportation company Hinomaru Kotsu to manage vehicles, positioning robotaxis as a supplement to a shrinking, ageing driver workforce rather than a replacement.

In every case, the safety argument a company must make to regulators rests on the vehicle knowing, verifiably, where it is and how its systems fail. That makes positioning integrity foundational.

GNSS

In cities, tall buildings block and reflect satellite signals, degrading GNSS accuracy. But the problem goes beyond accuracy: a standard GNSS receiver can report a position that looks tight and confident while being metres from the truth. For a human driver, that is usually an annoyance. For an autonomous vehicle with no one in the driver's seat, "confident but wrong" is a safety problem.

This is the mindset Nasir argues the industry has to design for. "You don't design a sensor suite for what might happen in a test lab," he said. "You design it for every edge case that can occur at 3am in a rainstorm on an unmarked rural road."

Cameras and radar tell the vehicle what it is around. Meanwhile, GNSS positioning tells it where it is in the world – which lane, which junction and where the boundaries are. The two are complementary. Notably, Wayve's system uses a suite of surround cameras and radar but no lidar, which places even greater weight on the remaining inputs being trustworthy.

In an urban canyon, surrounding buildings can block or reflect GNSS signals, creating multipath errors that distort the calculated position. The challenge is rarely that the vehicle has no positioning information; it is the system must gauge the quality of that



Waymo has scaled its robotaxi service dramatically

information and recognise when it should be trusted and when it should be treated with caution. The goal is GNSS that stays reliable in exactly the urban canyons where conventional receivers struggle, so location remains an input on which the vehicle can depend.

The city is an important testbed. Solving these problems here could help accelerate autonomous mobility elsewhere, particularly in other dense urban environments. The opportunity is therefore bigger than deploying driverless taxis in London. It's about demonstrating that autonomous systems can operate reliably in one of the world's most complex cities, and using those lessons to make self-driving technology safer and more accessible.

In the London trials, satellite signals can degrade quickly between tall buildings. But it is possible to filter out degraded or reflected signals, giving a vehicle a clearer picture of where it actually is, even in the parts of a city where GNSS struggles the most.

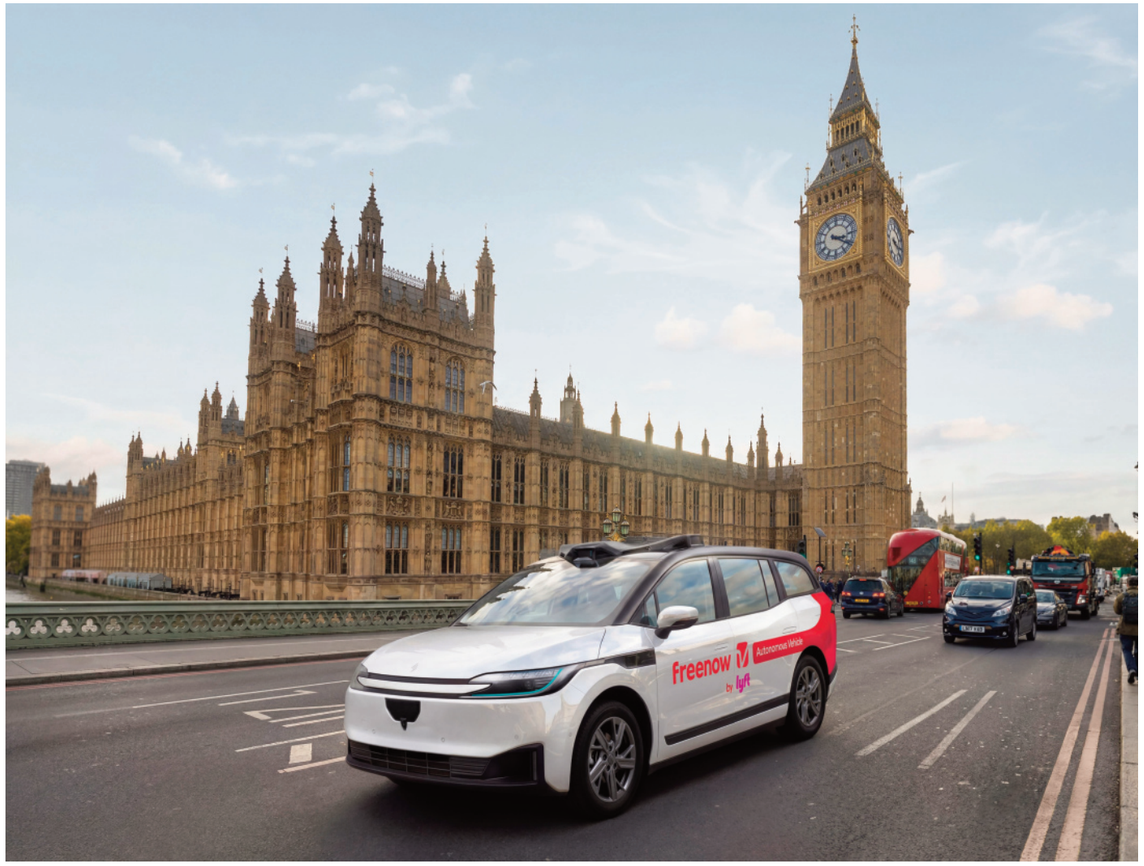
Scalable

Robotaxis are only one expression of a broader rollout, and the commercial model increasingly favours software that scales. Wayve's partnerships extend well beyond London: the company plans a Tokyo pilot with Uber and Nissan using the Nissan Leaf and is integrating its AI Driver software into Nissan's ProPilot system, bound for production in Japan from 2027.

This marks a genuine shift in how the industry is organising itself. For years, the working assumption was that each car maker would build its own autonomy stack in-house. That model is changing, due to the cost and difficulty of the task: Ford and Volkswagen wound down their jointly backed Argo AI in 2022, and GM has since folded its Cruise robotaxi programme back into the company.



Robotaxi testing on San Francisco's Golden Gate Bridge



Baidu's Apollo Go and Freenow by Lyft have started road testing in London

Building a full self-driving system and keeping it safe across every road, city and edge case has proven slow and capital-intensive for many OEMs to shoulder alone. Wayve represents the alternative: a platform that car makers license rather than build.

Stack

Cities are the toughest environment autonomy will face, which means they are also where the technology has the most to prove, and the most to gain. Solve positioning in a place like London, where the urban canyon does its worst, and it is also solved it for a great many places that are easier.

There's a temptation, especially as robotaxi economics come under pressure, to treat safety and cost as opposing goals: to assume that spending less inevitably means accepting more risk. Adding sensors to compensate for an unreliable positioning layer is expensive and doesn't guarantee safety. Getting more reliable, validated performance out of the sensors already in the stack helps achieve both goals simultaneously.

That is the opportunity facing the industry: not to treat degraded GNSS as an unavoidable weak point, but to turn it into a dependable input the rest of the adas stack can trust. This offers automotive OEMs a route to expanding the operational domain of their automated driving features into complex but everyday urban driving environments.



Manuel Del Castillo is vice president for business development at Focal Point Positioning

TELEMATICS

WATCHFUL EYE

Ashish Kolte looks at what's driving growth in automotive telematics

Volkswagen has one of the largest OEM telematics ecosystems

Automotive telematics has emerged as one of the surest areas of growth in terms of vehicle electronics. The latest market research estimates the automotive telematics communications market was worth $45.8bn in 2025 and will almost double to $89.2bn in 2034, growing at an annual rate of 8.2%.

This is far from the sensational numbers associated with vehicle technologies, but for engineers designing and building this technology, it could mean something much more important: a sign of an infrastructure-type market taking shape as opposed to chasing a passing trend.

The category covers a wide sweep of engineering disciplines. This is where one finds the cellular modems and GNSS modules that provide the vehicle's link to the outside world, the microcontrollers and edge computing devices that process sensor data from the device itself, the cloud-based software that provides meaningful use out of said data, and the managed service layer towards which fleet owners and insurance companies are increasingly looking. From a look at these numbers, it becomes clear there is an imbalance in these components and how much of their capabilities are being used.

Money

Hardware still leads the component breakdown, accounting for $18.1bn, or 39.5%, of the 2025 market. That is the physical layer – modems, antennas, microcontrollers, Can-bus interfaces – and it remains the foundation on which everything else builds.

But software platforms now hold 32.8% share, and services, a category that covers subscription cloud storage, driver-coaching analytics and managed connectivity, make up the remaining 27.7% and are growing faster than hardware sales, at around 10.5% a year. The pattern is a familiar one from other parts of electronics: suppliers are moving away from selling a box once and towards selling access, updates and insight on an ongoing basis.

That software shift shows up clearly when the market is split by vehicle type. Passenger cars are worth $28.6bn, which is 62.4% of the total amount, but there is a large gap in adoption for this class.

Vehicles that are valued at over $50,000 have a factory telematics adoption rate of 91.3%, while vehicles valued below $25,000 have an adoption rate of 34.7%. That is arguably the single largest



Automotive telematics communications systems market



What fleets are actually getting for their money

remaining growth opportunity in the category; not exotic new technology, but simply getting existing telematics capability down in cost far enough to reach the mass market.

Commercial vehicles, at $17.2bn and 37.6% share, tell a different story built on hard numbers rather than adoption curves: fleet operators report a $4.20 return for every $1 spent on telematics within two years, through fuel savings, lower maintenance bills and better utilisation.

Fleet management remains the application that anchors the whole market, worth $17.7bn and 38.5% of total value. Navigation and infotainment follow at $12.4bn (27.1%), with safety and security close behind at $10.3bn (22.5%).

The application worth watching, though, is remote diagnostics. At $4.2bn it is still the smallest major segment, but it is growing at 12.1% a year, faster than anything else in the category, as OEMs and aftermarket suppliers alike turn predictive maintenance into a subscription business rather than a one-time hardware feature.

Connectivity architecture has largely settled the question of embedded versus tethered systems.

Embedded telematics – modems and control units built in at the factory – now hold 54.1% share and are forecast to keep growing at close to 9% a year. Tethered systems, which lean on a driver's own smartphone for connectivity, are heading the other way, expected to shrink by roughly 2.3% annually as OEMs and fleet operators conclude that connectivity dependent on someone's phone being charged and paired is not something they want to build safety features around.

Edge

There are two different connectivity trends meeting in the telematics control unit, and they are almost diametrically opposed to each other. On the one hand, the spread of 5G is gaining momentum: in 2025, just 12% of all cars will be equipped with 5G connectivity, but that figure is expected to rise to 67% in 2030, thanks to reduced costs of chipsets falling from about $850 to $320 per chip. Carriers such as Vodafone, Deutsche Telekom and China Mobile have invested a total of more than $200bn in automotive 5G spectrum and infrastructure until 2028, as they seek to deliver sub-100ms latency for vehicle-to-infrastructure safety messaging and driver assistance applications.

At the same time, suppliers are making equally intensive efforts to eliminate the need to transmit information via the network. Companies such as Bosch and Denso are trying to process information right in the telematics control unit, analysing the information about engine, transmission, brakes and batteries and sending only the results of their work up the chain.

This is claimed to reduce the bandwidth required by about 68% compared with cloud processing of all the data.

For engineers specifying the next generation of control units, that means thermal headroom and on-board compute capability are becoming just as important a design consideration as raw radio performance, arguably more so given how quickly the two trends are compounding.

Regulation

It would be easy to read telematics growth purely as a technology story, but regulation deserves at least equal credit. The European Union's eCall directive, which requires automatic emergency-call capability in new vehicles, has effectively made a cellular connection standard equipment across the region.

Euro 7 testing protocols and GDPR's data-handling requirements layer further compliance obligations on top of that, and the EU has already levied a combined $15m in penalties against automakers over data-protection failures, a signal to the rest of the industry that these rules have teeth.

In the USA, NHTSA's performance standards for dedicated short-range communications (DSRC) and cellular-V2X are shaping how OEMs design connectivity into new platforms, while commercial-vehicle emissions-monitoring rules now affect around 8.2 million vehicles across the EU and China combined.

Insurance telematics adds a further, less obvious driver: usage-based insurance programmes from insurers including Generali, Allianz and State Farm already cover more than 15.2 million vehicles worldwide, a number expected to reach 38.4 million by 2030 and worth an estimated $6.8bn in additional market value by 2034.

Location

Asia Pacific will have the largest market share at a value of $19.4bn, representing 42.3% in 2025, driven by car manufacturing volumes in China, India and Japan along with quick 5G adoption and smart city projects supported by governments. This market share will increase slightly to 43.8% in 2034.

North America held 28.7% share in 2025 – AT&T alone provides embedded connectivity to 8.2 million Ford vehicles and Verizon supports 7.4 million General Motors vehicles – though its share is forecast to ease slightly to 27.4% as growth elsewhere outpaces the region.

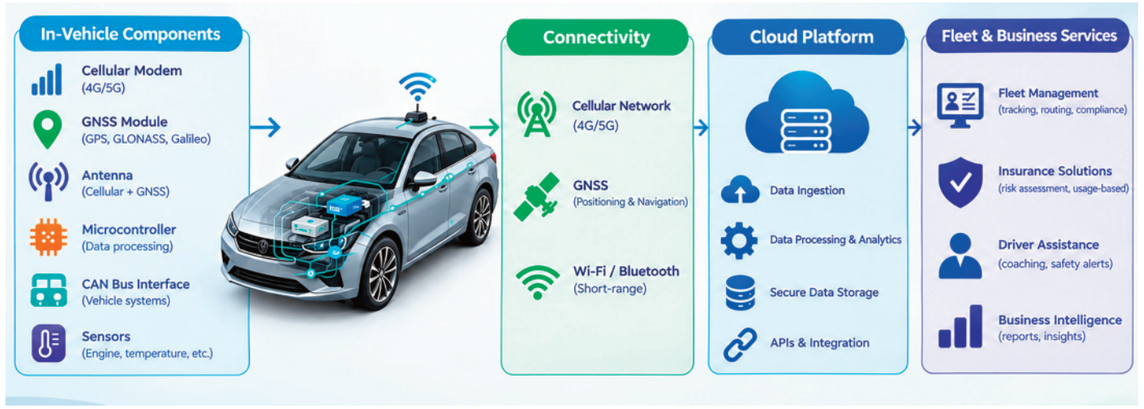
Europe held 18.9%, driven less by volume than by regulatory obligation, while Latin America, the Middle East and Africa together accounted for 10.1%, with Brazil and Mexico showing the fastest commercial-fleet growth of any markets tracked.

Fleets

The operational numbers behind fleet telematics adoption are consistent enough to be worth



5G and the push towards the edge



Telematics architectures connect cars, people and businesses

taking seriously. A saving of 18.2% in fuel consumption can be achieved using real-time tracking. The life span of vehicles rises to 24 months if maintenance scheduling is automated.

Driver-behaviour monitoring is linked to a 23.4% drop in preventable accidents. AI-driven predictive maintenance, specifically, is credited with cutting unplanned downtime by 35% and annual maintenance costs by 22% for the fleets that use it. And cloud analytics platforms from providers including Harman and Visteon are now processing data from more than 12 million connected vehicles worldwide.

Problems

None of this growth is arriving free of friction. Connected-car cyber attacks have increased 347% from 2022 to 2025, driven by the increasing attractiveness of location history data, driver behaviour logs and maintenance data stored by telematics companies.

In addition to GDPR requirements in Europe, China's data localisation policies and India's proposed frameworks for ownership of vehicle data are raising additional burdens on compliance with regulations, with suppliers forced to comply with the most restrictive of various jurisdictions.

Fragmentation is the other persistent headache. The five largest OEM telematics ecosystems – Mercedes-Benz, BMW, General Motors, Toyota and Volkswagen – operate largely closed platforms, which makes life difficult for commercial fleet operators trying to manage vehicles from more than one brand through a single system. There are only about 15 dominant firms that own up to 74.2% of the total share of the global market; these include Bosch (hardware – 18.3%), Continental (hardware – 13.7%), Harman (software and services – 9.2%) and TomTom (software and services – 7.8%).

Outlook

The figure of 8.2% CAGR until 2034 is not really a striking number but it is the indication of a category that has graduated from novelty to being a basic part of vehicle infrastructure, a type of growth that usually favours suppliers having their bases covered rather than innovators trying to chase the newest buzzwords.

The market for cloud services dedicated to automotive telematics is expected to grow from $3.2bn in 2025 to $8.7bn by 2034, with 11.8% CAGR due to the growing data requirements of self-driving cars.

As far as engineers who deal with this sphere are concerned, their immediate priorities seem quite obvious: incorporate 5G and edge computing capabilities within the given budgets of cost and energy consumption; work in accordance with a constantly changing regulatory environment on a regional level; and integrate cyber-security considerations directly into telematics.

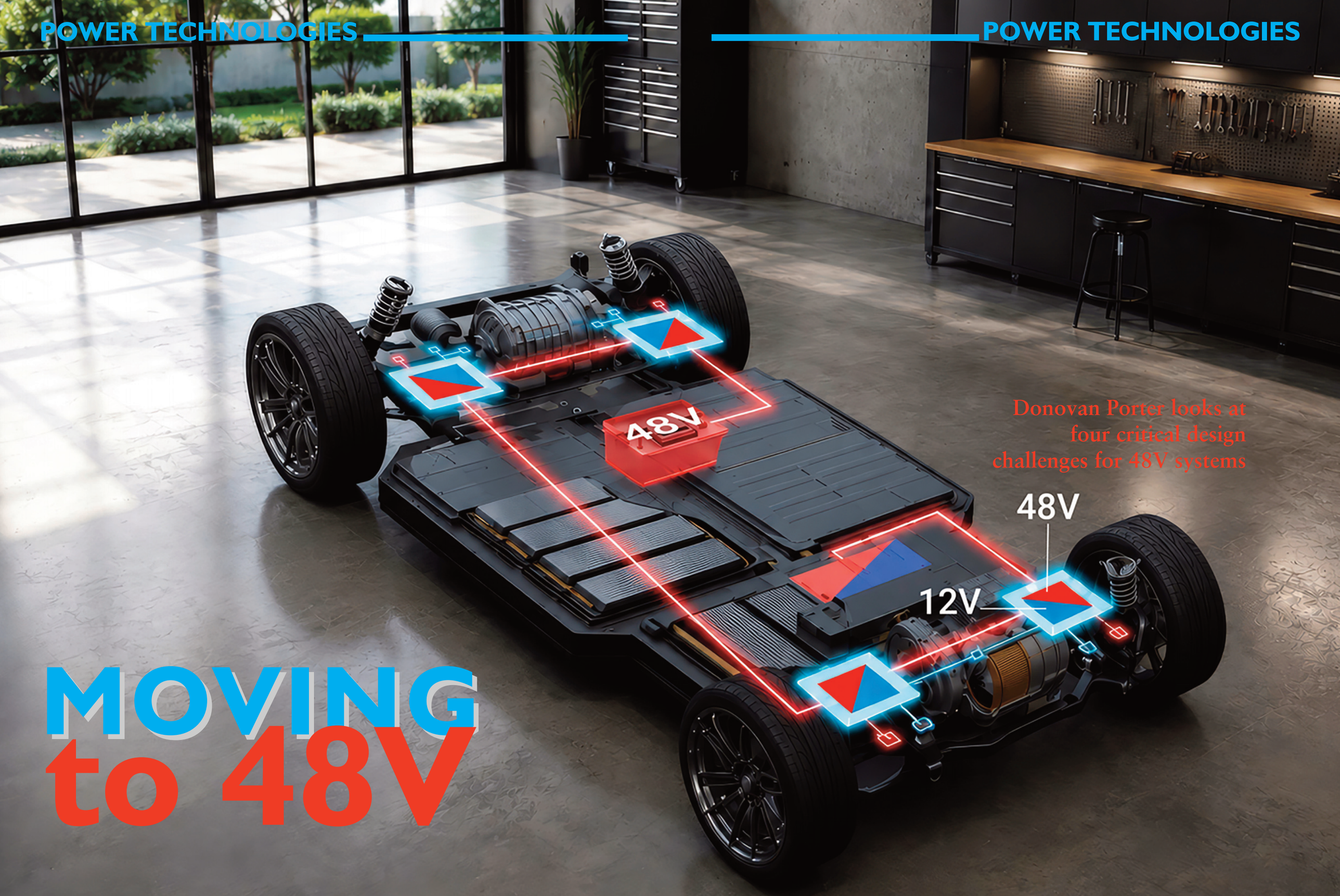


Ashish Kolte is marketing manager at Dataintelo

POWER TECHNOLOGIES

MOVING to 48V

Donovan Porter looks at four critical design challenges for 48V systems



Vehicle power supply demands are increasing to enable level-three autonomous driving and software-defined vehicles that implement advanced processing, edge AI, steer-by-wire and brake-by-wire systems. This has led to 48V replacing the traditional 12V power net to reduce wire harness weight and cost.

However, four key electronic system and circuit design challenges must be addressed:

1: Safe and reliable 48V power distribution
2: Efficient load actuation and 48V-to-12, 5 or 3.3V conversion
3: Protecting 12 and 5V IO circuits from 48V short faults
4: Maintaining Can and Lin integrity through 48V fault conditions

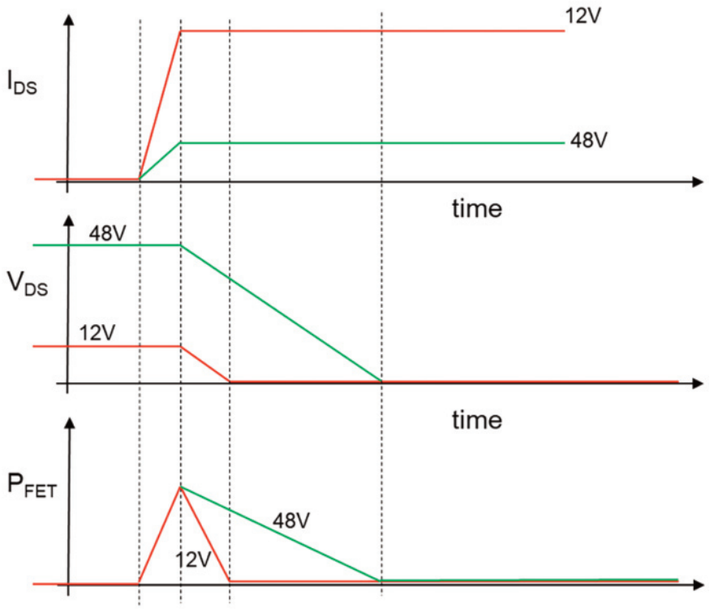


Fig. 2: Same voltage slew rate at 48 versus 12V mosfet turn-on

Challenge one

Automakers require cost-effective electronic architectures that can support fail-operational power supply and delivery for safety-critical ECUs including high-performance compute for autonomous driving and brake-by-wire control systems.

Replacing traditional melting fuses with smart e-fuse high-side switches provides the protection and diagnostics necessary to distribute 48V safely and reliably throughout the vehicle. Smart e-fuses integrate diagnostics including short-to-ground protection and programmable fuse time-current characteristic for adjustable wire-harness protection.

Additional e-fuse features include integrated ADC, current, voltage and temperature sensing circuits that equip the power distribution system to detect system-level faults and implement measures to guarantee critical electronics always remain powered.

Additionally, they meet ISO 26262 Asil B so designers can simplify safe power distribution design.

Safety-critical ECUs must manage redundant supply inputs often requiring ORing or power muxing of the supplies. Additionally, multiple 48-to-12V DC-DC converter outputs are often ORed together within a single zone control module to support low-power and normal operating modes. In both cases, ideal diode controllers can provide efficient ORing with reverse-current blocking and optional overvoltage and overcurrent protection.

Safe power distribution architectures can be further optimised with 48V due to the approximately 75% reduction in load current compared with 12V for the same amount of power. The reduction in load current

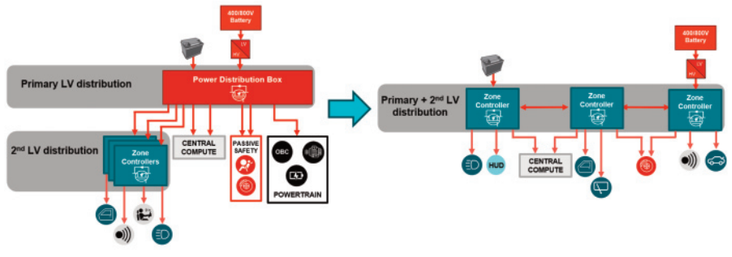


Fig. 1: Traditional 12 versus 48V backbone power distribution

directly reduces the thermal stress on power distribution electronics including e-fuses and discrete mosfets.

Therefore, designers can eliminate traditional power distribution boxes to reduce ECU quantity and cost. Zone control modules can perform both primary and secondary power distribution functions.

Fig. 1 shows a traditional 12V power distribution architecture vs a 48V backbone architecture.

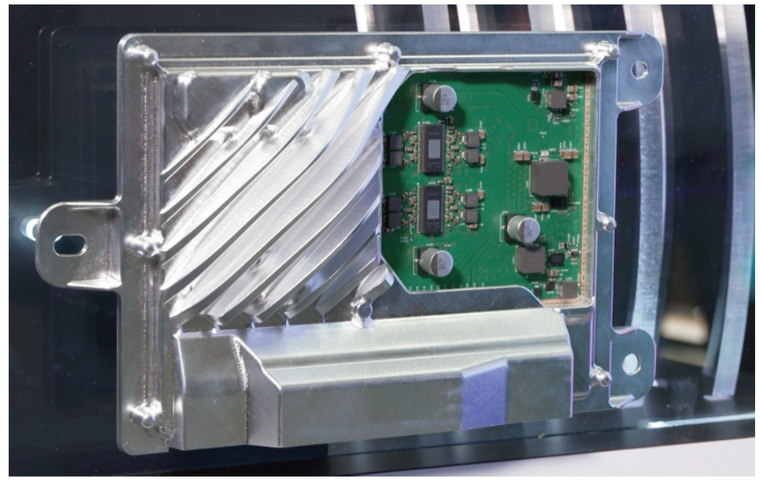


Fig. 3: 48-to-12V design using buck converter to supply class-D audio amplifiers in a compact form factor

Challenge two

Although 48V reduces load currents compared with 12V, switching losses (P_{SW}) increase approximately four times due to the longer rise and fall times (t_R, t_F) for the mosfet turn-on and off. The following equation can be used to estimate the switching loss increases of a mosfet when shifting from 12 to 48V:

$$P_{SW} = 0.5 \times (4 \times V_{DS}) \times (0.25 \times I_{DS}) \times [4 \times (t_R + t_F)] \times f_{SW}$$

Fig. 2 shows that a constant slew rate across 48 and 12V mosfets leads to four times longer t_R and t_F for 48V V_{DS}. While the drain-to-source voltage (V_{DS}) increase and drain-to-source current reduction cancel out, the remaining four times increase in t_R and t_F increases the overall P_{SW} by four for 48V versus 12V V_{DS}.

Designers must mitigate or reduce the additional P_{SW} across 48V devices that constantly switch mosfets on and off including DC-DC converters, motor drivers, high-side switches, LED drivers and audio amplifiers while limiting EMI.

Traditional design knobs to reduce EMI such as slew rate adjustment are limited. Therefore, alternative approaches must be taken including spread spectrum or dithering of the pulse-width modulation clock frequency with faster slew rate, improved packaging for thermal dissipation, and replacing mosfet technology with gallium nitride (GaN) to reduce thermal losses and mitigate EMI.

High-power applications for converting 48V to 12, 5 or 3.3V require different DC-DC topologies. Every topology choice – buck, buck-boost, switched capacitor converter (SCC), switched tank converter (STC) or inductor-inductor-capacitor (LLC) – has trade-offs between thermal performance, complexity, size and cost. Furthermore, as 12V loads remain in first-generation 48V vehicles, new 48-to-12V converters are added to supply external loads.

Finally, 48V vehicles must implement a 12-to-48V step-up or a bidirectional 48-to-12V converter to support jump-start from 12V vehicles.

Zone control modules, typically requiring more than 250W nominal on the 48-to-12V

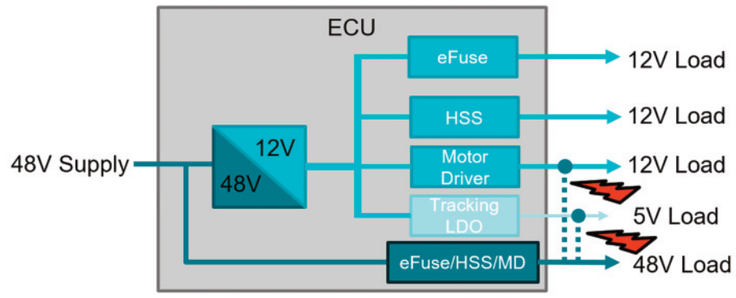


Fig. 4: Short circuit may occur at any voltage level when stepping down from 48V

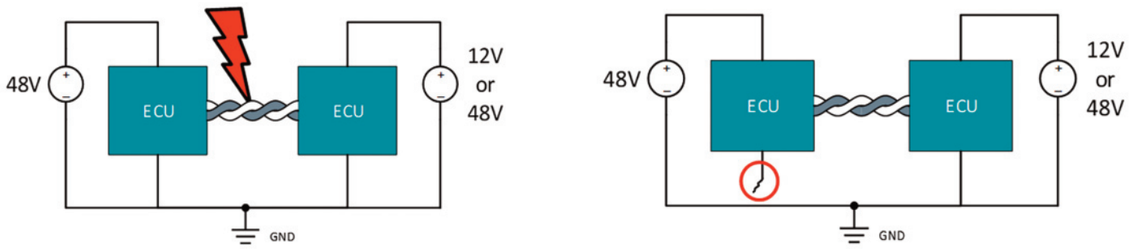


Fig. 5: Can bus short-circuit conditions impacting ECU communication bus

converter output, require additional topologies to improve efficiency and reduce thermal losses. Buck-boost converters handle a wide input voltage range, but may require multiple phases.

STC and SCC topologies offer a path for high-density, high-efficiency conversion with minimal to no magnetics, but require large ceramic capacitor banks and many mosfets. LLC converters push efficiency around 98%, but require large and expensive magnetics.

Fig. 3 shows a two-phase 48-to-12V buck converter supplying class-D audio amplifiers in a compact form factor.

Challenge three

Loads at 48, 12 and 5V will coexist in first-generation 48V architectures. The 48V supply will distribute power throughout the vehicle and directly drive high-power loads. Local converters in the zone control module will generate 12V from the 48V supply to drive multiple low-power (less than 60W) motors, solenoids, LEDs and resistive loads. Small off-board components such as negative temperature coefficient resistors and Hall-effect sensors will continue to be powered by 5V.

In addition to outputs, many ECUs have off-board inputs such as digital switches (buttons) and analogue sensors (NTC resistors, potentiometers and so on) that also require protection from 48V short conditions. A short circuit across connectors or wires between 48V and 12 or 5V inputs or outputs can damage legacy components, cause system-critical failures and lead to expensive ECU replacement.

ECU designs supplied by 48V must also support power-supply transient standards such as the upcoming ISO 25769 to ensure safe and reliable operation across the entire vehicle lifecycle. Additional protection circuits or expanded device capabilities are required to support worst-case conditions.

Challenge four

Can, Can-FD and Lin protocols are vital for ECU communication. All transceivers must avoid damage if a short between the 48V supply and communication bus occurs. Additionally, Can and Can-FD networks often carry safety-critical data that require communication even when a single node fails after a loss of ground.

Although these fault conditions are not new, 48V changes their requirements. Bus voltages will exceed legacy transceiver capabilities and a loss of ground can disable the entire bus due to increased common mode voltage from 48V floating Can nodes.

Some Can and Lin transceivers can survive both conditions supporting ±70V bus fault conditions to meet the latest ISO 25769 standard.

Next decade

The transition to 48V continues to gain momentum in the automotive industry. While the 48V power net can support future L3+ autonomous and AI-defined vehicles, new challenges for power distribution, power conversion, ECU IO protection and communication are introduced. Innovation at the semiconductor level directly addresses these challenges enabling automakers to streamline system design and release vehicles to market faster.



Donovan Porter is general manager of body electronics and lighting for automotive systems at Texas Instruments

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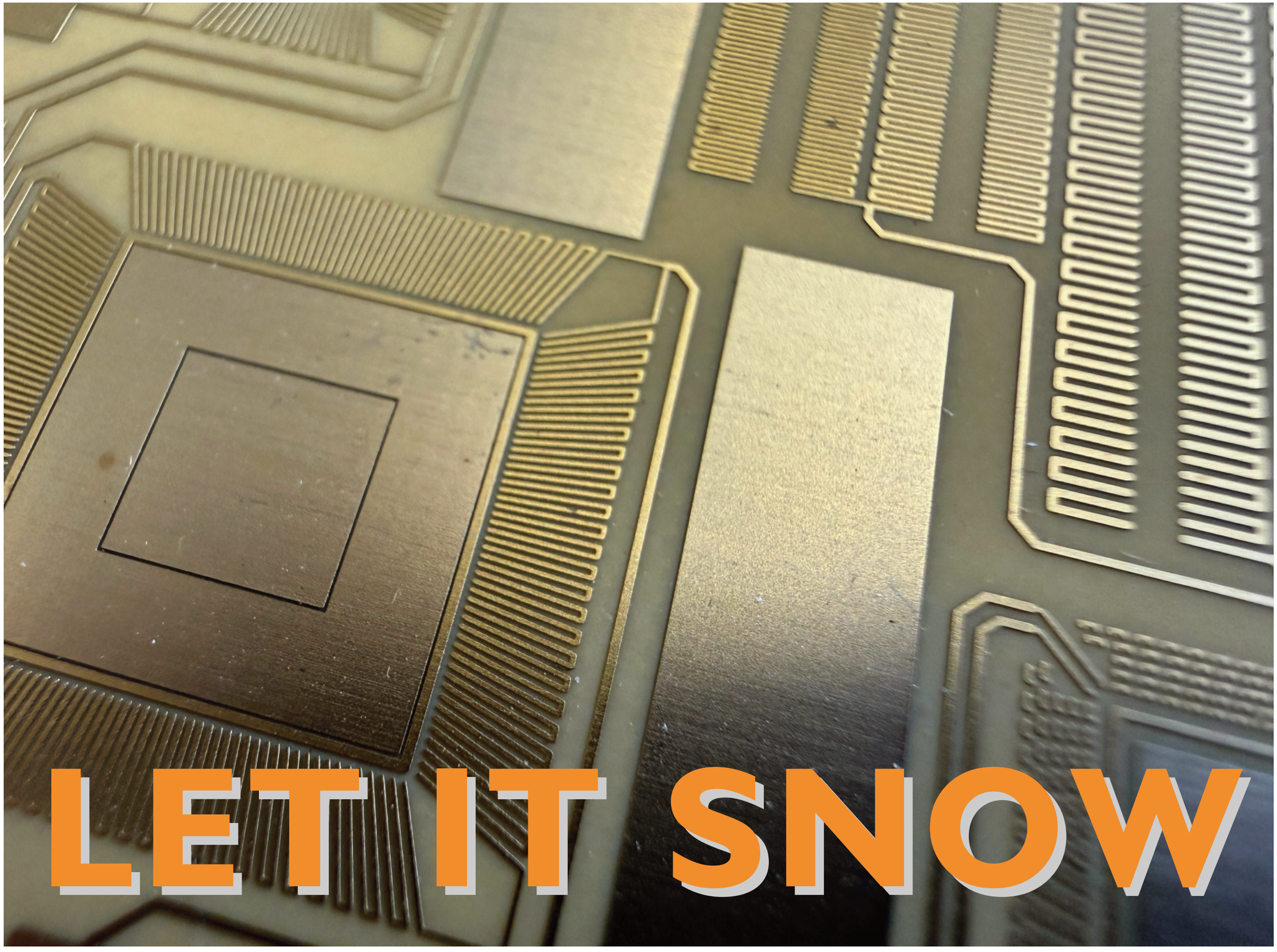
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MANUFACTURING



LET IT SNOW

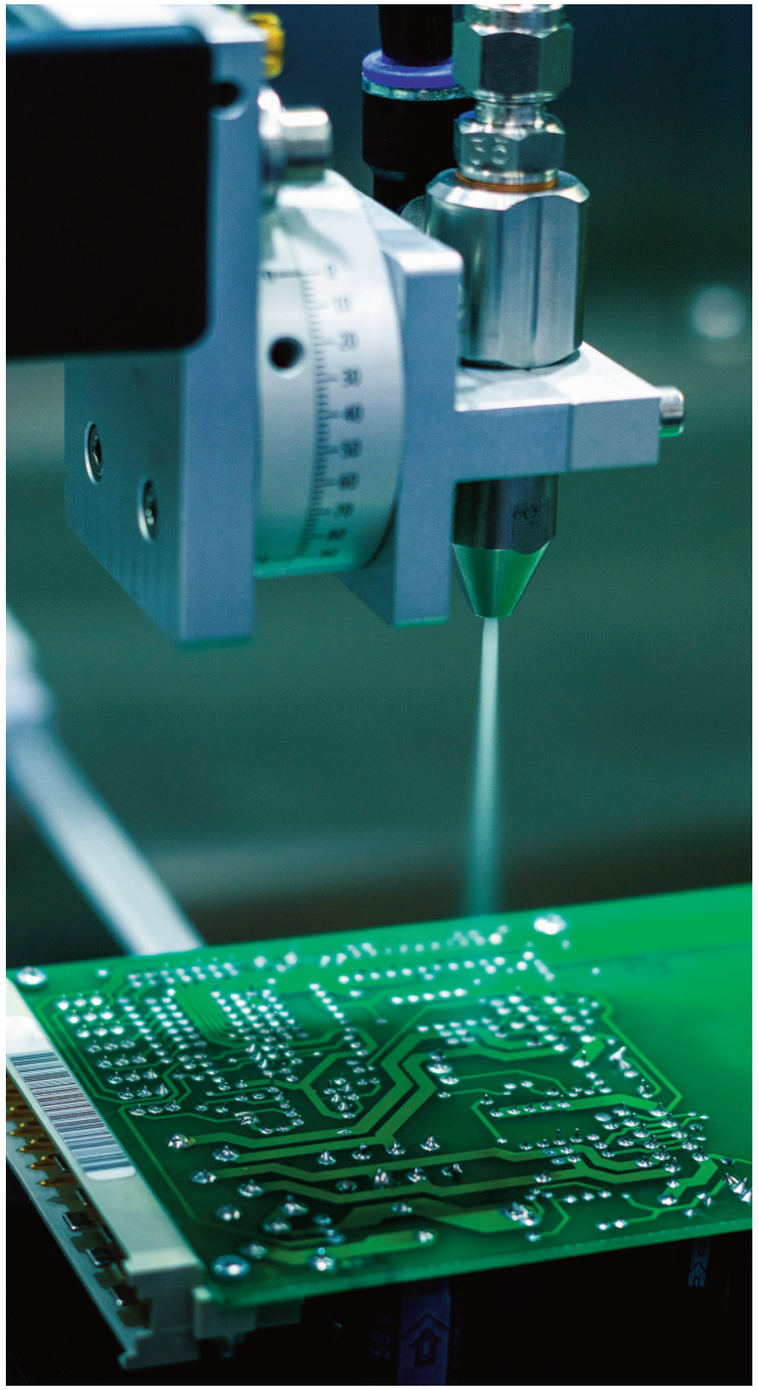
Doris Schulz explains how snow-jet cleaning prior to wire bonding can make a difference

Wire bonding is an established connecting technology in the semiconductor industry and microelectronics. Whether high-quality, long-lasting connections are achieved depends crucially on the cleanliness of the bonding surfaces.

Dry and scalable snow-jet technology can reliably and cost-effectively ensure the required cleanliness and can be automated as needed.

As the standard method for electrical contacting in assembly and interconnection technology, wire bonding has been established for 70 years across a broad spectrum of applications. These range from semiconductor technology, microelectronics and optical components to automotive, consumer products, mems and industrial sensors, as well as specialised applications such as the bonding of battery cells for electric mobility, cordless tools and energy storage systems.

“Wire bonding is generally divided into three major process groups,” said Stefan Schmitz, managing director of Bond-IQ. “Two of these are fine-wire processes, in which – depending on the application – wires made of gold, silver, aluminium or copper with diameters ranging from 18 to



The interaction of the four mechanisms ensures cleaning is effective and fast, yet gentle at the same time; the automated process, integrated into production, guarantees consistent, reproducible results

50µm are used. The third group involves thick-wire bonding with wire diameters ranging from 100 to 500µm."

Bond-IQ is a consulting firm specialising in wire bonding technology, and is the initiator of the Surf:Guide industry project. The project's goal is to develop a guideline on the cleanliness and condition of bond surfaces, which will serve as the basis for creating an internationally recognised, industry-standard specification.

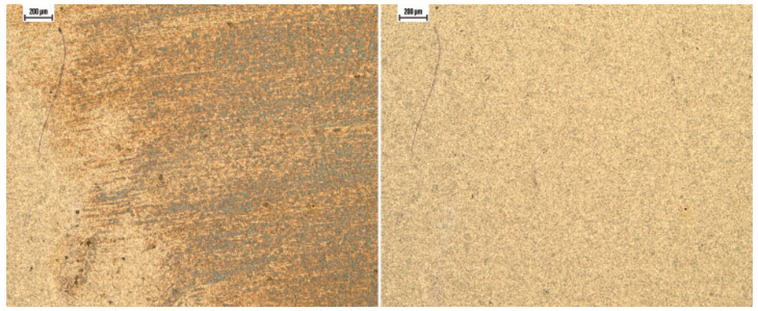
Cleanliness

Since the bond formation occurs in the nanometre range for both fine-wire and thick-wire bonding, the metals to be bonded must be brought into an atomic state relative to one another. Accordingly, contaminants or interlayers as small as 5 to 10µm can already hinder the bonding process. These include, for example, fingerprints, bleeding adhesives, flux residues, outgassing from adhesives and other polymers, dust, oxides, or residues from wet-chemical cleaning processes in particular.

"Visually detectable contamination is critical for bonding," said Schmitz. "If this contamination is no longer visible after cleaning, the bonding surface is usually sufficiently clean. This can generally be determined using a microscope and a visual before-and-after comparison. This alone can increase the success rate three- to fourfold."

Methods

Traditionally, bonding surfaces are still cleaned using wet chemical processes with solvents or water-based media, which



Snow-jet cleaning is a highly efficient method for removing film-like contaminants – in this case, a fingerprint – and particulate contaminants from PCBs

require energy-intensive drying. Plasma cleaning can be used for thin, known and very specific types of contamination. Laser cleaning represents another alternative.

"For very sensitive surfaces, such as those in microelectronics, however, the costs of a laser system and the appropriate laser technology must first be balanced," said Schmitz. "The industry is currently showing interest in QuattroClean snow-jet cleaning, as it can also remove more stubborn, encrusted contaminants."

Targeted

The scalable and cleanroom-compatible QuattroClean snow-jet technology from ACP Systems is a dry-cleaning process for full-surface and localised applications. The process is suitable for the reproducible removal of particulate contaminants down to the sub-micrometre range and film-like contaminants down to the nanolayer level.

The technology uses liquid, recycled and purified carbon dioxide – sourced from chemical production processes and biomass-based energy generation – as its cleaning medium. It is directed through a flexibly adjustable, wear-free dual-component ring nozzle and expands upon exiting into fine snow crystals, which are concentrated by a separate jet of compressed air and projected at supersonic speed onto the surface to be cleaned.

The cleaning effect is based on a combination of thermal, mechanical, solvent and sublimation effects. Since the crystalline carbon dioxide completely sublimates during the process, the treated surfaces remain dry. Removed contaminants are extracted along with the process gas, preventing recontamination of the surfaces and contamination of the surrounding area.

Applications

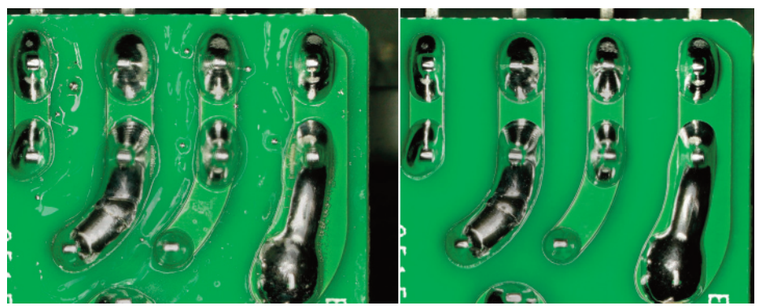
The low abrasiveness of the fine snow crystals allows even very sensitive and finely structured surfaces to be cleaned. The snow-jet technology can be applied to a very broad range of applications.

The process is used to clean flux and solder residues from PCBs and PCBAs, removing chemical and particulate contaminants from bond pads, and cleaning battery cells prior to contacting.

"The process can be used very efficiently on PCBs, which often have a mixture of organic residues such as grease, fingerprints, flux or residues from wet chemical cleaning processes," said Schmitz. "We have also achieved excellent results on semiconductors and on housings that have undergone electroplating or other wet chemical processes."

The relatively simple automation of the cleaning process and its integration into production lines also contributes to the ease of use.

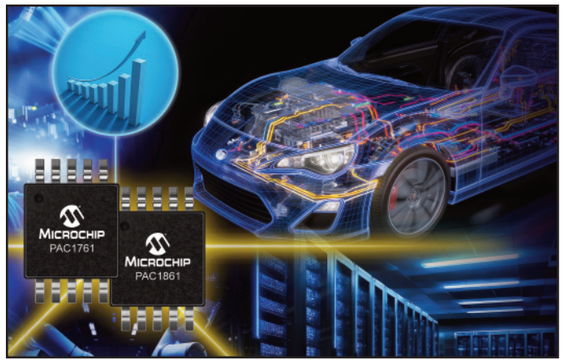
"This results in two advantages," said Schmitz. "First, automated cleaning ensures reproducible, uniform results. Second, when cleaning is integrated into manufacturing, freshly deposited contaminants can be removed immediately."



All flux residues are completely and reliably removed from the PCB without compromising the PCB structure

Power monitors aid move to 48V

Two families of 65V energy-aware digital power monitors from Microchip combine accumulated power-measurement insights with the necessary high-voltage measurement headroom and transient spike protection to help make 48V power architectures more efficient and resilient.



The move to 48V power architectures demands that digital power monitors have an additional operational margin of up-to-65V measurement and 75V of spike protection to ensure transient survivability.

The 12bit PAC1761 and 16bit PAC1861 devices add to these capabilities the intelligence to understand and react in real time to energy use dynamics based on accumulated power measurement data.

They feature programmable alerts for voltage, current and power excursions, step-limit detection to identify sudden load changes, and configurable accumulated-energy thresholds that enable proactive system management based on instantaneous and long-term power behaviour.

Applications include automotive, data centres, networking, industrial, servers, telecoms and 48V power distribution systems.

They come in VDFN-8 (similar to sot23-8), VDFN-10 and msop-10 packages including automotive-orderable variants.

Pin-compatible options can reduce redesign risk, shorten qualification cycles and give users flexibility to move between devices as requirements, availability, cost or performance change.

Development support includes the EV12R33A evaluation board, a Python command line interface with library, Linux driver and generic C library with multiple MCU code examples.

Products in the PAC1761 and PAC1861 families are available now in 10,000-unit quantities in the msop-10 package.

Common mode chokes resist vibration

Two low-profile common mode chokes from Vishay are for high current automotive, energy and industrial applications.

Available in surface-mount and through-hole packages, the Vishay Dale commercial ICM-S2321-10 and automotive-grade ICMS2321-1A combine a heat rating current to 30A with a 1.5kV DC dielectric withstand voltage between coils.

With their low profile, the devices offer a reduced size and volume, making them more resistant to shock and vibration, while their enhanced core design increases performance and saturation current at temperatures up to +150˚C.

With a self-shielded, rugged construction, the chokes are suitable for DC-DC converters, high voltage inverters, EMI filters and high current filters for noise suppression in motor control and other circuitry.

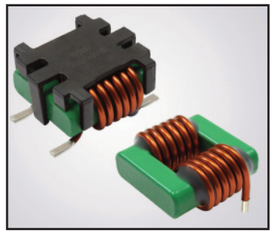
The AEC-Q200 qualified ICMS2321-1A is for use in automotive on-board chargers.

They have customisable inductance, impedance, DCR and current ratings. Devices with surface-mount terminations are available in tape-and-reel packaging and are compatible with automated pick-and-place assembly for flexibility in board layouts.

Inductance is 70 to 480μH. Typical DCR is 1.2 to 13.4mΩ and maximum DCR is 1.3 to 15.0mΩ. Common mode impedance is 540 to 3790Ω at 1MHz, 345 to 1920Ω at 10MHz and 220 to 410Ω at 100MHz. Maximum leakage is 1.7 to 11.5μH.

The chokes are RoHS-compliant, halogen-free and Vishay Green.

Samples and production quantities are available with lead times of 12 weeks.





Mitigating flicker

An 8Mpixel cmos automotive image sensor from Omnivision uses TheiaCel technology for adas and autonomous driving exterior cameras.

The OX08D30 extends single-exposure dynamic range to mitigate LED flicker and other temporal sampling artefacts, resulting in better image quality regardless of lighting conditions.

It is pin-to-pin compatible with the OX08D10 used in adas platforms.

Flicker from LED traffic lights creates problems for imaging, preventing systems from correctly detecting lighted traffic signs. The 2.1μm TheiaCel technology harnesses the capabilities of lateral overflow integration capacitors and DCG high dynamic range technology to mitigate LED flicker regardless of lighting conditions.

TheiaCel can improve HDR image quality, enabling enhanced detection ranges up to 200m.

It has 20% lower power consumption and is 50% smaller than other image sensors in its class. It uses the firm's a-CSP package technology to reduce size.

Gate driver completes AEC-Q100 qualification

The Skyworks Si829x isolated safety gate driver with ProVCD technology has completed AEC-Q100 automotive qualification and is available for prototyping.

Samples, tools, user guides and application notes are available.

For EV and hybrid traction inverters, the isolated safety gate driver provides 15A variable current drive ProVCD, supplying a current mode-controlled gate drive rather than traditional voltage mode drivers.

Current mode control lowers switching losses in traction inverters by up to 44% compared with TVMD, leading to improved efficiency. Simulation results demonstrate increased driving range per battery charge in EVs.

Designed to ISO 26262, it supports rigorous functional safety and is suitable for Asil-D applications.

The smaller physical size of a traction inverter PCB means more room for other EV electronics and lower material cost, and is accomplished through reduced BoM, easier cooling and lower EMI filtering burden.

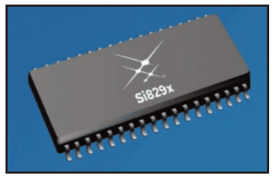
Traction inverters have long development cycle times, including selection of permanent, fixed gate resistors for TVMD. With ProVCD, there is no gate resistor, so configurations are flexible, eliminating the remove-replace resistor step and allowing changes via software.

The device can be deployed to multiple inverter variants without a gate driver change.

Traction inverters require components that are rigorously analysed for functional safety.

It tightly couples gate drive capabilities to SiC fet needs, demonstrated by DPT and efficiency gains unlike some devices that leverage existing IGBT TVMD for sub-optimal SiC drive.

Positive gate bias is regulated on-chip with programmable settings, and it generates negative rail voltage at lower net cost than incumbent transformer windings and LDO or Zener diode combinations.



Combining accelerometers and gyroscopes

Four automotive sensors from ST Microelectronics combine multi-axis accelerometers and gyroscopes (angular rate sensors) in a single ISO 26262 compliant device.

The sensors provide a unified platform to build active and passive safety systems that meet automotive requirements.

They have internal diagnostics and address use-cases from crash protection, rollover detection and airbag deployment to stability controls and radar beam stabilisation.

All support SafeSPI for automotive safety that enables independent monitoring of sensor data.

The NCS101-2BAEP has z-axis (yaw) angular rate and xy low g acceleration sensors; -2CAEP x-axis (roll) angular rate and yz low g acceleration sensors; -2EAEP x-axis (roll) angular rate and xy medium g acceleration sensors; and -135AEP z-axis (yaw) angular rate and xyz low g acceleration sensors.

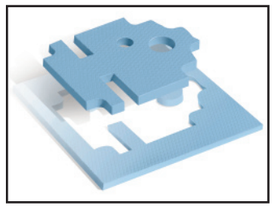
These are the first products launched in the mass market following STM's acquisition of NXP's automotive and industrial mems business this year.

Gap filler pad suits repeatable cycles

A thermally conductive gap filler pad from Parker Hannifin provides thermal conductivity of 3.0W/m-K.

Users can compress and reapply the Therm-A-Gap Pad 30RB material multiple times with little loss of thickness while maintaining the thermal performance of a fresh pad.

Designed to accommodate high stack-up tolerances, it helps reduce compressive loads and absorb shock, suitable for applications where components require reliable thermal management and with more than one assembly cycle. The material also provides vibration dampening and only very low compression force is required.



Applications include automotive electronics such as ECUs.

The material is naturally tacky on both sides to ensure secure positioning during assembly. It is also available with one non-tacky surface, providing flexibility to suit assembly requirements.

The material offers thermal impedance of 2.9°C-cm²/W, while electrical properties include dielectric strength of 0.02kVac/mm (ASTM D149 test method) and volume resistivity of $10^{13}\Omega$-cm (ASTM D257).

The RoHS-compliant material has an operating temperature of -55 to +200°C, carries a UL 94 flammability rating and provides a shelf life of 24 months from shipment.

It is available in thicknesses from 0.51 to 5.08mm in 0.254mm increments and comes in standard sheets measuring 228.6 by 228.6mm.

Carrier options include aluminium foil or Kapton thermally enhanced polyimide film, with parts available with or without pressure-sensitive adhesive (aluminium foil carrier only).

Custom widths, lengths and die-cut parts are also available either individually or on sheets.

Foldback flattens clamping for TVS diodes

Automotive-grade transient voltage suppression (TVS) diodes from Littelfuse use foldback technology to achieve a low, flat clamping voltage while handling up to 7kW of peak pulse power in a compact surface-mount package.

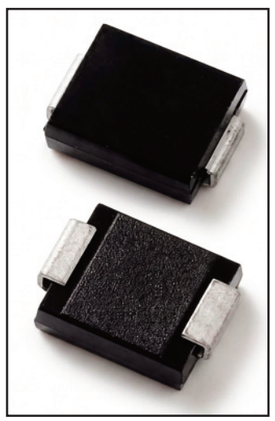
The TP7 0SMD24CA-XC has a flat 24V clamping voltage and up to 7kW of peak pulse power in a single DO-214AB SMC package.

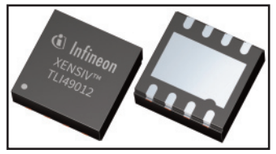
The result gives engineers more headroom to protect low-AMR (absolute maximum rating) ICs, while still meeting automotive 12 and 24V jump-start compliance requirements.

This reduces or eliminates series-connected TVS devices, lowering cost and board space. It enables selection of lower-voltage-rated mosfets while still meeting automotive requirements.

AEC-Q101 qualified and PPAP capable for automotive reliability, they have IEC 61000-4-2 ESD protection up to 30kV (air/contact) and IEC 61000-4-4 EFT protection on data lines.

Operating junction temperature range is -65 to +175°C.





Angle sensors

Four digital angle sensors from Infineon are based on Hall technology and suit motor control applications in automotive and industrial markets.

The Xensiv TLx49012 devices haves a self-calibration function that eliminates the need for user-developed calibration routines and external reference encoders, reducing development effort and cost across the product lifecycle.

Automatic initial calibration and continuous on-chip compensation enable on-axis and off-axis mounting configurations.

The family delivers an angle accuracy of less than 0.1° and a latency of 1.5μs, making it suitable for high-speed motor systems where precise, real-time rotor position feedback is critical.

The supported magnetic field range of 20 to 120mT provides compatibility with standard magnet configurations used across motor platforms.

Interface options include SPI, ABZ, UVW and PWM.

Automotive-qualified variants (TLE49012) are ISO 26262 compliant and achieve Asil B.

Sensors detect current up to 100A RMS

Isolated current sensors from Melexis are for high-voltage automotive and industrial applications.

The MLX91224 and MLX91225 deliver plug-and-play measurement up to 100A RMS, Asil-B readiness and a fast analogue response across three package options. They simplify design for EV powertrains, DC-DC converters, chargers and solar systems.

They combine the current conductor, sensing element, signal conditioning and isolation in a soic package. Current flows directly through the low-impedance lead frame of the package, while two sets of Hall plates differentially sense the magnetic flux generated by the current.

The architecture reduces disturbance from external magnetic fields and enables a high-speed linear analogue output proportional to the measured current, with package-dependent isolation ratings supporting working voltages up to 1.64kV RMS.

The Asil-B platform has been developed as an ISO 26262 SEooC.

The DE package provides a continuous operating current capability up to 50A RMS and overcurrent detection in a soic-6FL format.

In a soic-16W format, the DG variant supports a similar continuous operating current range and working voltage, enabled by increased creepage and clearance distance.

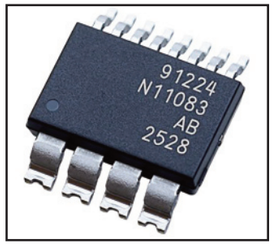
The DH package extends the platform to a continuous operating current capability up to 100A RMS in a soic-12W FL, with surge-current ratings up to ±29kA.

All devices support AC and DC current measurement, bipolar or unipolar sensing, and ratiometric or fixed output configurations.

The MLX91224 is for 5V systems, while the MLX91225 supports 3.3V.

Overcurrent detection is provided through a dedicated pin, with thresholds defined internally or externally to support protection and monitoring functions.

Operating ambient temperature is -40 to +150°C.



Resistors improve sensing flexibility

Automotive grade resistors from Bourns are for high-current applications that require accurate current measurement, low inductance and stable performance under demanding operating conditions

The CSS4C-1216 series adds resistance values and tolerance options of ±1, ±3 and ±5%.

The product extension provides designers with flexibility when optimising current sensing circuits in battery management systems, power modules and industrial electronics.

As power conversion and energy management systems continue to increase current density, designers must balance measurement accuracy, thermal performance, power dissipation and qualification requirements within limited board space.

Current sense resistors in these applications must maintain stable electrical characteristics while operating under elevated temperatures and continuous load conditions.

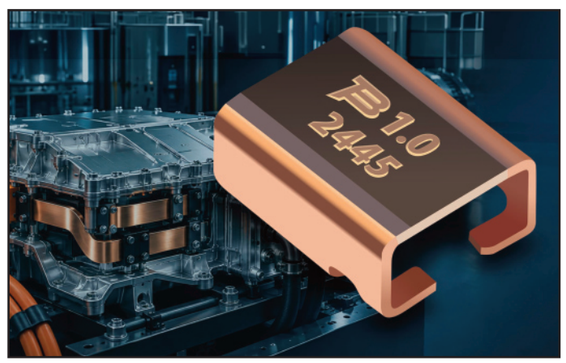
This series addresses these considerations through an EB welded metal strip construction, inductance of less than 2nH, and a four-terminal Kelvin configuration that improves current measurement accuracy.

The series is AEC-Q200 compliant, supporting use in automotive applications where validated reliability data are required.

Power rating is 2 to 5W at +100°C. Resistance is 0.2 to 3.0mΩ. TCR is ±50 to ±15-ppm/°C. Operating temperature is -65 to +170°C.

Four terminals improve current measurement accuracy.

RoHS compliant and halogen free, they support environmental compliance requirements.



Encoder reduces environmental impact

An automotive encoder from Alps Alpine enables automated assembly and can reduce environmental impact.

The EC11P 11mm SMD-type encoder is for use in automotive control panels and other applications.

The encoder replaces the conventional DIP mounting method with an SMD configuration, enabling use on automated assembly lines. This helps reduce manual insertion work while improving productivity and lowering mounting costs.

Because surface mounting eliminates the need for through-hole processing on PCBs, layout restrictions are reduced. In addition, single-side mounting enables more compact board designs and helps reduce costs through simplified PCB configurations.

It improves signal detection performance by 30% compared with the firm's conventional products. This enables stable signal detection even after extended use when internal component wear progresses.

It also helps reduce the risk of erroneous signal detection, ensuring reliable operation.

Conventional DIP mounting processes typically require the use of liquid flux to assist soldering, resulting in waste materials and cleaning wastewater. By adopting a surface-mount design, it reduces flux consumption, thereby lowering the burden associated with waste and wastewater treatment.

Detent torque is 10 ±4mN·m. Switch operating force is 4±2N. Switch travel is 1.5±0.5mm.

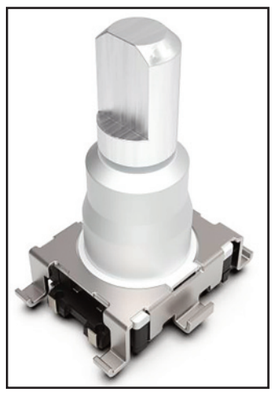
The device measures 11.7 by 15.3 by 24.5mm, and is rated at 5V DC, 10mA.

Rotational life is 100,000 cycles and switch operating life 100,000 operations.

Operating temperature is -40 to +85°C.

Applications include automotive air-conditioning controls.

Mass production is scheduled to begin this year.





Rectifiers more efficient than Schottky diodes

Automotive-compliant field-plated super barrier rectifier (SBRFP) products from Diodes include the 2A SBRFP-2M60P1Q and -2M60SAFQ, 3A -3M60SAFQ and 8A -8A60P5Q.

Serving as drop-in replacements for comparable Schottky and PN junction diodes, the devices have a low forward voltage (V_F) and low reverse leakage current (I_R). This enables the design of more efficient and reliable DC-DC converters, reverse-polarity protection, battery charging systems, automotive LED lighting and transmission control systems.

The SBRFP technology uses a metal oxide semiconductor manufacturing process that overcomes the limitations of Schottky and PN junction diodes.

The 8A60P5Q has a V_F of 0.55V at 8A, reducing conduction losses and enabling cooler operation in high-current applications.

The 2M60P1Q and 3M60SAFQ provide I_R maximum currents of 12 and 7μA, at 25 and 125°C. These characteristics help improve efficiency while reducing the risk of thermal runaway under high-temperature operating conditions.

The devices offer more avalanche capability than traditional Schottky rectifiers. Depending on the device, avalanche energy ratings reach up to 145mJ, letting the rectifiers withstand surge events, load dumps and transient conditions commonly encountered in automotive electrics.

This avalanche capability is five to ten times greater than conventional Schottky rectifiers, improving system robustness and reliability.

Packages include PowerDI123, PowerDI5 and SMAF.

The devices maintain stable operation across a junction temperature of -55 to +175°C.

Unified toolchain for NXP microcontrollers

Tasking has announced a single-vendor unified toolchain for NXP's S32K5 microcontroller family.

This brings compilation, debugging and verification together in one workflow, accelerating development of zonal architectures and electrification systems while reducing cost, complexity and certification risks.

As the automotive industry transitions to software-defined vehicles (SDVs), toolchain fragmentation introduces real schedule risk, inflates certification effort and complicates software reuse across platform generations.

With the unified toolchain, software engineers at OEMs and tier-one suppliers have a single, certified development environment optimised for the S32K5's architecture.

This support spans across zone controllers, domain controllers, body control modules, chassis and safety controllers, and other safety- and security-critical automotive applications.

Following Tasking's compiler introduction for the S32K3 family, the unified toolchain for the S32K5 provides an end-to-end workflow for compilation, debugging and verification.

The toolchain also includes full support, including out-of-the-box MCal certification via NXP's Autosar real-time drivers.

For teams with an existing S32K3 code base, reusability enables an efficient move to S32K5 without retooling the development environment, helping protect prior investment while reducing migration risk.

The toolchain is deeply integrated with the S32K5's features, including DSP acceleration, Arm Cortex-M7 and hypervisor-enabled Cortex-R52 cores, and hardware isolation mechanisms.

Developers get optimised performance along with ISO 26262 and ISO/SAE 21434 certifications and secure partitioning of mixed-criticality workloads without sacrificing safety or reliability.

The toolchain provides compiler-aware support for flashing, debugging and tracing, helping teams reduce friction and gain clarity when isolating and troubleshooting hard-to-diagnose issues.

Combining modern compiler technology, real-time debugging and automated testing can help engineers identify issues, trace requirements and verify standards compliance earlier in the development cycle.



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