VEHICLE electronics

The monthly magazine for automotive electronics engineers

Nissan and Honda plan to standardise ECUs for SDVs

Nissan and Honda have entered a joint development agreement to standardise multiple ECUs that form the core of future software-defined vehicles (SDVs).

The deal also includes the in-vehicle operating system and key parts of the middleware, as well as vehicle control software that runs on the ECUs.

The EE architecture incorporating the jointly developed ECUs and software is planned for application in both companies' SDVs from fiscal year 2029 onwards.

Nissan and Honda are also exploring opportunities to collaborate across a range of areas to accelerate progress towards carbon neutrality and help realise a future with zero traffic fatalities involving their vehicles.

In particular, the software domain centred on SDVs, which is key to vehicle intelligence and electrification, has been identified as an important area to collaborate, given the rapid pace of technological innovation and the need to strengthen competitiveness through improved R&D speed and investment efficiency.

Recognising the need to strengthen competitiveness through faster development cycles and more efficient investment, the two companies have conducted studies on potential collaboration in the software domain. As a result of these discussions, Nissan and Honda have agreed to develop and standardise jointly the core ECUs and software that underpin SDVs.

Under the agreement, the companies will work to establish common specifications for multiple core ECUs within the EE architecture, as well the in-vehicle operating system and key parts of the middleware and vehicle control software.

By standardising these foundational technologies, they aim to leverage their combined engineering expertise and development resources to improve efficiency, accelerate innovation and enhance competitiveness through reduced development costs and greater economies of scale.



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IDrive L2+ creates practical path to adas

IDrive has launched a low-cost, licensable L2+ driver-assistance platform to give automotive companies a practical path to deploying adas without having to build an autonomous-driving system from the ground up.

The company is positioning L2+ as a practical sweet spot: sophisticated enough to deliver meaningful driving automation on everyday roads, while keeping the human driver responsible for the car.

IDrive Autonomy is available for licensing now and is already operating on a production vehicle for real-world demonstration.

"The industry has spent years chasing the dream of full self-driving, but FSD is an entirely different problem," said Raghu Kulkarni, CEO of IDrive. "You are not just solving a perception and driving problem, you are taking on an enormous safety, validation, regulatory and liability burden. That makes a fully autonomous system extremely difficult to commercialise and even harder to license as a general-purpose product. We believe L2+ is where the real opportunity is today. Automakers want better driver assistance, but they don't want to reinvent the entire autonomy stack."

With L2+, the driver remains responsible and supervises the system, while the vehicle handles increasingly sophisticated tasks such as lane keeping, adaptive cruise control, stop-and-go driving and lane-change assistance. Companies can therefore deliver a more capable driving experience without taking on the same technological and liability burden associated with fully autonomous operation.

"L2+ is the sweet spot," said Kulkarni.

IDrive Autonomy is built as a single learned driving system rather than a collection of disconnected driver-assistance functions. The system is designed for ordinary driving environments, including urban streets, open freeways and mixed traffic.

The system is being demonstrated on public roads, with more than 1770 real-world kilometres engaged, more than 25 hours of driving and a top speed of 110kmph.

System changes are evaluated with a safety driver on the road and in simulation, with driving data feeding back into the underlying model.



Ottocast unveils CarPlay knob and in-car baby monitor

At September's IFA consumer electronics show in Berlin, Ottocast launched its Ottosafe safety product range with live demonstrations.

The headline product is the Ottosafe Knob, a physical controller for compatible Ottocast wireless CarPlay systems. As touchscreens increasingly dominate modern cockpits, simple actions often pull attention from the road.

The Knob brings back tactile, eyes-off-road control so drivers can browse and confirm CarPlay functions with clearer feedback and more natural hand movement.

Ottocast also introduced upgraded Cabin Care, its in-car baby monitor that provides real-time HD visibility of rear-seat passengers directly through CarPlay. Features such as HD monitoring, split-screen and PiP help parents stay aware without turning around or losing focus.



Ottocast upgraded in-car baby monitor

The IFA-launched upgraded Cabin Care model introduces a more powerful automotive-grade chipset, larger memory and enhanced Bluetooth. It also expands compatibility by supporting both wired CarPlay-to-wireless and wired Android Auto-to-wireless conversion, opening the product to a wider global user base.

Ottosafe represents a safety-focused layer within Ottocast's broader smart-cockpit ecosystem. It enhances awareness of road conditions and the in-cabin environment, introduces more intuitive tactile controls that require less visual attention, and creates less fragmented, more cohesive in-car interaction.

With Ottosafe, Ottocast is advancing its vision of a cohesive aftermarket ecosystem that integrates connectivity, entertainment, intelligent interaction and safety. The company sees safety and real-time cabin awareness as the next major dimension of smart mobility, complementing wireless CarPlay, Android Auto and smart cockpit upgrades.

Renesas joins Autoware for AI adas option

Renesas has joined the Autoware Foundation to accelerate development of pre–integrated adas and autonomous driving systems for automotive OEMs.

The collaboration aims to deliver entry-level L2 adas that can scale up to L2++ hands-free autopilot and fully driverless L4 robotaxis.

This means Autoware's open-source end-to-end AI stack becomes an AI driving software option for those using Renesas R-Car SoC and RoX software platforms.

OEMs and tier-one suppliers can retrain, tune and customise the open-source AI stack for specific vehicles and use-cases with deployment on R-Car SoCs.

"We believe this is the Linux moment for the adas and autonomous driving industry," said Christian John, board director at the Autoware Foundation. "By bringing Autoware's open-source technology stack to Renesas' R-Car SoC platform, we are able to deploy customisable, scalable and production-grade technologies to automotive OEMs and tier-ones around the world at a fraction of the cost of traditional suppliers."

Renesas vice president Aish Dubey added: "The automotive industry is moving beyond individual components towards integrated platforms that combine computing, AI and open software technologies."

The move lets OEMs and tier-one suppliers choose to build on an open-source technology substrate instead of building the entire AI stack in-house or buying a ready-made product from traditional commercial suppliers. This gives them a low-cost and flexible option that can be internalised and customised.

Autoware's software is supplied as Apache 2.0 licensed, enabling full commercialisation without restrictions.

Tasking and Wittenstein integrate safety-critical software

Tasking has announced a tighter integration between its unified toolchain and Wittenstein's SafeRtos pre-certified safety real-time operating system.

By using Tasking's Swat embedded software trace tool, developers can perform OS-aware timing analysis without requiring dedicated on-chip hardware trace support.

In safety-critical embedded systems, precise timing is critical. In a car's steer-by-wire system, a steering command that arrives even a few milliseconds too late can mean the difference between a responsive vehicle and a dangerous delay in a tight turn.

But not every SoC supports hardware-based trace and many lack the required features or cannot expose trace pins due to design constraints.

Even when it is possible to remodel hardware trace compatible SoCs into existing designs, it is costly and time-consuming.

The integration bridges this hardware gap to provide access to crucial timing data as well as help engineers leverage Tasking's debug and test tools to support and accelerate the development and verification of applications running on SafeRtos.

With Swat, developers can build runtime analysis into their development workflow from the start, without additional hardware changes to board design. In addition, the development environment is OS-aware to deliver the features to create robust systems.

As a pre-certified safety rtos with deterministic event handling, SafeRtos is for systems that need precision control or must respond quickly to safety events and place the system into a safe state within a defined time. It is pre-certified across IEC 61508 and ISO 26262, and includes design support packages that can reduce certification effort.

Developers can capture real-time timing data on targets without hardware trace capabilities. They can observe the timing behaviour of every state transition, context switch and key application event in real time.



Pony AI tests robotaxis in Zagreb without safety driver

Pony AI has started fully driverless robotaxi test rides with passengers on public roads in Zagreb.

The test rides take place along a 22km route linking Zagreb's main business districts with Franjo Tuđman Airport. The fully driverless routes will be expanded in the next few months, with the aim to cover the whole operating area in Zagreb.

Under the joint deployment model, Pony provides the autonomous driving technology, local firm Verne leads the service operations and Uber offers access to the service through its platform.

The test rides use Pony's seventh-generation robotaxi, powered by a Pony-developed L4 domain controller built on Nvidia Drive AGX, running on the safety-certified DriveOS operating system.

The robotaxi's safety architecture combines 360-degree sensor coverage with multiple layers of redundancy and fail-operational capabilities. This architecture has been validated through fully driverless commercial operations in major Chinese cities across complex urban traffic and adverse weather conditions.

Since the service operated by Verne with a safety driver was launched in April, the fleet has logged more than 200,000km in operations and completed several thousand customer rides.

Moving from commercial operations with an onboard operator to fully driverless testing demonstrates Pony's ability to apply technology and operational experience from its fully driverless commercial services in China to real-world deployment in Europe.

"Zagreb provides a strong foundation for expanding fully driverless mobility across Europe and other international markets," said James Peng, CEO of Pony AI.





Lotus rolls out update for Eletre and Emeya

Lotus has rolled out an over-the-air (OTA) software update for Eletre and Emeya owners across Europe, with enhancements to boost the in-car experience for drivers.

The update introduces features and optimisations developed from customer feedback and ongoing vehicle development.

These include active sound design, which adds amplified performance-inspired organic vehicle sounds that respond dynamically to acceleration, deceleration, driving inputs and driving modes, creating a more immersive experience.

Drive setup is a convenience feature developed as a direct response to user feedback. It lets drivers save and quickly activate frequently used vehicle and driver-assistance preferences with one tap.

The update also brings safety and usability enhancements. Both Eletre and Emeya receive improved insulation-fault monitoring, enabling earlier detection of potential issues, earlier warnings and automatic system protection.

For Eletre, Lotus has refined fatigue and distraction alert functionality to reduce false alerts while maintaining safety performance.

For Emeya, auto hold status is now visible when active, making it easier for drivers to confirm vehicle status in stop-and-go traffic.

As part of the update, Eletre users in Germany will gain access to the Lotus Hyper Pilot functionality, an assisted-driving feature designed for approved motorway routes on the Frankfurt–Stuttgart–Munich corridor, including sections of the A3, A5, A8 and A99 autobahns.

Drivers will get a notification when their vehicle is ready to download and install the update.

Contechs opens facility in Gothenburg

Automotive design and engineering consultancy Contechs has opened operations in Gothenburg, Sweden, establishing a permanent Nordic base.

With almost three decades of experience delivering complex vehicle programmes for automotive OEMs, Contechs provides end-to-end design and engineering capability from concept through to production.

Headquartered in the UK, the group now operates across seven locations in the UK, Germany, Sweden, Poland, India and USA.

The Nordics have become one of the world's most progressive automotive and mobility development centres, with investment in electrification, digitalisation and software-defined vehicles. A permanent presence there positions Contechs at the centre of that market and creates a platform for growth across Sweden, Norway, Denmark and Finland.

Rather than scaling through headcount and geography alone, the group is building a model that pairs local, specialist engineering and programme management with virtual delivery capability, underpinned by proprietary process IP developed over more than two decades of vehicle programme delivery and an increasing use of AI-enabled workflows across its virtual engineering capability.

Together, these allow Contechs to deploy specialist expertise consistently, whether a client's team is working alongside Contechs engineers on-site, through a regional delivery centre or entirely virtually, giving clients the flexibility to scale programmes wherever needed without compromising technical governance or rigour.

"The Nordics are home to some of the most progressive thinking in automotive and mobility, making the region a natural growth area for us," said Pete Jarvis, CEO of Contechs. "But this isn't just about adding a location to the map. Our strategy is about building a genuinely global engineering organisation."



Winbond acquires Infineon NOR flash and fram business

Taiwan's Winbond Electronics has acquired Infineon's NOR flash and fram business in California for $1.12bn.

Winbond is expected to bring over people from ten countries. Upon closing, the company will be renamed Spansion.

The business serves customers across automotive, industrial and infrastructure markets, and was called Spansion until it was acquired by Cypress Semiconductor in 2014. Cypress was acquired by Infineon in 2019.

"We are excited to bring back the Spansion company name and trademark," said Arthur Yu-Cheng Chiao, CEO of Winbond. "Spansion was a pioneer of the industry and made many innovations and technological breakthroughs that contributed to the IT industry. We are honoured to be able to carry on the torch under this name again."

The transaction is expected to close in the second half 2027, subject to closing conditions and regulatory approvals.

"The transaction represents a highly compelling outcome for all stakeholders," said Peter Schiefer, president of Infineon's automotive division. "It allows Infineon to focus its portfolio and capital allocation on its core growth drivers."

YFore opens US manufacturing facility

At the official opening of its North American manufacturing facility in Georgia, Chinese tier-one supplier YFore Technology debuted its occupant and driver monitoring system (ODMS) for integrated in-cabin full-coverage sensing.

It also showed its UWB radar sensing portfolio and expanded multi-scenario applications. Powered by proprietary high-precision algorithms, it enables versatile multi-functionality from vehicle UWB hardware across in-cabin safety, vehicle access and automated parking.

As in-cabin monitoring becomes standard, conventional vision-only setups often struggle with seatback occlusion, footwell blind spots and covered occupants, while distributed sensors complicate vehicle wiring and roof tooling.

To solve this, the ODMS combines a DMS and OMS-integrated smart mirror with automotive-grade cabin radar, delivering an integrated multimodal architecture for cabin protection.



UWB demonstration at Georgia facility

Integrating the smart mirror with in-cabin radar overcomes optical limitations through RF signal penetration. The smart mirror's high-definition camera tracks driver fatigue, distraction and unresponsive states from a prime forward angle. Simultaneously, the roof radar penetrates blankets, clothing and tall seatbacks to capture micro-breathing in rear rows and footwells, achieving 3D spatial coverage.

The ODMS architecture covers seven core functions: driver fatigue, distraction, unresponsive driver and phone use detection, alongside seatbelt status, occupant classification and full-cabin life presence detection.

By embedding optical components into the smart mirror and pairing them with a radar module, ODMS eliminates multiple headliner cutouts and complex roof wiring. This preserves clean interior aesthetics while simplifying platform adaptation across multiple vehicle models.

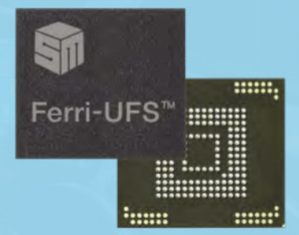
Unaffected by optical line-of-sight limitations, the UWB in-cabin monitoring system uses high-penetration pulse signals to detect subtle micro-breathing for child presence detection.

With a life-detection rate exceeding 99% and signal leakage through windows kept under 20cm, the system prevents false triggers while meeting Euro NCap safety standards with less than 13s response time.

In parallel, the UWB occupant detection system determines multi-target spatial coordinates to report exact passenger counts for emergency ecall response.

The portfolio expands UWB radar to vehicle exterior scenarios such as kick-sensing access.

SiliconMotion



Silicon Motion's Ferri-UFS®
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As vehicles become smarter, more connected, and software-defined, intelligent cockpits must process growing volumes of data in real time. From navigation and infotainment to ADAS and OTA updates, automotive systems demand storage that is fast, reliable, secure, and power-efficient.



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UFS 3.1 with data transfer speeds up to 11.6 Gbps, enabling faster boot times, responsive navigation, and smooth multimedia experiences.

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Ferri-UFS®
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Infac uses Vicor DC-DC converter to improve EVs

South Korea's Infac has designed an 800V battery pack block for electric vehicles that integrates a high-power 800-to-48V isolated and regulated DC-DC converter.

The design is said to improve vehicle performance and power efficiency, and boost range through the reduction of high-voltage cables and connectors.

Rather than treating the DC-DC conversion stage as a distributed standalone subsystem, Infac designed the power to be stepped down at the source for SELV distribution throughout the vehicle. That enables cleaner, flexible, more modular 48V zonal designs for various EV platforms without displacing battery cells or reducing range.

Infac saw traditional approaches to power delivery were misaligned with goals for weight reduction, cost optimisation and design simplicity.

High voltage DC-DC converters are typically mounted outside the high-voltage (800 or 400V) battery assembly, requiring additional safety and thermal management systems. The EV motor and inverter demand hundreds of kilowatts of power and require high-voltage wiring harnesses, brackets and enclosures. Other powertrain subsystems and body and chassis electronics require 3.5 to 12kW, and can be easily powered from a 48V SELV zonal power distribution network.

Physically separating the high-voltage source and DC-DC conversion power system unnecessarily duplicates power distribution and management systems, which wastes space, weight and cost and doubles the liquid cooling required.

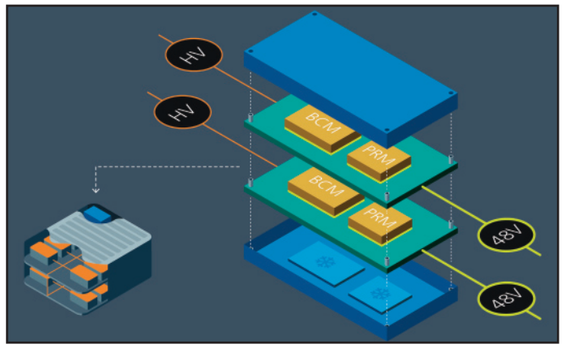
Infac's key insight was that the battery pack already incorporates a robust liquid cooling system for managing thermal loads. By integrating the high voltage DC-DC converter inside the battery and leveraging the existing infrastructure, it eliminated separate cooling that traditionally resides outside the battery pack for the DC-DC converter.

This departs from conventional design by positioning the battery pack as a central, intelligent power hub rather than a passive energy source.

The change was made using Vicor high-density BCM6135 DC-DC converters and PRM3735 regulators, which provide HV-to-48V conversion and regulation and enable a high-power, fully isolated and regulated bus for the zonal architecture.

By co-locating the DC-DC converter in the battery pack, Infac increased performance at the system level.

By leveraging the battery's liquid cooling network, the power module eliminates redundant coolant loops and reduces thermal interfaces.



Vicor DC-DC converter (BCMs and PRMs) fits inside the 800V battery pack, saving space and weight in the vehicle design

Mipi working group to standardise kinematic data

The Mipi Alliance has formed a working group to standardise the format of kinematic sensor data streams transported over the Mipi CSI-2 camera and imaging interface.

Kinematic sensors include radar and lidar to measure the motion, position, velocity or acceleration of an object and typically complement the use of other image sensors in applications such as automotive, robotics and aerospace where positioning data are critical.

Although radar and lidar often leverage the CSI-2 interface, they typically represent the sensor chirp data in proprietary ways. The forthcoming Mipi KSF kinematic streaming format specification is intended to harmonise these various approaches and standardise the representation of raw unprocessed kinematic data immediately following its digitisation.

In terms of the typical hardware-software stack, the kinematic sensor data would sit as an application layer above the CSI-2 protocol layer and could be used with Mipi phy specifications and other Mipi-authorised phys.

Nexperia and Aurobay look to unlock powertrain efficiency

Nexperia and Aurobay Technologies are collaborating on power semiconductors for electrified powertrains.

The joint evaluation of GaN and SiC technologies aims to unlock higher efficiency and more compact power electronics for automotive applications.

Aurobay, a division of Horse Powertrain, is part of a joint venture between Renault and Geely.

The collaboration aims to combine Nexperia's expertise in GaN and SiC with Aurobay's capabilities in powertrain design and integration.

Building on an existing collaboration, the companies aim to evaluate how closer cooperation across semiconductor development and powertrain integration can support future electrified and hybrid vehicle platforms.

This follows the deployment of Nexperia's GaN devices in Aurobay's integrated power generation system for range extender applications. The project demonstrated the potential of wide-bandgap semiconductor technologies to improve efficiency, reduce size and weight, and enhance performance.

Building on this, Nexperia and Aurobay will assess opportunities to optimise power electronics architectures for applications including traction inverters and power generation. They aim to evaluate joint engineering, including early-stage co-design and system-level optimisation.

"GaN and SiC technologies offer significant opportunities to improve efficiency, power density and system performance in automotive applications," said Edoardo Merli from Nexperia.

Ma Yongquan, chief engineer at Aurobay, added: "By combining our expertise in powertrains with Nexperia's semiconductor innovation, we can evaluate new approaches to improving efficiency, performance and packaging for future electrified propulsion systems."

Silicon Motion security recognition



Silicon Motion has earned ISO/SAE 21434: 2021 automotive cyber-security process certification from SGS-TÜV Saar. The certification independently validates that Silicon Motion's automotive cyber-security development and management processes meet the standard's requirements for road vehicles.

This demonstrates the company's ability to identify, assess and manage cyber-security risks throughout the automotive product lifecycle, reinforcing its commitment to delivering secure and reliable automotive storage.

The firm designs and markets NAND flash controllers for solid-state storage devices.

ISO/SAE 21434 was developed to address the growing cyber-security risks created by increasingly connected and software-defined vehicles. It provides a structured framework for identifying, assessing and managing cyber security throughout the lifecycle of automotive electrical and electronic systems.

"Earning this certification reflects our commitment to embedding cyber security throughout the product lifecycle and delivering secure, reliable and automotive-grade storage that helps customers meet evolving cyber-security requirements," said Nelson Duann, senior vice president at Silicon Motion.

Microchip and Marelli use ASA-ML to streamline content to displays

Microchip and Marelli have collaborated so graphics and video content generated by a vehicle's central computer can be streamed directly to displays using ASA Motion Link (ASA-ML).

The demonstrator helps vehicle makers simplify display architectures, optimise costs and increase sourcing flexibility while supporting the transition towards software-defined vehicles (SDVs).

ASA-ML is an open standard for automotive video connectivity and serdes communication, defined by the Automotive Serdes Alliance (ASA), a consortium of vehicle makers, tier-one suppliers and semiconductor companies.

By enabling secure, high-speed video and graphics transmission across products from multiple providers, the standard supports compatibility across the automotive ecosystem and provides a scalable alternative to proprietary video transmission technologies.

As a founding member of ASA, Microchip is advancing the industry's transition from proprietary connectivity technologies to open, interoperable standards.

In the joint demonstrator, graphics and video content generated by the vehicle's central computer is processed and transmitted through Microchip's VS7000 ASA-ML chipset over a high-speed standardised link.

Marelli pioneered the display-side integration of the technology by enabling the configuration and optimisation of the ASA-ML deserialiser to decode standardised video streams directly at the display.

This ensures accurate reception, synchronisation and delivery of centrally generated content, including camera feeds, navigation maps, infotainment graphics and vehicle control interfaces, while enabling simplified display-side electronic architectures.



Collaboration lets content be streamed directly to automotive displays

"This collaboration highlights how open standards can accelerate innovation while providing interoperability needed for the next generation of vehicle architectures," said Kelei Shen, president of Marelli's electronics business.

Kevin So, vice president at Microchip, added: "Our collaboration with Marelli demonstrates how ASA-ML provides automotive manufacturers with secure, interoperable and scalable connectivity that simplifies integration across the ecosystem."

Open interoperability enables seamless connectivity between cockpit and displays from multiple technology providers. Integrated security with link-layer authentication and encryption is embedded in the communication channel.

Scalable performance supports data rates up to 16Gbit/s to address various display requirements.

Improved efficiency is enabled by embedded time division duplex functionality and simplified forward error correction, contributing to lower power.

This also creates a path to increasingly Ethernet-centric architectures.



Emergency brake assist helps with wildlife crossings

BMW grows active safety across multiple models

Neue Klasse marks the first time BMW has offered an expanded portfolio of active safety assistance systems as standard across multiple model series.

Among them is an exit warning function with active door opening delay, helping prevent dooring accidents.

The iX3 was the first Neue Klasse production model to feature these technologies, with further models including the i3, X5 and 7 series to follow.

Active safety assistance systems support drivers in critical driving, parking and exit scenarios.

Symbiotic Drive understands the driver's intentions through steering inputs and line of sight, enabling assistance functions to intervene only when necessary.

As a result, functions such as the lane keeping assist only provide warnings or steering interventions when the vehicle detects an unintended lane departure or an imminent collision. When a manoeuvre is initiated deliberately by the driver, the system does not intervene, provided there is no foreseeable risk of a collision or the vehicle leaving the roadway.

Indicators of driver intent include activating the turn signal, making an active steering input or performing a shoulder check.

Side radars continuously monitor traffic around the parked vehicle and detect approaching vehicles, bicycles or other road users. If a risk of collision is detected, the electronic door lock delays the opening of the door until the danger has passed.

Emergency steering intervention automatically steers the vehicle around an obstacle while keeping it within its own lane, for example, if a person steps onto the road between two vehicles after a breakdown, or if a cyclist is overlooked in low-light conditions.

Emergency brake assist with evasive steering support helps prevent imminent head-on collisions. It can automatically apply the brakes up to full deceleration. Thanks to improved sensor technology, it can also assist in situations involving animals on the road and wildlife crossings.

Road priority warning displays recognise traffic signs directly in the driver's field of view. In addition to red traffic lights, yield signs, stop signs and no-entry signs, this now includes warnings at crosswalks.

Attentiveness assistant with emergency stop can provide support in medical emergencies. If the camera detects the driver is no longer fit to drive, the system temporarily takes control of the vehicle. It brings the vehicle to a controlled stop, automatically activates the hazard lights and triggers an ecall. The driver can override the system at any time.

Active park distance control can prevent collisions using ultrasonic sensors and surround-view cameras. When backing out of a parking space onto busy streets, the emergency braking function for cross-traffic can prevent accidents involving cyclists and other road users.

Start monitoring detects potential pedal misapplications such as confusing the accelerator with the brake.

SOFTWARE-DEFINED VEHICLES



VALUE PROPOSITION

Ivan Brajdic explains how software-defined commercial vehicles can turn technology into measurable fleet value

The commercial vehicle industry should not copy the passenger car approach to software-defined vehicles. Trucks, trailers, buses and vocational vehicles operate in a world where every technology decision must earn its place through uptime, safety, efficiency and total cost of ownership.

That means the software-defined commercial vehicle (SDCV) will not be defined by computing power or lines of code, but by its ability to turn digital capability into measurable fleet value.

Different

The passenger car industry first embraced software-defined architectures over a decade ago, but commercial vehicles will not follow that playbook. While cars are often shaped by infotainment, personalisation and driver experience, trucks, trailers, buses and vocational vehicles are judged by different criteria.

Fleet operators invest in technologies that help vehicles stay working, operate safely and reduce whole-life costs. Every decision must be backed by a robust business case.

This difference will shape how software-defined technologies are introduced and scaled across the CV industry.

Commercial vehicles also involve far greater diversity, ranging from trucks and trailers to buses and vocational applications. They operate across highly varied use cases, regulatory environments and business models, while often serving very specific operational requirements.

As a result, a one-size-fits-all approach is not realistic.

Flexibility and investment security are therefore just as important as innovation itself.

Practical

This means the route towards software-defined commercial vehicles must be practical, scalable and commercially useful from day one.

It also has to reflect commercial vehicle realities, including significantly lower production volumes than passenger cars and product life cycles that often exceed ten years.

Together

The opportunity lies not in software alone, but in combining intelligence across vehicle systems and ultimately across the broader transportation ecosystem.

Historically, vehicle systems such as braking, steering, driveline, adas and connectivity have often been developed and optimised independently.

A software-defined architecture creates opportunities for these systems to work together as an intelligent whole, enabling higher levels of safety, efficiency and operational performance.

Value

When connected systems share information seamlessly, vehicles can perform in ways that were previously impossible. Data collected throughout the lifecycle can support predictive maintenance, strengthen safety functions and improve utilisation, while software updates make continuous improvement possible in operation.

This evolution, however, will be gradual rather than disruptive. New technologies must integrate with existing architectures and deliver progress that operators can quantify.

Consider yard operations as an example. Through service-oriented architectures, middleware and standardised vehicle APIs, the vehicle could interact with external infrastructure and adapt its functionality to a specific depot, loading bay or operating environment. That could support digital workflows ranging from remote parking brake activation to automated vehicle configuration and targeted safety functions. The benefit is not software for its own sake, but safer operations, reduced manual effort and more efficient movement through the yard.



Software-defined architecture is next step for commercial vehicles

A second example is predictive maintenance for a haulage fleet. As SDCVs continuously collect and analyse operational and vehicle health data, they can identify early signs of potential component issues before they lead to unplanned downtime. Instead of relying solely on fixed service intervals, fleets can proactively schedule maintenance, secure parts in advance and service vehicles when operationally convenient. The result is higher uptime, more efficient workshop planning and lower total cost of ownership.

Developments are well underway for core commercial vehicle technologies that can be tailored for these future software-defined architectures. Depending on user and application requirements, future options may combine intelligent actuators, scalable computing resources such as a centralised domain controller, service-oriented software and connectivity.

SDCVs are created where vehicle physics, mechatronics and software intelligence come together, not through software alone.

So, it's a unique opportunity for suppliers with experience across truck, trailer and bus applications especially those who can bring hardware expertise, software capabilities and system integration know-how.



Software creates safety systems for commercial vehicles

Standardise

Standardisation will also play a critical role in the software-defined transformation because scalable ecosystems require common interfaces and interoperability across vehicles, suppliers and infrastructure. Without shared standards, software-defined capabilities cannot scale across the broader transportation ecosystem and the full benefits won't be realised.

One example is the development of high-speed truck-trailer communication concepts. By creating a future-proof data connection between truck and trailer, this can open the door to software-defined capabilities that extend beyond the tractor unit.

Practical use cases made possible include trailer-based remote functions, trailer reverse camera integration and connected cargo options. In the longer term, such connectivity could support even deeper vehicle integration and replace previous connectors.

Beyond connectivity itself, standardisation will also be essential for future middleware, software ecosystems and seamless data exchange across logistics.

AI

A related topic is AI. While there is growing discussion around the concept of the AI-defined vehicle, AI does not replace the software-defined vehicle. Instead, software-defined architectures provide the foundation that makes AI effective.

Data connectivity, cloud integration and harmonised software create the conditions for AI to generate meaningful value. AI has the potential to transform vehicle data into actionable insights that improve development processes, predictive services and operational efficiency. However, success depends on high-quality data and the ability to integrate intelligence across multiple vehicle domains.

Collaboration

Future progress will also depend on trusted collaboration across the commercial vehicle ecosystem. OEMs, suppliers and fleet operators will need transparent frameworks for data exchange, governance and value creation.

The challenge is no longer limited to delivering excellent individual components. The future requires expertise across systems, software, electronics, connectivity and cloud ecosystems.

This is particularly relevant in commercial vehicles, where software value increasingly emerges from the interaction of multiple physical systems such as braking, steering, suspension, driveline and adas. It requires the ability to help users navigate different regional requirements while maintaining flexibility for evolving technologies and business models.

Future

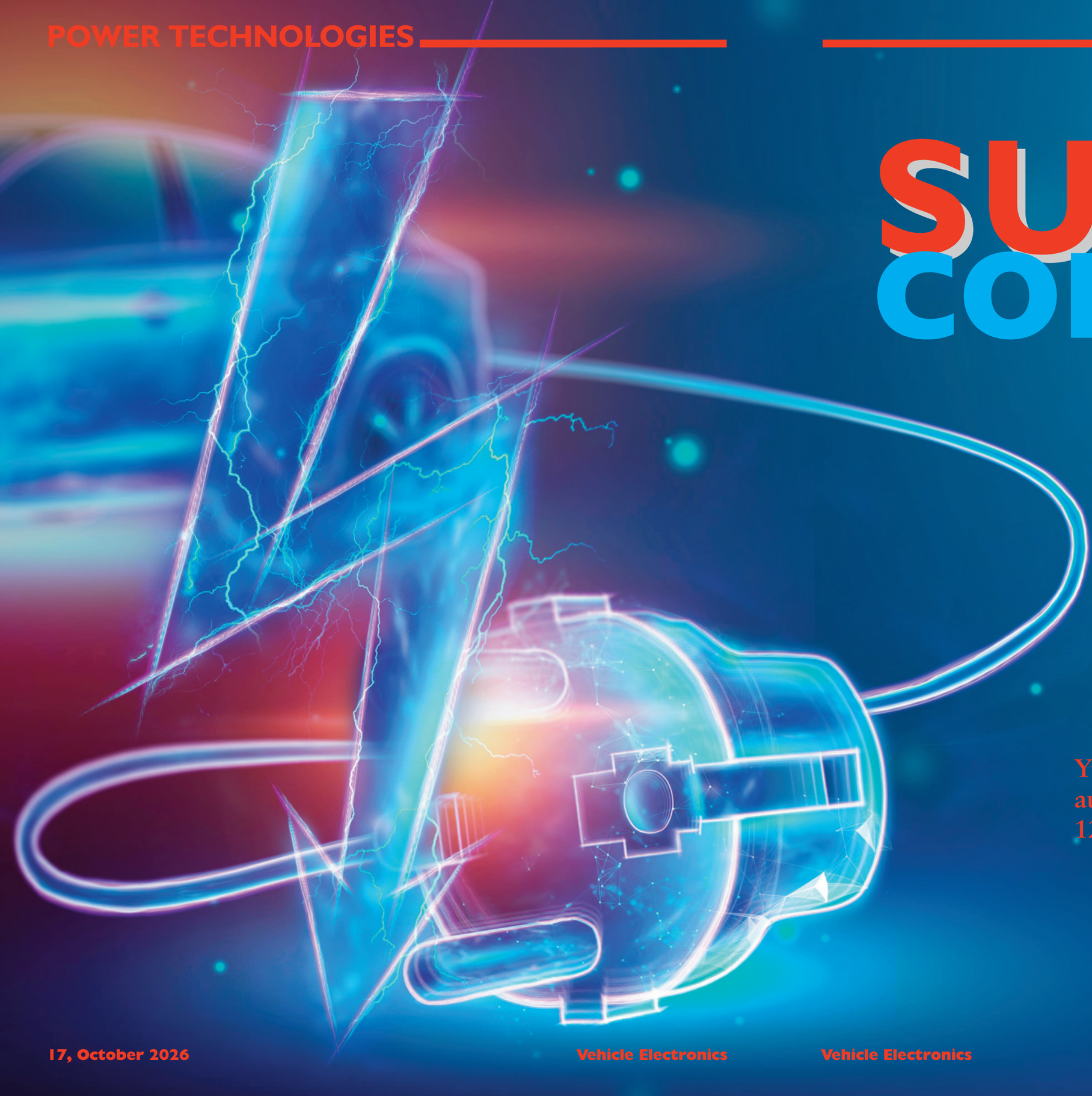
The long-term direction is clear. Commercial vehicles will become increasingly connected, intelligent and software-enabled. But technology alone will not determine success. The winners will be those who turn digital capability into better outcomes.

The SDCV is therefore not simply a technology trend. It represents a new way of thinking about commercial vehicle innovation, where success is measured by safer operations, higher uptime, greater transport efficiency and lower cost. In commercial vehicles, software will only matter when it earns its place in the fleet business case.



Ivan Brajdic is head of R&D at ZF Commercial Vehicles

POWER TECHNOLOGIES



SURGE control

Yujie Bai explores the evolution of automotive electrical systems from 12 and 24V architectures to 48V

Vehicle Electronics

The automotive industry is undergoing a significant transformation, shifting from internal combustion engines towards electrification, connectivity and enhanced intelligence. This transition is driving the development of vehicle designs, including software-defined vehicles, and reshaping existing electrical-electronic (EE) systems and power architectures.

Electrical systems have evolved from early 6V batteries to advanced 48V systems featured in mild hybrids and electric vehicles. Advantages of 48V systems include reduced wiring weight and improved efficiency, but there are technical challenges related to electromagnetic compatibility, arcing prevention and standards for transient surge protection.

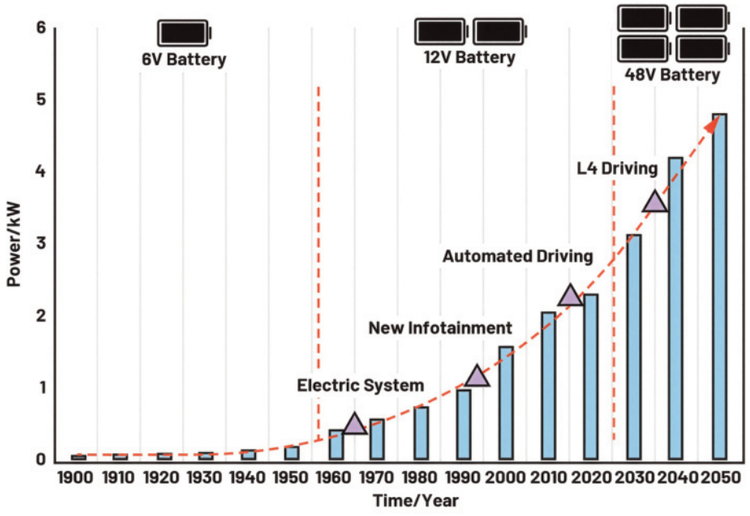


Fig. 2: Example of the evolution of low-voltage power in vehicles

Early vehicles relied on a magneto for engine ignition and gas-powered headlights rather than a dedicated battery-based electrical system. The 6V batteries were adopted in the electrical systems of vehicles from the 1920s to the 1950s.

Since more vehicles were equipped with higher power and compression ratio engines, the 6V batteries cannot provide enough cranking power and meet the growing power demands of the EE system. Since the 1950s, the 12V system has been the standard in the automotive industry.

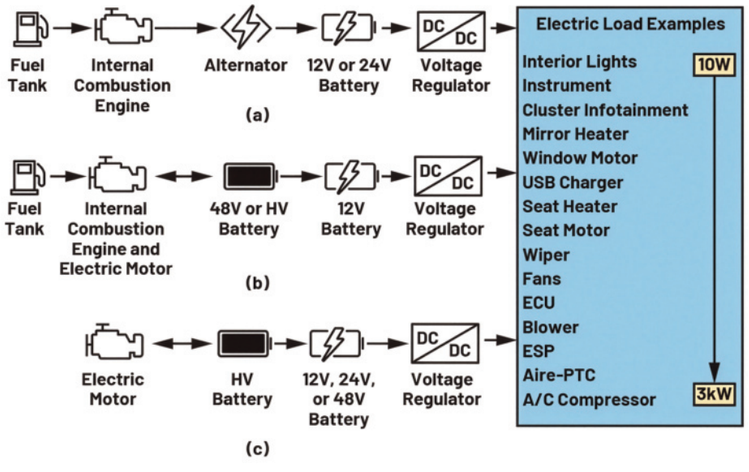


Fig. 1: Simplified electric powertrain: (a) internal combustion engine vehicle, (b) hybrid vehicle without on-board charger or plug-in hybrid vehicle with on-board charger, and (c) BEV

In the 2010s, the 48V mild-hybrid systems were used in hybrid powertrains for the improvement of performance and efficiency, which can achieve regenerative braking. Following the industry transition towards higher-voltage architectures, a fully integrated 48V electrical system was introduced in 2023.

Batteries

Automotive electrical systems commonly use 12, 24 and 48V batteries. The 12V battery is predominantly found in passenger vehicles, while 24V batteries are typically employed in heavy-duty trucks and commercial vehicles. In contrast, 48V batteries are used in mild-hybrid vehicles and for powering small electric motors. Currently, 48V batteries also serve as auxiliary power sources in electric vehicles.

Fig. 1 illustrates a simplified electric powertrain architecture.

Conventional vehicles, with an internal combustion engine, use an alternator to recharge the auxiliary battery. In contrast, hybrid vehicles supply charge to the auxiliary battery through either a 48V or high-voltage (HV, defined as ≥200V) battery.

Hybrid models equipped with 48V primary batteries are commonly designated as mild hybrids. Plug-in hybrid vehicles incorporate an HV battery and feature on-board charging capabilities. Vehicles powered exclusively by HV batteries are classified as battery electric vehicles (BEVs).

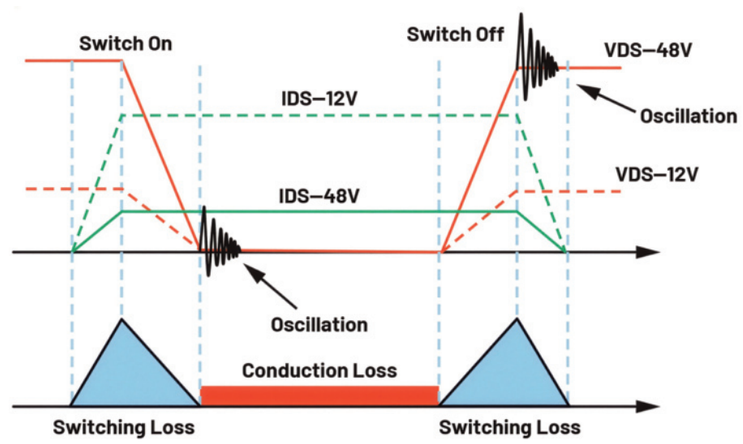


Fig. 4: Power loss of switching

Electrical

Innovations within the automotive industry have played a pivotal role in driving vehicle performance forward, elevating in-cabin comfort and establishing higher safety standards.

One prominent development has been the introduction of hybrid vehicles, which are designed to lower fuel consumption and boost overall efficiency. The integration of high-resolution displays with advanced cockpit platforms has significantly improved user interfaces, offering drivers and passengers a richer and more intuitive in-cabin experience.

Furthermore, advancements in autonomous driving, including the integration of radar and camera , have enhanced both safety and the overall driving experience.

The ongoing addition of sensors, high-performance SoCs, computing units and various electronic modules continues to refine driving dynamics and safety features. However, these technological enhancements also bring about new challenges for automotive power systems, as they increase the demands placed on electrical infrastructure.

Limitations

Historically, rising electrical demands drove the transition from 6 to 12V; today, similar trends are again pushing the limits of 12V architectures. This is largely attributed to the rapid expansion of autonomous driving technologies and the growing emphasis on vehicle connectivity.

The rise in the number of electronic control units (ECUs), sensors, infotainment modules and safety systems has resulted in an increase in overall power demand. Consequently, the automotive engineering landscape faces a range of challenges, while presenting opportunities for further innovation.

Due to these technological advancements and the proliferation of power-hungry components, the low-voltage power requirements in modern vehicles now span a range from 1.2 to 4kW. This progression is depicted in Fig. 2, which illustrates the evolution of low-voltage power demands in automotive applications.

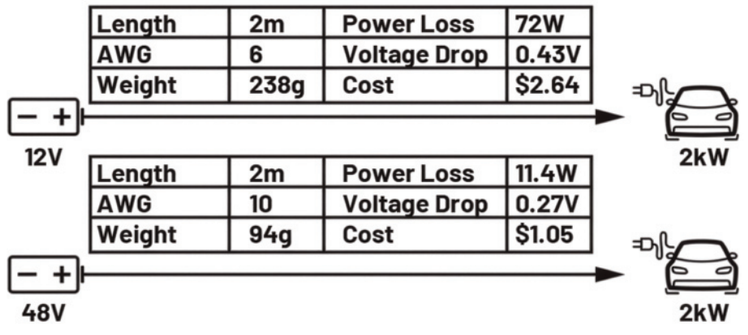


Fig. 3: Comparison of 12 and 48V, 2kW wire harnesses

Benefits

The 48V system is particularly well-suited to a modern electrical architecture that addresses

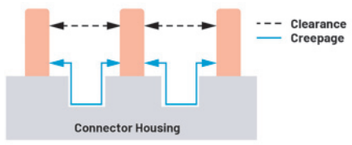


Fig. 5: Connector creepage and clearance

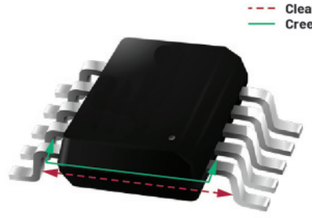


Fig. 6: IC creepage and clearance

increasing power demands by replacing traditional mechanical and hydraulic systems, such as steer-by-wire (2kW) and brake-by-wire (2kW) technologies.

Compared with conventional steering and braking mechanisms, steer-by-wire and brake-by-wire systems offer enhanced comfort, safety and agility. Additionally, these electrical systems reduce cabin space requirements and vehicle weight, enabling greater flexibility in interior design and contributing to improved fuel efficiency.

Furthermore, the electrical systems can respond rapidly and accurately to driver control inputs.

As the demand for electrical power continues to increase, adopting a 48V EE system presents notable benefits.

One of the primary advantages of the 48V EE system is its ability to reduce current significantly compared with a traditional 12V system. With the current reduced to one-fourth, both the weight of the wiring harness and the dimensions of the PCB are reduced. Additionally, power loss across the wire harness is decreased, as thinner wires with lower resistance and reduced current flow result in improved efficiency.

According to specifications outlined by the AWG system, Fig. 3 provides a general comparison between 12 and 48V wire harnesses. In addition to considering maximum power transmission, it is important the voltage drop due to wire resistance remains below 3%. This means wire resistance is more critical for 12V systems than for 48V systems. Using copper's density (8.96g/cm^3) and cost ($11.11/kg), the weight and price of the wires can be readily calculated.

Challenges

The design challenges of 48V systems at the power management IC level include electromagnetic compatibility (EMC), arcing prevention and voltage surges.

The transient voltage (dv/dt) and current (di/dt) produced during hard switching negatively impact the EMC of switching regulators. Electromagnetic interference (EMI) can be divided into differential-mode and common-mode noise: the former is primarily due to parasitic inductance and transient currents, while the latter stems mainly from parasitic capacitance and transient voltages.

As illustrated in Fig. 4, the process of turning semiconductor devices on and off creates transient voltages and currents, as well as power dissipation. When comparing 12V with 48V, the 48V system exhibits a higher dv/dt, whereas the 12V system displays a higher di/dt.

Although conduction losses are greater in the 12V system, the 48V system experiences

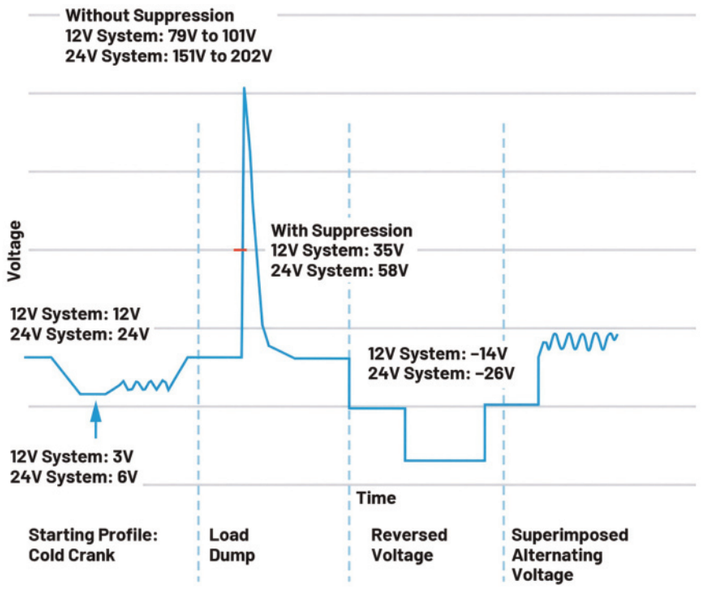


Fig. 7: ISO 16750-2: 2012 specification example

significantly higher switching losses, resulting in increased parasitic energy during switching. This can cause oscillations with greater amplitude at the switching node, thereby impacting EMI.

Creepage

Mitigating arcing phenomena in 48V automotive electrical architectures necessitates strict adherence to advanced insulation, mechanical and environmental design standards that surpass those applied to traditional 12V systems.

The increased voltage elevates the risk of sustained electrical arcing due to higher electric field intensity, with arc temperatures potentially reaching several thousand degrees Celsius, which can accelerate the degradation of terminals, plating layers and connector housings.

To preserve reliability, connectors must be designed with precisely defined creepage and clearance distances, as specified by IEC 60664-1 and related low-voltage transportation standards, to prevent discharge across insulating surfaces or through air under both standard and contaminated conditions.

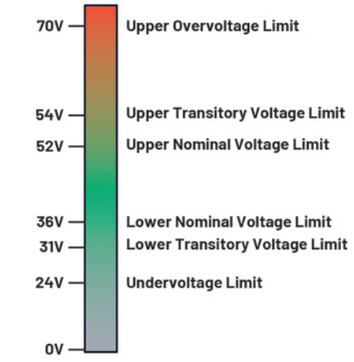


Fig. 8: ISO 21780 transient voltage

Furthermore, adopting 48V systems in automotive applications also heightens creepage and clearance requirements for ICs, PCBs and other components, which prevents unintended current flow between conductors.

Fig. 5 illustrates the creepage and clearance paths within the connector. Fig. 6 shows the creepage and clearance paths within the IC.

Surges

In automotive systems, addressing transient surges is crucial to safeguard sensitive semiconductor components. Two key standards for 12 and 24V systems – ISO 7637-2 and ISO 16750-2 – define protection requirements against such surges.

Fig. 7 illustrates the waveform of test pulses applied to the 12 and 24V power rails under ISO 16750-2 specifications. Typically, transient voltage suppressors (TVSs) are employed to limit the 12V power rail to 35V and the 24V power rail to 58V.

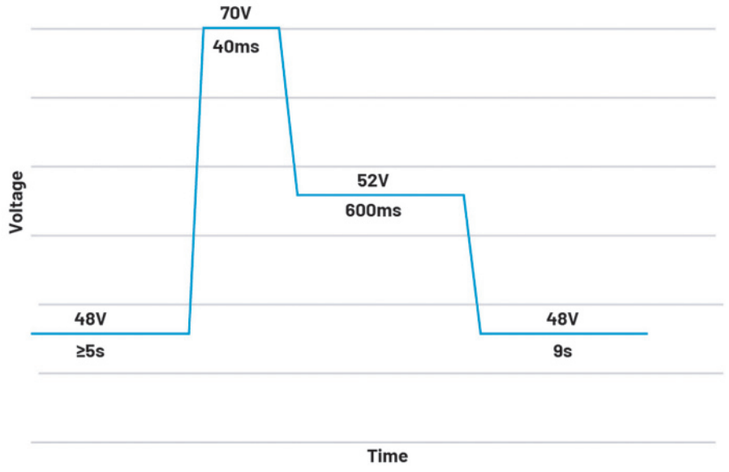


Fig. 9: ISO 21780 test 03: load dump (short term overvoltage)

ISO 21780 defines the 48V power rail voltage range, requiring overvoltage tolerance up to 70V, though switching transients can exceed this level.

Fig. 8 illustrates the voltage range, while Fig.9 shows the short-term overvoltage profile.

Conclusion

The implementation of 48V systems offers several benefits, including reduced cost and weight of wire harnesses as well as enhanced high-power capability. Nevertheless, challenges related to EMC, arcing prevention and voltage surges remain areas of concern. With the introduction of advanced features in software-defined vehicles, OEMs must determine their approach for transitioning to 48V architectures.



Yujie Bai is a staff applications engineer at Analog Devices

CUSTOM ROAD



Keeping HGV braking systems connected by using asic-enabled Can communications

Reliable communication between braking systems is fundamental in heavy goods vehicle (HGV) applications, where electrical noise, wiring faults and demanding operating conditions place considerable pressure on electronic systems.

For a heavy-vehicle brake system and air suspension manufacturer, introducing ISO 11992-compliant Can communications into its brake control products exposed a gap in standard semiconductor capabilities, leading the company to turn to an asic designer and manufacturer for a bespoke answer.

The Can protocol is widely used to let ECUs within automotive systems exchange data reliably. In HGVs, ISO 11992 defines communication between towing and towed vehicles, including braking and running gear systems.

At the time, commercially available ICs could not satisfy the combination of electronic performance, integration capability and production continuity needed for a safety-focused commercial vehicle platform.

The manufacturer therefore partnered with Swindon Silicon Systems to develop a bespoke asic designed specifically for heavy-vehicle brake controller systems.

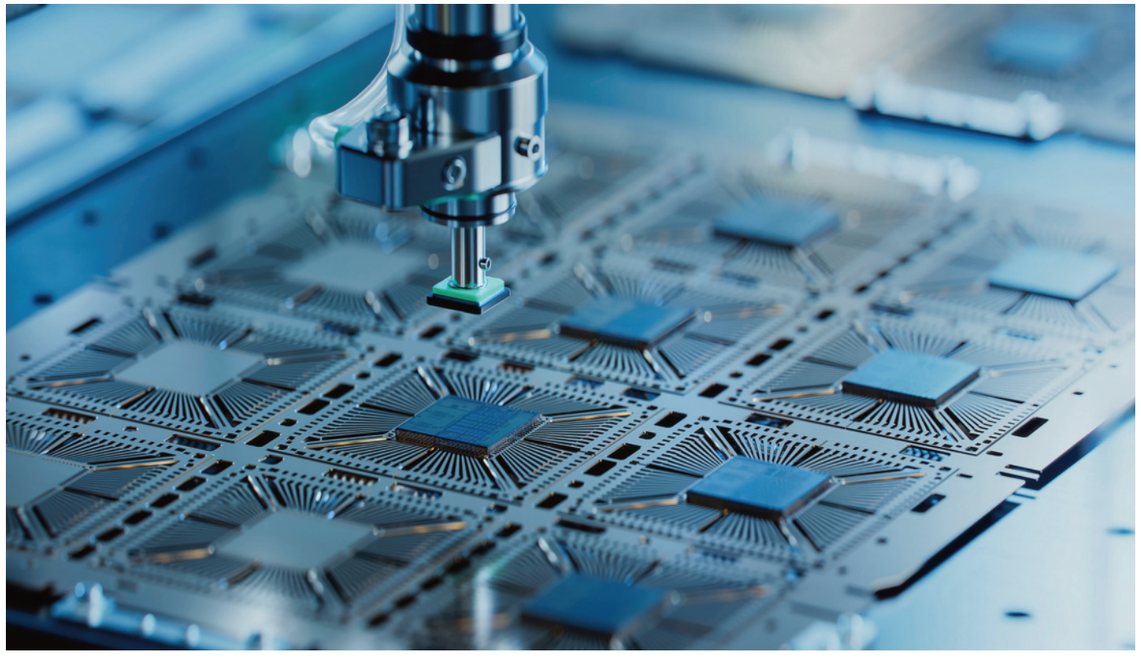
"Commercial vehicle electronics are expected to stay in service for a very long time, often in fairly unforgiving electrical conditions," said Ross Turnbull, director of business development at Swindon Silicon Systems. "You are not only looking at performance on day one, but how consistently that device behaves over years of production and operation."

Brake

ISO 11992 governs communication between truck and trailer systems in HGVs, particularly within braking applications where coordinated operation is essential. While Can itself is a well-established protocol, implementing it successfully within a commercial vehicle braking platform involves far more than basic compliance.

The application had to operate reliably under fluctuating supply voltages, electrical interference and potential wiring faults commonly found in HGV systems. Stable behaviour over extended service periods was equally important, particularly given the expected lifespan of commercial vehicle platforms and the need for repeatable production over many years.

To address this, a mixed-signal asic implemented the Can interface directly into silicon. This reduced reliance on external interface components and enabled tighter integration within the wider brake controller architecture.



The asic was deployed across multiple HGV brake controller programmes

The asic incorporated a revised physical Can interface intended specifically for HGV electrical systems, including operation against proportions of vehicle battery voltage and improved tolerance to wiring-related faults.

Integrating this functionality directly into the device also helped simplify surrounding electronics and reduce overall board-level complexity.

Alongside the technical design work, manufacturability and production stability remained central considerations throughout development. In commercial vehicle applications, electronic platforms are often expected to remain available for many years, with little variation between production generations. The asic therefore needed to support consistent manufacturing behaviour as well as dependable operation in the field.

"One of the biggest pressures in automotive electronics is not just performance at launch but keeping proven systems in production when parts start to disappear from the market," said Turnbull. "If you can design in continuity from the start, you end up with a much more resilient supply chain for the suppliers and a lot less disruption further down the line."

Development

Swindon Silicon Systems managed the full development flow internally through its full turnkey approach, covering asic design, physical layout, device evaluation, production, testing and development. Close collaboration with the manufacturer throughout formal design and release stages ensured the device aligned closely with the brake controller system architecture while remaining suitable for high-volume automotive production.

Because the asic was developed as a build-to-specification device, integration into existing brake controller platforms was comparatively straightforward. The manufacturer could implement the communication interface without extensive redesign work or additional external hardware, while maintaining tighter control over system-level electrical behaviour.

Following qualification, the asic entered production and was deployed across multiple HGV brake controller programmes. The device remained in service for many years, supporting communication between truck and trailer braking systems across demanding operating conditions.

Reliability

Reliability was naturally a major consideration throughout the programme. In braking applications, communication integrity between vehicle and trailer systems cannot become a point of instability or inconsistency.

The asic therefore had to maintain predictable operation throughout extended service lifetimes while continuing to tolerate the electrical conditions typical of commercial vehicle platforms.



Ross Turnbull

Over its production life, the device demonstrated stable field performance across multiple programmes, supporting the manufacturer's braking systems without reported issues relating to the communication interface itself.

The project also highlighted why asic development continues to play an important role in tiered automotive electronics. While standard ICs may reduce development time in some applications, they are not always capable of meeting specialised electrical, integration or lifecycle demands simultaneously.

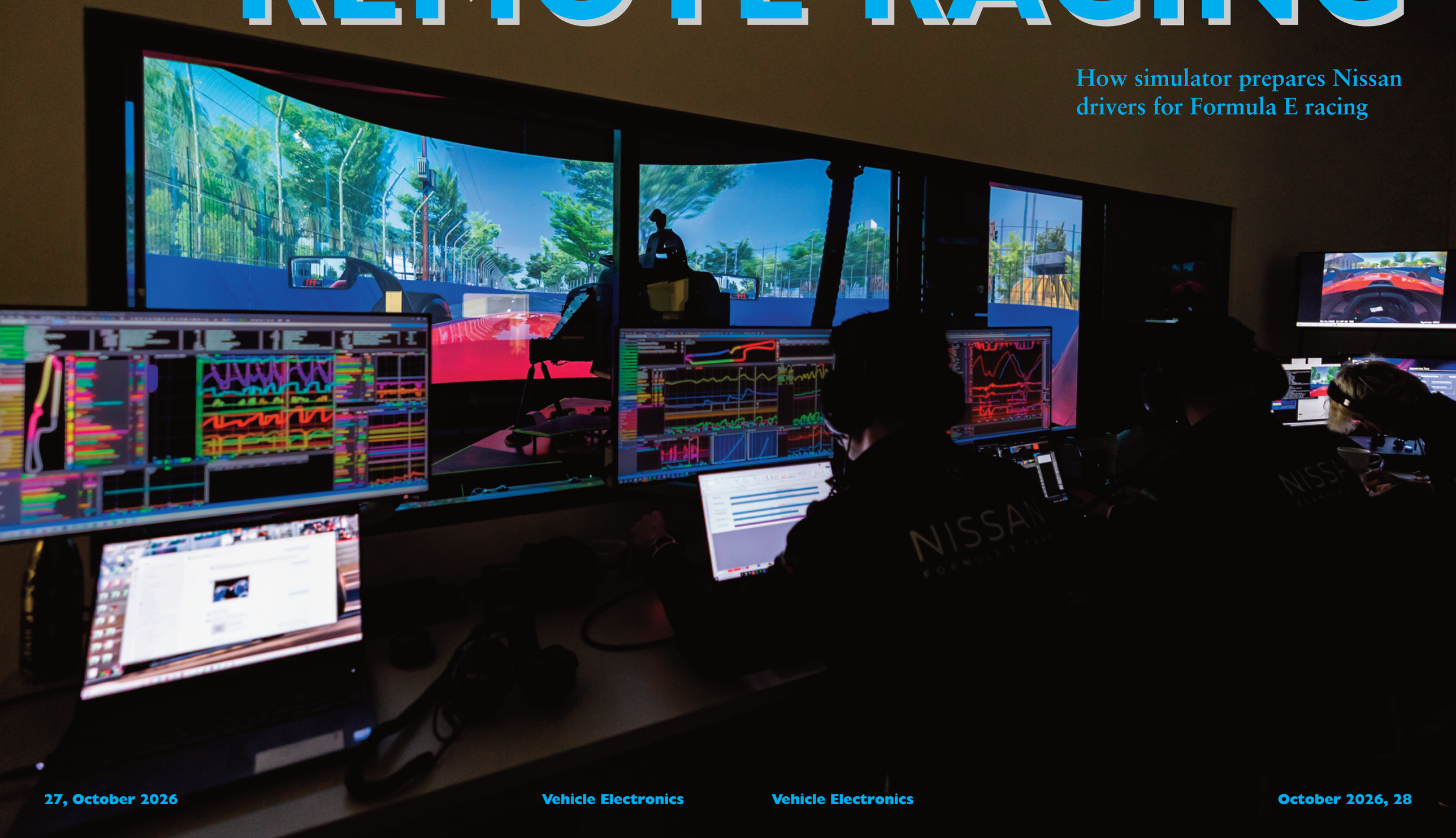
"In this case, the asic allowed the manufacturer to retain greater control over communication performance, system integration and product availability than would have been possible using available off-the-shelf alternatives," said Turnbull.

The programme remains a strong example of how bespoke asic development can support applications where reliability, integration and product continuity are all equally important considerations.

SIMULATION & MODELLING

REMOTE RACING

How simulator prepares Nissan drivers for Formula E racing



Vehicle Electronics

Formula E race weekend, up to 9600km from the circuit: a special ops team are working hard in the Nissan Formula E Team HQ in Paris, putting in vital and sustainable work to help drivers Oliver Rowland and Norman Nato secure more points in their pursuit of championship success.

Plenty about Formula E tallies beautifully with the advancing world of driver-in-the-loop simulators. The sport's limited track testing time and its celebrated street circuits, which can't be recced or rehearsed in any traditional sense, both ensure a state-of-the-art sim isn't just desirable, it's the bedrock of a successful team.

The Dynisma DMG-1, freshly installed at the Nissan Formula E Team HQ in 2025, helps combat the frenetic pace of a Formula E race weekend.

"With Formula E's limited physical testing, the ability to run highly accurate simulations is crucial not only for race preparation but also for car and powertrain development," said Tommaso Volpe, team principal for the Nissan Formula E Team. "This new simulator is already helping us accelerate our engineering process, validate software and optimise the car long before we reach the circuit."

New dawn

Drivers Oliver Rowland and Norman Nato can walk each track with their engineers on the Friday morning ahead of practice, feeding vital information they pick up on surface or corner geometry changes – which the series' temporary city courses can be especially vulnerable to – directly back to the team's Paris base so their race tactics can evolve via the sim ahead of the physical car running on track.

A pair of drivers are at the heart of Nissan Formula E Team's sim work. Reserve and development driver Sam Bird puts in race preparation work in the weeks ahead of a Formula E round, refining team strategies. As race weekend approaches, rookie and simulator driver Abbi Pulling can work antisocial hours to reflect the shifting time zones of the Formula E calendar, with races in Sao Paolo, Sanya and Tokyo all nudging 10,000km away as the crow flies.



Races can be monitored from nearly 10,000km away



Driver Norman Nato climbs into the simulator

"My role is to ensure that both Oli and Norman have everything that they would require when they jump in and do their testing in the simulator," said Bird. "We're also doing a lot of development for the Gen4 programme to ensure that it's pushing in the right direction. The sim is an awesome piece of kit. It gives us all the things that we need to sense movement and g-force and it feels very closely related to being in the physical car itself. It has to feel as close to reality as possible."

Volpe added: "Abbi and Sam do a lot of work on the simulator weeks before the race even happens. Our official drivers wouldn't be able to jump in the car and put together their performance without the job that has been done by our sim drivers; it acts as a work of screening as we discover the best way to approach each race. The drivers jump into the simulator a few days before the race when a lot of things have been already tested, proved and fine-tuned by the other members of our driving team."

Sim

The Dynisma DMG-1 is among the most advanced in the race series and a crucial component of both race preparation and future car development. It helps the team not only comply with rules on limited testing time but further support its sustainability by reducing the travel and transport of its team and facilities to different test tracks around the world.

Dynisma isn't merely a supplier to Nissan, but a technology partner. Its DMG-1 allies a low latency motion response of under 5ms to high bandwidth primary motion up to 100Hz. This gives it the necessary precision and responsiveness for accurate setup work and engineering analysis.

This is vital in Formula E, when the nuances of the powertrain system change between drives, and this needs to be precisely portrayed to the driver. Any small shifts in the car's balance are crucial for predicting its behaviour through tight, twisting city courses where there's

typically zero margin for error. Kerb strikes, weight transfer, vibrations and stability changes at the limit of grip are all essential cues for any sim driver.

"In Formula E, we have very few test days and only two short practice sessions before qualifying, so what we achieve in the simulator is incredibly important," said Rowland. "It helps us understand the track, prepare systems and arrive on race weekend ready to perform. The response rate and feel from the Dynisma system is excellent. I have been running simulators in different series for 10 to 15 years, and the Dynisma is the best in the business."

Team director Dorian Boisdron added: "We benchmarked several systems and chose Dynisma to ensure we had the highest precision and best possible preparation tool. The simulator is key to prepare not only for races but also to prepare our new cars. The DMG-1 is perfectly suited to our technical requirements, offering excellent realism and strong engineering support, in addition to our great working relationship with the Dynisma team which helps us to progress quickly."



Simulator provides precision and responsiveness for setup work and engineering analysis

Gen4

The Dynisma simulator forms a big part of Gen4 car development. The development of the Gen4 car's dual motors and their active differentials are quicker and more informed thanks to the accuracy of the DMG-1, helping educate the engineering team's decisions.

The fourth generation of the Formula E racecar represents a significant leap in performance while permanent all-wheel drive and the debut of a power steering system ensure a large shift in driving dynamics over its predecessor. Preparation work on the sim is core to the sustainable progression of this new chapter for single-seater motorsport.

Peak power soars from 350kW to 600kW. It completes 0-100kmph in 1.8s. A 335kmph top speed is faster even than Nissan's GT-R Nismo supercar. And it is the world's first single-seat racecar with permanent all-wheel drive.



Sim preparation work is core to sustainable progression

"When you begin designing a new car, especially for Gen4, simulation comes first," said Boisdron. "You start with a sophisticated virtual model, but it is essential to put the driver in the loop as early as possible. The DMG-1 allows us to do that with confidence. Its realism and fidelity give us the best possible chance of transferring performance from the virtual world to the track. The Gen4 car is very sophisticated. It is full of chassis systems and has the capacity to accurately control the motor. If you take it directly to the track, you have a low chance of quickly being in the performance ballpark; it requires so much track time. Preparation before each test means we are already in a good window to operate the car and as close to the peak of its performance as possible."

Legacy

Nissan has consistently embraced and celebrated the link between virtual and on-track performance, pioneering GT Academy in 2008 to bring gamers to the grid and prove talents fostered in a simulated world are directly transferrable to the tarmac. Over five million entrants produced 21 winners, with podiums at the 24 Hours of Le Mans and race and championship wins at renowned events attesting their skills.

"It is exciting to see Nissan Formula E Team already gaining value from its new driving simulator," said Simon Holloway, commercial director at Dynisma. "Our mission has always been to deliver the highest levels of correlation and accuracy so engineers and drivers can make better decisions, faster. The realism of the DMG-1 supports detailed chassis setup, software validation and powertrain development, all of which are crucial in Formula E. We are pleased to be working with Nissan Formula E Team as their official simulator partner and to support their preparations for Gen4, where advanced simulation will play a central role."



Nissan Formula E team HQ in Paris

MANUFACTURING



PASSPORT CHECK

Alexander Hale explains why passport-ready manufacturing depends on making traceability usable on the shop floor

Automotive manufacturers continue to invest in automation, but the challenge is shifting from speed alone to proof. As the EU develops its digital product passport (DPP) requirements, manufacturers face a new question: Can they produce audit-ready evidence without creating a data burden that slows production?

This pressure is arriving at a time when investment in digital manufacturing continues to accelerate. Manufacturers are increasing investment in digital technology, AI and automation.

At the same time, regulatory expectations are tightening. The DPP framework is moving from policy development to implementation, with the European Commission having already adopted rules governing the EU DPP registry in July 2026. While product-specific requirements are still being developed for many sectors, some deadlines are now confirmed.

In the automotive sector, for example, battery passports for electric vehicle batteries become mandatory from February 2027. DPPs are standardised digital records that capture a product's lifecycle and compliance data and, although they are an EU initiative, manufacturers supplying into European markets will still need to meet these requirements to maintain market access and remain competitive within European supply chains.

Alongside this, standardisation work is being formalised across Europe to ensure interoperability of product data systems, setting clearer expectations for how manufacturing information must be structured and shared.

Traceability

Traceability is no longer just a reporting function that sits at the edge of manufacturing. It is increasingly shaping how decisions are made on the shop floor in real time, from production control to quality assurance. Regulators, OEMs and end users increasingly expect a complete and consistent record of how a product was built.

This includes who performed each operation, when it was completed, what tools were used and which parameters were applied. In principle this sounds straightforward, but in practice it exposes a gap between what factories can physically produce and what they can prove after the fact.

Many manufacturing environments still rely on systems where data are captured across separate tools, stations and software layers. Those data may exist, but they are often fragmented or difficult to align when audits or reporting are required. The result is a growing gap between production reality and production evidence, creating problems in making those data usable at scale.

Approach

A passport-ready approach starts at the station. Many shop-floor assets are capable of recording data to their own internal systems, but to ensure data integrity fully it is vital to compile these data in real time, in a single source, at the station level.

This is where structured digital process control systems become critical. Instead of relying on manual input or disconnected systems, they embed traceability into the production sequence itself. Operators are guided through each step and required inputs are validated as the work progresses. This means traceability becomes a direct output of performing the operation correctly.

They can connect tooling, scanners, printers, sensors and testers into a single controlled environment. This creates a structured product history that is consistent across stations and scalable across lines, generating a digital birth certificate for each product that records its full production journey.

The value of this approach becomes most visible when production changes, because variants or process adjustments can be introduced without redesigning how data are captured each time.

Execution

As DPP frameworks evolve, the expectation is not only that data exist but that they are trustworthy. This places greater emphasis on how each step in production is

controlled and validated.

With process control systems, each stage of production is defined within a controlled workflow. Operators cannot proceed until required steps are completed and validated, ensuring traceability reflects actual execution rather than retrospective interpretation.

This is particularly important in environments where multiple systems interact. In many factories, tightening tools, fixtures, scanners and software platforms all contribute to a single product.

Without structured control, inconsistencies can emerge between systems even when individual components are functioning correctly.

Overload

One of the most common concerns around DPP is the risk of generating excessive data without clear structure or purpose. Without alignment, traceability systems can quickly become complex to manage and difficult to scale.

To scale this beyond individual stations, standardisation becomes important. The European Commission has already initiated formal steps towards defining how digital product data should be structured across industries. That includes a commission implementing decision on a standardisation request to Europe's standard bodies CEN, Cenelec and Etsi with regards to DPP.

The direction of travel is clear. Data will need to be interoperable, structured and consistent across systems and suppliers. This means manufacturers must avoid building isolated data silos at station level. Instead, information must be captured in a structured way that can flow into higher level systems such as MES, ERP and data analytics platforms without rework or translation layers.

When this structure is in place, traceability shifts from being a storage problem to an integration layer that supports production flow.

Value

A passport-ready system should not only support compliance. It should improve how manufacturing operates day to day. When traceability is fully integrated into production, it enables a complete and accessible product history. This can be used to generate what is often described as a digital birth certificate for each product. Instead of searching across multiple systems, manufacturers can retrieve a single structured record of how a product was built.

This also supports wider operational improvements. The same data used for compliance can be used to identify process variation, support continuous improvement and reduce the effort required for audits and reporting.

Digital process control systems support this by connecting station level traceability with higher level data analytics systems. Data generated at each station feed into a central view of production where trends can be analysed, alerts can be raised and issues can be assigned and resolved as they happen, extending traceability beyond compliance into day-to-day decision making.

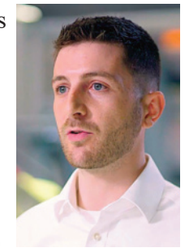
When combined with connected tightening tools and other production technologies, it creates a consistent data layer that supports both real-time control and longer-term analysis.

Production

DPP is often framed as a regulatory requirement. It is actually becoming a test of how well manufacturing systems are designed to handle complexity.

Factories that treat traceability as a by-product of production will struggle to scale it without adding friction. Those that embed it into workflow design will be able to expand capability without increasing administrative burden.

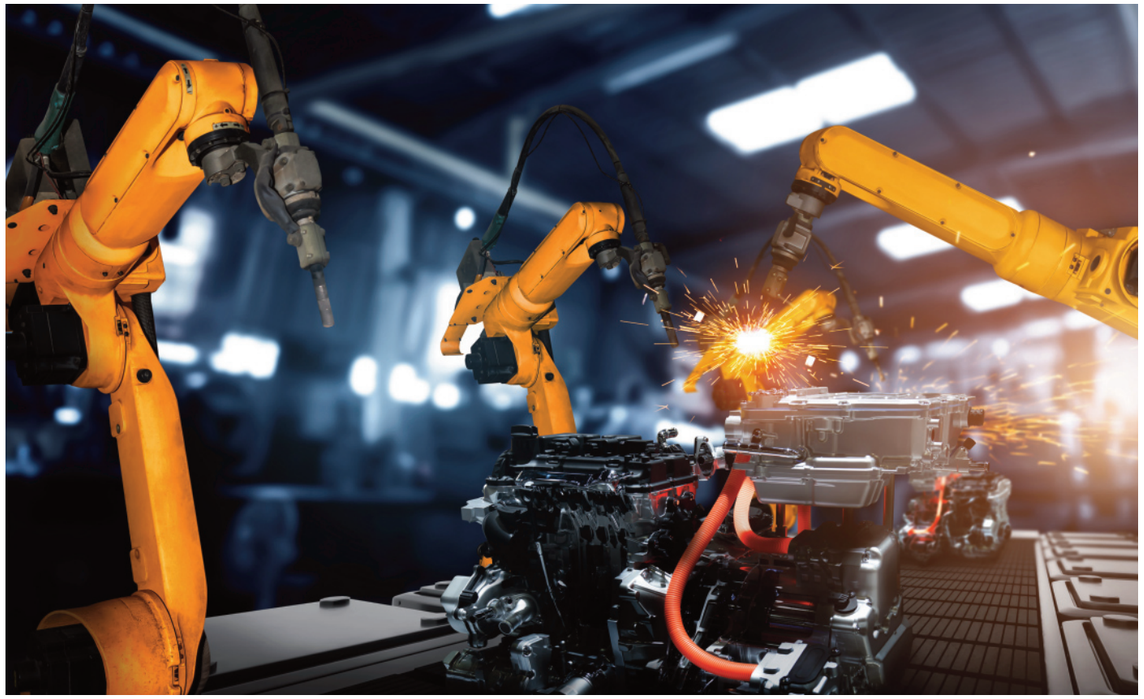
The difference is architectural, not procedural. It sits in how data are captured, how processes are controlled and how systems are connected across the shop floor. For manufacturers preparing for passport-ready production, the goal is not more data, but better structured data that are created as part of the work itself.



Alexander Hale is product manager at Desoutter Tools



Structured production data can help manufacturers improve quality, support compliance requirements and maintain visibility across complex assembly operations



Automation systems are enabling manufacturers to combine process control, quality assurance and traceability within a single production environment

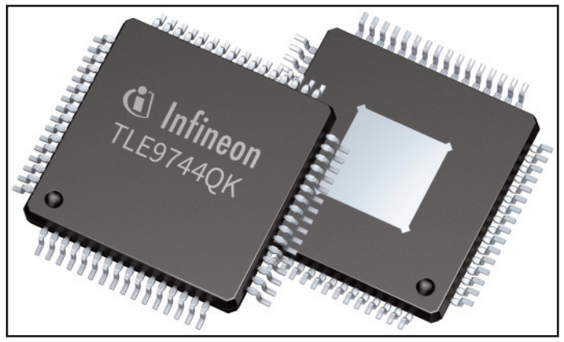
PMIC consolidates functions in one device

An integrated power management IC (PMIC) from Infineon is for high-voltage traction inverter applications in electric and hybrid vehicles.

The Optireg TLE-9744QK consolidates complete power-supply functions, resolver excitation and dedicated safety engine in one device.

This simplifies traction inverter ECU design and addresses the complexity of supplying multiple isolated power rails for microcontrollers, communication modules and sensors.

By replacing multiple discrete components, this chip can reduce cost and complexity. It shrinks the PCB footprint by up to 70 per cent for the replaced devices, while enhancing overall reliability and functional safety.



This integration is achieved by embedding critical peripheral functions directly into the silicon.

It can generate the resolver excitation signal internally, eliminating the need for external resolver driver and monitoring circuits. Furthermore, it offers broad power supply compatibility and functional interoperability with a wide range of microcontrollers and gate drivers.

This flexibility lets designers leverage existing MCU platforms without extensive hardware redesigns, thereby accelerating time to market.

Support for off-board sensor supply provides additional layout flexibility.

The device enhances reliability and safety through an independent hardware architecture.

The integrated safety logic (ISL) continuously supervises critical parameters, including phase currents, DC-link voltage, and the health status of the MCU and gate drivers.

Acting as a secondary independent safety path, the ISL determines and enforces a safe state in the event of main MCU dysfunction.

To ensure this protection remains active during power faults, a redundant supply input keeps the ISL operational if the main low-voltage supply fails. This independent design ensures safety functions are not compromised by a main low-voltage supply failure, fulfilling ISO 26262 Asil-D compliance.

Samples, evaluation boards, reference designs, documentation, software and tools are available.

Detector switch supports 48V

An automotive detector switch from Alps Alpine supports the growing adoption of 48V EV architectures.

The SPVQK helps ensuring reliable switching performance under demanding electrical conditions and simplifies circuit design.

It is for use in door latches, seat belt buckles and other automotive mechanisms.

With a maximum rating of 52V DC, it can be used directly in 48V electrical systems without voltage conversion circuitry. This simplifies circuit design while increasing design flexibility.

Compared with the SPVQ8, which supports a maximum inrush current of 0.1A peak (C-load), the SPVQK withstands up to 3A peak (C-load).

Its contact structure reduces contact wear and degradation, ensuring stable electrical performance and long-term reliability.

External current-limiting components, such as chip resistors previously required for circuit protection, are no longer necessary.

It can withstand overcurrent of up to 18A for five minutes typical and has an operational life of 300,000 cycles.

Its dust- and water-resistant construction is compliant with IP6K7.

It has the same 5.3 by 8.3 by 6.5mm form factor as the SPVQ8.

Operating force is 1.4 ±0.5N. Initial contact resistance is up to 500mΩ.



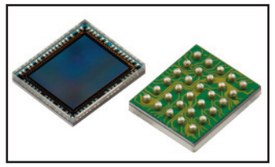


Image sensor

A 1.1MP automotive image sensor from ST Microelectronics is for infra-red in-cabin sensing to help OEMs and tier-one suppliers scale driver and occupant monitoring across vehicle lines while balancing performance, integration and cost.

The SafeSense VD56-GA has a compact sensor architecture, high infra-red sensitivity and embedded image-processing that can simplify camera design and integration.

The sensor can give camera developers the image quality for driver and occupant monitoring while preserving the size and cost advantages of a compact format.

A backside-illuminated pixel architecture, called DeepNIR, is optimised for infra-red imaging. It has 35% higher modulation transfer function sharpness and nearly 60% higher quantum efficiency than the previous generation.

Housed in a 3.7 by 3.2mm CSP package, it integrates embedded image-processing functions, including mirror, crop, dark calibration, auto exposure and piecewise-linear processing.

Diodes simplify load-dump protection

AEC-Q101 qualified transient voltage suppression (TVS) diodes from Littelfuse can simplify ISO 7637-2 pulse 5b load-dump protection for 12V vehicle electronics.

Unlike conventional TVS diodes that can allow transient voltages to rise to levels requiring additional protection circuitry, the TPSMD-FL series leverages proprietary FlatSuppress X technology to maintain a low, flat and stable clamping voltage profile during high-energy transient events.

This helps designers meet automotive load-dump requirements with lower clamping and fewer external components, reducing design complexity, PCB space requirements and cost.

Rated for 3kW peak pulse power dissipation and housed in a surface-mount DO-214AB package, the series can protect sensitive automotive electronics from high-energy surges.

The FlatSuppress X technology has foldback I-V characteristics that maintain a low, stable clamping voltage during transient events.

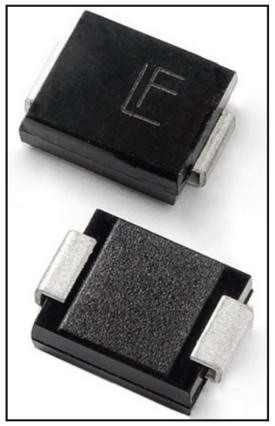
They provide IEC 61000-4-2 ESD protection up to 30kV air and contact discharge.

They suit automotive applications requiring protection from load-dump transients, including zonal control modules, powertrain electronics, infotainment systems, body control modules and other vehicle electronic subsystems operating on 12V power networks.

The technology maintains a flatter, lower clamping voltage during transient events without latch-up risk. This helps protect downstream electronics more effectively and can eliminate the need for additional protection components.

Because the devices offer low clamping-voltage performance, designers may be able to meet load-dump requirements without adding secondary protection stages.

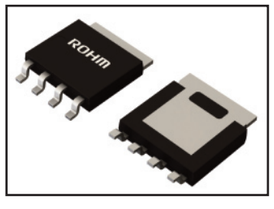
They are available in tape-and-reel format.



Safety mosfet achieves wide SOA

A 100V mosfet from Rohm is optimised for automotive safety functions and protection circuits.

The RS4P063BPHZG achieves a wide SOA (safe operating area) across a broad voltage range in the standard HPLF5060 (5060-size) package widely used in automotive applications.



By incorporating a design that suppresses secondary breakdown, it delivers approximately five times the SOA tolerance of standard equivalent-sized products under V_{DS} = 100V and PW = 100μs. Adopting the standard 5060-size package simplifies replacement evaluation with existing layouts, helping reduce the workload and costs associated with design changes.

The firm is developing automotive wide-SOA mosfets in the HPLF8080 8.0 by 8.0mm and TOLG (TO-leaded with gull-wing) 9.9 by 11.7mm packages as well.

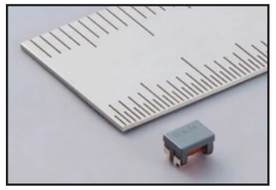
Choke meets Can-FD requirements

A common mode choke coil from Murata complies with the strictest DCMR class-three requirements of the automotive Can-FD network standard.

The DLW32SH_MF series supports a maximum operating temperature of 150˚C.

Despite their 1210 (3.2 by 2.5mm) size, the products have a metal terminal structure to achieve high reliability and durability. Mass production has already begun.

In recent years, advancements in autonomous driving systems and adas have driven the shift from conventional Can at up to 1Mbit/s to Can-FD, which enables higher-speed and higher-capacity communication. However, as speeds increase, systems become more susceptible to noise, making high-performance noise suppression components essential.



These products address this by being suitable for noise suppression on signal lines in automotive networks, including Can and Can-FD.

The DLW32SH-510MF2 has a common mode inductance of 51μH (+50%/-30%) at 0.1MHz, rated currents of 125mA at 125˚C, 90mA at 140˚C and 50mA at 150˚C, with a maximum DC resistance of 1.5Ω.

The DLW32SH-101MF2 offers 100μH (+50%/-30%) at 0.1MHz, rated currents of 115mA at 125˚C, 90mA at 140˚C and 50mA at 150˚C, with a maximum DC resistance of 2.1Ω.

Both have an operating temperature range of -55 to +150˚C and comply with the AEC-Q200 standard.

Leveraging Murata's proprietary winding and ferrite assembly technologies, combined with the recently adopted metal terminal structure, these products are said to deliver more reliability and durability than the company's previous products.

Wire-to-board connector for Automotive Ethernet

The GT37 wire-to-board connector from Hirose is for use with high-speed Automotive Ethernet.

Its fully shielded connector structure can maintain signal integrity in electrically noisy automotive environments.

The connector supports 1000baseT1, enabling gigabit data transmission over a single twisted-pair cable for bandwidth-intensive vehicle systems. This simplifies harness architecture by reducing wiring volume.

An optimised cable strip length supports hand-crimping operations, helping assemblers achieve consistent termination without complex preparation steps.

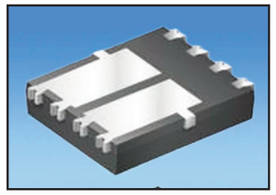
The design eliminates the need to cut the inner cable sheath during assembly. And the sleeve removes the need to apply commercial copper tape.

Impedance matching at the stripped-cable section maintains transmission performance through the termination area.

The two-position interface measures 8.6mm wide by 10.6mm high.

A dual-lock mechanism with a clear tactile feel gives assemblers positive confirmation.





Mosfets

Automotive-grade power mosfets in a PDFN56UD package have been added to Taiwan Semiconductor's TQM series.

The 60V dual n-channel devices support drop-in pin compatibility with other commonly used package types.

The 5 by 6mm packaging with heat-spreader contacts, 40A drain current and 13mΩ $R_{DS(ON)}$ improve thermal management and increase power density.

Their wettable flank connections are suitable for automated placement, help meet automotive board-mount and AEC-Q qualification testing, and facilitate high-yield manufacturability.

Uses include H-bridge and half-bridge rectifiers, motor and actuator controls, and solenoid drives.

With their dual mosfet configuration, the devices are produced to meet AEC-Q standards, and documentation for PPAP can be provided.

PDFN56UD footprint compatibility makes them a drop-in source for DFN8, LFPak56 and PowerFlat packages.

SM chokes filter DC-DC power supplies

Vishay has expanded its portfolio of automotive-grade common mode chokes with four surface-mount devices designed to improve efficiency while saving board space.

Offered in compact case sizes, the Dale ICM-5050-A, ICM-6050-A, IFLN-1210BE-A and IFLN-1812CZ-A combine low DCR with high current capability and impedance.

Offering high temperature operation up to +150˚C, the AEC-Q200 qualified devices provide noise suppression and filtering for DC-DC power supplies, LCDs, lighting drivers, in-vehicle Ethernet networks and battery powered devices.

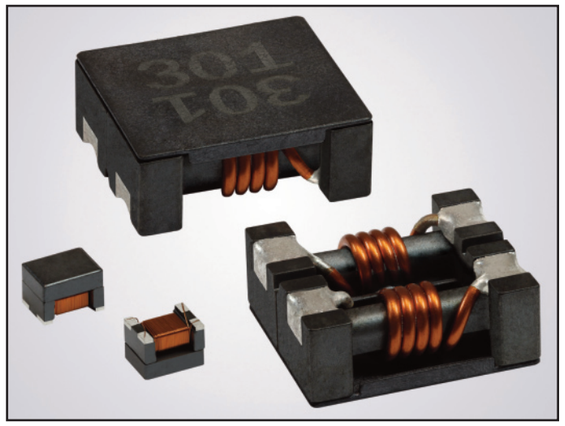
While toroidal common mode chokes typically provide DCR of 23mΩ, these offer DCR from 0.4 to 12mΩ to reduce power losses and increase efficiency.

The ICM-5050-A and ICM-6050-A are wire-wound ferrite common mode chokes that offer high current capabilities up to 11A in the 5050 case size and 14A in the 6050 case size. With sizes of 12.0 by 11.0 by 6.0mm and 15.0 by 13.0 by 6.0mm, respectively, the devices can save board space by replacing larger toroidal common mode chokes, which typically measure 19 by 30 by 28mm.

The IFLN-1210BE-A and IFLN-1812CZ-A are ferrite common mode chokes with precision winding. The devices provide common mode impedance up to 11kΩ at 100MHz in the 1210 and 1812 case sizes, making them suitable for suppressing EMI noise in automotive applications.

RoHS-compliant, halogen-free and Vishay Green, all four devices are suitable for reflow soldering and compatible with automated pick-and-place assembly.

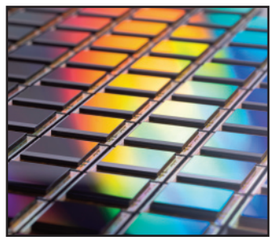
Samples and production quantities are available now, with lead times of ten to twelve weeks.



Sensor uses thermal imaging to detect obstacles

A thermal imaging sensor from Lynred can improve automotive obstacle detection to reduce the number of collisions, particularly at night when visibility is poor.

Where a visible-light camera is hindered by darkness, headlight glare, backlighting, rain or fog, the CAPT640 thermal imaging sensor can detect the heat emitted by living beings and objects to identify the presence of pedestrians, cyclists, animals or obstacles, regardless of lighting conditions or weather.



This 12-micron pixel pitch detector enhances the perception capabilities of driver-assistance systems to improve detection of obstacles in the vehicle's path, without requiring lighting and while consuming little energy.

It converts naturally emitted thermal energy, focused by an optical system, into a high-quality digital image thanks to its VGA resolution (640 x 480). Combining a wide dynamic range with high NETD (thermal sensitivity), the result is rich in detail and enables reliable long-range detection.

It is marketed as a bare die, allowing it to be easily manufactured and integrated in large volumes.

Certified to AEC-Q100 grade three for -40 to +85˚C operation, the product has passed more than thirty tests across production batches, covering approximately 3000 components, including temperature cycling tests at extreme temperatures, both during operation and when powered off.

When combined with other sensors such as visible-light cameras, radar and lidar, it can improve automatic emergency braking (AEB) systems, adas features and future autonomous vehicles.

It can also help manufacturers anticipate regulatory changes.

IMU modules maintain precision in engine bay

Three six-axis inertial measurement unit (IMU) modules from Quectel have automotive-grade reliability engineered to survive years inside a car engine bay, combined with precision from factory calibration.

The LUA501RA is developed to ISO 26262. The LUA300C and LUA301C IMU modules have additional mechanical mounting options.

The LUA501RA targets automotive adas, GNSS and INS navigation, autonomous mobile robots, and unmanned vehicles.

Built around Bosch's SMI270, it integrates a three-axis gyroscope and three-axis accelerometer in a 11.5 by 19.5 by 12.0mm module weighing 8g.

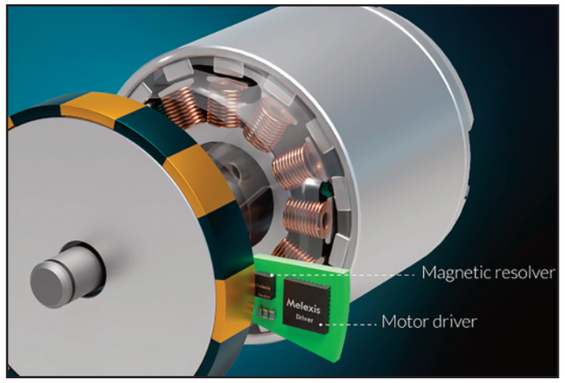
Every module is individually factory-calibrated, with unique compensation parameters for bias error over temperature, scale factor error and sensor misalignment. Users receive a ready-to-use, calibrated IMU rather than a raw sensor that would require system-level characterisation and compensation.

The module's temperature-dependent bias is individually compensated across an operating range of -40 to +105°C, delivering stable, accurate inertial measurements in under-bonnet, exterior automotive and outdoor industrial environments.

The LUA501RA and LUA301C automotive-grade, compact, factory-calibrated six-axis IMU modules are built around STM's ASM330LHB. Every gyroscope and accelerometer parameter, bias error over temperature, scale factor error, and misalignment error is precision-trimmed and factory calibrated.

The pin-mounted LUA300C measures 18.8 by 10.4 by 11.1mm and weighs 2.4g. The screw-mounted LUA301C measures 19.5 by 11.5 by 12.0mm and weighs 8g.





Pico resolver increases placement flexibility

To support more automotive, alternative mobility and robotics motor applications, Melexis has added the MLX90381 5V version to its Triaxis pico-resolver range.

Unlike TMR options, this 5V variant increases placement flexibility so engineers can shrink motor sizes without sacrificing accuracy.

It combines Hall technology with high-speed sine and cosine analogue outputs in a DFN-6 package. By sensing magnetic flux density in three dimensions and allowing selectable x/y, x/z or z/y magnetic axis pairs, the device gives engineers more freedom to position the sensor relative to the rotating magnet.

In side-of-shaft and through-shaft motor designs, this lets the sensor be placed below or close to the magnetic track rather than requiring additional side space, helping reduce mechanical constraints, simplify PCB placement and ease tolerance management in compact assemblies.

Output refresh rate is 2μs and it can measure rotational speeds of more than 50,000rpm, making it suitable for precise rotor position detection in DC, BLDC and PMSM motor architectures.

Programmable sensitivity and filter bandwidth provide flexibility when optimising performance, while I²C communication enables device configuration and calibration during production.

Housed in a 2.0 by 2.5 by 1.0mm package, it has an operating temperature of -40 to +160°C, embedded diagnostics, Asil-B SEooC capability and AEC-Q100 qualification.

Applications include e-valves, seat motors, door handles, braking motors, steering motors and e-bike motors.

Split core current sensors aid in-vehicle testing

Yokogawa's second-generation of AC/DC split core current sensors are for space-constrained environments, such as in-vehicle xEV testing.

The CT500SA and CT200SA provide accurate current measurements for the 200 and 500A ranges.

The sensors are compatible with power analysers and waveform measurement instruments to improve testing reliability and efficiency, and reduce sensor costs.

Automotive and electrified vehicle (xEV) validation requires that measurements take place post-assembly. At this stage, the space around components is limited and cables cannot be cut.

While through-hole sensors may offer greater accuracy, they require wires to pass through their central aperture. This creates logistical installation and removal hurdles in late-stage production testing.

Split core current sensors clamp directly onto wires. This is more practical for engineers who typically have to install and remove sensors repeatedly as they progress through test phases and switch between waveform and power analysis.

The main sensor unit of both devices measures 110 by 62 by 25mm.

Each has a single unlock-and-open button for one-handed clamp-on installation, while the body includes an M4 screw hole and a cable tie slot to secure the sensor in place. This improves measurement repeatability as outputs are sensitive to positioning.

They guarantee accuracy of ±0.1% from -40 to 85°C. Within 23±5°C range, this improves further, achieving a peak accuracy of ±0.09% of reading +0.01% of full scale.

Both models guarantee accuracy one order of magnitude higher than that of conventional current sensors, equivalent to through-hole types but with the convenience of clamp-on installation.

The CT500SA delivers a frequency bandwidth of 500kHz (-3dB), while the CT200SA extends to 1MHz (-3dB). Both can also measure switching frequencies, used for motor inverter validation and requiring wideband measurement.

They hold a phase accuracy of ±0.1° (0.1Hz ≦ f ≦ 1kHz).



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